CIVE 489: Senior Design—A Peer Review of Teaching Project Benchmark Portfolio

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INTRODUCTION TO THE PORTFOLIO

Over recent years, the careers of professional civil engineers have become increasingly collaborative, multidisciplinary, entrepreneurial and focused on sustainability. With that comes an expectation from the profession to adequately prepare work force entrants for such challenges. In addition to traditional foundations in math, science, engineering fundamentals and an understanding of professional ethics, graduates now need interdisciplinary depth, critical thinking ability, ingenuity, creativity, leadership, multifaceted communication skills, flexibility and a broad understanding of civil systems in global economic, environmental and societal contexts. The UNL Civil Engineering Department strives to meet the profession’s expectation with the capstone design course, CIVE 489, Senior Design.

CIVE 489 is the final required course of the UNL Civil Engineering undergraduate program. The course meets once per week on Fridays and consists of a 105-minute lecture and a 3-hour laboratory for teamwork. The course content requires some basic knowledge of all subdisciplinary engineering areas of the broad career field which include the following:

- Environmental engineering;
- Geotechnical engineering;
- Structural engineering;
- Transportation engineering; and
- Water resources engineering.

Professional engineering licensure is a requirement of the course instructor. Instruction responsibility periodically rotates through the qualified faculty at the discretion of the Civil Engineering Department Chair.

The quality of student outcomes from this course is a direct reflection of the knowledge, skills and abilities undergraduate students have collected over the course of their four-year academic experience in the Civil Engineering Program. The course is the first time that students have been given an opportunity to practice what they have learned to design coordinated systems in a team setting. The course is an Achievement Centered Education (ACE) 10 course which “generates a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis interpretation, presentation and reflection.”

CIVE 489 outlines the framework that is necessary for a successful career as a licensed professional civil engineer. In 2012, the Civil Engineering Department faculty with input from undergraduate students and the Civil Engineering Advisory Board (comprising public, private and industrial licensed professionals) approved qualities expected of graduates several years into their civil engineering careers. These objectives are listed below.

“With a UNL BSCE degree, a few years beyond graduation alumni are likely to…
  - Apply their solid foundation in civil engineering toward the practice, advanced degree education and a broad range of career choices;
• Perform technical analysis or design of a complex system, component or process as acting representatives of governmental agencies, private consulting engineering firms, research organizations or industry;
• Explain engineering concepts accurately and effectively to inform technical and non-technical audiences using appropriate verbal, written, virtual and graphical means;
• Apply basic project management and business concepts and processes;
• Engage in lifelong learning to foster technical growth, ethical conduct, and practice of professional communication, teamwork and leadership skills; and
• Obtain licensure in a profession such as civil engineering.

My reason for choosing this course for benchmark portfolio development is the recognition of the impact student success in this course has upon its stakeholders who range from the students themselves to the employers that hire them to the civilians who depend so critically on the systems they will ultimately design. My key goals to be accomplished are:

• Improving my teaching methodology to achieve my objectives;
• Development of student educational assessment tools to recognize both shortcomings and highly effective learning aids; and
• Development of a process for myself to implement changes for continual improvement of the course content by effectively using assessment tools for reflection and sharing outcomes with undergraduates, departmental faculty, advisory board members and accreditation reviewers.

My course portfolio identifies methods to assist inexperienced engineers to develop a logical and insightful approach for solving complex infrastructure system problems by contemplating their academic background and using it for experiential learning. Key features of the method are listed below.

**Fundamental Introspective Resources**

• recognizing their ability to draw upon their foundational coursework;
• recognizing when additional learning is required;
• encouraging resourcefulness to obtain knowledge;
• practicing to gain experience; and
• assessing their results for the purpose of ongoing inquiry and improvement in their subsequent endeavors.

Assessment includes the process of documenting, in measurable terms, the knowledge, skills, attitudes and beliefs of both the individual learners and the organized group of learners (design teams) participating in the course. The outcome would be to accurately assess both the individual and team aptitude and preparation, motivation and preferred learning styles, learning outcomes in achievement and satisfaction in different educational contexts. Meaningful education assessment would promote the Department’s goal of continual improvement of this capstone course as a successful synopsis of the undergraduate academic program geared to meet expectations of the profession, which is a key factor in meeting the program criteria for Accreditation Board for Engineering and Technology (ABET) endorsement.
OBJECTIVES OF PEER REVIEW COURSE PORTFOLIO

Course Goals
The broad objective of the capstone design course is to provide senior undergraduate civil engineering students in their last semester with the opportunity to apply engineering concepts and principles along with other skills and abilities learned during their academic careers to a comprehensive design project involving all sub-disciplinary aspects of the broad civil engineering field. The Engineering Accreditation Council (EAC) which is the professional educational program quality-monitoring arm of the American Society of Civil Engineers (ASCE) requires that the course result in “a consistent student experience that demonstrates breadth, depth, and design based on the knowledge and skills acquired earlier in the curriculum.”

Specific goals of this course include that students must:

- Identify key issues and stakeholders related to an infrastructure design project;
- Propose sustainable solutions, outlining their potential benefits and detriments;
- Reflect upon, review and implement previous course work to accomplish a shift from passive knowledge receiver to constructor of meaning;
- Develop a written proposal response to an RFP with accompanying “sales” presentation;
- Outline the sequential preliminary design process of each sub-discipline required for the project;
- Identify sequential elements of the entire civilian infrastructure project life-cycle with an emphasis on design features to determine the critical timeline path to meet deadlines;
- Identify design controls and criteria upon which to base design decisions;
- Be a highly-functional, contributing member of a design team by performing varying roles required of team members tasked to plan, schedule, and conduct specific sub-disciplinary design roles associated with the successful completion of civilian infrastructure system project deliverables that exhibit a unified preliminary design package addressing the client’s needs by performing varying roles required of team members;
- Explain engineering concepts accurately and effectively to inform technical and non-technical audiences using appropriate verbal, written, virtual and graphical means to translate culminating findings and recommendations via the development of preliminary construction plans, a formal technical oral presentation and final technical written report including identification of critical project issues, design system calculations, and solutions that accomplish the goals of the project in an optimal manner;
- Accomplish key performances that will result in enduring understanding that develops as a result of ongoing inquiry and rethinking; and
- Speculate on how to apply their course experiences to new situations within or beyond the boundaries of the semester’s project.

Context of the Course
CIVE 489 is taught on Friday afternoons in the fall and spring semesters on both the Lincoln and Omaha campus of the UNL Civil Engineering Department. It is currently my responsibility to instruct the spring semester course on the Lincoln campus.
The following details describe the format of course instruction. Each spring semester a local infrastructure project under the jurisdiction of the City of Lincoln Public Works Department in the functional or final design stage is chosen as the project to be undertaken by the class. The project is selected through collaboration between the City of Lincoln’s Design and Construction Department and the instructor. The students begin with the City’s Request for Proposal (RFP) and Scope of Services documents and are responsible to prepare a written proposal, oral proposal presentation, and preliminary design plans with sustainable solutions to key project issues.

This semester’s infrastructure project was the reconstruction of Old Cheney Road between 72\textsuperscript{nd} Street and 82\textsuperscript{nd} Street to widen the roadway from a two-lane rural cross section to a four-lane urban cross section with raised median and left-turn lanes. A 10-ft wide hiker/biker trail on the north side and 5-ft sidewalk on the south side was also part of the ultimate design. The functional engineering portion of the coursework required each team member to assume the responsibility for the preliminary design of the following sub-disciplinary elements;

- **Environmental** – Design of erosion control measures, rain gardens and completion of a Stormwater Pollution Prevention Program (SWPPP) form;
- **Geotechnical** – Design of the concrete dimensions of conventional concrete retaining walls;
- **Structural** – Box culvert dimensions and steel reinforcement design for pedestrian underpass;
- **Transportation** – Three dimensional elements of vertical, horizontal and cross sectional roadway and walkway design within the right-of-way limits, traffic control analysis; and
- **Water Resources** – Storm water drainage pipe system.

The course syllabus is shown in **APPENDIX A**.

**Lecture Sessions, 12:30 – 2:15 pm; Fridays:**
The lecture period is comprised of presentations provided by:

- the instructor (who also plays the role of “project manager” with individual students in the role of team members when situations arise for a teachable moment, the time at which learning a particular topic or idea becomes possible or easiest).
- practicing professional civil engineers or other civil engineering instructors on various topics that relate to the engineering components of the project, criteria, and required project plan format; and
- student team presentations outlining key project issues, proposing sustainable solutions and defining their development of preliminary engineering designs.

**Laboratory Session, 2:30 – 5:20 pm, Fridays:**
The laboratory sessions are devoted to instructional sessions, oral progress reports by members of the design team and team discussion sessions presided over by the assigned project manager to coordinate the necessary work required for each of five defined milestone project segments.
**Team Interactions:**
Team discussion sessions promote group synergy, brainstorming to make best use of the collective knowledge of the group and serves as a means of coordinating the design development, alerting the team of conflicting problem areas, and involving all members in each sub-disciplinary area of the design process.

Students are assigned to multi-disciplinary teams and given a general framework within which to develop their preliminary design. Each of five milestone assignments are coordinated by a “project manager” selected from available team members by the instructor. Each team member has an opportunity to be a project manager for at least one of the milestone tasks. The project manager is responsible for:

- overall project coordination with team members;
- communications with the course instructor; and
- project quality control.

To facilitate the best use of team meeting time, the project manager is responsible for providing an agenda prior to each meeting which states the following:

- Project progress summary;
- Objectives of the meeting;
- Outline of team contributors; and
- Planned participation of each member (including the project manager).

Milestone project managers are also required to submit a spreadsheet form of billable hours for the team prior to the class lecture on Friday afternoon. The spreadsheet lists all team members and their functions and shows their week’s progress in quarter hour time increments (similar to the practice used by engineering consulting firms). A blank template and team example are shown in **APPENDIX B**.

Each team member is also assigned to perform as “scribe” transcribing meeting minutes for the duration of one milestone activity during the semester. The minutes must be formalized and disseminated to the team members and the instructor within 24 hours of the team meeting. Guidelines for meeting minutes and a team example are shown in **APPENDIX B**.

Team members not performing as the milestone project manager or scribe are designated as “support engineers” and are responsible for the various civil engineering milestone tasks of the preliminary design which are on-going throughout the semester. Each team member is expected to perform designated weekly assignments and report progress to the group.

**Enrollment and Demographics**
This course is only open to Civil Engineering majors, preferably in the final semester of their undergraduate degree. Students must have completed at least four of the five required introductory civil engineering courses in the environmental, geotechnical, structural, transportation, and water resources areas of specialization and be concurrently enrolled in the
final required course. CIVE 385, Professional Practice and Management is also a prerequisite or parallel course.

The class size in the spring semester averages 34 students. Females normally comprise about 10 to 15 percent of the total enrollment and about 10 percent are international students. This semester there are 33 students: 5 females (15 percent) and 3 international students (9 percent).

TEACHING METHODS, COURSE MATERIALS AND STUDENT ACTIVITIES

Methodology
The framework of the course is described in detail within the “Context of the Course” heading. My teaching methodology is a result of refinements made over the past few times I’ve taught this course. I’ve designed my methods to complement the framework and exemplify the objectives (see “Course Goals”) by transitioning students from the highly structured, quantitative classroom style of knowledge transfer (to which they’ve become accustomed) to the forms of life-long learning they will experience as they continue to become practitioners or recipients of advanced degrees (see “Fundamental Introspective Resources”). TABLE 1 below describes the roles used for professional examples and student practice created to promote the transition in learning styles.

TABLE 1 Roles Required for Learning-Style Transition from Passive Knowledge Receiver to Constructor of Meaning

<table>
<thead>
<tr>
<th>Role</th>
<th>Role Player</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecturer</td>
<td>Instructor</td>
<td>Example of the use of education and expertise in the design of complex infrastructure projects</td>
</tr>
<tr>
<td>Sub-Discipline</td>
<td>Instructor,</td>
<td>Example of the outcome of education, skill and experience as a professional in a specialized subject area</td>
</tr>
<tr>
<td>Expert</td>
<td>Professional</td>
<td></td>
</tr>
<tr>
<td>Project Manager</td>
<td>Instructor</td>
<td>Example of educated, skilled and experienced manager of a team of functional engineers</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Individual Student</td>
<td>Practice of team management skills</td>
</tr>
<tr>
<td>Scribe</td>
<td>Individual Student</td>
<td>Practice of oral, listening and recording skills</td>
</tr>
<tr>
<td>Support Engineer</td>
<td>Individual Student</td>
<td>Practice of engineering knowledge and skills and group volunteerism</td>
</tr>
<tr>
<td>Production Unit</td>
<td>Team</td>
<td>Practice of working with a group to coordinated design systems</td>
</tr>
</tbody>
</table>

Course Materials
Once a suitable project involving all sub-disciplinary areas is identified through collaboration with the Design and Construction Section of the Engineering Services Department, the following project documents and computer files are requested from the City or their contracted consulting firm:
- Original RFP;
- Original Scope of Services;
- Graphic computer file of the plan view of existing features of the project showing edges of pavement, utilities, buildings, trees, bushes, waterways, etc. and
- Incremental cross sectional views of the existing elevation of the terrain within the limits of the project.

Due to the fact the City designs projects both internally and by contract, their internet website [http://lincoln.ne.gov/city/pworks/engine/index.htm](http://lincoln.ne.gov/city/pworks/engine/index.htm) provides an organized and effective resource for all guide documents and peripheral information required to allow the students to define key issues to be resolved, research suitable engineering guides, define criteria that constrains their designs and establish the format in which the owner requires deliverables.

**Course Activities**

Activities designed to enhance experiential learning and understanding of the course objectives are presented in tabular form below. Course period agendas describing homework assignments along with example student submittals are show in [APPENDIX C](#).
<table>
<thead>
<tr>
<th>Focused Activity</th>
<th>Focused Activity Designed for Course Objective</th>
<th>Instructor, as PM Example</th>
<th>Course Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Individual</td>
</tr>
<tr>
<td>1</td>
<td>Given an RFP and Scope of Services for an infrastructure project, identify key issues and stakeholders.</td>
<td>Review RFP and Scope, assess talent, assign teams balancing expertise amongst teams if possible</td>
<td>Outline key issues and stakeholders.</td>
</tr>
<tr>
<td>2</td>
<td>Propose sustainable solutions outlining their potential benefits and detriments.</td>
<td>Define sustainability, provide examples, define and provide example of brainstorming.</td>
<td>Identify two sustainable options per sub-discipline. Outline benefits/detriments.</td>
</tr>
<tr>
<td>3</td>
<td>Reflect upon, review and implement previous course work to accomplish a shift from passive knowledge receiver to constructor of meaning.</td>
<td>Lead brainstorming discussion to list foundational resources.</td>
<td>Identify previous coursework with may be drawn upon for expertise. Identify areas requiring more background.</td>
</tr>
<tr>
<td>4</td>
<td>Develop written proposal and accompanying “sales” presentation.</td>
<td>Provide examples, expectation rubrics for written and oral communication. Videotape Presentations.</td>
<td>Prepare a resume, technical written content, presentation slides and oral explanation of sub-discipline solutions. Critique performance citing two speaking characteristics in need of improvement.</td>
</tr>
<tr>
<td>5</td>
<td>Outline the sequential preliminary design process of each civil engineering sub-discipline required for the project.</td>
<td>Reflect on sub-discipline background courses and create flow chart for development of the initial design solution proposal.</td>
<td>Discussion of flow charts identifying need for clarification</td>
</tr>
<tr>
<td>6</td>
<td>Identify sequential elements of infrastructure project life-cycle with an emphasis on design features to determine the critical timeline path to meet deadlines.</td>
<td>Work through a reasonable example plan.</td>
<td>Discussion of project sequencing to meet preliminary design deadline.</td>
</tr>
<tr>
<td>Focused Activity</td>
<td>Focused Activity Designed for Course Objective</td>
<td>Instructor, as PM Example</td>
<td>Individual</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>7</td>
<td>Identify design controls and criteria upon which to base design decisions.</td>
<td>Define format. Brainstorm obvious assumptions.</td>
<td>Identify key design guides and internet links for each sub-discipline.</td>
</tr>
<tr>
<td>8</td>
<td>Become a highly functional, contributing member of the design team by performing varying roles required of team members.</td>
<td>Role play example of all team functions. Brainstorm characteristics of high performing teams.</td>
<td>Perform role of task assistant and functional sub-discipline engineer.</td>
</tr>
<tr>
<td>9</td>
<td>Explain engineering concepts accurately and effectively to inform technical and non-technical audiences using appropriate verbal, written, virtual and graphical means.</td>
<td>Provide examples of previous exceptional projects.</td>
<td>Prepare technical written report, presentation slides, oral explanation, and preliminary project plan sheets.</td>
</tr>
<tr>
<td>10</td>
<td>Accomplish key performances that will result in enduring understanding that develops as a result of ongoing inquiry and rethinking.</td>
<td>Provide an example from professional experience.</td>
<td>Outline the process for preliminary design of the sub-disciplinary area and identify examples that required ongoing inquiry and rethinking.</td>
</tr>
<tr>
<td>11</td>
<td>Speculate on how to apply course experiences to new situations within or beyond the boundaries of the semester’s project.</td>
<td>Use previous outline to speculate on how course learning will influence how to approach a future project.</td>
<td></td>
</tr>
</tbody>
</table>
Description and Nature of Student Understanding for Achievement of Course Goals

The nature of student understanding for each focused activity being analyzed is shown below.

**Focused Activity 1: Given an RFP and Scope of Services for an infrastructure project, identify key issues and stakeholders.**

**INDIVIDUAL Activity, Preparation for Milestone #1A:**

Reading Assignment:
- Request for Proposal
- Scope of Services
- Relevant portions of the City of Lincoln Long Range Planning Comprehensive Plan
- Relevant portions of the City of Lincoln Long Range Transportation Plan
- Chapter 2, Guide to Quality in Preconstruction Engineering
- Chapter 4, Guide for Consultant Contractors

Written Assignment:
- List two goals the project should accomplish to fulfill the Comprehensive Plan
- List two goals the project should accomplish to fulfill the Transportation Plan
- Summarize the two chapters about quality consulting
- List five stakeholders in the project and speculate on whether they will be for or against the improvement and why.

In-Person Project Site Visit:
- Visit the project site during an AM or PM peak traffic hour and take a picture of the congestion you witness and evidence of the need for improvements.

**TEAM Activity (1st Team Meeting) of Milestone #1B):**

- Identify members and key staffing positions
- Select a firm name (logo optional)
- Determine potential non-class meeting times during the week
- Identify the top 5 most influential opposing and supporting stakeholders
- Discuss how to mitigate opposition points and maximize opportunities to take advantage of the momentum of supporters
- Identify staffing of functional engineering sub-disciplinary roles

**Focused Activity 2: Propose sustainable solutions outlining their potential benefits and detriments.**

**INDIVIDUAL Activity, Preparation for project understanding statement, Milestone #1C:**

- Research, identify and document key issues related to the project by sub-discipline listing three ways to build sustainability into your sub-discipline area
- Project managers asked to list weak team management skills
- Preparation of resume of sub-disciplinary qualifications

**TEAM Activity, Preparation for proposal document, Milestone #1D:**

- Solidify content of proposal consisting of background, project understanding, design approach for solutions to key issues, project scope, organizational chart, work plan with schedule and resumes.
Focused Activity 3 and 4: Reflection, review and implementation of previous academic coursework to optimize written and oral performance of proposal:

CLASS Activity, Preparation for written proposal and oral presentation, Milestone #1E:
Request the class to list previous courses on the white board that taught them to write technical reports, speak publically and practice both.

TEAM Activity, Proposal presentation, Milestone #1F:

INDIVIDUAL Activity, Reflect on professional evaluations and video of performance.
- Identify positive feedback to continue
- Identify areas to improve
- Commit to two oral presentation flaws to improve in final presentation

Focused Activity 5 and 6: Outline the sequential sub-disciplinary preliminary design process, Milestone #2A:

INDIVIDUAL Activity, Reflect on previous applicable sub-disciplinary design courses and create draft flow chart

TEAM Activity, Review individual flow charts and optimize team knowledge of the process

CLASS Activity, List steps to preliminary plan design
- Discussion of each step toward 30% plans at end of semester.
- Discussion of project sequencing to complete the work in the order necessary to complete it as quickly as possible.
- Discussion of how to use teamwork to maximize the knowledge and manpower of the group.

Focused Activity 7: Identify design controls and criteria to frame constraints and acceptable value ranges upon which to base design decisions, Milestone #2B:

INDIVIDUAL Activity, Identify general design guides and internet links for each sub-discipline.
Summarize content of available references.

TEAM Activity, Identify relevant guides for individual sub-discipline designs
Complete design memorandums for each sub-discipline.

CLASS Activity, Finalize key guides.
Recognize the need to research more areas than will actually be required for each sub-disciplinary design.
Focused Activity 8: Become a highly functional, contributing member of the design team by performing varying roles required of team members.

**INDIVIDUAL Activity**, Each member of the team must perform three roles during the semester:
- Project Manager for at least one Milestone
- Scribe for at least one Milestone
- Functional support engineer for two or three milestones

**TEAM Activity**:
- Judge the contribution of the individual and each team member with respect to the first two milestones with a simple significant/adequate/sub-average categorization.
- Identify specific characteristics the team possesses in the 10\textsuperscript{th} and 15\textsuperscript{th} week of the semester.

Focused Activity 9: Explain engineering concepts accurately and effectively using audience appropriate verbal, written, virtual and graphical means.

**INDIVIDUAL Activity**, Each member must complete a technical written report with the following content:
- Reference Guides
- Design Criteria
- Assumptions
- Design Calculations
- Recommendations
- Summary of Positive and Potentially Detrimental Aspects of the Recommendations
- Quantity Calculations
- Cost Estimation

**INDIVIDUAL Activity**, Each member must create construction plan sheets describing their designs clearly and accurately.

**TEAM Activity**, The team must create a poster and brochure for E-Week describing the problem they are trying to solve and the preliminary design ideas they have developed over two-thirds of the semester, presenting their work to two volunteer professional engineers who judge their displays and oral descriptions of their process.

**TEAM Activity**, The team must create a brief, descriptive presentation of their preliminary design solutions for two volunteer professional engineers representing the owner of the project.

Focused Activity 10: Accomplish key performances that result in enduring understanding that develops from on-going inquiry and rethinking.

**INDIVIDUAL Activity**, Each student must prepare a final essay reviewing all of the activities performed over the semester, reflecting upon how they would improve their process and further research areas still in need of refinement.
Focused Activity 11: Speculate how to apply course experiences to new situations within or beyond the boundaries of the semester’s project.

**INDIVIDUAL Activity.** The final essay also asks that they be introspective to apply what they have experienced to their future career endeavors.

**COURSE INTERACTION WITH THE BROADER CURRICULUM**

This course is referred to as a “capstone” course requiring the practical use of the knowledge, skills and abilities undergraduate students have collected over the course of their four-year academic experience in the Civil Engineering Program. It is considered the pinnacle course of a civil engineering student’s body of undergraduate academic education. It is also a Certified Achievement Centered Education (ACE) 10 course which “generates a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis interpretation, presentation and reflection.”

The broad objective of the capstone design course is to provide senior undergraduate civil engineering students in their last semester with the opportunity to apply engineering concepts and principles along with other skills and abilities learned during their academic careers to a comprehensive design project involving all sub-disciplinary aspects of the broad civil engineering field. The Engineering Accreditation Council (EAC) which is the professional educational program quality monitoring arm of the American Society of Civil Engineers (ASCE) requires that the course result in “a consistent student experience that demonstrates breadth, depth, and design based on the knowledge and skills acquired earlier in the curriculum.”

Accreditation of the Department within the UNL College of Engineering is highly dependent upon the outcomes of the students in this course since it provides direct achievement evidence of the eleven student outcomes required for certification.

**ANALYSIS OF STUDENT LEARNING**

Since this is a benchmark portfolio, I consider this semester to be one in which baseline data was collected to provide a beginning point from which to assess:

- previous goals I’ve had for the course;
- two new objectives (and related activities) to overcome previous weaknesses; and
- student achievements in meeting objectives with performance measures.

The two new objectives comprised;

1) Allowing students to directly experience the different roles they will need to perform to be a highly efficient and effective professional technical team member; and

2) Reviewing, reflecting and rethinking their participation in the development of the preliminary design of an infrastructure project to directly experience the process of developing a robust frame of reference from which they may draw upon for engineering judgment.
I intend to focus my analysis of data upon the areas of motivation I stated in my proposal when applying to be involved in this year’s program which include:

- Improvement of my teaching methodology to achieve my objectives;
- Development of student educational assessment tools to recognize both shortcomings and highly effective learning aids;
- Development of a process to implement changes for continual improvement of the course content by effectively using assessment tools for reflection; and
- Sharing outcomes with undergraduates, departmental faculty, advisory board members and accreditation reviewers.

**Improving Teaching Methodology to Achieve Objectives**

I found the reference suggested at the very beginning of the Peer Review Teaching Project “*What is Backward Design?*, Chapter 2, *Understanding by Design* by Wiggins and McTighe to be highly effective in clarifying my ultimate intension for students who have completed CIVE 489 that are transitioning from an academic career to a professional career or advanced study (see “Course Goals”). I created a new assessment tool shown in **EXHIBIT 1** that required students to estimate their level of preparedness to achieve my given objectives on the first day of class (Week 1) and again at semester’s end (Week 15) using an A-F “grading” range.

![EXHIBIT 1 Assessment Tool to Measure Achievement of Student Preparedness related to Course Objectives](image-url)
As defined on the form, a selection of “A” indicated the student thought they were “Very Well Prepared” to accomplish the objective and a selection of “F” indicated being “Totally Unprepared”. A blank version of the tool is located in APPENDIX B along with an example showing two different student Week 1 and Week 15 responses. Students were not required to identify themselves on the form nor did they receive course credit for its completion to encourage candid responses. TABLE 3 compiles the responses of the assessment tool.

<table>
<thead>
<tr>
<th>Obj #</th>
<th>Week 1 Ability &quot;Grade&quot; Responses, All Students</th>
<th>Week 15 Ability &quot;Grade&quot; Responses, All Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
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<tr>
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<td>15</td>
<td>1</td>
<td>7</td>
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<tr>
<td>16</td>
<td>2</td>
<td>8</td>
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<tr>
<td>17</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Totals</td>
<td>54</td>
<td>148</td>
</tr>
</tbody>
</table>
Using the sum of responses for each letter grade level of preparedness, a “GPA” may be calculated to give myself a “grade” of improvement with respect to student learning as shown in TABLE 4.

**TABLE 4 Overall Achievement Level Improvement with respect to Course Objectives**

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Letter Grade Value</th>
<th>Wk 1 Number of Responses (593 total)</th>
<th>Wk 1 Responses x Point Value</th>
<th>Wk 15 Number of Responses (593 total)</th>
<th>Wk 15 Responses x Point Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.0</td>
<td>54</td>
<td>216</td>
<td>283</td>
<td>1132</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>148</td>
<td>444</td>
<td>281</td>
<td>843</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
<td>264</td>
<td>528</td>
<td>29</td>
<td>58</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
<td>112</td>
<td>112</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>0.0</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SUM</td>
<td></td>
<td>1300</td>
<td>2033</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPA, Grade</td>
<td></td>
<td>2.19, C</td>
<td></td>
<td>3.43, B</td>
<td></td>
</tr>
</tbody>
</table>

I was very satisfied with my “B” grade, raising average student preparedness related to my course objectives by over a full letter grade equivalent. I would expect my students to rarely attest to being “very well prepared” in any of the objective topic areas since CIVE 489 would be the first course in which they had the opportunity to practice much of the content. Since I was very focused on improving teamwork skills this semester, I compiled the student responses to the Student Evaluation of Course Objective Achievement by teams. After quantitatively and qualitatively ranking the seven team final presentations and submittals from 1 (Best) to 7 (Worst), I developed EXHIBIT 2 which shows the average team GPA, the total number of improvement steps* made by each team member with respect to the 18 course objectives (divided by 100 to allow reasonable relative comparisons on the same exhibit), and the team average improvement steps (divided by 10 to allow for reasonable comparisons). I must clarify that Team 7, considered by me to have the “worst” outcome, still prepared a somewhat better than adequate final product but relative to the results of the other groups in this particular class, it was the least impressive.

*One improvement step is defined as one letter grade improvement between Week 1 and Week 15. For example, if a student selected a “D” letter grade in Week 1 for the objective of “preparation of meeting agendas” then selected a “B” letter grade for the same objective in Week 15, that would qualify as two improvement steps.
As one would expect, the average team GPA predicted the overall performance of the teams. Though Teams 5 and 6 performed less successfully than Teams 1 through 4, the statistics show that they felt they had greater range of improvement than the higher performing groups. This could be due to higher GPA students having a better previous understanding of some of the material. I found it interesting that Team 1 (which I considered the best performing group) and Team 7 (the worst performing group) had almost identical team scores.
I took the data compiled by team and recorded percentages of average preparedness response “grades” to compare each team’s overall competence in Week 1 and also Week 15. Exhibit 3 shows the results, with a focus upon the best team (in bold red) and the worst team (in bold black).

EXHIBIT 3 Comparisons of Overall Total Team Objective Preparedness Grades, Week 1 and Week 15
Six of the seven teams have a similar range of preparedness in both Week 1 and Week 15 approximating a normal curve shape with a large response percentage in the average preparedness range (letter grade of “C”). However, the worst team seems to have been overconfident in their understanding of the requirements and/or their ability to achieve a high quality product since a large number of responses were in the well-preparedness range.

The results of the data from Teams 1 through 6 match my expectations. In Week 1, though the students have 7 semesters of engineering education in their backgrounds, requirements of this course demand they apply that knowledge in the way they will need to in their professional careers. The high percentage of “C” or average preparedness suggests a conservative estimation of their talents. This same group improved to the “very well prepared” (A grade) and “well prepared” (B grade), again expressing a somewhat conservative guess at their proficiency since they have merely practiced the content one time.

The worst team appears to have overestimated their skills in both Week 1 and Week 15 since evidence of their estimations was not provided in their final product. I looked further into the characteristics of each individual team in an effort to identify reasons for the responses for Team 7.

One of my most important course objectives was:

*Be a highly-functional, contributing member of a design team by performing varying roles required of team members tasked to plan, schedule, and conduct specific sub-disciplinary design roles associated with the successful completion of civilian infrastructure system project deliverables that exhibit a unified preliminary design package addressing the client’s needs by performing varying roles required of team members.*

In previous semesters, I had noticed a lack of group synergy at the end of the semester. Having only one member of the team act as project manager in those semesters unevenly distributed the work load and work styles amongst team members. I used the book “Collective Excellence, Building Effective Teams” by Mel Hensey, published by the American Society of Civil Engineers to instruct the students about team development and the characteristics that apply to the range of effectiveness levels Hensey defined. **EXHIBIT 4** shows the Team Development Evaluation sheet given to students in the 10th and 15th week of the semester which enabled them to document their opinion of characteristics of their own team at the time the evaluation form was given to them. **EXHIBIT 5** shows the results of their evaluations. The results of the team self-evaluations show Team 7 gave themselves fewer improving characteristics in the later part of the semester, indicating characteristics of a developing team declined with time instead of increasing with time, as the other team results tend to show.
Team Development Evaluation Sheet, Week 10 of 15

- Write your Team Name and Number on the line below.
- Circle the descriptions that best describe how your team is functioning at this point in the semester.
- DO NOT PUT YOUR NAME ON THIS SHEET.
- Fold the sheet in half and submit it to Karen.

| Team Name__________________________ | Team Number__________________________ |

<table>
<thead>
<tr>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
<th>Stage IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>collection (1)</td>
<td>group (2)</td>
<td>developing team (3)</td>
<td>high-performing team (4)</td>
</tr>
</tbody>
</table>

People are cautious, guard their secrets, wondering.

Lack visible disagreement.

Lacks an identity.

Little investment in the group.

Watching for the norms here to see what is okay or expected of members.

Developing identity, purpose;

People are taking risks and getting to know one another.

Conflict is in fits and starts, nonproductive.

High level of frustration and/or confusion.

Pairing and cliques.

Developing goals, roles, relationships.

Learning to appreciate the differences in people.

Conflict is usually on issues, not about egos.

Communication open and clear.

Sense of belonging.

Sense of progress.

Enjoying work.

Acting on common goals with synergy.

High morale, high productivity.

Easy shifting of roles from one to another.

Differences are valued.

Looking out for one another’s interests.

Spontaneous collaborative efforts.

Sharing of all relevant information.

Conflict is frequent, often looks like problem solving.
EXHIBIT 5 Team Development Self Evaluation in Best to Worst Order
The last assignment of the semester is shown in **EXHIBIT 6** below. The highlighted requirement asked students to reflect on specific elements of their teamwork skills over the past semester.

---

**Exhibit 6: Final Assignment for Review, Reflection and Rethinking**

**Course Objectives:**
- Accomplish key performances that will result in enduring understanding that develops as a result of ongoing inquiry and rethinking; and
- Speculate on how to apply their capstone course experiences to new situations within or beyond the boundaries of the semester’s project.

**Format:**
- Times New Roman, 12 point font
- 1 inch margins on all sides
- Single spaced
- Minimum of 750 words (this page has 533 words on it)
- Maximum of 1000 words
- **Excellent** spelling, grammar and punctuation
- The essay should be written in brief, fluid, cohesive paragraphs with minimal usage of bullet lists. All major components described below should be included. Do not use verbatim prompt points in your essay.

**For example:**
- **DON’T** — The process I used for the preliminary design of my sub-disciplinary assignment from the RFP review to the completion of my portion of the final technical written report is summarized by the outline below.
- **DO** – The overall objective of the capstone design course was for me to take on the role of a consulting engineer and work with a design team to develop the skills required to complete the preliminary design of an urban infrastructure project to meet the needs of the client, the City of Lincoln Public Works and Utilities Department. The following points summarize the sequence of project development.

**Major Components of the Essay:**
- **Engineering and Technical Skills:**
  - Outline the process you used for the preliminary design of your sub-disciplinary assignment from the RFP review to the completion of your portion of the final technical written report.
  - Identify examples of your preliminary work that would require you to further research or refine to create the final design plans of your sub-disciplinary component of the overall project.
  - Describe the **most critical** assumptions you had to make due to a lack of adequate data and propose how you would obtain the information you needed to avoid making the assumptions given unlimited time and budget.
  - Describe features of your design that you feel you should rethink due to the fact that during your design process, you discovered expensive or weak elements of your initial design proposal.
  - Describe the modern engineering tools (software products, internet resources, etc.) you used to complete your sub-disciplinary assignment and how the use of those tools aided your design process.
- **Team Skills:**
  - Describe the development of your team from Week 2 through Week 16 by outlining positive and negative aspects of team design.
  - Describe your experiences in the roles of project manager, scribe and functional support engineer and how those experiences improved your ability to perform in these situations.
  - Propose suggestions for improvement that could ameliorate the negative teamwork outcomes.
- **Communication Skills:**
  - Describe ways in which your oral, written and graphic skills were enhanced in the past semester.
  - Propose suggestions for improvement in your own abilities in these areas.
- **Enduring Understanding:**
  - Speculate on how knowledge you’ve gained in the capstone design course will influence how you approach a similar future project in the sub-disciplinary area of your expertise.
I collected quotations from each member of the best team and the worst team which are included in **APPENDIX D**. From the quotations, I summarized beneficial and detrimental comments which illustrate team characteristics to promote and avoid in **TABLES 5 and 6**. It is clear the best team had many beneficial and few detrimental comments and the worst team had the opposite result.

**TABLE 5 Beneficial Characteristics Observed by Members from Best and Worst Teams**

<table>
<thead>
<tr>
<th>Team 1 (Best)</th>
<th>Team 7 (Worst)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust developed knowing each member would put forth a quality effort, communication more open.</td>
<td>As time progressed, each members abilities became evident and delegation of tasks became more effective.</td>
</tr>
<tr>
<td>Brainstorming and cooperation minimized late design changes</td>
<td>Each team role is different but all roles are indispensible.</td>
</tr>
<tr>
<td>Team deadline 2 days before instructor deadline throughout the semester</td>
<td></td>
</tr>
<tr>
<td>Members asked questions on topics they were struggling with at team meetings to take advantage of the entire team’s knowledge bank</td>
<td></td>
</tr>
<tr>
<td>Project was considered one multi-disciplinary project instead of a collection of individual sub-disciplinary projects</td>
<td></td>
</tr>
<tr>
<td>Numerous meetings made it easy to work together and become friends</td>
<td></td>
</tr>
<tr>
<td>Switching roles was an amazing experience that gave everyone some experience but no one was overwhelmed with one particular role</td>
<td></td>
</tr>
<tr>
<td>Members worked equally on general responsibilities proven by similar weekly billable hours</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 6 Detrimental Characteristics Observed by Members from Best and Worst Teams**

<table>
<thead>
<tr>
<th>Team 1 (Best)</th>
<th>Team 7 (Worst)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfamiliar with how to approach large project</td>
<td>Apprehensive</td>
</tr>
<tr>
<td>Team roles, strengths not established</td>
<td>Didn’t know abilities or working styles of others</td>
</tr>
<tr>
<td>Confusion about directing the team</td>
<td>Unsure of fit with team roles</td>
</tr>
<tr>
<td>Frustration with chaotic meetings</td>
<td>Little chemistry</td>
</tr>
<tr>
<td>Hard to be critical of others, fear of conflict</td>
<td>Fear of conflict</td>
</tr>
<tr>
<td></td>
<td>Unorganized brainstorming, multiple opinions</td>
</tr>
<tr>
<td></td>
<td>Unequal effort</td>
</tr>
<tr>
<td></td>
<td>Inexperienced members taking unfair advantage of experienced members</td>
</tr>
<tr>
<td></td>
<td>Miscommunication of team progress and expectations, especially with international student</td>
</tr>
<tr>
<td></td>
<td>Didn’t take advantage of everyone’s abilities</td>
</tr>
<tr>
<td></td>
<td>Two members with similar effective working styles and practical internship experience dropped their dominant roles at mid-semester due to an imbalance in workload.</td>
</tr>
</tbody>
</table>
Benefits and Detriments of Project Manager, Scribe and Support Engineer Role Playing
The team member role rotation proved to be a very effective method of developing management, documentation and altruistic support characteristics required of highly effective professionals. It forced students who were natural leaders to play ancillary roles and students who normally prefer subordinate tasks to direct team progress. Below are quotes from different individuals describing beneficial and challenging team experiences.

“The organization of individual teams and the switching of roles every few weeks was an amazing experience. Everyone got a little experience but nobody was overwhelmed with one role for the entire semester.”

“Role switching happened rapidly during our design phases but it didn’t affect our performances much.”

“Having experience in each role helped everyone break out of their shell a little more.”

“I feel switching project managers could get confusing but it was worth the result of spreading out the work load.”

“As project manager, I liked to oversee the project and help motivate people to do great work. It makes me want to play that role in the future.”

“Being the scribe was a good experience because I have never before been in charge of the meeting minutes so I’d never realized how important it is to record the group decisions and make sure all meeting information is available to be referenced later.”

“Being the scribe helped me to learn to be a better note-taker during meetings and relay all that was discussed in a clear and cohesive manner.”

“The support engineer function allowed me to use my knowledge to intervene and I experienced pride knowing I’d helped and my opinion mattered.”

“I had the chance to be in different roles on the design team, and even though I will not fill some of those roles anytime soon in my career, it helps me to experience the task at hand from different perspectives.”
Other Assessment Tools

I felt the need to create assessment tools that would provide direct and indirect performance measures from individual students, teams, the instructor and practicing professional engineers.

<table>
<thead>
<tr>
<th>Focused Activity Number</th>
<th>Direct Assessment Provider</th>
<th>Indirect Assessment Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Student</td>
<td>Instructor</td>
</tr>
<tr>
<td>1</td>
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<td>X</td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td>X</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Copies of blank and completed indirect assessment forms are shown in APPENDIX B.

PLANNED CHANGES

Given the fact that the development of this portfolio has provided baseline data and significant feedback from students and professional reviewers, I have a frame of reference to refine effective teaching methods, reorganize confusing elements and share lessons learned by me and by successful student teams to enhance knowledge building in future capstone courses.

Reducing Student Confusion

Customized assessment tools in this semester’s course resulted in student feedback comments related to elements of the course which caused them confusion. With this information, I could identify where more thorough organization of instructions and resources was required.

Some of these issues were resolved during the semester. For example, though hard copies of homework instructions were supplied in each lecture period on the page immediately following the agenda, there was some confusion about what the assignments were and when they were due. I tried two different ways of improving this issue. The first was to positively reward and recognize students who followed instructions successfully and went beyond requirements to provide an exceptional product. The second method was to deduct homework points if the assignments were not submitted on time. The third and successful attempt involved the students in the resolution. I role-played the team project manager dealing with a problem and outlined the process I used to get the desired outcome. EXHIBIT 7 shows the PowerPoint slide I used to explain my process. I spent time on it in the lecture reviewing how the problem was identified and resolved.
EXHIBIT 7 Classroom Role Playing Example of the Process of Resolving an Issue

Students need to be exposed to and involved in a variety of ways to use their academic background and frame of reference to solve many problems that are not related to math, science and engineering which is a large part of their careers as professionals. They can readily relate to processes since they have many opportunities to use algorithms for the bulk of their coursework so I plan to illustrate and bring to their attention how they may apply those skills to problem solve with others.

I plan to use this teaching method more in the following topic areas of the course:

- More interactive classroom brainstorming to build experience with the creative process.
- More interactive classroom practice of reviewing, reflecting and rethinking design processes as the semester progresses in addition to the final assignment which requires the students to do this as a graded assignment.
- More emphasis on the process the students are undertaking to produce an exceptional final product by using previous semesters’ product examples and customized rubrics.

Improving Interdependent Teamwork Skills

I found significant evidence that well-developed teamwork has a significant effect upon the quality of the course submittals, resulting in exceptional as opposed to adequate final products. Civil engineering students have a number of opportunities in their academic background that requires interdependent and independent teamwork but most of them don’t recognize what is required to transition from a collection of people with a joint goal to a highly effective team.

I plan to prepare and submit a proposal to the 2013-2014 Peer Review of Teaching Project. The proposal will outline an inquiry course portfolio with this very topic as the issue to be studied. My experience with the Teaching Project community this year has been very successful in providing suggestions that have bolstered my own methods and improved student performance. I believe the experiences of a broad collection of instructors in the inquiry phase of a course
portfolio would be essential to me optimizing my effort. As a professional, I find that many of my peers and colleagues are unaware of the required characteristics of participants needed to expedite synergy and evolve to the highest level of production. If successful with my inquiry portfolio, I may be able to adapt a model for the faculty of the Civil Engineering Department to follow in order to improve collegiality.

**Identification, Promotion and Instruction of Optimal Teamwork**

**Communication Tools**

Popular social communication systems such as Google, Facebook and Twitter are readily understood software means of interaction between people. The wide dispersion of smart phones has made it incredibly easy to remotely chat, e-mail and text other individuals or groups. These tools are commonly used between friends and are quick ways to keep in touch.

I plan to identify the most useful of these tools to be used for team communication. For example, Google Drive was used by two very successful teams to edit written documents and have real time versions available to them. It is even possible for more than one person to be editing the document at the same time. At the beginning of the semester, I will promote the use of these tools and provide limited instruction to optimize their application to the capstone course team functions.

**Better Definition of the Characteristics of High Quality Products**

Grading homework and team project assignments in this course is very subjective. Nearly all of the students are in the final semester of their academic career and are able to provide adequate products which exhibit their understanding and command of the skills required to enter the professional practice of civil engineering.

I have instructed this course for six semesters and have improved the quality of the course with each effort. At this point in time, it has become more difficult to distinguish specific elements that separate exceptional work from adequate work. Through my interaction with the Peer Review Teaching Project community I have had more exposure to scoring rubrics. I intend to customize rubrics for use in grading two activities:

1) Written proposal and presentation in response to an RFP; and
2) Technical written proposal, technical presentation and project plans for the preliminary design of a civil engineering infrastructure project.

The use of customized rubrics will allow me and my students to evaluate criteria which can be complex and subjective. I hope to design the rubrics as formative assessment tools to provide a basis for self-evaluation, reflection, and peer review aimed at accurate and fair assessments, fostering understanding, and indicating a way to proceed with subsequent learning/teaching. The main features of the rubrics will:

- focus on measuring a stated performance, behavior, or quality;
- use a range to rate performance; and
contain specific performance characteristics arranged in levels indicating either the
developmental sophistication of the strategy used or the degree to which a standard has
been met.

My limited use of rubrics has been disappointing since the levels of performance have been
relatively indistinguishable from each other. I hope to keep this in mind when creating my own.
I will also prepare specific features which must be shown on each required preliminary plan
sheet. Although example plan sheets are provided, some students have limited practical use of
graphical computer skills they have learned in their freshman year and therefore provide
marginally acceptable visual presentation of their designs.

Solving this issue may require some refresher instruction for the students at the beginning of the
semester. I will investigate the opportunity to have one of the lab periods devoted to reminding
students of the software programs and associated skills needed to create good graphical
representations of their ideas.

Examples of the best team submittals, Team 1 and the worst team submittals from Team 7 are
shown in APPENDIX E.

SUMMARY AND OVERALL ASSESSMENT OF PORTFOLIO PROCESS

I have had a very positive experience from participating in the Peer Review Teaching Project in
AY 2012-13. I was encouraged to participate by my Department Chair since the capstone course
is such an important element with respect to the positive culmination of a student’s academic
career and providing evidence to accreditation reviewers of student outcome success. I was
somewhat reluctant to participate since the thought of additional responsibilities to my list of
commitments seemed counter-productive but understood the importance of the effort.

I attended all of the organized functions provided by Project coordinators except one in January
which conflicted with the time of my portfolio course. Each time I received my “gentle
reminder” e-mail of upcoming Project community functions, I winced at the thought of having to
break my concentration on my current responsibilities to make room for further development of
my benchmark portfolio. However, after attending each event, my attitude toward teaching was
refreshed and I was overwhelmed with ideas for improvements gleaned from other participants.

I found the program to be everything it claims to be and more. The process, execution and
facilitation of the project are well honed to optimize exceptional results with the least amount of
effort. The cast of facilitators are perfect in their guidance roles and share practical examples of
their techniques and tools of teaching and learning.

I’m looking forward to preparing another proposal for this course for AY 2013-14 to best use the
information collected in my benchmark portfolio. This will aid an inquiry course portfolio on
recognizing what is required to transition from a collection of people with a joint goal to a highly
effective team. Kudos to all the current and former program facilitators of the Peer Review
Teaching Project to make it the quality experience it is today. Exhibit 8 shows two teams
exhibiting synergy.
Exhibit 8 Second and Third Best Teams Celebrate Their Accomplishments on Their Last Day of Class
Appendices

APPENDIX A, COURSE SYLLABUS

APPENDIX B, ASSESSMENT FORMS WITH SAMPLES

APPENDIX C, LECTURE AGENDAS, ASSIGNMENTS AND STUDENT SAMPLES

APPENDIX D, STUDENT COURSE CONTENT REVIEWS, REFLECTIONS ON THEIR WORK AND RETHINKING THEIR APPROACH FOR FUTURE FRAME OF REFERENCE

APPENDIX E, FINAL ASSIGNMENT SUBMITTALS FROM BEST AND WORST TEAM
CIVE 489/489H – Senior Design Project Syllabus- Spring 2013

Instructor Contact Information:
Karen Schurr, PE
330H Whittier Research Center (22nd and Vine Sts)
E-mail: kschurr1@unl.edu
Phone: 402-472-2233
Office Hours: By appointment

Course Background:
Over recent years, the careers of professional civil engineers have become increasingly collaborative, multidisciplinary, entrepreneurial and focused on sustainability. With that comes an expectation from the profession to adequately prepare work force entrants for such challenges. In addition to traditional foundations in math, science, engineering fundamentals and an understanding of professional ethics, graduates now need interdisciplinary depth, critical thinking ability, ingenuity, creativity, leadership, multifaceted communication skills, flexibility and a broad understanding of civil systems in global economic, environmental and societal contexts. The UNL Civil Engineering Department strives to meet the profession’s expectation with the capstone design course, CIVE 489, Senior Design.

CIVE 489 is the final required course of the UNL Civil Engineering undergraduate program. The course content requires some basic knowledge of all sub-disciplinary engineering areas of the broad career field which include the following:
- Environmental engineering;
- Geotechnical engineering;
- Structural engineering;
- Transportation engineering; and
- Water resources engineering.

The quality of student outcomes from this course is a direct reflection of the knowledge, skills and abilities undergraduate students have collected over the course of their 4-year academic experience in the UNL Civil Engineering Program. The course is the first time that students have been given an opportunity to practice what they have learned and use combine the content of their education to design a system or process. The course is an Achievement Centered Education (ACE) 10 course which "generates a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis interpretation, presentation and reflection."

Course Goals:
The broad objective of the capstone design course is to provide senior-level undergraduate civil engineering students in their last semester with the opportunity to apply engineering concepts and principles along with other skills and abilities learned during their academic careers to a comprehensive design project involving all sub-disciplinary aspects of the broad civil engineering field. The Engineering Accreditation Council (EAC) which is the professional educational program quality monitoring arm of the American Society of Civil Engineers (ASCE) requires that the course result in “a consistent student experience that demonstrates breadth, depth, and design based on the knowledge and skills acquired earlier in the curriculum.”

Specific goals of this course include that students must:
- Identify key issues and stakeholders related to an infrastructure design project;
- Propose sustainable solutions, outlining their potential benefits and detriments;
- Reflect upon, review and implement previous course work to accomplish a shift from passive knowledge receiver to constructor of meaning;
- Develop an RFP written proposal and accompanying “sales” presentation;
- Outline the sequential preliminary design process of each sub-discipline required for the project;
- Identify sequential elements of the entire civilian infrastructure project life-cycle with an emphasis on design features to determine critical path time line;
- Identify design controls and criteria upon which to base design decisions;
- Become a highly-functional, contributing member of a design team tasked to plan, schedule, and conduct specific sub-disciplinary design roles associated with the successful completion of civilian infrastructure system project deliverables that exhibit a unified preliminary design package addressing the client’s needs by performing varying roles required of team members;
- Explain engineering concepts accurately and effectively to inform technical and non-technical audiences using appropriate verbal, written, virtual and graphical means to translate culminating findings and recommendations via the development of preliminary construction plans, a formal oral presentation and final technical written report including identification of critical project issues, design system calculations, and solutions that accomplish the goals of the project in an optimal manner.
- Accomplish key performances that will result in enduring understanding that develops as a result of ongoing inquiry and rethinking; and
- Speculate on how to apply their capstone course experiences to new situations within or beyond the boundaries of the semester's project.

**Team Interactions:**

Students will be formed into multi-disciplinary teams and given a general framework within which to develop their preliminary design. Each milestone assignment will be coordinated by a project manager selected from available team members by the instructor. Each team member will have an opportunity to be a project manager for at least one of the milestone tasks. The project manager will be responsible for:

- overall project coordination with team members;
- communications with the course instructor; and
- project quality control.

Other members of the team will be responsible for the various civil engineering milestone tasks of the preliminary design. Each member of the design team will have defined responsibilities for the oral and written reports throughout the semester.

**Lecture Sessions, 12:30 – 2:15 pm, Fridays:**

The lecture period will be comprised of presentations provided by:

- the instructor;
- practicing professional civil engineers or other civil engineering instructors on various topics that relate to the components of the project, criteria, and required plan format dissemination; and
- team presentations required for development of the project solutions and preliminary designs.
Laboratory Session, 2:30 – 5:20 pm, Fridays:
The laboratory sessions will be devoted to instructional sessions, oral progress reports by members of the design team and team discussion sessions presided over by the assigned project manager to coordinate the necessary work on the different design components. The assigned project manager will be responsible for providing an agenda prior to each meeting which states the following:

- Progress summary;
- Objectives of the meeting;
- Outline of team contributors; and
- Participation of each member (including the project manager).

Each team member will be expected to perform designated weekly assignments and report progress to the group. Assigned project managers will monitor team member progress and file weekly formal electronic meeting minutes (with the assistance of the assigned team scribe) to the instructor by Saturday evening at 6 pm. PM reports received after the deadline will receive point deductions that apply to all team members. Team discussion sessions serve as a means of coordinating the design development, alerting the team of mutual problem areas, and involving all members in each area of the design process.

Be aware that the Engineering Library has been updated to meet the needs of project teams. It has many small group areas with comfortable chairs, white boards, etc. It also has a large screen monitor for practicing presentations. Laptop reservations may be made by calling the Engr Library at 402-472-3411. This is a very good place to work together for presentation practice!

Project Submittal Format:
All written submittal will have the author’s initials in parentheses at the end of each paragraph to signify which team member is responsible for the information. This will enable fair grading of individuals who over- or under-achieve with respect to teamwork activities. All written submittals will be completed using complete sentences, good grammar, spelling and punctuation. Phrases may be used in item lists.

Sources of Project Information:
It will be the responsibility of each team to determine what additional information is necessary for completion of the design project and to obtain this information from the appropriate sources. Prime resources can include:

- RELIABLE internet resources;
- Libraries;
- State and local agencies;
- Public and private practicing civil engineers;
- Product vendors;
- Civil Engineering Department faculty members; and
- Other RELIABLE resources.

Contact with the Project Sponsor:
Design engineers from the City of Lincoln Public Works and Utilities Department are volunteering to sponsor this semester’s project and the staff of the agency has limited time to directly participate in the project development process. To simplify communications, only the assigned project manager will be permitted to ask questions in writing by e-mail which will be submitted to the instructor for review and resolution.
Attendance:

It is expected that all team members will be present at all lectures and lab sessions. Failure to attend all lectures and labs adversely affects the progress of all team members and unfairly gives preference to individuals. Any unexcused absence will result in a 5% deduction in the individual's final grade for EACH OCCURRENCE.

Grading:

Individual letter grades will be determined according to the following percentages. Professional panel evaluators will have some grading input on the final project submittals (45 percent of total grade).

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<th>Grade Based on Individual Performance or Group Performance (all team members receive the same grade)</th>
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Letter Grade Determination:

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CIVE 489H:

Students taking the capstone class as an honors course should make arrangements as soon as possible by e-mail to meet with the instructor to discuss options for honors credit.

Professionalism:

All interactions in CIVE 489/489H will be taken as an opportunity to develop characteristics of successful and respected professionals such as:

- Responsibility;
- Accountability;
- Commitment; and
- Mutual respect for others.
**Academic Honesty:**

Academic honesty is each student’s responsibility. You are responsible for not cheating or plagiarizing and not allowing anyone to copy your work. Academic dishonesty is described in Section 4.2 of the University of Nebraska-Lincoln Student Code of Conduct and Disciplinary Procedures. The Code of Conduct and Disciplinary Procedures are available on the web at [http://stuafs.unl.edu/ia/code/](http://stuafs.unl.edu/ia/code/). If there is evidence of academic dishonesty, the minimum penalty will be a zero for all parties involved for that specific examination, assignment, paper, etc. Evidence of academic dishonesty also may be reported to the Vice Chancellor for Student Affairs in accordance with University guidelines for dealing.

**Distribution of Informed Student Consent Statement:**

The instructor is currently part of the UNL Peer Review of Teaching Project. All students must read, sign and return the Informed Student Consent Statement for understanding of how each individual’s course materials may be used to improve the content and learning objectives associated with the capstone course.
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<td>Erosion Control Design, JB Dixon, Felsburg, Holt and Ullevig</td>
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<td>LRFD Conventional Retaining Wall, Jordan Larsen, NDOR</td>
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<td>5-Apr</td>
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<td>Estimating, Final Details of Deliverables</td>
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<td>26-Apr</td>
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<td>Final Presentations</td>
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<td>Application of Capstone Course Experiences to Future Project Situations</td>
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# APPENDIX B - ASSESSMENT FORMS WITH SAMPLES

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### Milestone Task Team Function Assignments

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**PM = Task Project Manager**  
**SCR = Task Scribe**  
**SUP = Task Support**

1. Mark the appropriate box with an “X” showing CIVE courses that you have completed and are currently enrolled in.

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2. Mark the appropriate box with an "X" showing your skill level related to the use of civil engineering related software products. You may enter a specific software name related to a sub-discipline that you are familiar with that isn't shown in the list.

### CIVIL ENGINEERING RELATED SOFTWARE EXPERTISE

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<td>Other</td>
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</tbody>
</table>

3. If you have had jobs related to subject matter you believe will be involved in this course, please list your employer and a brief description of your duties.

<table>
<thead>
<tr>
<th>Initials</th>
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<th>Brief Job Description</th>
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</table>

4. Put a “1” in the box in front of your favorite CE sub-discipline and a “2” in the box in front of your second preference.

- Environmental
- Hydrology/Water Resources
- Geotechnical
- Transportation
- Structures
- No Specific Interest Area
# CIVIL ENGINEERING SUB-DISCIPLINE COURSES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>Req</th>
<th>Elect</th>
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<tr>
<td>CIVE 326</td>
<td>Intro to Environmental Engineering</td>
<td>X</td>
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<td>Pollution Prevention: Principles and Practices</td>
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<td>Bioremediation of Hazardous Waste</td>
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<td>Special Topics in Structural Engineering</td>
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2. Mark the appropriate box with an “X” showing your skill level related to the use of civil engineering related software products. You may enter a specific software name related to a sub-discipline that you are familiar with that isn’t shown in the list.

<table>
<thead>
<tr>
<th>Software Sub-Discipline</th>
<th>Software Name</th>
<th>Expert User</th>
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<th>Non User</th>
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<td>Other</td>
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<th>Brief Job Description</th>
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<tbody>
<tr>
<td>JC</td>
<td>Kiewit, UNL</td>
<td>Hwy proj design, planning, cost reviews; stormwater quality research</td>
</tr>
<tr>
<td>JD</td>
<td>Olsson</td>
<td>Use MicroStation to assist in project design-transportation</td>
</tr>
<tr>
<td>AK</td>
<td>Allied Surv/Map</td>
<td>Land surveying</td>
</tr>
<tr>
<td>KK</td>
<td>Lamp Rynearson</td>
<td>Traffic intern</td>
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<tr>
<td>NP</td>
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</table>

4. Put a “1” in the box in front of your favorite CE sub-discipline and a “2” in the box in front of your second preference.

- Environmental AK1, JD2
- Hydrology/Water Resources AK2
- Geotechnical JC2
- Transportation KK1, JD1, NP2
- Structures JC1, KK2, NP1
- No Specific Interest Area
TEammate Evaluation Form for Milestone #1: Proposal
Due Friday, February 15th, 2013

This evaluation form assists in understanding how your team is working together as we proceed through each milestone of the project by assessing **your own** performance.

- Write your team name and number in the blanks provided in the first column.
- Write the names of ALL your teammates (including your own) in the first column.
- Put an “X” in the column that, in your opinion, most accurately describes each teammate’s performance (including your own) during the development and completion of Milestone #1.
- Fold the form in half and submit it at 12:30 pm Friday, February 15th.

<table>
<thead>
<tr>
<th>Team Number &amp; Name</th>
<th>Significant team contribution</th>
<th>Adequate team contribution</th>
<th>Below average team contribution</th>
</tr>
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<tbody>
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<tr>
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<thead>
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<th>Team Number &amp; Name</th>
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TEAMMATE EVALUATION FORM FOR MILESTONE #1: PROPOSAL
Due Friday, February 15th, 2013

This evaluation form assists in understanding how your team is working together as we proceed through each milestone of the project by assessing YOUR OWN performance.

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- Put an "X" in the column that, in your opinion, most accurately describes each teammate's performance (including your own) during the development and completion of Milestone #1.
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<tr>
<th>Team Number &amp; Name</th>
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<th>Adequate team contribution</th>
<th>Below average team contribution</th>
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<td>[Name 4]</td>
<td>![Thumb Up] (X)</td>
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</table>
STUDENT FEEDBACK OPPORTUNITY #1

As you know, I’m in the process of trying to improve CIVE 489 to make it the best learning experience possible for you. We are about one third of the way through the semester and I would like to give you an opportunity to provide me with feedback that you think may improve the course, especially since we still have about 2.5 months remaining.

Please thoughtfully answer the questions below so that I may get a better idea of your understanding of the course, your early expectations and any suggestions you may have to make it more rewarding as we continue through the semester. Submit this sheet on Friday, Feb 22nd at 11:30 am.

DO NOT PUT YOUR NAME ON THIS FORM.

1. In your opinion, what is the main objective of this course?

2. List any positive outcomes you have experience so far that may help you in your continued practice of civil engineering after you graduate.

3. List aspects of the course you have experienced so far that could be improved. If you have suggestions for improvement, please include them with your listed items.

4. If this is NOT your last semester in your undergraduate career, do you feel you are able to contribute to teamwork as well as the students who are in their final semester? (If this is your last semester, ignore this question.)

5. If not, how would you suggest the course be changed to better meet your needs? (If this is your last semester, ignore this question.)
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DO NOT PUT YOUR NAME ON THIS FORM.

1. In your opinion, what is the main objective of this course?
   To put us in a team oriented environment to give us a little taste of what the work environment might be like. To give us the expectation of professionalism and collaboration to make a team work and succeed.

2. List any positive outcomes you have experience so far that may help you in your continued practice of civil engineering after you graduate.
   The atmosphere of a team environment in a professional setting has shown me the responsibility involved. Plus, the cohesion of ideas from different types of character from team members has given small challenges to know what other people expect.

3. List aspects of the course you have experienced so far that could be improved. If you have suggestions for improvement, please include them with your listed items.
   I kind of feel like you spoon feed us information we need. Thus not letting us make mistakes, learn, and find our own data which includes our own assumptions. I realize the time table isn’t suitable for a proper 20% plan and maybe that could be the reason. But I feel as an engineer we should make mistakes, retrace our steps to make a successful project.

4. If this is NOT your last semester in your undergraduate career, do you feel you are able to contribute to teamwork as well as the students who are in their final semester? (If this is your last semester, ignore this question.)
   Yeah I think I can, some people have really good memories and can pull calculations out, but I think mostly a little research goes far to put you on the right track.

5. If not, how would you suggest the course be changed to better meet your needs? (If this is your last semester, ignore this question.)
   I kind of expected to be thrown into the “Lion’s Den” so to speak. Yes there are many aspects to the designated project, but I figured this class would fully prepare us to engineer and make design’s work. Essentially have some ups now and get “fired” as opposed to a real life job when it is taken much more seriously.
STUDENT FEEDBACK OPPORTUNITY #1

As you know, I’m in the process of trying to improve CIVE 489 to make it the best learning experience possible for you. We are about one third of the way through the semester and I would like to give you an opportunity to provide me with feedback that you think may improve the course, especially since we still have about 2.5 months remaining.

Please thoughtfully answer the questions below so that I may get a better idea of your understanding of the course, your early expectations and any suggestions you may have to make it more rewarding as we continue through the semester. Submit this sheet on Friday, Feb 22nd at 11:30 am.

DO NOT PUT YOUR NAME ON THIS FORM.

1. In your opinion, what is the main objective of this course?

This course provides students the opportunity to work on a project just as we would when work for an engineering firm after college. It shows us how much time and effort must be put into a project in order to win a big and actually complete the project. Every other engineering class that we have taken just gives us hypothetical problems that we solve by plugging in numbers into a formula. This class allows us to work on a project hands on and actually design something which will be what we do for our careers.

2. List any positive outcomes you have experience so far that may help you in your continued practice of civil engineering after you graduate.

I think the entire class has been a positive outcome for me. I am not graduating this spring and haven’t had any engineering internships yet due to conflicts of schedule and studying abroad. This class has already been a great thing to discuss with employers while searching for an internship this summer. I am also project manager right now and I think it is a great idea to make each student be the project manager to see the challenges they face, but to also see if we would want to be a project manager in the future. I have become much closer with the people in my group and it has been great being able to talk about different engineering aspects and outlooks with each group member. I feel like I have always been a team player, but this will help me work better in engineering teams in the future.

3. List aspects of the course you have experienced so far that could be improved. If you have suggestions for improvement, please include them with your listed items.

I think it would be a great idea to pass on information about Google Docs to future students in this class. Our group has been using Google Docs to work on our entire project without having to all meet together. It allows multiple users from different locations to edit a document at the same time while automatically saving the document. From talking with most groups, they just use word and usually have to meet up frequently or have to send in partial word documents and have one person compile them together.

It is much more helpful to have a handout of what is due each week especially when you are the project manager because you not only have your own homework, but the groups homework as well to turn in and sometimes like this past week it would be very hard to remember what needs to be done.

Other than that I think you have mastered how to teach this course. You are the perfect instructor for this class. You do a great job keeping everyone attentive while providing us with a great number of
helpful background information that might be useful to us. Thank you for taking the time to teach this class!

4. If this is NOT your last semester in your undergraduate career, do you feel you are able to contribute to teamwork as well as the students who are in their final semester? (If this is your last semester, ignore this question.)

I believe that I can contribute about as well as the students who are in their final semester. I only have two or three engineering classes left to take so I am not very far behind the others. Of course, I would be able to contribute better if I had those two or three classes under my belt, but I believe I can do just as must as the other students.

5. If not, how would you suggest the course be changed to better meet your needs? (If this is your last semester, ignore this question.)

The only way I can think of to fix the issue about not contributing as well as other students is to make it impossible to sign up for this class unless you are in your final semester OR until you have taken “X” amount of prerequisite engineering classes.
TEammate Evaluation Form for Milestone #2: Determination of Design Controls and Criteria
Due Friday, March 8th, 2013

This evaluation form assists in understanding how your team is working together as we proceed through each milestone of the project by assessing your own performance.

- Write your team name and number in the blanks provided in the first column.
- Write the names of ALL your teammates (including your own) in the first column.
- Put an “X” in the column that, in your opinion, most accurately describes each teammate’s performance (including your own) during the development and completion of Milestone #2.
- Fold the form in half and submit it at 12:30 pm Friday, March 8th.

<table>
<thead>
<tr>
<th>Team Number &amp; Name</th>
<th>Significant team contribution</th>
<th>Adequate team contribution</th>
<th>Below average team contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>![Thumb Up]</td>
<td>![Thumb Up]</td>
<td>![Thumb Down]</td>
</tr>
<tr>
<td>Team Members</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Teammate Evaluation Form for Milestone #2:
**Determination of Design Controls and Criteria**

**Due Friday, March 8\textsuperscript{th}, 2013**

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<th>Below average team contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingman Designs</td>
<td>![Thumbs Up]</td>
<td>![Happy Face]</td>
<td>![Sad Face]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Team Members</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andy Kingman</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kathleen Kasski</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Noah Pitts</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jesse Coefy</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jordan Ustalis</td>
<td>X</td>
<td></td>
<td></td>
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**TEammate Evaluation Form for Milestone #2: Determination of Design Controls and Criteria**

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<td>![Thumbs Up]</td>
<td>![Neutral]</td>
<td>![Thumbs Down]</td>
</tr>
<tr>
<td>Team Members</td>
<td>![Thumbs Up]</td>
<td>![X]</td>
<td>![X]</td>
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<td></td>
<td>![X]</td>
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<td></td>
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<td>![X]</td>
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Team Development Evaluation, Week 10 of 15

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- Circle the descriptions that best describe how your team is functioning at this point in the semester.
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<thead>
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<th>Stage III</th>
<th>Stage IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>collection (1)</td>
<td>group (2)</td>
<td>developing team (3)</td>
<td>high-performing team (4)</td>
</tr>
</tbody>
</table>

- People are cautious, guarded, wondering
- Little visible disagreement
- Lacks an identity
- Little investment in the group
- Watching for the norms here to see what is okay or expected of members.

- Developing identity, purpose, interest
- People are taking risks and getting to know one another
- Conflict is in fits and starts, nonproductive.
- High level of frustration and/or confusion
- Pairing and cliques

- Developing goals, roles, relationships
- Learning to appreciate the differences in people
- Conflict is usually on issues, not about egos.
- Communication open and clear
- Sense of belonging
- Sense of progress
- Enjoying work

- Acting on common goals with synergy
- High morale
- High productivity
- Easy shifting of roles from one to another
- Differences are valued
- Looking out for one another's interests
- Spontaneous collaborative efforts
- Sharing of all relevant information
- Conflict is frequent, often looks like problem solving.
| Team Name | Fine Line | Team Number | 5 |

<table>
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<td>High level of frustration and/or confusion</td>
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<tr>
<td>Watching for the norms here to see what is okay or expected of members.</td>
<td>Pairing and cliques</td>
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</tr>
<tr>
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**Synergy** 5A 1 A D SD NC
Team Development Evaluation, Week 10 of 15

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<tr>
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<tbody>
<tr>
<td>Prime</td>
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</tr>
<tr>
<td>People are cautious</td>
<td>Developing identity</td>
<td>Developing goals</td>
<td>Acting on common goals with synergy</td>
</tr>
<tr>
<td>guarded</td>
<td>purpose</td>
<td>roles</td>
<td>high morale</td>
</tr>
<tr>
<td>wondering</td>
<td>interest</td>
<td>relationships</td>
<td>high productivity</td>
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<tr>
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</tr>
<tr>
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<td>and getting to know one another</td>
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Team Development Evaluation, Week 15 of 16

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Synergy in terms of management and in relation to team working refers to the combined effort of individuals as participants of the team. Positive synergy has effects such as improved efficiency in operations, greater exploitation of opportunities, and improved utilization of resources.

I believe my team was a good example of positive synergy at the end of the semester.

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ No Comment
Team Development Evaluation, Week 15 of 16

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### Team Name: Fine Line Designs  
Team Number: 5

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☑ Strongly agree  ☐ Agree  ☐ Disagree  ☐ Strongly Disagree  ☐ No Comment
Team Development Evaluation, Week 15 of 16

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| Team Name | Prime Engineering | Team Number | #7 |

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I believe my team was a good example of positive synergy at the end of the semester.

- [ ] Strongly agree
- [X] Agree
- [ ] Disagree
- [ ] Strongly Disagree
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Below are course objectives outlined in the syllabus the first day of class. Check the appropriate “grade” to estimate your level of preparedness to achieve the given objective both on the first day of class and at the semester’s end (today).

**DO NOT WRITE YOUR NAME ON THIS EVALUATION SHEET.**

*A: Very well prepared ➔ F: Totally unprepared*

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Your Ability “Grade”* Jan 11, 2013</th>
<th>Your Ability “Grade”* April 19th, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify key issues and stakeholders related to an infrastructure project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propose sustainable solutions, outlining their potential benefits and detriments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflect upon, review and implement previous course work to accomplish a shift from passive knowledge receiver to constructor of meaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop an RFP written proposal and accompanying “sales” presentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outline sequential elements of the entire civilian infrastructure project life-cycle with an emphasis on design features to determine critical path time line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify design controls and criteria upon which to base design decisions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Become a highly-functional, contributing member of a design team tasked to plan, schedule and conduct specific sub-disciplinary design roles associated with the successful completion of civilian infrastructure system project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Meeting agendas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design criteria memorandums</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project displays and brochures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Preliminary construction plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentation slides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral technical presentation</td>
<td></td>
<td></td>
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<tr>
<td>Technical written report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design system calculations</td>
<td></td>
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</tr>
<tr>
<td>Accomplish key performances that will result in enduring understanding that develops as a result of ongoing inquiry and rethinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apply newly acquired knowledge to situations beyond the boundaries of the semester’s project</td>
<td></td>
<td></td>
</tr>
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</table>
CIVE 489 – Student Evaluation of Course Objective Achievement  
Spring 2013

Below are course objectives outlined in the syllabus the first day of class. Check the appropriate “grade” to estimate your level of preparedness to achieve the given objective both on the first day of class and at the semester’s end (today).  
DO NOT WRITE YOUR NAME ON THIS EVALUATION SHEET.

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<td>Technical written report</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Design system calculations</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Accomplish key performances that will result in enduring understanding that develops as a result of ongoing inquiry and rethinking</td>
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</tr>
<tr>
<td>Apply newly acquired knowledge to situations beyond the boundaries of the semester’s project</td>
<td>X</td>
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</tbody>
</table>
Below are course objectives outlined in the syllabus the first day of class. Check the appropriate "grade" to estimate your level of preparedness to achieve the given objective both on the first day of class and at the semester's end (today).

DO NOT WRITE YOUR NAME ON THIS EVALUATION SHEET.

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Your Ability &quot;Grade&quot;** Jan 11, 2013</th>
<th>Your Ability &quot;Grade&quot;** April 19th, 2013</th>
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<tbody>
<tr>
<td>Identify key issues and stakeholders related to an infrastructure project</td>
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<tr>
<td>Propose sustainable solutions, outlining their potential benefits and detriments</td>
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<tr>
<td>Reflect upon, review and implement previous course work to accomplish a shift from passive knowledge receiver to constructor of meaning</td>
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</tr>
<tr>
<td>Develop an RFP written proposal and accompanying &quot;sales&quot; presentation</td>
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<tr>
<td>Outline sequential elements of the entire civilian infrastructure project life-cycle with an emphasis on design features to determine critical path time line</td>
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<tr>
<td>Identify design controls and criteria upon which to base design decisions</td>
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<td></td>
</tr>
<tr>
<td>Become a highly-functional, contributing member of a design team tasked to plan, schedule and conduct specific sub-disciplinary design roles associated with the successful completion of civilian infrastructure system project</td>
<td></td>
<td></td>
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<tr>
<td>Preparation of Meeting agendas</td>
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<tr>
<td>Meeting minutes</td>
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<td>Design criteria memorandum</td>
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<tr>
<td>Project displays and brochures</td>
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<tr>
<td>Preparation of Preliminary construction plans</td>
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<td>Presentation slides</td>
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<td>Oral technical presentation</td>
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CIVE 489 SENIOR DESIGN PROJECT
Spring 2013

Professional Reviewer Evaluation of Student Team Presentation

Group Name: ________________________________________________________________

Reviewer Name: ____________________________________________________________

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The presentation was well organized with objectives and recommendations clearly stated.</td>
<td>10</td>
<td>9</td>
<td>8</td>
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<tr>
<td>2. The speakers maintained reasonable eye contact and minimally relied upon notes or the laptop screen.</td>
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<tr>
<td>3. The visuals were well prepared, readable, and appropriate for the subject.</td>
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<td>4. The speakers answered questions adequately and/or spoke clearly.</td>
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<td>9</td>
<td>8</td>
<td>7</td>
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Notes/Questions/Comments/Suggestions:

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________________________________________________________________________
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<table>
<thead>
<tr>
<th>Project Identification Number</th>
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<tbody>
<tr>
<td>1. Display Appearance         1-10 points</td>
</tr>
<tr>
<td>2. Project Technical Difficulty</td>
</tr>
<tr>
<td>a. problem statement/background information</td>
</tr>
<tr>
<td>i. problem statement is adequately displayed 1-10 points</td>
</tr>
<tr>
<td>ii. clarity of requirements 1-10 points</td>
</tr>
<tr>
<td>iii. technical challenge 1-10 points</td>
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<tr>
<td>b. research and development difficulty 1-10 points</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>c. knowledge and ability to answer questions 1-10 points</td>
</tr>
<tr>
<td>4. Overall Impression         1-10 points</td>
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TOTAL out of 100 points

Comments

Project #____

Project #____

Project #____

Project #____

Judge’s Name:
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<tr>
<th>Table Number</th>
<th>Project Name (Undergraduate)</th>
<th>Team Contact</th>
<th>Department</th>
<th>Place</th>
<th>Score</th>
<th>Best/Worst Teams</th>
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<td>216</td>
<td>Old Cheney Road Improvements, 70th to 84th Streets</td>
<td>Leah Kottwitz</td>
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<td>Rachel Plessing</td>
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<td>Kortney Kosiski</td>
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<td>Kari Parke</td>
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# E-Week Open House Senior Design Project Score Sheet

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<td>Problem statement/background information</td>
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<tr>
<td>Integration/construction difficulty</td>
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<td></td>
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<tr>
<td>TOTAL out of 100 points</td>
<td>24</td>
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</tbody>
</table>

**Comments**

**Project #209**
- 1) Avoided technology due to cost. 2) New layout could be challenging. 3) New process is a large improvement. 4) Display board items were small and hard to read. 5) Verbal presentation did not clearly state the objective.

**Project #210**
- 1) Verbal presentation was confusing due to all three presenters jumping in to talk at once.
- 2) Display board told the story well.

**Project #211**
- 1) Display board was clear and understandable.
- 2) A couple of decisions made in design were not backed up with solid data or reasoning, i.e. use of pervious concrete would not be constant slope on first portion of roadway.

**Project #212**
- 1) Display was organized and clear.
- 2) Verbal presentation was clear and professional.
- 3) Good reasoning for decisions made was given.

Judge's Name: Kurt Palik
<table>
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<th>Project Identification Number</th>
<th>209</th>
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<tbody>
<tr>
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<tr>
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<td>33</td>
<td>36</td>
<td>36</td>
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</tbody>
</table>

Comments

Project # 209 - Need to consider technologies impact on the solution
- Good job staying in contact with customer

Project # 210 - Good photos
- Good job working with client and union facility
- Need to not underestimate value of items - like space for United Way

Project # 211 - Good job considering people & bike trails
- Good job looking for new technology applications - porous concrete & wall designs
- Need to do more to monitor cost/budget

Project # 212 - Good display & presentation of road way
- Need to make sure & consider new technologies
- Need to do more to monitor cost/budget

Judge's Name: Chad Nagawick
# E-Week Open House Senior Design Project Score Sheet

<table>
<thead>
<tr>
<th>Project Identification Number</th>
<th>213</th>
<th>214</th>
<th>215</th>
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</tbody>
</table>

**TOTAL out of 100 points**

## Comments

**Project #213**

EXCELLENT PRESENTATION - ALL ENGAGED AND ASKING QUESTIONS - VERY GOOD PRESENTATION

**Project #214**

VERY GOOD PRESENTATION - ALL MEMBERS ENGAGED, VERY REASONABLE

**Project #215**

VERY GOOD PRESENTATION - AN UNLUCKY DISCUSSION USE OF GOOGLE DOES TO CATEGORIZE

**Project #216**

GOOD PRESENTATION - NEED TO HAVE ALL MEMBERS ENGAGE IN PRESENTATION

**Judge’s Name:** Patricia Hanrahan
# E-Week Open House Senior Design Project Score Sheet

<table>
<thead>
<tr>
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<td>47</td>
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</table>

**Comments**

Project #213: Good overall, hands in pockets, talking into board. Keep eye contact. Speculate or answer if not known.

Project #214: Good presentation. Speculate on answer if not known.

Project #215: Good speaking. Good knowledge of project details. Problem statement on board not defined large enough.


**Judge's Name:** Mark Albrecht
# E-Week Open House Senior Design Project Score Sheet

<table>
<thead>
<tr>
<th>Project Identification Number</th>
<th>227</th>
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## Comments

Project #227
Good presentation, but problem statement information a little blurry. Very professional in presenting. Answered all questions well. Blended specialization knowledge very well and were overall impressive.

Project #228
Good presentation, nice spin for the humanitarian benefit. No real depth as to whether it will be paid for. Very informed towards the needs of the end user. Nice to see there was design work done. Very professional and informed group.

Project #229
Very good presentation, somewhat undefined outcome, but seemed to be due to lack of help from LI-CSR. Answered all questions well and were very pleasant. Presentation was very upbeat and...

Project #

Judge’s Name: Ryan Hume

34
# E-Week Open House Senior Design Project Score Sheet

<table>
<thead>
<tr>
<th>Project Identification Number</th>
<th>227</th>
<th>228</th>
<th>229</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Display Appearance</strong></td>
<td>1-5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>2. Project Technical Difficulty</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. problem statement/background information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. problem statement is adequately displayed</td>
<td>1-10 points</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ii. clarity of requirements</td>
<td>1-10 points</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>iii. technical challenge</td>
<td>1-10 points</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>b. research and development difficulty</td>
<td>1-10 points</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>c. integration/construction difficulty</td>
<td>(Is this a feasible and applicable design?)</td>
<td>1-10 points</td>
<td>3</td>
</tr>
<tr>
<td><strong>3. Verbal and Visual Presentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. professional image of presenters</td>
<td>1-10 points</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>b. verbal communication of results</td>
<td>1-10 points</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>c. knowledge and ability to answer questions</td>
<td>1-10 points</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>4. Overall Impression</strong></td>
<td>1-10 points</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL out of 100 points</strong></td>
<td></td>
<td>27</td>
<td>42</td>
</tr>
</tbody>
</table>

## Comments

**Project #227**

Biggest question I had was "What is the problem you are trying to solve" Person was inconsistent.

**Project #228**

Interesting idea and well researched. I would have liked to see testing of temperature and flow through copper pipe in compost to prove feasible.

**Project #229**

Good presentation, good ideas. Well researched. Be nice to see figures in dollars saved if available.

**Project #___**

Judge's Name: **DAN PETERSON**
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department

Team Name and Number: ________________________________

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5–Strongly Agree  4–Agree  3–Somewhat Agree  2–Disagree  1–Strongly Disagree  NA–Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.
Rating: ______
Comments: ____________________________________________
__________________________________________________________
__________________________________________________________

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.
Rating: ______
Comments: ____________________________________________
__________________________________________________________
__________________________________________________________

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.
Rating: ______
Comments: ____________________________________________
__________________________________________________________
__________________________________________________________

36
4. The design team used current design methodology, reliable resources and recent practitioner code manuals to design environmental, geotechnical, structural, transportation and water resource elements of their project.

Rating: ______
Comments: _____________________________________________
__________________________________________________________

5. The design team was well prepared for their presentation, displayed confidence in their engineering solutions and exhibited a strong sense of teamwork.

Rating: ______
Comments: _____________________________________________
__________________________________________________________

6. The design team explained engineering concepts accurately and effectively using audience-appropriate verbal, written, virtual and graphical means expected of entry level engineers or graduate students.

Rating: ______
Comments: _____________________________________________
__________________________________________________________

7. The design demonstrated a high level of engineering and technical competency expected of entry level engineers or graduate students.

Rating: ______
Comments: _____________________________________________
__________________________________________________________

8. If you have additional comments, please write them here.

_______________________________________________________________________
_______________________________________________________________________
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_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department
Team Name and Number: JPAc

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5–Strongly Agree 4–Agree 3–Somewhat Agree 2–Disagree 1–Strongly Disagree NA–Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.
Rating: 4
Comments: ____________________________ ____________________________

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.
Rating: 4
Comments: ____________________________ ____________________________

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.
Rating: 4
Comments: Good job discussing project stakeholders and construction phasing.
4. The design team used current design methodology, reliable resources and recent practitioner code manuals to design environmental, geotechnical, structural, transportation and water resource elements of their project.
Rating: 5
Comments: __________________________________________
__________________________________________________________________________

5. The design team was well prepared for their presentation, displayed confidence in their engineering solutions and exhibited a strong sense of teamwork.
Rating: 6
Comments: Team seemed confident in their knowledge of the subjects + well prepared to explain
__________________________________________________________________________

6. The design team explained engineering concepts accurately and effectively using audience-appropriate verbal, written, virtual and graphical means expected of entry level engineers or graduate students.
Rating: 5
Comments: Presentation + report were well written, thorough + easy to follow
__________________________________________________________________________

7. The design demonstrated a high level of engineering and technical competency expected of entry level engineers or graduate students.
Rating: 4
Comments: __________________________________________
__________________________________________________________________________

8. If you have additional comments, please write them here.
Great Job! Very impressed with quality of deliverables!

__________________________________________________________________________
__________________________________________________________________________
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department
Team Name and Number: Kemp Engineering

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5–Strongly Agree  4–Agree   3–Somewhat Agree  2–Disagree  1–Strongly Disagree  NA–Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.

Rating: 4
Comments: 

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.

Rating: 4
Comments: 

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.

Rating: 4
Comments: Good job discussing permanent traffic control (signal & stop sign controlled) and identifying concerns of project stakeholders.
4. The design team used current design methodology, reliable resources and recent practitioner code manuals to design environmental, geotechnical, structural, transportation and water resource elements of their project.
Rating: 5
Comments: 

5. The design team was well prepared for their presentation, displayed confidence in their engineering solutions and exhibited a strong sense of teamwork.
Rating: 5
Comments: Team appeared well prepared & confident in their delivery

6. The design team explained engineering concepts accurately and effectively using audience-appropriate verbal, written, virtual and graphical means expected of entry level engineers or graduate students.
Rating: 5
Comments: Great job explaining the drainage areas. Presentation & report were well thought out and easy to follow

7. The design demonstrated a high level of engineering and technical competency expected of entry level engineers or graduate students.
Rating: 4
Comments: 

8. If you have additional comments, please write them here.
Great job on presentation & project deliverables!
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department
Team Name and Number: Flatwater Engineering

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5—Strongly Agree  4—Agree  3—Somewhat Agree  2—Disagree  1—Strongly Disagree  NA—Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.
Rating: __4__
Comments: ________________________________
______________________________
______________________________

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.
Rating: __4__
Comments: ________________________________
______________________________
______________________________

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.
Rating: __4__
Comments: Good job identifying key project issues and proposed solutions ________________________________

v2
4. The design team used current design methodology, reliable resources and recent practitioner code manuals to design environmental, geotechnical, structural, transportation and water resource elements of their project.

Rating: 
Comments: 

5. The design team was well prepared for their presentation, displayed confidence in their engineering solutions and exhibited a strong sense of teamwork.

Rating: 
Comments: 

6. The design team explained engineering concepts accurately and effectively using audience-appropriate verbal, written, virtual and graphical means expected of entry level engineers or graduate students.

Rating: 
Comments: Good use of pictures & model outputs to help convey message.

7. The design demonstrated a high level of engineering and technical competency expected of entry level engineers or graduate students.

Rating: 
Comments: 

8. If you have additional comments, please write them here.

Good job!
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department
Team Name and Number: Engineering 720 (Team 4)

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5—Strongly Agree  4—Agree  3—Somewhat Agree  2—Disagree  1—Strongly Disagree  NA—Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.
Rating: 4
Comments: Overall - Nice Design. Might look at Inlet spacing - seems like the inlets are farther apart than what I'd expect. Also, in tight Right-of-Way situations like this consider designing the retaining wall footing under the sidewalk - saves on earthworks and easements/right-of-way

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.
Rating: 5
Comments: Nice job designing the project using appropriate standards

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.
Rating: 5
Comments: I liked how you thought out of the box and were proposing to potentially utilize the retaining wall. Just need to consider maintenance when doing this.
4. The design team used current design methodology, reliable resources and recent practitioner code manuals to design environmental, geotechnical, structural, transportation and water resource elements of their project.
Rating: 5
Comments: Technical manuals are formatted so that all information is presented clearly. Team did a great job utilizing appropriate design resources.

5. The design team was well prepared for their presentation, displayed confidence in their engineering solutions and exhibited a strong sense of teamwork.
Rating: 5
Comments: Great job on your presentation and introducing your team. Nice that you considered surrounding areas instead of focusing on "the box" of the project.

6. The design team explained engineering concepts accurately and effectively using audience-appropriate verbal, written, virtual and graphical means expected of entry level engineers or graduate students.
Rating: 4
Comments: Report could have used a little more graphics to break up the text.

7. The design demonstrated a high level of engineering and technical competency expected of entry level engineers or graduate students.
Rating: 5
Comments: Nice job!

8. If you have additional comments, please write them here.
   Good executive summary in presentation packet
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department
Team Name and Number: Prime Engineering (Team F)

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5–Strongly Agree 4–Agree 3–Somewhat Agree 2–Disagree 1–Strongly Disagree NA–Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.
Rating: 4
Comments: Overall good design. Look at spacing of inlets - seems like they are farther apart than what I'd expect. Also, consider placing retaining wall footing on underside of sidewalk in situations with tight spaces to save on backwork and right-of-way costs

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.
Rating: 4
Comments: Good use of standards. I suggest showing the underpass on the plan/profile sheets to show how it will connect to the trail and sidewalk system

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.
Rating: 5
Comments: Nice job referencing to City's Comp Plan in the presentation. It’s important to know what will be happening in the area in the near and long-term futures

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4. The design team used current design methodology, reliable resources and recent practitioner code manuals to design environmental, geotechnical, structural, transportation and water resource elements of their project.

Rating: 4

Comments: You mentioned in presentation the wall is to be placed at 47.5' from C with a 2:1 slope. Be mindful of clear zone and slight distance/shift distance in relation to wall. Also, with a wall of this height maintenance of a 2:1 slope will be dangerous for adjacent owners.

5. The design team was well prepared for their presentation, displayed confidence in their engineering solutions and exhibited a strong sense of teamwork.

Rating: 4

Comments: Nice work!

6. The design team explained engineering concepts accurately and effectively using audience-appropriate verbal, written, virtual and graphical means expected of entry level engineers or graduate students.

Rating: 4

Comments: Nice job thinking of the SWPPP and utilizing BMP's in environmental design.

7. The design demonstrated a high level of engineering and technical competency expected of entry level engineers or graduate students.

Rating: 4

Comments: Nice work!

8. If you have additional comments, please write them here. (As Appropriate)

I usually like to add graphics or photos to reports to break up the technical text.
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department
Team Name and Number: Fine Line Designs (Team 5)

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5—Strongly Agree  4—Agree  3—Somewhat Agree  2—Disagree  1—Strongly Disagree  NA—Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.
Rating: 4
Comments: Overall nice design. Good job on design of median boxes. Look at inlet spacing and locations. Also, need to consider how box culvert undercrossing will transition back to street level. You will likely need to have additional right of way to accomplish this.

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.
Rating: 5
Comments: Geometrics were good—tapers were designed appropriately.

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.
Rating: 5
Comments: Nice job balancing all aspects of the project to form a good design. (i.e. having plant materials at a height less than driver's eye)

48
4. The design team used current design methodology, reliable resources and recent practitioner
code manuals to design environmental, geotechnical, structural, transportation and water
resource elements of their project.
Rating: _5_
Comments: TECHNICAL MEMOS ARE CLEARLY FORMATTED WITH ASSUMPTIONS
AND RESOURCES USED. THESE ALL SEEMED TO BE USED APPROPRIATELY

5. The design team was well prepared for their presentation, displayed confidence in their
engineering solutions and exhibited a strong sense of teamwork.
Rating: _5_
Comments: FANTASTIC PRESENTATION! YOU DID A FANTASTIC JOB SHOWING
TEAM UNITY IN YOUR PRESENTATION.

6. The design team explained engineering concepts accurately and effectively using audience-
appropriate verbal, written, virtual and graphical means expected of entry level engineers or
graduate students.
Rating: _4_
Comments: NICE WORK- I JUST SUGGEST TRYING TO INCORPORATE
A FEW GRAPHICS WHERE APPROPRIATE IN THE TECHNICAL MEMO
TO BREAK UP THE TEXT.

7. The design demonstrated a high level of engineering and technical competency expected of
entry level engineers or graduate students.
Rating: _5_
Comments: NICE JOB!

8. If you have additional comments, please write them here.

WHEN DESIGNING IN FUTURE, ALWAYS REMEMBER MAINTENANCE COSTS
AND NEEDS - THESE COSTS ADD UP OVER TIME.
CIVE 489 Senior Design Team Project Evaluation for Professional Practitioner Reviewers

Project: Old Cheney Road, 70th to 84th Streets, Lincoln, NE
Semester: Spring 2013
Instructor: Karen Schurr
Client: City of Lincoln Public Works and Utilities Department
Team Name and Number: KINGMAN DESIGNS (Team 1)

Please rate and comment on the competencies of senior civil engineering students to meet the expectations of entry level practicing engineers or graduate students in the following areas:

Ratings:
5—Strongly Agree 4—Agree 3—Somewhat Agree 2—Disagree 1—Strongly Disagree NA—Not Applicable

1. The design team demonstrated a mastery of fundamental science and mathematics.
Rating: 4
Comments: LOOK AT INCL SPACING AND LOCATIONS. SEEMS LIKE THE SPACING SHOULD BE CLOSER TOGETHER. MAY WANT TO LOOK AT AN ALTERNATE FOOTING DESIGN FOR RETAINING WALL TO MINIMIZE EARTHWORK AND RIGHT-OF-WAY EXPENSES.

2. The design team was able to apply essential civil engineering related science, perform analyses and problem solve issues relevant to the project.
Rating: 4
Comments: NICE JOB INCORPORATING YOUR PUBLIC INVOLVEMENT IN THE PROJECT. THE "SOFT SIDE" OF ENGINEERING IS JUST AS IMPORTANT AS TECHNICAL COMPETENCE.

3. The design team’s approach and resolution of project issues adequately addresses professional ethics, public safety, social concerns, environmental impacts and overall sustainability.
Rating: 4
Comments: LANE WIDTHS ARE LESS THAN MINIMUM STANDARDS AND SHOULD BE 11' ABSOLUTE MINIMUM FOR THIS MATERIAL. LEFT-TURN STORAGE LENGTHS WERE GOOD. BAY GARDENS WERE DESIGNED APPROPRIATELY BUT NEED TO CONSIDER MAINTENANCE IN MEDIANS, ESPECIALLY WITH HEAVY SALT USE IN WINTER.
4. The design team used current design methodology, reliable resources and recent practitioner code manuals to design environmental, geotechnical, structural, transportation and water resource elements of their project.

Rating: 4

Comments: Underpass height minimum is 8' and we typically design height at 10', so a bicyclist will be comfortable going through it. Also, parking lot uses small vehicles to go through boxes during maintenance and snow removal.

5. The design team was well prepared for their presentation, displayed confidence in their engineering solutions and exhibited a strong sense of teamwork.

Rating: 5

Comments: Very nice presentation. Good job explaining goals of the project.

6. The design team explained engineering concepts accurately and effectively using audience-appropriate verbal, written, virtual and graphical means expected of entry level engineers or graduate students.

Rating: 4

Comments: Nice job preparing your presentation and documents.

7. The design demonstrated a high level of engineering and technical competency expected of entry level engineers or graduate students.

Rating: 4

Comments: Nice job.

8. If you have additional comments, please write them here.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>High Proficiency</th>
<th>Proficiency</th>
<th>Some Proficiency</th>
<th>No/Limited Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>• Purpose is very clear</td>
<td>• Purpose is fairly clear</td>
<td>• Purpose is somewhat vague.</td>
<td>• Audience cannot determine purpose.</td>
</tr>
<tr>
<td>Organization</td>
<td>• Introduction effectively gains audience attention.</td>
<td>• Introduction is somewhat interesting.</td>
<td>• Introduction is vague.</td>
<td>• Introduction is missing, unclear, or inappropriate.</td>
</tr>
<tr>
<td></td>
<td>• Main points are well organized.</td>
<td>• Sequence of ideas could be improved.</td>
<td>• Sequence of ideas shows some signs of logical organization.</td>
<td>• Main points are unclear.</td>
</tr>
<tr>
<td></td>
<td>• Details fully support the thesis.</td>
<td>• More supporting details are needed.</td>
<td>• Supporting details are lacking.</td>
<td>• Thesis is not supported.</td>
</tr>
<tr>
<td></td>
<td>• Conclusion provides thoughtful evaluation.</td>
<td>• Conclusion could be stronger.</td>
<td>• Conclusion is abrupt and fails to provide strong evaluation.</td>
<td>• Conclusion is missing or ineffective in drawing conclusions.</td>
</tr>
<tr>
<td>Clarity</td>
<td>• Information is presented in a logical, interesting manner.</td>
<td>• Information presented is mostly logical and interesting.</td>
<td>• Information presented is disjointed and not completely relevant.</td>
<td>• Information presented is unclear and uninteresting.</td>
</tr>
<tr>
<td></td>
<td>• Explanation of key concepts is easy to understand.</td>
<td>• Explanation of concepts is incomplete or inaccurate.</td>
<td>• Key concepts are confusing.</td>
<td>• Key concepts are not explained.</td>
</tr>
<tr>
<td></td>
<td>• Language is tailored to audience.</td>
<td>• Most language is tailored to audience.</td>
<td>• Language used is too complex or simplistic for audience.</td>
<td>• Language used is not sophisticated or appropriate.</td>
</tr>
<tr>
<td></td>
<td>• Key terms are clearly defined.</td>
<td>• Key terms need more explanation.</td>
<td>• Key terms are not explained.</td>
<td>• Key terms are not defined.</td>
</tr>
<tr>
<td>Content depth,</td>
<td>• Development of ideas is thorough and logical.</td>
<td>• Ideas presented offer solid but less original thought</td>
<td>• Ideas are obvious, unoriginal, or too broad.</td>
<td>• Idea development is simplistic, undeveloped, or cryptic.</td>
</tr>
<tr>
<td>support, and accuracy</td>
<td></td>
<td>and reasoning.</td>
<td></td>
<td>• Few relevant details are given.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Too detailed for audience, or not detailed enough.</td>
<td></td>
<td>• Support for main points is inappropriate, off topic, too general, or faulty.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Main points are somewhat supported by details/examples.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research effort,</td>
<td>• Provides evidence of good research.</td>
<td>• Shows evidence of some research using varied sources.</td>
<td>• Uses relevant sources but lacks in variety.</td>
<td>• Neglects important sources.</td>
</tr>
<tr>
<td>incorporation, and</td>
<td></td>
<td>• Uses source ideas more than own ideas.</td>
<td>• Uses source information as basis or substitute for own ideas.</td>
<td>• Uses source information instead of developing own ideas.</td>
</tr>
<tr>
<td>documentation</td>
<td></td>
<td>• Most sources are cited properly.</td>
<td>• Sources are not identified or cited.</td>
<td>• Uses source material without proper citations.</td>
</tr>
<tr>
<td>Use of communication</td>
<td>• Graphics reinforce presentation thesis and maximize audience understanding.</td>
<td>• Graphics are somewhat supportive and helpful, but more</td>
<td>• Graphics are minimally effective in supporting the thesis and audience.</td>
<td>• Graphics are not used or are ineffective.</td>
</tr>
<tr>
<td>aids</td>
<td></td>
<td>are needed.</td>
<td>• Media are somewhat professional and effectively incorporated.</td>
<td>• Media are unprofessional, unexplained, or not used appropriately.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Media are mostly professional and effectively incorporated.</td>
<td>• PowerPoint is used but could be used more effectively.</td>
<td>• PowerPoint is used ineffectively.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• PowerPoint is used but could be used more effectively.</td>
<td>• PowerPoint is used as a backbone for the presentation rather than an aid.</td>
<td>• Visual aids are missing or completely inappropriate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Only a few types of visual aids are used.</td>
<td>• Visual aids are minimal and not easy to see.</td>
<td>• Visual aids are too small or lack creativity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visual aids are good and can be seen by most of the</td>
<td>• Data is presented but needs to be clearer and more effective.</td>
<td>• Data is not presented at all or is unclear and ineffective.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>audience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Presentation of data is adequate.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Use of Language
- Terms are used and pronounced correctly.
- Uses rich, precise vocabulary and correct grammar.
- Sentences are logical and flow together easily.
- Most terms are used and pronounced correctly.
- Vocabulary and grammar are, for the most part, well used.
- Sentences are mostly logical and flow together.
- Some important terms are mispronounced or misused.
- Uses improper vocabulary and/or grammar at times.
- Illogical sentences interrupt the flow of the presentation in places.
- Important terminology is missing, mispronounced, or misused.
- Vocabulary and/or grammar are inappropriate or poor.
- Sentences are illogical and create a choppy presentation.

### Delivery
- Speaker shows confidence/comfort in front of the group.
- Speaker is very well prepared.
- Speaker displays enthusiasm for the topic and project.
- Presentation is delivered extemporaneously.
- Speaker maintains effective eye contact throughout the presentation.
- Demonstrates excellent use of gestures, movement, and body language that do not detract from the message.
- Completely avoids verbal fillers/distractions (uh, um, well, etc.).
- Presentation is well paced while taking the necessary time to be thorough.
- Use of voice (volume/articulation/variety) enhances the presentation.
- Personal appearance is completely appropriate for the occasion and audience.
- Speaker is somewhat comfortable with the group.
- Speaker is mostly prepared.
- Speaker displays adequate interest in the topic.
- Speaker uses notes quite a bit but still delivers a smooth presentation.
- Eye contact is maintained through most of the presentation.
- Some gesturing and movement are used to convey the message.
- Uses a few verbal fillers
- Pace of presentation is a bit fast or slow.
- Voice is used to give some variety and effect to the presentation.
- Personal appearance is mostly appropriate.
- Speaker appears uncomfortable and nervous.
- Speaker is somewhat unprepared.
- Speaker displays mild interest in the topic.
- Speaker relies entirely on notes throughout presentation.
- Eye contact with the audience is minimal throughout.
- Speaker uses minimal or distracting gesturing or movement.
- Uses enough verbal fillers that they become distracting.
- Pace is very fast or very slow.
- Volume and/or articulation are inappropriate and ineffective.
- Personal appearance is not completely appropriate and distracts from the presentation.
- Speaker shows no confidence or comfort in front of the group.
- Speaker is not prepared.
- Speaker shows little interest in the topic.
- Speaker reads the presentation to the audience.
- Eye contact with audience is nonexistent.
- Speaker stands in one place and uses no gesturing or movement.
- Uses many verbal fillers that are distracting.
- Pace of presentation is inappropriate and loses the audience.
- Voice is not used effectively.
- Personal appearance does not meet requirements for presentation.

### Audience response and interaction
- Holds the audience's attention throughout.
- Engages the audience.
- Demonstrates extensive knowledge of the topic by responding confidently, precisely and appropriately to audience questions.
- Handles difficult questions with poise and professionalism.
- Mostly holds the audience's attention.
- Encourages audience interaction.
- Demonstrates good knowledge of the topic when answering questions.
- Handles difficult questions with some tact.
- Loses audience's attention at times.
- Does not encourage audience interaction.
- Demonstrates mediocre knowledge when answering questions.
- Could handle difficult questions with more professionalism.
- Completely loses audience.
- Ignores audience for the most part.
- Is unable to answer questions.
- Handles difficult questions with "I don't know" or "I didn't study that."
<table>
<thead>
<tr>
<th>Criteria</th>
<th>High Proficiency</th>
<th>Proficiency</th>
<th>Some Proficiency</th>
<th>No/Limited Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis, focus, and originality</td>
<td>- Thesis/Purpose is original.</td>
<td>- Thesis is somewhat original.</td>
<td>- Thesis is obvious or unimaginative.</td>
<td>- Thesis is not well planned.</td>
</tr>
<tr>
<td></td>
<td>- Purpose is very clear to the reader.</td>
<td>- Purpose is fairly clear.</td>
<td>- Purpose is somewhat vague.</td>
<td>- Reader cannot determine purpose.</td>
</tr>
<tr>
<td>Organization</td>
<td>- Introduction effectively gains audience attention.</td>
<td>- Introduction is somewhat interesting.</td>
<td>- Introduction is vague.</td>
<td>- Introduction is missing, unclear, or inappropriate.</td>
</tr>
<tr>
<td></td>
<td>- Main points are well organized.</td>
<td>- Sequence of ideas could be improved.</td>
<td>- Sequence of ideas shows some signs of logical organization.</td>
<td>- Main points are unclear.</td>
</tr>
<tr>
<td></td>
<td>- Details fully support the thesis.</td>
<td>- More supporting details are needed.</td>
<td>- Supporting details are lacking.</td>
<td>- Thesis is not supported.</td>
</tr>
<tr>
<td></td>
<td>- Conclusion provides thoughtful evaluation.</td>
<td>- Conclusion could be stronger.</td>
<td>- Conclusion is abrupt and fails to provide strong evaluation.</td>
<td>- Conclusion is missing or ineffective in drawing conclusions.</td>
</tr>
<tr>
<td>Clarity</td>
<td>- Information is presented in a logical, interesting manner.</td>
<td>- Information presented is mostly logical and interesting.</td>
<td>- Information presented is disjointed and not completely relevant.</td>
<td>- Information presented is unclear and uninteresting.</td>
</tr>
<tr>
<td></td>
<td>- Explanation of key concepts is easy to understand.</td>
<td>- Explanation of concepts is incomplete or inaccurate.</td>
<td>- Key concepts are confusing.</td>
<td>- Key concepts are not explained.</td>
</tr>
<tr>
<td></td>
<td>- Language is tailored to audience.</td>
<td>- Most language is tailored to audience.</td>
<td>- Language used is too complex or simplistic for audience.</td>
<td>- Language used is not sophisticated or appropriate.</td>
</tr>
<tr>
<td></td>
<td>- Key terms are clearly defined.</td>
<td>- Key terms need more explanation.</td>
<td>- Key terms are not explained.</td>
<td>- Key terms are not defined.</td>
</tr>
<tr>
<td>Content depth, support, and</td>
<td>- Development of ideas is thorough and logical.</td>
<td>- Ideas presented offer solid but less original thought</td>
<td>- Ideas are obvious, unoriginal, or too broad.</td>
<td>Idea development is simplistic, undeveloped, or cryptic.</td>
</tr>
<tr>
<td>accuracy</td>
<td>and reasoning.</td>
<td>Too detailed for audience, or not detailed enough.</td>
<td>- Details provided are confusing or inadequate.</td>
<td>- Few relevant details are given.</td>
</tr>
<tr>
<td></td>
<td>- Main points are somewhat supported by details/examples.</td>
<td>- Details are general/irrelevant and do not fully support main points.</td>
<td>- Support for main points is inappropriate, off topic, too general, or faulty.</td>
<td>- Neglects important sources.</td>
</tr>
<tr>
<td>Research effort, incorporation,</td>
<td>- Provides evidence of good research.</td>
<td>- Shows evidence of some research using varied sources.</td>
<td>- Uses relevant sources but lacks in variety.</td>
<td>- Uses source information instead of developing own ideas.</td>
</tr>
<tr>
<td>and documentation</td>
<td>- Uses source ideas more than own ideas.</td>
<td>- Uses source information as basis or substitute for own ideas.</td>
<td>- Uses source material without proper citations.</td>
<td>- Uses source material without proper citations.</td>
</tr>
<tr>
<td></td>
<td>- Most sources are cited properly</td>
<td>- Sources are not identified or cited.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of visuals / figures / tables</td>
<td>- Combines variety of original visuals.</td>
<td>- Original visuals use some variety.</td>
<td>- Visuals are original but mostly uninteresting and/or ineffective.</td>
<td>Visuals are missing or not original.</td>
</tr>
<tr>
<td></td>
<td>- Visuals are used but could be more interesting and</td>
<td>- Visuals do not enhance content.</td>
<td>- Visuals are unprofessional in design and appearance.</td>
<td>- Visuals are ineffective or inappropriately placed.</td>
</tr>
<tr>
<td></td>
<td>effective.</td>
<td>- Most visuals are professional in appearance.</td>
<td></td>
<td>- Visuals are unprofessional in design and appearance.</td>
</tr>
<tr>
<td>Writing style and mechanics</td>
<td>- Sentences are varied and effective.</td>
<td>- Sentences are less varied/complex.</td>
<td>- Sentences are simple and awkward in places.</td>
<td>Sentences are simplistic and display poor writing skills.</td>
</tr>
<tr>
<td></td>
<td>- Word choice is precise and advanced vocabulary is used.</td>
<td>- Word choice is good and displays some advanced vocabulary.</td>
<td>- Word choice is fair and shows little advanced vocabulary.</td>
<td>- Word choice is inappropriate.</td>
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<tr>
<td></td>
<td>- Tone is mature, consistent, and well-suited to topic and audience.</td>
<td>- Tone is mature and appropriate for the topic and audience.</td>
<td>- Tone is less sophisticated and not completely appropriate.</td>
<td>- Tone is inappropriate and/or unsophisticated.</td>
</tr>
<tr>
<td></td>
<td>- Grammar, spelling, and punctuation are essentially correct.</td>
<td>- Grammar, spelling, and punctuation are mostly correct.</td>
<td>- Errors in grammar, spelling, and punctuation decrease readability.</td>
<td>- Grammar, spelling, and punctuation errors appear throughout the document.</td>
</tr>
</tbody>
</table>
GRADING CRITERIA FROM SYLLABUS

Grading:
Individual letter grades will be determined according to the following percentages. Professional panel evaluators will have some grading input on the final project submittals (45 percent of total grade).

<table>
<thead>
<tr>
<th>Course Element</th>
<th>Percent of Final Grade</th>
<th>Grade Based on Individual Performance or Group Performance (all team members receive the same grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Proposal Presentation</td>
<td>5</td>
<td>Group</td>
</tr>
<tr>
<td>Written Proposal Document</td>
<td>10</td>
<td>Individual</td>
</tr>
<tr>
<td>Written Design Criteria Report</td>
<td>5</td>
<td>Group</td>
</tr>
<tr>
<td>Displays for E-Week/Hearing Rpt</td>
<td>5</td>
<td>Group</td>
</tr>
<tr>
<td>Misc Individual Assignments</td>
<td>10</td>
<td>Individual</td>
</tr>
<tr>
<td>Written Draft Report</td>
<td>15</td>
<td>Individual</td>
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<tr>
<td>Oral Final Presentation</td>
<td>15</td>
<td>Group</td>
</tr>
<tr>
<td>Written Final Report &amp; Notebook</td>
<td>15</td>
<td>Individual</td>
</tr>
<tr>
<td>Preliminary Project Plans</td>
<td>15</td>
<td>Individual</td>
</tr>
<tr>
<td>Team Participation</td>
<td>5</td>
<td>Individual (based on weekly progress reports and team evaluations)</td>
</tr>
</tbody>
</table>

Letter Grade Determination:

<table>
<thead>
<tr>
<th>Percentage Requirements for Letter Grades:</th>
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<td>Letter Grade</td>
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<td>18-Jan 70 points</td>
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<td>Background Resume, Design</td>
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<td>Team</td>
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<td>Development Survey #1</td>
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<td>Development Survey #2</td>
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<td>Total Team Participation</td>
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</tbody>
</table>
UNL Online Course Evaluation System

Individual Course Report - CIVE489 Sec. 150

CIVE489 Section 150: SENIOR DSGN PROJECT

Semester: 12-13: Spring Semester
Survey Trigger: UNL Spring 2013
Instructor: Karen S. Schurr
Students: 33
Respondents: 18

54.5%

Download raw response data (CSV/Excel)

Evaluation of Course and Instructor

Base Questions item 4

<table>
<thead>
<tr>
<th></th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>Graduate Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My year in college is:</td>
<td></td>
<td></td>
<td></td>
<td>18</td>
<td>0</td>
</tr>
</tbody>
</table>

Base Questions item 5

<table>
<thead>
<tr>
<th></th>
<th>4.0 to 3.5</th>
<th>3.5 to 3.0</th>
<th>3.0 to 2.5</th>
<th>2.5 to 2.0</th>
<th>Below 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. My overall grade point average is:</td>
<td>8</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Base Questions item 6

<table>
<thead>
<tr>
<th></th>
<th>More than 18 hours</th>
<th>15 to 17 hours</th>
<th>12 to 14 hours</th>
<th>9 to 11 hours</th>
<th>Less than 9 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. I am enrolled for the following number of credit hours this semester:</td>
<td>4</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Base Questions item 7

<table>
<thead>
<tr>
<th></th>
<th>More than 40 hours</th>
<th>30 to 40 hours</th>
<th>20 to 30 hours</th>
<th>10 to 20 hours</th>
<th>Less than 10 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. I currently work the following number of hours per week at a job:</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

Base Questions item 8

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. This course is my major field of study:</td>
<td>18</td>
<td>0</td>
</tr>
</tbody>
</table>

Base Questions item 10

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Indifferent (3)</th>
<th>Agree (4)</th>
<th>Strongly Agree (5)</th>
<th>N/A (0)</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
</table>

http://crseval.unl.edu/course_report/index/2/59819?survey_trigger_id=84

5/22/2013
| 6. I see myself as a motivated student in this course. | 0 | 0 | 1 | 8 | 9 | 0 | 4.44 | 5 | 0.62 |
| 7. I was academically prepared to take this course. | 0 | 0 | 1 | 8 | 9 | 0 | 4.44 | 5 | 0.62 |
| 8. I was challenged to think in this course. | 0 | 0 | 1 | 7 | 10 | 0 | 4.50 | 5 | 0.62 |
| 9. My course grade will be a fair representation of my learning. | 0 | 0 | 0 | 9 | 9 | 0 | 4.50 | 5 | 0.51 |
| 10. I treated the instructor fairly and respectfully. | 0 | 0 | 0 | 8 | 10 | 0 | 4.56 | 5 | 0.51 |

**Base Questions item 12**

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Indifferent</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>N/A</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Before taking this course, my interest in this subject was very high.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>4.39</td>
<td>4</td>
<td>0.61</td>
</tr>
<tr>
<td>12. I understand the objectives of this course.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>10</td>
<td>0</td>
<td>4.56</td>
<td>5</td>
<td>0.51</td>
</tr>
<tr>
<td>13. The organization of the course topics is reasonable and logical.</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>4.39</td>
<td>5</td>
<td>0.78</td>
</tr>
<tr>
<td>14. The pace at which course topics are covered is reasonable.</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>10</td>
<td>0</td>
<td>4.44</td>
<td>5</td>
<td>0.70</td>
</tr>
<tr>
<td>15. This course helped me improve my rational thinking, problem-solving and decision-making ability.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>10</td>
<td>0</td>
<td>4.56</td>
<td>5</td>
<td>0.51</td>
</tr>
<tr>
<td>16. After taking this course, my interest in this subject is very high.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>4.44</td>
<td>5</td>
<td>0.62</td>
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</tbody>
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**Base Questions item 14**

<table>
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<tr>
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<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Indifferent</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>N/A</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. The textbook, workbook, and/or lesson notes help me understand course material.</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>8</td>
<td>1</td>
<td>4.35</td>
<td>5</td>
<td>0.70</td>
</tr>
<tr>
<td>18. The method (or methods) of presenting information in class enhances my learning.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>4.39</td>
<td>4</td>
<td>0.61</td>
</tr>
<tr>
<td>19. The coursework helps me understand and apply the subject matter.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>10</td>
<td>1</td>
<td>4.53</td>
<td>5</td>
<td>0.62</td>
</tr>
<tr>
<td>20. The amount of coursework is reasonable for what I am expected to learn.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td>4.50</td>
<td>5</td>
<td>0.51</td>
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<tr>
<td>21. Testing methods fairly measure my understanding of the course material.</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>10</td>
<td>1</td>
<td>4.47</td>
<td>5</td>
<td>0.80</td>
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</table>

**Base Questions item 16**

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Indifferent</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>N/A</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. The instructor is prepared for the class and is concerned about his or her preparation.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>15</td>
<td>0</td>
<td>4.83</td>
<td>5</td>
<td>0.38</td>
</tr>
<tr>
<td>23. The instructor makes good use of class time.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>13</td>
<td>0</td>
<td>4.72</td>
<td>5</td>
<td>0.46</td>
</tr>
<tr>
<td>24. The instructor is enthusiastic and interested in teaching this course.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>15</td>
<td>0</td>
<td>4.83</td>
<td>5</td>
<td>0.38</td>
</tr>
<tr>
<td>25. The instructor treats students in a professional manner.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>15</td>
<td>0</td>
<td>4.83</td>
<td>5</td>
<td>0.38</td>
</tr>
<tr>
<td>26. New concepts and examples are clearly explained at a level students can comprehend.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>11</td>
<td>0</td>
<td>4.61</td>
<td>5</td>
<td>0.50</td>
</tr>
<tr>
<td>27. The instructor motivated me to understand and apply course concepts.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>12</td>
<td>0</td>
<td>4.67</td>
<td>5</td>
<td>0.49</td>
</tr>
<tr>
<td>28. The instructor provides useful feedback on how I am doing in the course.</td>
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<td>0</td>
<td>1</td>
<td>5</td>
<td>12</td>
<td>0</td>
<td>4.61</td>
<td>5</td>
<td>0.61</td>
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<tr>
<td>29. The instructor is accessible for help outside the classroom.</td>
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<td>0</td>
<td>0</td>
<td>4</td>
<td>14</td>
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**Question Set Statistics**

- **Base Questions item 12**: 4.49, 5, 0.57
- **Base Questions item 14**: 4.46, 5, 0.62
- **Base Questions item 16**: 4.74, 5, 0.46

http://crseval.unl.edu/course_report/index/2/59819?survey_trigger_id=84

5/22/2013
30. The classroom physical environment (e.g. temperature, lighting, acoustics) is comfortable for learning.  

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Indifferent</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>N/A</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td>1</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>4.44</td>
<td>5</td>
<td>0.62</td>
</tr>
</tbody>
</table>

31. The classroom is free from outside distractions.  

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Indifferent</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>N/A</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>4.39</td>
<td>4</td>
<td>0.61</td>
</tr>
</tbody>
</table>

32. The classroom design and furnishings do not interfere with my learning.  

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Indifferent</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>N/A</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>4.44</td>
<td>5</td>
<td>0.62</td>
</tr>
</tbody>
</table>

33. The classroom has adequate instructional equipment and technology.  

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Indifferent</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>N/A</th>
<th>mean</th>
<th>mode</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>4.44</td>
<td>5</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Question Set Statistics 4.43 5 0.60

34. What are 1 or 2 specific things that helped you learn in this class?  

- The invited speakers are really helpful for the project.  
- Blackboard documents  
- Useful examples of past years work  
- Karen's availability to help and the guest speakers she brought in were good.  
- The amount of resources offered helped grasp what was needed to be done.  
- Powerpoint slides -Homework, handouts/agendas  
- I liked the speakers that came in to give presentations  
- All of the agendas and ways information was presented in class helped to learn what was expected clearly  
- Having the professionals come in and present info about the project really helped me understand what was going on.  
- How to run/be apart of a business meeting and what the entire engineering process looks like.  
- Having the powerpoints for each class was helpful.

35. What are 1 or 2 specific things that caused a problem with your learning in this class?  

- The amount of information and emails was sometimes overwhelming.  
- Too many things going on at once  
- The structural presentation was not very clear and made the design process difficult.  
- No problems, Karen is great!!  
- There was a lot of information to be handled that wasn't always presented to us in the same place all semester long. This led to confusion sometimes on what was needed of our group and whether it was told to us verbally or written in our objectives sheet.

36. Please provide 1 or 2 practical suggestions on ways to help improve student learning in this course.  

- The changing project manager was okay. Just don't have the project managers change in the middle of the meeting/class. The one time that happened, it was a little confusing.  
- I think the structural people should be involved earlier in the semester and maybe have Mr. Jaber come to class twice. The first one would be to give his presentation and the second one would be to answer questions and provide immediate help on the design. Another idea is to have professors from the CIVE department help with each discipline. For example Dr. Nowak would give a presentation to the structures people, Dr. Admiral to the water resources and so on. I think this would help because if we had questions we could go to their office hours and get help rather than having Karen email them for us.  
- Organize the information into subgroups in order for students to better access the information on Blackboard.
• If future projects are going to be transportation focused, I would recommend 2 transportation engineers per team. Even at the end of the semester, the total hours the transportation engineer spent on this project is double what the other engineers actually spent on this project.

• Having two structural presentations, or having it sooner would be beneficial for structural engineers. And I know the heat can’t be controlled, but maybe the class be hosted in a cooler classroom.

• MORE SNICKERS BARS!!!

• Have all assignments wrote on one page given in class that will be expected on the following week as it was for the end of our semester.

Base Questions item 23

37. Other comments that you would like to make:

• Well done Karen! Having each team member be the project manager worked very well and was an excellent idea. I learned a lot throughout the semester with this class. Your deadlines made it so I couldn’t wait until the end of the semester to do everything, which was very nice. I am very pleased with my Senior Design experience. Great job!

• I think Karen is the best Professor/Advisor one could have. She’s very helpful, knowledgeable, and a very nice person.

• Great class on summing up everything I learned throughout my years here. It incorporated everything into one project and gave people with little or no work experience an idea of how a project works in the real world and working with teams.

• -Keep the position switching within the groups, keeps students on their toes

• Overall I am happy with how this course was structured. Could maybe have more options for design, but that would also be way more confusing.

• I always enjoy my classes with Karen, and I had fun working on a design project and feeling like a real engineer.

• Over all, I enjoyed the class, and I will miss Karen.
APPENDIX C – LECTURE AGENDAS, ASSIGNMENTS AND STUDENT SAMPLES

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   REVIEWER EVALUATION SAMPLES ..................................................................... 113
The agenda communicates important information to meeting attendees such as:
- Topics for discussion;
- Presenter or discussion leader for each topic; and
- Time allotment for each topic.

The agenda may also be used as a checklist to ensure all topics are covered and if distributed a day or so in advance of the meeting gives attendees an opportunity to be prepared for discussions or decision making. The objective of the meeting should be clearly stated in the agenda.

Objectives:
- Outline course expectations and collect student expertise information for determination of multi-interdisciplinary teams;
- Provide background material on design project; and
- Assign relevant tasks to familiarize students with the improvement for which they will develop preliminary plans.

Attendance:
Karen Schurr, 5 min

Course Description:
Karen Schurr, 15 min

Design Project Introduction:
Karen Schurr, 15 min

Collective Excellence, Building Effective Teams by Mel Hense
Karen Schurr, 15 min

Project Manager Hints
Karen Schurr, 15 min

Assignments for Friday: January 18th
Karen Schurr, 15 min

Assignments for Today: Friday, January 11th
Complete and submit the Student Expertise Survey, 15 min
Complete and submit the Informed Student Consent Statement, 5 min

Final Question Period:
Karen Schurr, 15 min
PREPARE TWO COPIES OF YOUR ANSWERS, ONE TO SUBMIT AND ONE TO USE FOR DISCUSSION PURPOSES ON JANUARY 18TH.

GAINING BACKGROUND INFORMATION ABOUT THE PROJECT SITE AND SPONSOR EXPECTATIONS
NOTE: Items for review are on Blackboard under the "Course Documents" category.

1. Read the RFP and Scope of Services. Record which tasks you feel you would be interested in supporting with your expertise.
2. Read relevant portions of the City of Lincoln Long Range Planning Comprehensive Plan
   http://lincoln.ne.gov/city/plan/long/comp.htm
   Record two primary goals you think the project should accomplish to fulfill the Comprehensive Plan.
3. Read relevant portions of the City of Lincoln Long Range Transportation Plan
   http://lincoln.ne.gov/city/plan/long/lrtp.htm
   Record two primary goals you think the project should accomplish to fulfill the Transportation Plan.
   Write a summary of each chapter in your best writing style. Each summary should be at least 200 words.
5. Complete the Potential Stakeholder worksheet and be prepared to discuss it with your team.

1. Tasks I am interested in working on this semester:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

2. Two primary goals to accomplish to fulfill the Comprehensive Plan:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

3. Two primary goals to accomplish to fulfill the Transportation Plan:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

4. Write a summary of each chapter on a separate page (or pages) in your best writing style. Each summary should be at least 200 words. Format: Times New Roman, font size 12, single spaced, 1 inch margins on all sides. Show titles of each summary in bold print. Staple to the rest of this assignment.
5. ASSESSMENT OF STAKEHOLDERS
List potential stakeholders involved in the Old Cheney Road, 70th to 84th Street Project (5 entries minimum). Guess at whether the stakeholder you list would be for or against the improvement project and why.

DEFINITION:
Project Stakeholder: A person, group, or organization with an interest in a project.

Example:
STAKEHOLDER: Parent of a small child in the neighborhood who must cross Old Cheney Road to attend elementary school.
FOR (if the project will increase safety for pedestrians)
AGAINST (if appropriate measures aren’t taken during construction to insure a safe crossing for their child)

<table>
<thead>
<tr>
<th>STAKEHOLDER (and why FOR or AGAINST)</th>
<th>FOR</th>
<th>AGAINST</th>
</tr>
</thead>
<tbody>
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</table>

NOTES:

6. VISIT THE PROJECT SITE TO EXPERIENCE POTENTIAL PROBLEMS
Visit the project site on a weekday between 4:30 AND 6:00 PM (note: sun sets at about 5:30 pm).

WITH PERSONAL AND PUBLIC SAFETY AS A PRIORITY,
TAKE AN ELECTRONIC PHOTO OF A PROBLEM AREA WITHIN THE PROJECT LIMITS.

SEND THE PHOTO TO kschurr1@uni.edu BY FRIDAY, JAN 18th AT 8:00 AM.

NOTE THE DAY, DATE AND TIME AND THE TRAFFIC-BOUND DIRECTION YOU ARE PHOTOGRAPHING.

EXAMPLE:
Tuesday, Jan 17th, 2013
5:10 pm
Eastbound on Old Cheney Road, about 75th Street
Picture taken by Karen Schurr
(Don’t forget to attach the picture)
PREPARE TWO COPIES OF YOUR ANSWERS, ONE TO SUBMIT AND ONE TO USE FOR DISCUSSION PURPOSES ON JANUARY 18TH.

GAINING BACKGROUND INFORMATION ABOUT THE PROJECT SITE AND SPONSOR EXPECTATIONS
NOTE: Items for review are on Blackboard under the “Course Documents” category.

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2. Read relevant portions of the City of Lincoln Long Range Planning Comprehensive Plan http://lincoln.ne.gov/city/plan/long/comp.htm
   Record two primary goals you think the project should accomplish to fulfill the Comprehensive Plan.
3. Read relevant portions of the City of Lincoln Long Range Transportation Plan http://lincoln.ne.gov/city/plan/long/lrtp.htm
   Record two primary goals you think the project should accomplish to fulfill the Transportation Plan.
   Write a summary of each chapter in your best writing style. Each summary should be at least 200 words.
5. Complete the Potential Stakeholder worksheet and be prepared to discuss it with your team.

1. Tasks I am interested in working on this semester:
   - Design of box culvert
   - Drainage Analysis
   - CAD work

2. Two primary goals to accomplish to fulfill the Comprehensive Plan:
   - Improve thru-traffic handling without compromising nearby neighborhood residents' convenience and safety
   - Incorporate trees/vegetation into design

3. Two primary goals to accomplish to fulfill the Transportation Plan:
   - Implement ITS at relevant intersection(s)
   - Foster increased bicycle and pedestrian usage in the area to alleviate vehicle traffic

4. Write a summary of each chapter on a separate page (or pages) in your best writing style. Each summary should be at least 200 words. Format: Times New Roman, font size 12, single spaced, 1 inch margins on all sides. Show titles of each summary in bold print. Staple to the rest of this assignment.

(attached)

5. ASSESSMENT OF STAKEHOLDERS
List potential stakeholders involved in the Old Cheney Road, 70th to 84th Street Project (5 entries minimum). Guess at whether the stakeholder you list would be for or against the improvement project and why.

DEFINITION:
Project Stakeholder: A person, group, or organization with an interest in a project.

Example:
✓ **STAKEHOLDER**: Parent of a small child in the neighborhood who must cross Old Cheney Road to attend elementary school.
FOR (if the project will increase safety for pedestrians)
AGAINST (if appropriate measures aren’t taken during construction to insure a safe crossing for their child)

<table>
<thead>
<tr>
<th>STAKEHOLDER (and why FOR or AGAINST)</th>
<th>FOR</th>
<th>AGAINST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents of children in the neighborhood</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Commuters</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Environmentalists</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Non-parent neighborhood residents</td>
<td>___</td>
<td>X</td>
</tr>
<tr>
<td>Residents of other neighborhoods in Lincoln</td>
<td>___</td>
<td>X</td>
</tr>
</tbody>
</table>

NOTES:

Parents, for the most part, will be for the project since an integral part of it is to provide safe crossing for pedestrians. Some concerns with safety could arise if a tunnel is proposed instead of a bridge.

Environmentalists will be for the project since increased roadway and intersection capacity reduces emissions and noise pollution.

Non-parent neighborhood residents will likely be against the project because of concerns about inconvenience during construction.

Residents of other neighborhoods in Lincoln could potentially be against the project, since it is a use of their tax money that does not directly impact them.

✓ 6. **VISIT THE PROJECT SITE TO EXPERIENCE POTENTIAL PROBLEMS**
Visit the project site on a weekday between 4:30 AND 6:00 PM (note: sun sets at about 5:30 pm).

**WITH PERSONAL AND PUBLIC SAFETY AS A PRIORITY, TAKE AN ELECTRONIC PHOTO OF A PROBLEM AREA WITHIN THE PROJECT LIMITS.**

SEND THE PHOTO TO kschurr1@unl.edu **BY FRIDAY, JAN 18th AT 8:00 AM.**

NOTE THE DAY, DATE AND TIME AND THE TRAFFIC-BOUND DIRECTION YOU ARE PHOTOGRAPHING.

Wednesday, Jan 16th, 2013
4:45 pm
Eastbound on Old Cheney Road, 80th Street
Picture taken by
Chapter 2 of the *Guide to Quality in Preconstruction Engineering* discusses how quality is developed in a project. The recurring theme throughout the chapter is that a quality process needs to be implemented and practiced throughout the entirety of the preconstruction process. It is not enough to simply do plan-checking at the end of the design process. Performing quality assurance checks early and often allows errors to be caught before further work is built on top of them. It also allows the entire design approach to be evaluated, eliminating costly re-designs late in the process.

This chapter also gives a few general ways to help improve quality. It suggests, among other things, to ensure a comfortable and productive workplace, improve communication, proper project scoping, and tracking the budget and schedule of the project. This chapter asserts that one of the most important factors that hinders the quality assurance process is the project schedule. Too often, quality assurance is not properly employed or in some cases is skipped entirely due to a fast-approaching deadline. According to this chapter, solving problems with scheduling is not always a matter of adjusting the preconstruction planning and design process, but a matter of evaluating whether or not the schedule originally laid out was feasible.

In summary, quality assurance in the preconstruction phase should be implemented early and often to result in a better and cheaper solution for the client and a larger profit for the designer.

**Guide for Consultant Contractors**

Chapter 4 of *Guide for Consultant Contractors* primarily discusses the process of selection of a design firm. Throughout the chapter, it is emphasized that for public infrastructure projects and especially transportation projects, in most states, selection is based upon qualifications and the proposed solution. Only after a design firm is selected by these criteria do the price negotiations begin. There are some cases where cost is a secondary factor and other cases where cost is a weighted factor along with the other criteria, but these are not the norm.

Agencies typically employ selection committees that consist of upper management so that the committee membership is relatively constant over time. This also allows the committee members to gain knowledge about the design firms in the area, which aids in a quicker and more efficient selection process.

The chapter then goes on to list some of the allowed criteria for the selection of a design firm. These include, but are not limited to, the expertise and experience of key firm employees and their available time commitment, ability of the firm to meet the deadline, location of the firm’s office, quality of previous projects with the agency, quality of previous similar projects, and equipment/technology available to the firm. Price, indirect cost rate, contract quotas, and in-state preference are not allowed to be factors in firm selection.
PREPARE TWO COPIES OF YOUR ANSWERS,
ONE TO SUBMIT AND ONE TO USE FOR DISCUSSION PURPOSES ON JANUARY 18TH.

GAINING BACKGROUND INFORMATION ABOUT THE PROJECT SITE AND SPONSOR EXPECTATIONS
NOTE: Items for review are on Blackboard under the “Course Documents” category.

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   http://lincoln.ne.gov/city/plan/long/lrtp.htm
   Record two primary goals you think the project should accomplish to fulfill the Transportation Plan.
   Write a summary of each chapter in your best writing style. Each summary should be at least 200 words.
5. Complete the Potential Stakeholder worksheet and be prepared to discuss it with your team.

1. Tasks I am interested in working on this semester:
   Geotechnical Evaluation: a) Data Research b) Design Recommendations c) Soil Testing
   Report of Box Culvert Structure Designs: a) Structure Alternative Analysis
   b) Bridge Design and Plan Preparation c) Box Culvert Design & Plan Preparation

2. Two primary goals to accomplish to fulfill the Comprehensive Plan:
   1) To develop parks and building structures for the growing community, but at the same time, balancing the use of urban vs rural land.
   2) To develop businesses which need to be for the best economic development for the growing community

3. Two primary goals to accomplish to fulfill the Transportation Plan:
   1) Maintain the existing transportation system to maximize the value of these assets.
   2) Provide consistency between land use & transportation plans to enhance mobility and accessibility

4. Write a summary of each chapter on a separate page (or pages) in your best writing style. Each summary should be at least 200 words. Format: Times New Roman, font size 12, single spaced, 1 inch margins on all sides. Show titles of each summary in bold print. Staple to the rest of this assignment.
Guide to Quality in Preconstruction Engineering

Quality is dealing with excellence and superiority. It consists of achieving customer satisfaction, doing the job right the first time and every time. It has to do with taking pride in the work accomplished, communicating, cooperating, and working as a team to achieve excellence. All of these traits of quality should be present the entire process.

The type of quality put into a project can make or break it. There are many steps of achieving quality in preconstruction engineering. That starting with Scheduling. It has the greatest effect on quality. Also, decisions made can have affect as well. One group's decision affects other groups involved with the project as well as the next step to come. Quality can be used for many opportunities for improvement for example having experienced staff who knows how to handle problems or a good work environment. It can influence how the project is progressing, needs to be positive and utilize space toward from disturbances, increase productivity and of course, quality. Qualitative technology helps reduce the factor of human error which improves efficiency during the design or gives a view of the project of what it could be even before construction would begin.

Setting goals is another step needed. They must be established so that checks and inspections are made to ensure that the actual goals are reached or achieved. Along with goals, rules are must. They're set to keep members on track, set flexible work hours to balance home life with the office. Involving the preconstruction team provides great feedback for the project development team to make sure that the project follows through as first thought out.

As said before it's all about having the correct steps, that meaning order. Quality is related to order in which work is done, constraints on how work is done, coordinated, timeliness of input and feedback, efficiency of methods used.

Good management is the difference between great quality in a project to mediocre. They would have the responsibilities of tracking financial budgets, identifying customers to be involved in the project, detailed scoping of the project, schedules developed by considering detailed scope of work and involvement of all who is involved, etc.

Communication is another key to a successful engineering group. It's the building block for achieving quality. It will ensure all issues and concerns are received and resolved. Field reviews can expedite project development and reduce re-work. Feedback provides valuable information to improve process and product quality.

If these traits for quality are included in the steps for preconstruction engineering, then the project will succeed.
Guide for Consultant Contracting

The guide for consultant contracting addresses methods and steps necessary to successfully accomplish consultant selections successfully. There are many methods: competitive selection; method selected by factors not costs; noncompetitive selection; specialized services; competitive bidding; and value based selection. A short description of each one will be given followed by the steps after.

Competitive selection can have one or two steps. The first step is to narrow down the list to the most qualified firms, usually three to five. Step two involves advertising a request for technical proposals and leads to selection of a firm through detailed submission and interview.

Method selected by factors not costs looks at technical expertise, previous experience, capability to adequately staff project, and the location of the firm with respect to the project. There's noncompetitive selection which obtains services from a sole source or under direct select dollar limit. The firms involved specialize in a service only available from that one firm.

Selection/assignment contracts are accomplished by assigning work in specific regions to a consulting firm or based on special expertise. Another method is competitive bidding where the contract is awarded to the lowest bidder, but quality of design can affect overall cost of the project. It is wanted most of the time is to design with the lowest design effort or cost and still meet engineering standards. This method though doesn't provide opportunities to improve upon overall design within the contract.

The next step is to write up a contract after the work has been identified so that the consultant can be prepared and proposal elicited. Then establish a selection committee, establish selection criteria, qualifications/ prequalification, request statement of interest. Then the responses must be reviewed and a detailed proposal scoping conference be made, request for technical proposal request for proposals, receive and evaluate technical proposals, conduct interviews, final rankings/approval and finally notifications.

A selection committee will be established where their purpose is reviewing and evaluating statements of interest or proposals submitted by consulting firms. The committee should be made of an odd number of people for voting purposes. There are different types of leadership: fixed membership, top management department, division, office directors or rotating membership. This is most likely the case so it's less likely to be criticized for favoritism. Criteria guidelines should be established for consultant selection by the selection committee, statements of interests or proposals, depending on funding sources.

Qualifying/ pre-qualifying should be required to meet qualification. For the selection committee to see firms should publish firm details, names of principals, office locations, current workload, types of service they're qualified for, previous performances, resumes of key persons, specialists, or qualify by project by project details of particular project.

The committee then reviews statements of firms for completeness, reviewed according to established evaluation criteria or factors, they establish a short list of at least three consultants that fit the position.
A request for technical proposal, indicate content of proposal, technical review procedures, anticipated schedule of activities, scope of work, project description, where proposals are to be delivered to, the number of copies required, and the due date.

The final steps of selecting a firm consist of evaluating the proposals of the selected firms and finally ranking and approval and notification to the selected firm.
Objectives:
- Summary of Homework #1: Building Background Knowledge and Resources
- Outline preliminary design process
- Define milestone tasks
- Preparation of project understanding statement
- Discuss outline of written proposal and workshop goals
- Discuss Homework #2 assignment
- Recognize opportunities for sustainability
- Recommendations for team meeting and outside team activity protocol
- Begin building a synergistic team, define individual responsibilities

Today’s “Deliverables” (A project management term for the quantifiable goods or services that will be provided upon the completion of a task or project. Deliverables can be tangible or intangible parts of the development process, and are often specified functions or characteristics of the project.):
- Homework #1 Worksheet, summaries from Chapter 2 and 4 reading assignment
- Project pictures was due by e-mail to Karen by 8 am, Friday, Jan 18th

Project Picture Review:
View most descriptive pictures from Homework #1

General Description of Preliminary Project Process for Consulting Firm:
- Sponsor releases RFP and scope of services
- Physical review the project (in both directions?)
- Project research to identify key issues of concern (class discussion today)
- Identify stakeholders to anticipate construction and political problems early
- Develop a problem statement that outlines project understanding
- Identify potential countermeasures or treatments that promote sustainability
  Problem ⇒ Potential Solution(s) ⇒ Benefits/Detriments
- Evaluate potential treatments for feasibility, safety, operational effectiveness and cost effectiveness.
- Prepare written proposal and 15-20 minute presentation
- Refine treatment choices and define controls and criteria
- Research and outline selected treatment
- Prepare preliminary design solutions
- Prepare written technical report
- Prepare 30% plans
- Prepare preliminary design presentation
- Reflect on changes to make to preliminary design process

Project Milestone Tasks:
- Project Proposal
- Design Criteria
- Functional Design
- E-Week Public Meeting
- Final report, plans and presentation

Developing a Project Understanding Statement:
- List potential issues which may be relevant to this project
- Research all issues, determining problems to resolve
- Prove to the sponsor that you’ve research the project area and are aware of key issues
A Look Ahead to the Proposal Workshop, January 25th

Written Proposal Elements:
- Title Sheet
- Table of Contents
- Project Understanding
- Design Approach
- Project Scope
- Organizational Chart
- Work Plan with Schedule
- Resumes

Oral Proposal Elements:
- Format
- Content
- Practice

Homework Assignment #2:
1) Prepare a resume with a picture of yourself following the format of the examples supplied on Blackboard under the “Assignments” category.
2) Research key issues identified in the class discussion and assigned to you in your team meeting today. Provide a couple of sentences or a paragraph about your assigned issues to contribute to the Project Understanding Statement of your team’s proposal.
3) Do research on sustainable solutions relative to your individual discipline area. **Sustainability: the long-term maintenance of responsibility, which has environmental, economic, and social dimensions, and encompasses the concept of stewardship and the responsible management of resource usage.**
4) List 3 potential ways to build sustainability into your discipline area of the project for discussion during the Week 3 team discussion.
5) Make two copies of your work for Items 1, 2 and 4: one for submittal and one for Week #3 team discussion purposes
6) **PROJECT MANAGERS ONLY:** Prepare a list of your weak team managing skills. Send it to Karen by 8 am, Mon Jan 21st.

Team Meeting Protocol:
- Agenda Guidelines for Project Managers
- Potential Civil Engineering Disciplinary Task Breakdown
- Meeting Minute Guidelines for Scribes
- Billable Hours Log
- First Team Phase: Collection of people ⇒ Developing Team

New to Blackboard:
- Example Resumes
- Word Copies of Agenda, Meeting Minutes and Billable Hours
- Old Cheney Traffic Counts, Crashes

Helpful Websites:

http://www.lincoln.ne.gov/ > City of Lincoln > Departments > Planning Department > GIS Development Viewer

http://www.lincoln.ne.gov/ > City of Lincoln > Departments > Public Works and Utilities Department

2010 Crash Study: http://lincoln.ne.gov/city/pworks/engine/crash/
Karen,

My weakness as a leader was that I was too commanding in the meeting. I tend to overpower other people's opinions by accident if they don't stick to them or really speak up. I need to listen and include the people that might be timid and apprehensive about voicing their views.
Karen Schurr

From: Monday, January 21, 2013 1:11 PM
To: Karen Schurr
Subject: CIVE 489 Group 4 PM skills

Karen,

I have been thinking about my possible weak team managing skills. While there may be more than these the couple I could directly think of were not trusting team members to do the quality of work I expect, doubting team members work even though they have done nothing to show that, and not fully listening to everyone. I have been a concrete canoe team captain for 3 years, and still somewhat in charge this year, and when working on different aspects of the project I tend to not trust other people. I tend to put most of the work on myself which ends up stressing me out more and probably hurting the team in the long run. When I have tried to let other team members do certain aspects of the project I am not satisfied with what they have done and if time permitting end up re-doing their work. I can also sometimes not listen to everyone in the group, thinking that their ideas don’t fully answer the problem or something in their solution is wrong and cannot be done. Much of these problems I feel like come from the fact that the concrete canoe team has a very diverse set of skills and knowledge. Freshman that are on the team or new members of the team sometimes don’t understand certain details that have to be followed for the competition. They do not know all of the extensive rules that are given out at the beginning of the year. These rules often make their ideas not plausible to the project that year. I want to represent the university to the best of my ability and want to do well in the certain parts of the judging and scoring that I know we can compete in. This tends to make me do a lot of the work myself or me re-doing work that I find unsatisfactory. I want to avoid all these things in the senior design project and I hope I can. I think it helps that I am working with a group of my peers that all have equally the same abilities so that will help with my trusting the team members more. Also since everyone is equally in charge of the project, splitting PM throughout the emester, I hope everyone wants to the best they can on the project.
CIVE 489

1/21/13

After my first meeting being Project Manager I learned much from things that I did wrong and things that I could do better. Below is a list of my weak team managing skills:

- Lack of confidence
- Not prepared enough
- Not experienced in management
- Not organized
- Did not have a clear understanding of the assignment
- Asked questions to my group about topics I should have known
- Did not prepare the agenda so I was unfamiliar with its content
- Let the group get off topic a couple times
- Did not move the meeting as efficiently as possible
Karen Schurr

From: [Email Address]
Sent: Friday, January 18, 2013 5:02 PM
To: Karen Schurr
Subject: PM Weak Team Managing Skills

Karen,

Our first team meeting went very well, which was aided by the fact that we all know each other fairly well already and have worked together on group projects before. There was only one minor thing that gave me trouble. I had difficulty taking everything in and staying organized due to the volume of information, lack of familiarity, and stress from work and school. Add in the fact that it was a beautiful day out and mid-afternoon on a Friday, and keeping everything straight in my head and staying focused was somewhat challenging. So, more formally, here is the "list" of the my weak team management skills that I encountered at our first meeting.

- Organization of material, due dates, and requirements

Thanks,
1. Time Management: I tend to leave tasks uncompleted until the last minute. This is the skill that I want to acquire the most.

2. Leading Meetings: I put this skill down because I don’t have much experience leading a meeting.

3. Performance Counseling: The same goes for this skill, not much experience with this.

4. Conflict Management: I’m not one that likes conflict so much. I’m usually the person that tries to persuade everyone to get along.
Objectives:
- Identify changes to syllabus and syllabus schedule
- Summarize successes and “learning opportunities” identified in Homework #2
- Recognize team development as a work in progress
- Advice for PMs
- Guidance for the development of a draft written proposal
- Begin preparations for future technical engineering presentations
- Assign homework to prepare teams for discussions next week
- Introduce Oral Presentation Workshop

Today’s “Deliverables”
- Resume and picture
- Documentation of research done over the past week
- Three potential ways to build sustainability into your sub-discipline area

Changes to Grading and Syllabus Schedule
Void originals and retain revised versions

Success and Learning Opportunities from Homework #2
- Chapter summary comments
- Billable hours
- Revisions to billable hours and minutes guidelines
- Team meeting discussion
- PM Advice
- Weekly deadline review

Written Proposal Workshop

Next Week’s Topic
Oral Presentation Workshop

Homework Assignment #3:
1) Prepare draft written proposal.
2) Each functional engineer needs to review the potential list of tasks associated with their sub-disciplinary assignment and identify areas in which they already have and require expertise. List data resource needs that are not currently available to you (see following page for example).
Project Environmental Engineer

... is a senior environmental consultant with an emphasis on wastewater treatment and collection, water treatment and distribution, and water conservation. She has taken many classes within the discipline of environmental engineering including Intro to Environmental Engineering, Solid Waste Management, Design of Water Treatment Facilities, and Environmental Engineering Process Design. Since May 2011 she has interned with the Environmental Engineering Department of JEO Consulting Group, Inc. in the Wahoo, Omaha, and Lincoln, Nebraska offices. Her responsibilities at JEO have included site visits and construction observation, design work, plan and specification preparation, permit creation, O&M manual creation, project description writing, and various other tasks. Upon graduation in May 2013, ... will pursue a master's degree in environmental engineering.
### Key Issues

#### General Issues

<table>
<thead>
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<th><strong>Major arterial</strong></th>
<th><strong>Near Nebraska HWY 2.</strong></th>
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</table>
| **Residences- homes & apts.** | - Home owner association contact for Edenton North and Edenton South is Stephen Nickel.  
- The name of the home-owner association is Family Acres according to Lincoln.ne.gov GIS viewer. |
| **Schools** | - Schools in the area include Lincoln Christian School Preschool, Lincoln Christian Elementary School, and Maxey Elementary School.  
- All crosswalks need to be designed with adequate safety features. |
| **Green space- zoning** | - Green space to the East of 80th Street is owned by “Nelson, Sanford H Trustee”.  
- Green space on corner of 84th and Old Cheney (across from Lincoln Christian) is owned by “Realty Trust Group Inc. Trustee” and is classified as a “Pine Garden Addition”.  
- The other green space on the corn of 84th and Old Cheney is owned by “Lincoln Care Group LLC” and is classified as “Pine Garden Addition”.  
(Additional information on these areas is attached below.) |
| **Bus route** | - There is currently no city bus route within the project limits. However, according to the 2040 Comprehensive Plan, the City limits are expected to extend to 96th Street.  
- Consequently, a city busy route may eventually be within the project limits. As a result, bus turnout areas need to be planned for and kept clear of potentially conflicting features. |
| **Hiker/biker trail** | - Trail needs to be wide enough. The trail should also be consistently sized and constructed to max the other trails in the area.  
(See attached Great Plains Trail Network Map) |
### Environmental Issues

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
</table>
| Are there any wetlands in this area? | - According to the Fish and Wildlife Wetlands Mapper there are two small freshwater ponds somewhat near Old Cheney between 70th & 84th.  
- Despite this, there are no major wetlands in this area. |
| What are some current or potential pollutants? | - The creation of a hiker/biker trail will potentially cause more garbage related pollution.  
- Also, increased trail traffic could result in animal waste from dog-walkers. |
| Where are areas of erosion? | - An inadequately sized (not wide enough) trail could result in pedestrians and pets walking outside of the trail and tearing up vegetation.  
- There are some areas with light erosion alongside the road.  
- Removing existing trees could make areas more susceptible to erosion.  
- During the design and construction of the project an effort to be made to maintain existing drainage patterns. |
| Removal of trees | - It will likely be necessary to remove trees because of their close proximity to the roadway. |
### Parcel Information

**Legal Description:** PINE GARDEN ADDITION, BLOCK 1, Lot 1

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<th>Property ID:</th>
<th>16-10-446-001-000</th>
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<table>
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<th>Exemption Codes:</th>
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<td>Primary Class: C1( Commercial Improved )</td>
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<tr>
<td>Primary Use: 15( Other - Commercial )</td>
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<tr>
<td>Zoning: R3( R3-Residential District )</td>
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<td>Neighborhood: SECOM(Southeast Lincoln)</td>
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<tr>
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<tr>
<td>Imp Type: N/A</td>
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<tr>
<td>No of Buildings: 0</td>
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<tr>
<td>Total Living Area:</td>
</tr>
</tbody>
</table>

### Owner Information

**Owner Name:** LINCOLN CARE GROUP LLC

**Owner Address:** 12115 NE 99 ST STE 1800

**Property Address:** VANCOUVER, WA 98682

**Property Address:** 5601 S 84 ST

**Property Address:** LINCOLN, NE

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### Parcel Information

**Legal Description:** PINE GARDEN ADDITION, OUTLOT A

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<td>Primary Use: 19( Vacant Land )</td>
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<td>Neighborhood: SECOM(Southeast Lincoln)</td>
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<td>Year Built: N/A</td>
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<tr>
<td>Imp Type: N/A</td>
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<tr>
<td>No of Buildings: 0</td>
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<tr>
<td>Total Living Area:</td>
</tr>
</tbody>
</table>

### Owner Information

**Owner Name:** REALTY TRUST GROUP INC TRUSTEE

**Owner Address:** 2300 S 48 ST

**Property Address:** LINCOLN, NE 68506

---

### Parcel Information

**Legal Description:** S10, T9, R7, 6th Principal Meridian, LOT 112 SE

<table>
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<table>
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<tr>
<th>Exemption Codes:</th>
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<td>Map Page:</td>
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<tr>
<td>Primary Class: R2( Residential Unimproved )</td>
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<tr>
<td>Primary Use: 01( Single Family )</td>
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<td>Zoning: R3( R3-Residential District )</td>
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<tr>
<td>Neighborhood: 7MSE760(Edenton)</td>
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<tr>
<td>Year Built: N/A</td>
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<tr>
<td>Imp Type: N/A</td>
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<tr>
<td>No of Buildings: N/A</td>
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<tr>
<td>Total Living Area: N/A</td>
</tr>
</tbody>
</table>

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**Owner Information**

**Owner Name:** NELSON, SANFORD H TRUSTEE

**Owner Address:** 4830 BIRCH HOLLOW DR

**Property Address:** LINCOLN, NE 68516

**Property Address:** 8000 OLD CHENEY RD

**Property Address:** LINCOLN, NE
Sustainability Ideas

1. Vegetation that is native to Nebraska should be used within the rain gardens and also along the road. Using this type of vegetation should result in a minimal amount of maintenance and upkeep.

2. Trash cans and dog waste bags could be implemented along the trail to minimize pollution and prolong the quality of the area.

3. The rain garden can be used as a teaching tool. The nearby schools can incorporate it into their lesson plans, and the new trails should make the area easier to access by walking. Additionally, the nearby schools could also help maintain the rain garden, creating a hands-on learning experience.
1) Prepare a resume with a picture of yourself following the format of the examples supplied on Blackboard under the "Assignments" category.

---

r - Project Geotechnical Engineer
---

is a senior at the University of Nebraska-Lincoln studying in the field of Civil Engineering. He is responsible for overseeing the design of conventional concrete retaining walls. Other tasks will include identifying the soil in the surrounding area of the project; determining the dimensions of the concrete walls as well as the thickness for the foundation. With his discipline focusing in structural and geotechnical engineering while attending the University r will be able to apply his knowledge obtained from these areas to the project at hand. Classes that were taken in this discipline include: Geotechnical Engineering, Structural Engineering, Foundation Design, Geology, Water Resources, Fluid Mechanics and is currently taking Steel Design, Advanced Structural Analysis, and Reliability of Structures. He will be graduating in May of 2013 with a Bachelor's Degree in Civil Engineering with an emphasis in Structural Engineering.

2) Research key issues identified in the class discussion and assigned to you in your team meeting today. Provide a couple of sentences or a paragraph about your assigned issues to contribute to the Project Understanding Statement of your team's proposal.

The terrain on Old Cheney from 70th to 84th street has a slope to it. From the south side being the high side and on the north side of the road it is the low end. This meaning that earthwork needs to be done for the new roadway to be built on a level terrain. This being that the south side needs to be cut away, and some of the north side needs to be filled in. Once earth is cut away the new slope that would be created from the existing terrain to the new level of where Old Cheney will be, will be will be too steep and unstable and eventually from the pressure from behind the slope it will fail. This is why Retaining walls should be built where there isn't room for a nice gradual slope from one existing to terrain to the new one; this mostly being the case between 70th and 74th ST.

The soil type in the area is loamy soils that are formed from weathered sandstone. This is acceptable as this type of soil drains well and do not have to worry excess runoff coming on to the road as most of it should drain into the ground and the rest that does come onto the road can be handled by the drainage system.
This stretch of road is runs almost perpendicular with Homes Lake watershed, and Cross Creek’s natural course intercepts Old Cheney near Cross Creek Road. Settlement due to the watershed in the area needs to be considered while prepping the dirt material and making sure there is enough fill for the extra settlement that would occur. Not only for the ground underneath the newly laid pavement but also for the pedestrian bridge. The dirt also needs to be prepped correctly to handle the loads of the bridge and foundation supporting it. The slope of the ditches need have the correct number so the water continues to drain towards Holmes Lake.

3) List 3 potential ways to build sustainability into your discipline area of the project for discussion during the Week 3 team discussion.

1) Building the correct type of retaining wall for the soil with a slope to step to hold up its weight and the weight distributed into the ground of buildings. Such as the correct height and thickness. Building the correct one the first time will make the surrounding landscape easier to maintain and not worry about parts of the earth giving out do to external pressures.

2) Having the correct slopes used on the ditches for correct drainage toward Cross Creek and eventually Holmes Lake. This Will help the surrounding area be prepared with a 50 year or 100 year storm that could otherwise ruin structures and the surrounding landscape.

3) Proper foundations for the whole project. If they’re built with the correct dimensions the first time and are apple to handle loads that exceed the normal, then they won’t have to been maintained or repaired in the future, from an economical view this is very good.

[Signature]

Trey's website he found
CIVE 489/489H – Senior Design Project – Spring 2013
Agenda for Week 2, February 1st, 2013
12:30 – 2:20 pm, W357 Nebraska Hall

Objectives:
- Summarize successes and “learning opportunities” identified in Homework #3
- Discuss requirements, hints and evaluations for proposal presentations
- Outline sequence of events for Proposal Presentation Day
- Introduce the process of collecting criteria for project design systems

Today’s “Deliverables”
- Draft proposal
- Homework Assignment #3, Part 2

Success and Learning Opportunities from Homework #2
- E-Week Coordinator: Kortney, Rachel, Brett, Kari, Craig, Amy, and Leah
- Billable hours
- Changes to minutes format
- Methods to improve key information delivery

Preview of Next Milestone: Collection of Design Criteria
- New PM
- New Scribe
- New flunkies

Oral Proposal Workshop
Guidelines for presentation content

Oral Presentation Hints
Hints to improve presentation skills

Topic on Feb 15th
Collection of design criteria for subdiscipline areas

What happens next?
1) Karen edits proposals and sends redlined, scanned copy to each team member Monday morning at the latest.
2) Written proposal should be edited to its final form and prepared for submittal.
3) Today: Outline of presentation slides should be prepared, naming responsible party.
4) Saturday, 6 pm: Basic template of presentation slides must be established and sent to all team members.
5) Individual team members should finalize their assigned slides and return them to the presentation coordinator (NOTE: This does not have to be the PM. Use the most experienced and qualified team member to do this.)
6) Team should meet Weds or Thurs for formal practice. Run through the presentation at least three times. The closer to Friday this is, the better. You’ll sleep better if you don’t practice on Friday morning UNLESS you make changes at your previous meeting and you need to practice the final version you’ll present. Be prompt for your team’s session time.

Agenda for Feb 8th:
Session 1, 10:30 am to Noonish
- Team 5
- Team 3
- Team 6
- Discussion of Milestone 2, Collection of Design Criteria

Session 2, 12:30 pm to 2:30ish
- Team 1
- Team 2
- Team 4
- Team 7
- Discussion of Milestone 2, Collection of Design Criteria

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CIVE 489 – Senior Design Project – Spring 2012
Agenda for Week 5, February 10th, 2012

Team Proposal Presentations

MORNING SESSION: 10:45 am to 12:30 pm, Room W357 Nebraska Hall
Professional Reviewers:
Mark Lujieharms, The Schemmer Associates
Holly Lionberger, City of Lincoln
Karen Schurr, University of Nebraska

NOTE: All morning session teams should be in attendance at 10:30 am. Afternoon session teams are not required to come to the morning session.

10:45 – 11:10
Top Notch Engineering
11:10 – 11:35
Mosbious Designs
11:35 – 11:40
Break
11:40 – 12:05
KA Consulting
12:05 – 12:30
B.B.M.N.D.
12:30 – 12:35
Closing comments

AFTERNOON SESSION: 1:00 to 3:00 pm, Room W357 Nebraska Hall
Professional Reviewers:
Angela Schmidt, E & A Consulting
Erin Sokolik, City of Lincoln
Karen Schurr, University of Nebraska

NOTE: All afternoon session teams should be in attendance at 12:45 pm. Morning session teams are not required to come to the afternoon session.

1:00 – 1:25
SYNTEC Engineering
1:25 – 1:50
VIP Enterprise
1:50 – 1:55
Break
1:55 – 2:20
AGMS Associates
2:20 – 2:45
Global Sustain
2:45 – 2:50
Closing comments
Proposal of Site Improvements

Old Cheney Road Improvements Project
Lincoln, Nebraska
Project Control No. 200028

Prepared for
City of Lincoln, Nebraska

Prepared by

JPAC
ALWAYS LOOKING DOWN THE ROAD...

February 1, 2013

Proposal Contributors:
Patrick Malcolm  John Diediker
Amy Jewell  Cody Kimball
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- Project Scope .................................................................................. 5
- Organizational Chart ........................................................................ 6
- Work Plan with Schedule ................................................................. 7
- Team Member Resumes ................................................................. 8
Project Understanding

This proposal is in response to an RFP by the City of Lincoln regarding a project to convert the section of Old Cheney Road between 70th Street and 82nd Street from a two-lane facility to a four-lane facility with a median and dedicated left-turn lanes. The goal of this project is to increase the level of service of this section of Old Cheney Road which currently acts as a bottleneck. Other major components of this project are sidewalks, bike paths, a pedestrian bridge or underpass, retaining walls, and an improved drainage system. These components are discussed in more depth later in this section and throughout this proposal.

Old Cheney Road from 70th Street to 84th Street currently acts as an urban minor arterial with a speed limit of 45 mph. Current and future land use along the entire corridor is residential with the exception of the elementary school and the drainage canal that extends to Old Cheney from the north near its intersection with 77th Street.

During the design and construction processes, the interests of the primary project stakeholders will be considered. The primary stakeholders for this project are the City of Lincoln Public Works Department, Lincoln Christian School, neighborhood residents, area business owners, commuters, bikers, and pedestrians.

Potential Complications
In order to properly meet the goals of this project, additional right-of-way will likely need to be acquired from some property owners to make way for the proposed facilities. Affected property owners will be contacted prior to construction.

Due to the narrow right-of-way and relatively steep slope, retaining walls on one or both sides of the road will be required to ensure proper soil stability.

Traffic Flow Improvements
Capacity along the corridor will be increased by making it a four-lane divided roadway with 12 ft wide lanes. Intersections along the corridor that currently meet warrants for signalization will continue to be signalized. No other intersections along the corridor appear to warrant new signals. Warrants will also be checked for the necessity of turn lanes.

No other warrants for intersection safety appear to be critical within the project area with reference to the most recent crash study conducted in Lincoln. Considerations of roundabouts and HAWK pedestrian signals are not necessary along the corridor.

Vehicle Accessibility
Access along the corridor will need to be reassessed as more traffic will use the corridor. Access points along corridor can be marginalized by possible right-in-right-out access at 72nd Street, the entrance of the electrical switching station, or 80th Street. Westbound traffic along Old Cheney making left turns into

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Lincoln Christian Elementary School driveway will be maintained for optimal traffic operations within the facility.

The project will be completed in two phases: east of 77th Street and west of 77th Street. In each phase, the traffic in both directions along the respective section of the project will be shut down completely for the duration of that phase. There will be a final sub-phase in which the intersection at 77th Street is completed. This phasing provides the benefits of quick construction, while maintaining partial access for most of the construction period.

Construction projects often generate concerns among residents about noise, safety, and access for the surrounding neighborhoods. JPAC will communicate with these homeowners as well as the Edenton South Neighborhood Association to ensure that residents are made aware of alternate access routes, that safety will be a top priority, and that the project will be completed in a timely manner.

There are only a few businesses within a half mile of the project site, so the impact of construction on area businesses will be minimal. JPAC will ensure detour routes are designated in order to maximize efficiency and minimize any negative impact on the surrounding area.

Currently, there are no StarTran bus routes along Old Cheney Road within the project limits. However, according to the City of Lincoln’s Long-Term Transportation Plan, there will eventually exist a bus route along this section of roadway. Bus pull-offs are not included in the scope of this project, but consideration will be given in the design process to allow for the ease of installation of such facilities in the future.

The Lincoln Public Schools Transportation Department will be notified of the project and plans will be made to adjust any necessary school bus routes around the project site during construction. Bus access to the driveway to Lincoln Christian School Preschool on Old Cheney Road will be maintained throughout the duration of construction.

Pedestrian and Bicycle Accessibility
As denoted in the Long Range Comprehensive Plan, the expansion of the corridor along Old Cheney from 70th to 84th Street is a Tier I, Priority A redevelopment. In accordance with this plan, pedestrian walkways will be designed and implemented along both sides of the corridor. The sidewalk along the north edge of the roadway will be a hiker/biker trail. The trail will be designed to meet the specifications outlined in the Long-Term Transportation Plan.

A pedestrian crossing will be placed at 77th street to improve pedestrian safety. This will either be a pedestrian bridge or an underpass crossing. The type of crossing will be determined after geotechnical analysis and civil considerations. The crossing will connect to the bike path.

Flooding and Drainage Considerations
According to the City of Lincoln Floodplain Standards, the project site does not lie within a floodplain. Additionally, the project is not near any major streams, lakes, or rivers that would impact construction.

This section of Old Cheney Road resides in the Holmes Lake Watershed and efforts will be made to
improve the watershed by ensuring that runoff ultimately makes its way to Homes Lake. Although growth is not expected in the community between 70th and 84th Streets, the existing watershed in this area will be maintained in order to improve the natural means of managing stormwater runoff and any potential drainage issues. In 2006 the City of Lincoln proposed a Water Quality Improvement Plan that was completed in 2008 which offered rain garden and rain barrel installation to property owners within this watershed. Those rain gardens will be protected, and new ones will be constructed if needed.

Although flooding is not a major issue in this area, there have been some complaints from area homeowners who have seen stormwater nearly overflowing from swales near their homes. In the event of a 50- or 100-year storm, flooding would become a major problem resulting in significant property damage. Existing culverts and swales will be evaluated or redesigned to ensure proper capacity.

Environmental Considerations
Wetlands, pollutants, and erosion areas will not be key issues for the project. The area is densely populated with residences. Drainage systems will be designed to limit the stormwater that flows through the area. There is current evidence of erosion in ditches, but once the road is widened and retaining walls are built, there will be little erosion. When erosion problems do arise, JPAC will use best practices and the NDOR Drainage Design and Control Manual. The area has many trees which will have to be removed to make way for the new design. Reasonable efforts will be put forth to keep as many trees as possible and owners will be compensated fairly for loss of private trees.

Geotechnical Considerations
In general, the terrain within the project site is higher on the south side of Old Cheney Road than on the north side. This will affect decisions made regarding side-slopes and retaining walls as well as the drainage plan for the project site.

The project site is composed almost entirely of various types of silty clay loam, which is similar in composition to the soil in the rest of Lincoln. A soil report will be prepared and utilized in the design of the retaining wall and subbase preparation.
# Design Approach

Table 1 below lists the most crucial issues of the project, how the engineers at JPAC will approach solving these problems, and the benefits that these approaches can provide to the community.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Approach</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway Capacity</td>
<td>● Expand corridor to 4-lane divided roadway</td>
<td>● Decreased delay</td>
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<tr>
<td></td>
<td></td>
<td>● Increased capacity</td>
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<td>● Improved Level of Service</td>
</tr>
<tr>
<td>Flooding</td>
<td>● Implement Sustainable Urban Drainage Systems (SUDS)</td>
<td>● Prevent flooding</td>
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<tr>
<td></td>
<td>● Improve Watershed</td>
<td>● Reduce pollutant runoff</td>
</tr>
<tr>
<td></td>
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<td>● Reduce erosion</td>
</tr>
<tr>
<td>Residential Access</td>
<td>● Neighborhood access will be maintained when feasible from 70th and 84th Streets</td>
<td>● Expedite project completion</td>
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<tr>
<td></td>
<td></td>
<td>● Minimize public dissent</td>
</tr>
<tr>
<td>Pedestrian Crossing</td>
<td>● Construct pedestrian bridge or underpass crossing</td>
<td>● Pedestrian safety</td>
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<tr>
<td></td>
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<td>● Continuous flow of traffic</td>
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<tr>
<td></td>
<td></td>
<td>● Aesthetics</td>
</tr>
<tr>
<td>Property in Right-of-Way</td>
<td>● Meet with property owners and establish fair settlements</td>
<td>● Provide room for road, sidewalk, and bike path</td>
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<tr>
<td>Terrain Configuration</td>
<td>● Place retaining walls where space is insignificant for proper side-sloping</td>
<td>● Soil stability</td>
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<td>● Safety</td>
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<tr>
<td></td>
<td></td>
<td>● Increased room for facilities</td>
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<tr>
<td>Hiker / Biker Access</td>
<td>● Create sidewalks and bike paths that are separated from roadway by trees and/or vegetation</td>
<td>● Contributes to existing city trail system</td>
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<td></td>
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<td>● Improved aesthetics, leading to increased usage by citizens</td>
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</table>

The issues listed above are the primary issues regarding this project. Additional issues include residential access and demolition of trees in the area. Neighborhood access along Old Cheney will be available at all times and sufficient efforts will be made to avoid the demolition of trees. After construction, new trees and rain gardens will be constructed.
Project Scope

Project Limits
- This project will extend along Old Cheney Road from 70th Street to approximately 82nd Street.

Roadway Capacity Improvements
- Widen Old Cheney Road from a two-lane roadway to a four-lane roadway with a median, an additional left-turn lane when warranted and dedicated right-turn lanes as warranted.
- Traffic demand at side-streets will be evaluated and intersecting streets may be converted to cul-de-sacs or right-in-right-out intersections to improve traffic flow.
- Update traffic signals, signal timing, signs, and striping as necessary to facilitate proper traffic flow.

Sidewalk / Bike Path
- Construct a sidewalk along the south side of Old Cheney Road.
- Construct a bike path along the north side of Old Cheney Road with greenery separating the path and the road to provide pleasing aesthetics along the trail.

Pedestrian Crossing
- Construct either a pedestrian bridge or underpass crossing Old Cheney Road and 77th streets.

Storm Sewer Drainage Improvements
- Determine new inlet locations for storm sewer.
- Install new inlet and outlet piping with larger diameters to better support the amount of water flowing through the system.
- Develop an emergency overflow path in case of extreme rainfall.

Retaining Walls
- Retaining walls will be constructed on either side of the roadway where necessary to provide proper soil stability where space is insufficient for side-sloping.

Environmental Considerations
- Improve watershed and add rain gardens to reduce pollutants and need for drainage systems.
JPAC has carefully selected their best engineers for each task at hand. The team members listed below are available to begin work upon notice to proceed. This project will receive immediate attention and JPAC promises to complete it as efficiently and effectively as possible. Figure 1 shows the hierarchy which will be followed for communication during the extent of this project.

Figure 1 - Organizational Chart
# Work Plan with Schedule

## Table 2 - Work Schedule

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Team Member Resumes

Patrick Malcolm – Project Manager & Geotechnical Engineer
Mr. Malcolm is a civil engineering student at the University of Nebraska-Lincoln set to graduate in May 2013. He has taken classes on geotechnical engineering and foundation design and has passed the FE exam. His primary role on the project will be to design the concrete retaining wall(s) and to analyze the local soil conditions. His two civil-engineering-related internships have provided him with an invaluable familiarity with the design and drafting process.

Amy Jewell – Project Structural & Environmental Engineer
Ms. Jewell is senior civil engineering student at the University of Nebraska-Lincoln. She has taken many structural-based classes including Introduction to Structural Engineering, Materials of Construction, Foundation Engineering, and Reinforced Concrete Design. She has gained structural analysis experience through a prior aerospace internship and has also passed the FE exam. She is looking forward to getting back on the civil side of her career. She will also contribute to the environmental side of the project.

John Diediker – Project Transportation Engineer
Mr. Diediker has nearly two years of experience working with traffic impact studies, traffic operations design, corridor analysis, and ITS planning and design that allows him to bring effective solutions to transportation issues of all types. He has successfully completed his FE exam in October 2012 and will be graduating from the University of Nebraska-Lincoln in May 2013.

Cody Kimball – Project Water Resources & Environmental Engineer
Mr. Kimball is a senior civil engineering student at the University of Nebraska-Lincoln. He is the water resources consultant for JPAC and will responsible for the completion for all the water resources and some of the environmental aspects of this project. He has taken many courses at UNL including Flow Systems Design, Fluid Mechanics, Surface Water Hydrology, Process Design of Wastewater, and Intro to Environmental Engineering. Mr. Kimball will graduate with a Bachelor’s Degree in Civil Engineering in December of 2013.
PROPOSAL OF IMPROVEMENTS FOR OLD CHENEY ROAD, 70TH TO 84TH STREETS

Submitted to: City of Lincoln, Nebraska
Submitted by: Prime Engineering
February 4, 2013
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
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<tbody>
<tr>
<td>Project Understanding</td>
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<tr>
<td>Project Approach</td>
<td>3</td>
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<tr>
<td>Project Scope</td>
<td>4</td>
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<tr>
<td>Organizational Chart</td>
<td>6</td>
</tr>
<tr>
<td>Work Plan/Schedule</td>
<td>7</td>
</tr>
<tr>
<td>Project Design Team</td>
<td>8</td>
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</table>
PROJECT UNDERSTANDING

The following proposal describes the reconstruction of Old Cheney Road from S 70th to S 84th Streets in Lincoln, Nebraska. This project is in the preliminary stage of development and is continuously being researched by Prime Engineering to develop the optimum product for the city of Lincoln. The area surrounding the reconstruction consists of residential housing, utilities owned by the city of Lincoln, and a parking lot owned by the Lincoln Christian Elementary School. The project consists of improving the current two-lane roadway to a four-lane roadway consisting of two lanes of traffic traveling in the east and westbound directions as well as left turn lanes. Adding more lanes will ease the already congested roadway as well as accommodate the increased traffic flow due to Lincoln’s continuous expansion. Plans also include the addition of a pedestrian bridge that spans the 77th street intersection connecting the North and South sides of the intersection. A bike path will be added to the North side of the roadway as well as the implementation of retaining walls when deemed necessary.

Many potential issues were researched for this project; some were found to be inconsequential. The area does not lie in a floodplain, so certain floodplain features will not be incorporated. There is no bus route within the project limits and according to the LPlan 2040 there will not be one in the near future. Though the LPlan 2040 does not show a bus route for the project area, due to Lincoln’s continual expansion, potential bus turnout will be free of conflicting elements.

A portion of the issues that were investigated were found to be key issues for an optimal design. There is currently very little pedestrian access along the project which causes pedestrians to either find an alternative route or walk in the grass that parallels the roadway. A hiker-biker trail on the North side of the roadway as well as a sidewalk on the South side will be proposed. This coincides with the City of Lincoln’s LPlan 2040 to add a trail along this section of Old Cheney. Another key issue for the area is the large slope within a relatively short distance, thus we propose several retaining walls along the South side of the roadway and possibly the north side. With the increase of concrete into the area additional drainage systems will be needed to reroute the excess water and prevent flooding of nearby properties. Additional storm sewers will be used to reroute the excess water. The intersection at 77th street is a place of congestion on the site so with the addition of two more lanes, a four-lane roundabout is proposed for the 77th street intersection. Roundabouts eliminate the need for a signalized intersection and reduce overall maintenance costs. Roundabouts also reduce the frequency and severity of crashes while maintaining efficient traffic flows.
Various issues will be assessed and managed accordingly during the redesign of Old Cheney Road between 70th and 84th. A list of primary issues is included within the following table. The design team approach and potential benefits are also presented.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Approach</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve traffic flow</td>
<td>- Installation of roundabout at 79th St&lt;br&gt;- Widening of the roadway from two to four through lanes</td>
<td>- Increase capacity&lt;br&gt;- Reduce maintenance and operation cost&lt;br&gt;- Reduce frequency and severity of crashes&lt;br&gt;- Less noise and vehicle emissions</td>
</tr>
<tr>
<td>Maintaining access during construction at all times</td>
<td>- Phased construction and temporary surfacing will be utilized</td>
<td>- Residents, businesses, and schools will be minimally impacted</td>
</tr>
<tr>
<td>Soil stability</td>
<td>- Conduct geotechnical analysis&lt;br&gt;- Construct retaining walls</td>
<td>- Prevention of soil failure</td>
</tr>
<tr>
<td>Storm water management</td>
<td>- Proper storm water facility locations will be assessed</td>
<td>- Maintain proper drainage and improve drainage patterns&lt;br&gt;- Decreased erosion</td>
</tr>
<tr>
<td>Environmental control and protection</td>
<td>- Implement rain gardens&lt;br&gt;- Utilize erosion control measures&lt;br&gt;- Creation of a Storm Water Pollution Prevention Plan (SWPPP)</td>
<td>- Aid the pre-existing drainage system&lt;br&gt;- Help manage increased runoff due to large concrete cross-section&lt;br&gt;- Protection of the natural environment</td>
</tr>
<tr>
<td>Pedestrian crossing</td>
<td>- Construction of pedestrian overpass</td>
<td>- Reduce pedestrian related accidents&lt;br&gt;- Easier and safer crossing for pedestrians/students&lt;br&gt;- Link to proposed bike trail</td>
</tr>
<tr>
<td>Potential bus route</td>
<td>- Future bus turnout areas will be planned for and kept clear of conflicting elements</td>
<td>- Implementing a bus route in the future will be easier</td>
</tr>
<tr>
<td>Hiker/biker trail and pedestrian sidewalk</td>
<td>- Trails and walkways will be adequately sized and consistent with others located throughout Lincoln</td>
<td>- Will maintain the cohesiveness of the City trail network of the City</td>
</tr>
</tbody>
</table>

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PROJECT SCOPE

Project Limits:

- The Old Cheney Road improvements will begin with reconstruction of Old Cheney from approximately 70th Street and ending at approximately 84th Street in the city of Lincoln, Nebraska.

Roadway Capacity Improvements:

- Old Cheney will be widened from a two-lane urban street to a full four-lane urban street.
- The existing pavement will be removed and replaced with full depth concrete pavement between 70th and 84th Streets.
- Roadway will have a median dividing the traffic, curbs and gutters, and required turning lanes and U-turn movements for vehicles.
- Intersections will have new traffic signals, street lighting, and communication infrastructure.
- Access points for residents and businesses will be maintained at all times through the phases of the project through the use of phased construction or temporary surfacing.
- Reconstructing adjacent roads as required to match with the improvements.
- Design a two-lane roundabout at the 77th intersection.

Pedestrian Safety Improvements:

- Five-foot wide concrete sidewalk proposal on south side of Old Cheney Road.
- Ten-foot hiker/biker trail proposal along north side of entire length of project.
- Under or over pedestrian crossing will be provided at the most convenient location which will connect the hiker-biker trail system with residential neighborhoods.
- Curb ramps at intersections or where cross walks are placed.

Drainage Improvements:

- Installing drainage facilities and reconstructing water and wastewater mains will be designed and constructed for proper drainage of the roadway and surrounding areas.
- Installing rain gardens located North across from Cross Creek Road to aid the already pre-existing drainage.

Geotechnical Design:

- Grading is expected to be moderate based on current site topography with cuts and fills expected to be 15 feet or less.
- Retaining walls will be constructed along selected sections of the project to minimize private property impacts.
  - Wall one: 400 feet after 72nd to 300 feet short of Crosscreek Road.
  - Wall two: 300 feet after Cross Creek Road to 77th St.
• Wall three: 150 feet after 77th St to 100 feet short of 80th St.

• Drainage structures, pole foundations, bridges/underpass and pavement for the project will be designed with geotechnical recommendations.

Environmental Protection:

• Full environmental evaluation will be required including rain gardens and a Storm Water Pollution Prevention Plan (SWPPP).
• Considerations will be put into effect to minimize impact on the surrounding environment.
• Prevention of soil erosion and sediment loss will be put into effect during and after the construction phase.
• Do not have to worry about wetlands or flood plains.

Structural Design:

• Structural design of box culverts with steel girder superstructure and reinforced concrete box.
• Bridge design alternatives will take into count the impacts of fill slopes vs. MSE walls at the bridge abutments.
• The soil types will be determined for the bridge design.

Project Information and Education:

• Open houses for the public.
• Consultants will be able to answer questions and receive comments.
• Newsletters and informational material to keep the public up to date.
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As the Head Water Resources Engineer for Prime Engineering, Mr. will incorporate his previous experience and extensive knowledge of Water Resources Engineering into the Old Cheney Road, 70th to 84th Street project. Mr. will graduate from the University of Nebraska-Lincoln in May with a Bachelor’s Degree in Civil Engineering. He has previously worked for the Nebraska Department of Roads for over two years assisting engineers with all aspects of projects in the Roadway Design division. His experience in design of culvert pipes and storm sewer systems will be vital to the sustainability of this roadway. Mr. has also taken Culvert Design and Storm Sewer Design classes sponsored by the Nebraska Department of Roads.

I – Project Structural Engineer

attended the University of Nebraska-Lincoln with a Bachelor’s degree in civil engineering with an emphasis in Structural Engineering. His responsibilities will be the structural portion of the project, which mainly consists of locating and designing the pedestrian crossing structures. His background includes Bridge Design, Foundation Engineering and Reinforced Concrete Design; he can use this to assist other members on this project.

– Project Transportation Engineer

Mr. is a senior Civil Engineering major at the University of Nebraska – Lincoln. His responsibilities are mainly focused on the transportation side of the project. Mr. has a strong understanding in the fields of highway engineering, highway design, urban transportation planning, and traffic engineering. He has knowledge in several fields but his background in transportation engineering will be a key asset during the project.
Leah Kottwitz – Project Environmental Engineer

She is a senior environmental consultant with an emphasis on wastewater treatment and collection, water treatment and distribution, and water conservation. She has taken many classes within the discipline of environmental engineering including Intro to Environmental Engineering, Solid Waste Management, Design of Water Treatment Facilities, and Environmental Engineering Process Design. Since May 2011 she has interned with the Environmental Engineering department of JEO Consulting Group, Inc. in the Wahoo, Omaha, and Lincoln, Nebraska offices. Her responsibilities at JEO have included site visits and construction observation, design work, plan and specification preparation, permit creation, O&M manual creation, project description writing, and various other tasks. Upon graduation in May 2013, Ms. Kottwitz will pursue a master’s degree in environmental engineering.

Mr. M. J. is a senior at the University of Nebraska Lincoln studying in the field of Civil Engineering. He is responsible for overlooking the design of conventional concrete retaining wall. Other tasks will include identifying the soil in the surround area of the project; determine the dimensions of the concrete walls as well as the thickness for the foundation. With his discipline focusing in structural and geotechnical engineering while attending the university Mr. M. J. will be able to apply his knowledge obtained from these areas on to the project at hand. Classes that were taken in this discipline include: Geotechnical Engineering, Structural Engineering, Foundation Design, Geology, Water Resources, Fluid Mechanics and is currently taking Steel Design, Advanced Structural Analysis, and Reliability of Structures. He will be graduating in May of 2013 with a Bachelor’s Degree in Civil Engineering with an emphasis in Structural Engineering.
Transportation

- Four lane facility with median and space for left / right turn lanes
- Keep all access points open

Geotechnical

- Subsurface exploration data
- Analysis of the data
- Recommendations for design
  Source: www.leonwall.com

Structural

- Pedestrian underpass
- Separate pedestrians and vehicles
- Multiple locations possible
- Add night-time safety features
Water Resources

- Storm sewer pipeline
- Increased storm water diversion efficiency
- Flood prevention
- Maintain traffic during heavy rain

Environmental

- Rain gardens
- Erosion control blankets
- Possible relocation of trees

Sustainability Strategies

- Increase recycling/reuse of material
- Rain Garden Design
- Better, Greener, Faster
- Include sustainability in every decision
Project Schedule

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Summary

- Widening Old Cheney Road
- Added sidewalk and biker trail
- Storm water moved away from project
- Sustainable design

Engineering 720 Is For You!

- Experienced Team
- Creative approach
- Willing to go around world twice for clients
Project Team

Brandon Gardels – Project Manager/Geotechnical
Christopher Getter – Transportation
Ben Harrett – Environmental
Craig Mayfield – Water Resources
Trey Allen – Structures

[Map of the area with annotations]

[Photograph of the road intersection]

58
Project Understanding
- Traffic congestion
- Narrow right-of-way
- Future development
- No current bike path/walkway

Faster-Safer Corridor
- Four-lane facility
- Median separated
- Multi-modal transportation

An Alternative Intersection
- Higher traffic flow
- Less noise pollution
- Lower maintenance costs
Water Resources

- Surface water runoff
- Storm sewer design
- Temporary storage of storm water

Structural

- Pedestrian underpass below Old Cheney Road
- Makes the intersection safe for pedestrians
- Encourages continuous traffic flow

Environmental

- Rain garden design
- Pervious pavement
- Erosion control
Geotechnical

- Soils analysis
- Subgrade design
- Retaining wall design

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PROJECT SCHEDULE

---

PROJECT APPROACH

- Stakeholders
  - City of Lincoln
  - Local Residents
  - Lincoln Christian School
  - Daily Commuters

- Geotechnical & Water Resources Design
- Construction Planning & Public Education
Project Highlights
Roundabout at 77th Street Intersection
Pedestrian underpass below Old Cheney Road near 77th Street
New bike trail on the north side of Old Cheney Road
Rain gardens to help control runoff

Why Fine Line Designs?
Well qualified team
Invested interest
Sustainable design solutions

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**Billable Hours Log Team 1**

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**Date of Summary:** Friday, February 8th, 2013  
**Project Control Number:** 700028  
**Project Name:** Old Cheney Road, 70th to 84th Streets  
**Prepared by:**  
**Team Number/Name:** 1, Kingman Designs

**Project Billable Hours Weekly Summary**

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EXAMPLE, HOMEWORK ASSIGNMENT #3, PART 2:

Name and Functional Engineering Sub-Discipline Area:
I am Karen Schurr, the Water Resources Engineer for Team 8, 4-Schurr Engineering.

Current Knowledge Skills and Abilities:
I can delineate watersheds, identify major drainage systems and determine small drainage area flows. I've done this in previous course work and also applied it to an internship that I currently have with TaDah Engineering. I've used AutoCADD to delineate watershed boundaries from digital topographic maps and determine contributing areas.

Additional Knowledge Needs:
I have never located the position of storm sewer inlets, designed sewer pipe diameters nor determined hydraulic gradelines in pipes.

Resources Required to Complete the Storm Sewer Design:
I need to know where the existing drainage pipe systems are located and I need an elevation topographic map of the Holmes Watershed area.

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| **Transportation** | Traffic Engineering | - Accident Analysis  
- Traffic Projections  
- Left and Right Turn Lane Warrants and Storage Lengths  
- Signal Warrant Review  
- Signal Timing  
- Construction Phasing  
- Stripping Plan |
| **Roadway Design** | | - Horizontal Alignment Design  
- Vertical Alignment Design  
- Lane Edge Geometry  
- Typical Cross Section Determination  
- Hiker-Biker Trail Design |
| **Water Resources** | Flow Systems Design | - Delineate relevant watersheds  
- Identify major drainage system  
- Identify minor roadway drainage system  
- Locate storm sewer inlets  
- Identify storm sewer flows  
- Design storm sewer pipe diameters  
- Design storm sewer hydraulic gradelines |
| **Geotechnical** | Conventional Concrete Retaining Wall Design | - Identify soil characteristics  
- Determine wall height  
- Design dimensions of concrete wall and foundation |
| **Structural** | Reinforcing Steel for Concrete Retaining Wall  
Preliminary Design of Hiker-Biker Crossing (Bridge or Box) | - Design steel reinforcement for wall and foundation  
- Decide on ped crossing option (over/under)  
- Determine ped accessibility constraints, clearances, loading and cross section  
- Provide preliminary plans for design of structure |
| **Environmental** | Erosion Control Design  
Rain Garden Design | - Complete SWPPP form  
- Recommend erosion control measures  
- Recommend locations along the project for rain gardens  
- Design basic features of rain gardens |
Objectives:
- Discuss changing roles for Milestone #2
- Requirements of four and five member teams
- Discuss homework assignment for Week 6

Today’s “Deliverables”
- Final response to RFP
- Hard copy of presentation notes

Success and Learning Opportunities
- Billable hours for Week 5

New Team Roles for Milestone #2: Establishing Design Controls and Criteria

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Preview of Week 6, February 15th Objectives
- Discuss changing roles for Milestone #2, Establishing Design Controls and Criteria
- Discuss design sequencing for the near future
- Discuss needs for Project Design Information Memos
- Introduction of computer project files
- Outline team assignments for transportation and water resources design work

Homework due Friday, Feb 15th, 12:30 pm
Each sub-discipline functional engineer (ENV, GEO, STR, TRN, WTR) will provide a minimum 100-word summary of each link provided on the “Internet Links for City of Lincoln Design Standards and Guidelines as of 2-9-12” and the list of Blackboard Course Documents that applies to their respective design role (both shown on the next pages). The summary should provide enough information for an individual to know which document would be applicable for each expected aspect of design control or criteria they will eventually need to complete the Project Design Information Memo for their individual area. The summary should be descriptive enough to guide another sub-disciplinary engineer to take over each individual’s role, if needed. **NOTE**: The word count for this paragraph at the end of this sentence is 142 to give you an idea of the minimum length the description needs to be.

The documents related to TRN should be split between the TRN, ENV and STR engineers. Two hard copies of this assignment must be printed. One copy of this assignment will be submitted to Karen and one will be used to provide reference information for your team meeting on Feb 15th.
Internet Links for City of Lincoln Design Standards and Guidelines as of 2-9-12

Water Resources and Environmental Engineers
http://lincoln.ne.gov/city/attorn/designs/contents.htm Sections: 2.05, 2.07, 2.35, 3.65
http://lincoln.ne.gov/city/pworks/watrsheid/maps/wtrsheds/index.htm
http://lincoln.ne.gov/city/pworks/watrsheid/educate/bmpguide/
http://lincoln.ne.gov/city/pworks/watrsheid/educate/garden/rgp/
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http://lincoln.ne.gov/city/pworks/watrsheid/mplan/bealslmp/
http://lincoln.ne.gov/city/pworks/watrsheid/require/drainage/
http://lincoln.ne.gov/city/pworks/watrsheid/require/standard/
http://lincoln.ne.gov/city/pworks/watrsheid/require/erosion/

Transportation Engineers
http://lincoln.ne.gov/city/attorn/designs/contents.htm Sections: 2.15, 2.35, 3.50, 3.65, 4.00, 4.20, App A

Geotechnical and Structural Engineers

Blackboard “Course Documents” Sub-Discipline References

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<td>2/6/2013 11:20 AM</td>
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</table>
Summary of Box Culvert Design

This section of the AASHTO LRFD Bridge Design Specifications focuses on the design of buried structure and tunnel liners. Specifically, it talks about the design for cast in place or precast box culverts. These design specs discuss calculating the earth load for different box culvert installations. It discusses how the placement of the wheel loads in relation to the ends of the culvert or near expansion joint affects the strength of the culvert. These specs show how to calculate the loads on the top, sides, and bottom of a culvert. The specs discuss how the depth of fill below the roadway and the compaction of fill beside the culvert affect its strength.

Summary of Proposed Cross Section

This file shows proposed typical cross sections for the reconstructed Old Cheney Roadway between 70th and 84th. There are six cross sections included. The basic cross section: no right or left turn lanes, just four driving lanes and a median. Cross sections showing four driving lanes, left and right turn lanes are shown. There is a cross section for the transition from four driving lanes to four driving lanes plus both turn lanes. The cross sections shown include proposed lane widths, proposed slopes. Stationing is shown for where each cross section will be implemented. Plans for the sidewalks and medians are also included on the cross sections.

Summary for Guidelines for Turn Lane Storage Length

This pdf describes the Nebraska Department of Roads method for determining turn lane storage length. Multiple factors are considered for the determination of a turn lane storage length. These lengths are considered on a case by case basis considering through traffic volumes, turning traffic volume, required storage length, approach design speed, stopping distance for approach speed, and type of intersection traffic control. Turning lanes consist of three parts: a section for entering turn lane, a deceleration space, and then a storage space. There should be enough storage space for a minimum of two vehicles. The deceleration space is not practical in all circumstances especially in an urban environment where intersections are frequent. Equations are included for calculation of turn lane length.

Summary of Urban Public Street Design Standards (Chapter 2.15)

This chapter from the department of public works and utilities outlines everything needed for urban street design. It includes everything from speed, to grade, to geometry standards for sight distance, curbs, and drainage. Design speeds stated outright for local and collector streets, but decided upon on a case by case basis for arterials. Horizontal alignment is detailed including minimum radii and tangents between curves. Vertical alignment k values are shown. Recommended grades are included and detailed for intersection approach/departure. Roadway widths and cross section grades can also be found in this chapter along with paving material recommendations for roadway, intersections, and sidewalks.

Summary of Design Standards for Trails (Chapter 3.65)

The design standards for hiker/biker trails include nine sections: clearing, drainage, bases, sight distance, grade, curvature, width, bridges, and signage. Clearing must be maintained off the side of the paths as well as above. Clearing is maintained for 3 feet off the side of the path, and for a minimum of 10 feet above the path. Trails generally slope to provide runoff to a drainage ditch. Four different sub grade/surfacing combinations can be used. Three inches of concrete above sub grade is usually used. Sight distance must be 50 feet at 10 mph otherwise signage is required. The max grade on paths is 5%. Curvature is based on a 20 mph design speed. 6 feet minimum width is required on paths and bridges.
Project Design Information Memo – Bridge

This document is a memo which is to be filled out with information regarding the design of a bridge in the City of Lincoln. This memo is to be filled out by the engineer in charge of the design of the bridge. Once filled out, the memo includes a description of the bridge location, length, spans, project scope, the need for the project, pedestrian needs, and aesthetic considerations. Some other information is requested on this memo, such as abutment details, prevention of bird roosting, management of runoff, construction phasing, governing codes and design criteria, existing and proposed utilities, and hydraulic information about the body of water being crossed (if relevant).

Example Retaining Wall Plans

This document is a set of three sheets from a plan set which detail a retaining wall. These plans are from a project designed by Olsson Associates and Parsons Brinckerhoff. The plans contain a cross-section view of the retaining wall with dimensions and locations of reinforcement. There are also details for expansion joints, control joints, and construction joints. There is also a plan view of the retaining wall showing where it is located with respect to the overall project. This specific project also involves a drainage pipe opening at the bottom of the retaining wall, which is detailed on these drawings. Likewise, the fence that was to be installed above the retaining wall is detailed on these drawings.

LRFD Conventional Retaining Wall Design

This document provides an in-depth description of the LRFD design procedure for both gravity retaining walls and cantilever retaining walls. In this project, we will most likely be employing a cantilever retaining wall, so that section will be most useful. The procedure begins with an explanation of how to calculate the load combinations and determine load factors. The values needing checked during design of conventional retaining walls are overall stability, bearing resistance, overturning or eccentricity, and sliding. There is an example of the design procedure for each of the types of retaining walls in this document.

NDOR Geotechnical Manual

This document provides a general overview of the field of geotechnical engineering. It begins with an explanation of different soil types and classifications as well as methods used to measure soil properties in the field such as the cone penetration test and the dilatometer test. It goes on to give some general requirements for geotechnical projects as well as some discussion of specific aspects of geotechnical projects such as boring and subgrade considerations. Next, it goes on to explain laboratory soil testing procedures and some general soil properties such as shear strength, moisture content, atterberg limits, and hydraulic conductivity. Finally, the document discusses soil modification techniques including, fly ash stabilization, moisture content adjustment, and soil cement stabilization.

2010 AASHTO LRFD, Chapter 10, Foundations

This document provides in-depth information about the design of foundations, including equations, tables, and graphs necessary for design calculations. The chapter begins by including a list of definitions of all the variables used in the equations in the chapter. It also includes a brief discussion of soil and rock properties, methods for subsurface exploration, and a table with guidelines for the amount of exploratory work to be done on different types of projects. Notably, the document covers the design of spread foundations using the Vesic equations as well as a very in-depth discussion of the design of several types of deep foundations including driven piles and drilled shaft foundations.
Drainage Criteria Manual
This website includes several documents which together explain various aspects of drainage system design and analysis. Chapter 2 begins with an explanation of the rational method of determining stormwater runoff. It then explains the unit hydrograph approach for determining the amount of runoff at a given time during a storm. Chapter 3 discusses storm drainage systems, including methods for calculating gutter flow capacity, and curb inlet capacity and design. Chapter 5 discusses design of open channel flow, including rock-lined channel design, rock riprap design, vegetated slope design, and filter fabric design. Chapter 6 discusses runoff storage facilities, Chapter 8 discusses best management practices for stormwater management, and chapter 9 discusses erosion and sediment control.

Floodplain Standards
This website contains the City of Lincoln regulations and standards on watershed management and flood regulations for new growth areas and existing urban areas. The information regarding new growth areas is not relevant to this project, because the project area is already a developed community. The Lincoln Subdivision Ordinance, Title 26 chapter 7 contains a list of definitions pertaining to watershed and floodplain management. This website contains links to the relevant portions of the 2025 Comprehensive Plan which includes maps of current and future land classification pertaining to water resources and explanation of various land usage types.

Erosion and Sediment Control
This website contains several links pertaining to erosion and sediment control. There are links to several brochures including best management practices and the neighborhood greenspace brochure & handbook. There is also a link to information regarding erosion and sediment control procedures during construction. Several links to information from the EPA regarding fines for violations, sample construction site inspection reports, and information on stormwater prevention plans. Some of the methods discussed throughout the documents linked on this website are using vegetation and the construction of rain gardens to control runoff and using silt fences to reduce erosion.
Objectives:
- Discuss success and learning opportunities from Milestone #1
- Discuss major scope changes in the project based on current project knowledge
- Discuss changing roles for Milestone #2
- Discuss functional design and sequencing for the near future
- Discuss needs for Project Design Information Memos
- Discuss Week 7 assignment

Today's "Deliverables"
- Description of the content of each sub-discipline reference item on Blackboard. Descriptions should be at least 100 words.
- Milestone #1 Team Evaluation Sheet

Status of Project Design Team Selection
In progress

Billable Hours
Comparison of team work effort over the past week

Successes from Milestone #1
- Presentation
- Written Proposal

Learning Opportunities from Milestone #1
- 3 color copies of PowerPoint slides for evaluators (4 of 7 teams)
- Prompt arrival
- No dual lane roundabout
- No bike path in median
- Underpass rather than overpass
- Existing watershed restrictions

Milestone #2: Collection of Design Criteria
- New PM
- New Scribe
- New flunkies

Objective of Senior Design Course
Discussion

Assumptions to Date
See page 3

Specific Sub-Disciplinary Tasks
See page 4

Format for Sub-Discipline Technical Written Report
See page 5

Project Design Information Memos
- Roadway
- Stormwater

Assignment for Week 7, Friday, February 22nd
See page 2
Week 7 Homework Assignment
Friday, February 22\textsuperscript{nd}

Combined Reference List
1) Prepare a combined reference summary list that includes each sub-disciplinary area. List them in order of ENV, GEO, STR, TRN and WTR.
2) PM sends one electronic copy to Karen and all team members by 8 am, Friday, Feb 22\textsuperscript{nd}.

Draft Design Information Memos
1) A minimum of two team members should work together on each of the Roadway and Stormwater Design Information Memos. Complete as much information as possible to prepare a draft.
2) Send the draft memo to the PM by Weds, Feb 20\textsuperscript{th} at 5 pm.
3) PM sends both “massaged” draft memos to Karen electronically by 8 am, Friday, Feb 22\textsuperscript{nd}.

Partial Completion of Technical Written Report
1) Format your technical written report according to the guidelines at the top of page 5.
2) Complete the report through the Design Criteria section with as much information as you know at this point in time.
3) Send an electronic copy of your draft technical written report to Karen by 8 am, Friday, Feb 22\textsuperscript{nd}.

Evaluate Your Presentation Performance and Try to Improve
1) Watch your individual performance on video.
2) Complete the oral performance improvement form on page 6 by selecting two things you think you can improve upon in your final oral presentation.
3) Submit the oral performance improvement form at 12:30 pm, Friday Feb 22\textsuperscript{nd}.

Week 7 Lecture Content

- Introduction of Electronic Files in MicroStation and AutoCAD Formats
- Discussion of Initial Sequence of Preliminary Design

TRN:
- Define min cross section widths
- Define horizontal alignment
- Define vertical alignment
- Define cross slopes

ENV:
- Find locations for rain gardens
- Find examples (east side 48 & Prescott, standards)

GEO:
- Define wall design methodology

STR:
- Research bike path + ADA standards
- Define underpass dimensions

WTR:
- Define existing drainage patterns
I, _______ will improve my oral performance in the following two ways:

1. 

2. 

Individual performance improvement
Objectives:
- Discuss new attendance policy
- Discuss continuing successes and learning opportunities from Milestone #1
- Discuss changing roles for Milestone #2
- Discuss assumptions to date

Today’s “Deliverables”
- Combined sub-disciplinary reference list
- Draft Design Memos for Roadway and Stormwater
- Partial Completion of Technical Report
- Presentation Performance Improvement Points

NEW ATTENDANCE POLICY
- Old policy still applies for UNEXCUSED absence:
  
  Attendance:
  
  It is expected that all team members will be present at all lectures and lab sessions. Failure to attend all lectures and labs adversely affects the progress of all team members and unfairly gives preference to individuals. Any unexcused absence will result in a 5% deduction in the individual’s final grade for EACH OCCURRENCE.

- Karen defines an appropriate excused absence.
  Reasons for inappropriate excused absences so far: unexpected illness with no doctor’s note, voluntary running or biking events in other cities, spring break plane departures

- An inappropriate excused absence will result in the loss of half the homework points for the week of absence (homework is valued at 10% of your total grade)

- All team assignments must be completed for the week of absence or the absence will be considered unexcused.

Billable Hours
Comparison of team work effort over the past week

More Successes from Review of Written and Oral Proposal
- 1 point off for no Ppt handouts

More Learning Opportunities from Milestone #1
- Review the final printout of your written report – sometimes prints don’t match electronic file
- Oral presentation evaluation comments are meant to be constructive criticism. Don’t take it personally.
- Top three oral presentation complaints
  - Lack of enthusiasm
  - Too many uhhs or ums
  - Questioning tone at the end of spoken sentences?????
  - Talk louder
  - Talk slower

Milestone #2: Collection of Design Criteria
- Team #3 (KEMP) and #6 (JPAC): Make sure you team name and number are on the billable hours document
- Slightly shaky transition of power from Milestone #1 to #2

Assumptions to Date
See page
Continuing Work on Sub-Discipline Technical Written Report

Project Design Information Memos
- Roadway
- Stormwater

Week 7 Lecture Content
- Initial Preliminary Design Sequence
  TRN:
  • Define min cross section widths
  • Define horizontal alignment
  • Define vertical alignment
  • Define cross slopes
  ENV:
  • Find locations for rain gardens
  • Find examples (east side 48th & Prescott, standards)
  GEO:
  • Define wall design methodology
  STR:
  • Research bike path + ADA standards
  • Define underpass dimensions
  WTR:
  • Define existing drainage patterns

Questions
Week 8 Homework Assignment
Friday, March 1st

Combined Reference List
1) Prepare a combined reference summary list that includes each sub-disciplinary area. List them in order of ENV, GEO, STR, TRN and WTR.
2) PM sends one electronic copy to Karen and all team members by 8 am, Friday, Feb 22nd.

Revise Design Information Memos
1) Receive graded electronic design memo from Karen
2) Revise electronic design memo
3) PM sends revised electronic design memo to Karen by Thurs Feb 28th by 8 am.

More Work on LRFD Conventional Retaining Wall Design
1) GEO engineers should outline the LRFD Conventional Retaining Wall Design methodology in their written technical report

Look for more homework assignment details in upcoming e-mails next week.

Week 8 Lecture Content
- Storm Sewer Design Presentation by Kevin Donahoo, NDOR
- Storm sewer design
- Retaining wall height determination
- Box culvert standard plan
PROJECT DESIGN INFORMATION MEMO – Roadway

Project Number 700028
Project Name Old Cheney Road, 70th to 84th Streets
Prepared By Fine Line Designs Date: 2/17/13
Reviewed By Karen Schurr Date: 2/27/13
Last Update By Date:

PROJECT SCHEDULE
PS&E Plan Submittal 30 Percent Plan Submittal on April 26th, 2013
Estimated Construction End Date November 2014

PROJECT DESCRIPTION – Project Scope of Work, Location, Limits:

- Project Location and Limits
  The project is located on Old Cheney Road from 70th to 84th Streets. The area surrounding the project is primarily residential with one school located along the project. Project is one mile long and contains both eastbound and westbound traffic. The project area will extend 100 feet perpendicularly from Old Cheney Road centerline on all side streets.

- Project Scope, Purpose and Need
  Currently this is a two-lane facility and is over capacity during peak hour traffic. The purpose of this project is to widen Old Cheney road to a four-lane facility along the length of the project. This will increase capacity and improve the level of service. There will be a raised center median separating traffic directions throughout the length of the project. There will be a signalized intersection with left turning lanes at the 77th Street intersection.

- Scope of Work
  - Define minimum width typical cross section for driving lanes and median
  - Project traffic volumes to 2030
  - Design left-turn storage lengths at intersection median breaks
  - Define locations where cross section may be sloped totally in one direction to minimize retaining wall heights and ROW conflicts
  - Design vertical alignment to complement cross section
  - Create project CAD file showing lane lines and curb edges
  - Draw cross sections at full station locations (hand or CAD drawn)
  - Prepare a summary of quantities for roadway items
  - Prepare a cost estimate for the summary of quantities
**DESIGN CRITERIA** City of Lincoln; AASHTO; and Nebraska Board of Public Roads Design Standards will govern the design of this project. The following are the proposed roadway design controls for the project:

| City of Lincoln Classification: | Urban minor arterial |
| AASHTO Classification: National: Urban minor arterial State: Other Arterial |
| Board of Public Roads Standard: | N/A |

| Roadway: | Old Cheney Rd. |设计速度: | Design Speed: |
| Post Speed: | 45 | 额定速度: | Posted Speed: |
| Design Vehicle: | WB-50 | 设计车辆: | Design Vehicle: |

**Typical Section:** See Attached Proposed Roadway Typical Section(s)

**Horizontal Parameters:**
Horizontal Alignment: Centered along the Section Line
Minimum horizontal curve radius: No Curves
Intersection Sight Distance: 700 Feet*
* Based on the four-lane, left turn condition with stop control crossroad
Curb Return Radii: 20 ft
Roadway Transition Taper Rate: 1 ft lateral to 45 ft longitudinal
Lateral Obstacle / Clear zone requirements: 2 feet from back of curb to face of obstacle
Superelevation: Yes ☐ No ☒ Superelevation Transition Runout
&

**Vertical Parameters:**
Minimum vertical curve values: “K” Sag 68 “K” Crest 80
Mainline SSD: 360 Ft (Level conditions)
Minimum Profile Grade ≈ 0.5% Maximum Profile Grade ≈ 3%
$± 4.0\%$ for length $≤ 500'$

**Traffic**

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<th>Volume</th>
<th>Year</th>
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<td>2010</td>
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<tr>
<td>Projected Average Daily Traffic (ADT)</td>
<td>11980</td>
<td>2030</td>
</tr>
<tr>
<td>Design Hourly Traffic (DHV)</td>
<td>1080</td>
<td>2030</td>
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<tr>
<td>Percent Trucks (Existing/Future)</td>
<td>1.89%/2%</td>
<td>2030</td>
</tr>
</tbody>
</table>

Through traffic to be accommodated during construction: Yes ☐ No ☒

79
If No, Possible Detour Route(s): Traffic can use Highway 2 to the South and Pioneers to the North

Special access issues to be aware of: Lincoln Christian Schools will need vehicular and pedestrian access at all times

Lane closures allowed during peak hours: Yes ☑  No ☐
If yes, document approval

**Intersection Information** – See Attached Proposed Intersection sketches labeled TBD

<table>
<thead>
<tr>
<th>Intersection Location</th>
<th>Signal with construction</th>
<th>Set up for future</th>
<th>RI</th>
<th>RO</th>
<th>LI</th>
<th>LO</th>
<th>Change for Existing? / Comments</th>
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<tbody>
<tr>
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<td>Yes</td>
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<td>Y</td>
<td>No</td>
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<td>No</td>
<td>Y</td>
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<td>N</td>
<td>Yes / LO &amp; LI currently allowed</td>
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<td>Y</td>
<td>Y</td>
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<td>Y</td>
<td>Yes / Adding separated left turn lanes</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>No</td>
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<td>Old Cheney Rd. &amp; 82nd St</td>
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<td>No</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>No</td>
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</table>

**STORM DRAINAGE**

Pavement Runoff Design Storm _10-year storm_

Bridge/Culvert Design Storm _N/A_

Hydraulic Design Method _Rational Method or SCS Number Method_


Major Stream Crossing: Yes □  No ☒

**RIGHT OF WAY: Not Applicable**

Proposed Right of Way Width:

ROW Acquisition Anticipated: Yes □  No ☐

Estimated Number of Tracts:

Permanent Easements Anticipated: Yes □  No ☐

Estimated Number of Tracts ___ PE Only

Temporary Easements Anticipated: Yes □  No ☐

Estimated Number of Tracts ___ TE Only

80
<table>
<thead>
<tr>
<th>Description</th>
<th>Yes</th>
<th>No</th>
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<td>Relocations Required:</td>
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<td></td>
</tr>
<tr>
<td>* Tracts + PE Only + TE Only</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Replacements of Utility Easements^</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>^See Stakeholder checklist for Specifics</td>
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</table>
PROJECT DESIGN INFORMATION MEMO – Stormwater

Project Number 700028
Project Name Old Cheney Road, 70th to 84th Streets
Prepared By Fine Line Designs Date: 3/1/13
Reviewed By Karen Schurr Date: 2/27/13
Last Update By Date:

PROJECT SCHEDULE
PS&E Plan Submittal 30 Percent Plan Submittal on April 26th 2013
Estimated Construction End Date November 2014

PROJECT DESCRIPTION – Project Scope of Work, Location, Limits and Key Issues

• Study Area Description
  The project is located on Old Cheney Road from 70th to 84th Streets. The area surrounding the project is primarily residential with one school located along the project. The general slope is rolling terrain with water draining to a low point north of the intersection of Old Cheney Road and Cross Creek Road. A current drainage problem is that the low point of the project collects water at a faster rate than it can be discharged by the small creek that drains the low point.

• Description of Existing System
  The existing two-lane roadway drains water to ditches on either side of the roadway. The ditches then transfer the water towards the low point of the project located at the intersection of Old Cheney Road and Cross Creek Road. Near Cross Creek Road a pipe or culvert allows the water on the south side of Old Cheney Road to be transferred to the low point on the north side.

• Project Scope, Purpose, Need
  ▪ Delineate project watershed and identify major and minor drainage systems
  ▪ Identify and develop solutions for existing drainage issues
  ▪ Design storm sewer system to adequately handle storm water flows

• Scope of Work
  ▪ Determine existing drainage patterns
  ▪ Locate curb inlets
  ▪ Determine minor drainage system watershed flows
  ▪ Size pipes
  ▪ Determine hydraulic grade line for one storm sewer segment on the project
  ▪ CAD drawing of drainage elements
  ▪ Summary of quantities for storm sewer items
  ▪ Cost estimate for the summary of quantities
PROJECT DESIGN INFORMATION MEMO – Stormwater

- Summary of Key Issues
  - Develop a solution to the drainage issue located at the low point of the project
  - Design an economical storm sewer system that will meet the drainage needs of the area
  - Implement sustainable and aesthetically pleasing features throughout the project

DESIGN CRITERIA City of Lincoln Drainage Criteria Manual (current edition), City of Lincoln Flood Standards for New Growth Areas, previous Watershed Master Plan, City of Lincoln Standard Specifications for Municipal Construction, and City of Lincoln Standard Plans will govern the design of this project. The following are the proposed design controls for the project:

Classification:

Existing System or New System New System
Condition of Existing System Primarily roadside ditch drainage with three main undercrossings
Pipe, Open Channel, and/or Overland Flow Combinations of all contribute to the drainage within the project limits
Watershed Name Holmes Lake Watershed
Sub-Basin Name Salt Creek
Drainage Area (acres) To be determined
Outlet Name/Location Not applicable
Hydraulic Design Method Open channel flow (Manning)
Design Storm Not applicable
Culvert Analysis Method Not applicable
Hydrologic Design Method Rational Method
Pavement Runoff Design Storm 10-year return period
Bridge/Culvert Design Storm Not applicable
Watershed Master Plan Yes ☐ No ☑

Major Crossings or Outlet Discharge (Streams, Drainage Ways, Railroad, Highway):

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Type of Crossing or Outlet</th>
<th>Issues/Comments</th>
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<tbody>
<tr>
<td>RCP</td>
<td>Cross Ck RD</td>
<td>54”</td>
<td>Existing</td>
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<tr>
<td>RCP</td>
<td>77th St</td>
<td>21”</td>
<td>Existing</td>
</tr>
<tr>
<td>RCP</td>
<td>81st St</td>
<td>42”</td>
<td>Existing</td>
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PROJECT DESIGN INFORMATION MEMO – Stormwater

Roadway Parameters:

<table>
<thead>
<tr>
<th>Roadway:</th>
<th>Arterial or Residential:</th>
<th>Pavement or BOC:</th>
<th>Condition of Pavement and Curb:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overland Flow Path:
To be determined from USGS topographic maps

Downstream Impacts:
Increasing impervious surfacing will increase storm water runoff volumes. Impacts to adjacent residential neighborhoods will be considered and amelioration methods will be incorporated to minimize impacts in storm water outlet locations.

TRAFFIC
Through traffic to be accommodated during construction: ☐ Yes □ No
If No, Possible Detour Route(s): Access to 70th and 84th Streets can be gained through the surrounding neighborhoods.

Special access issues to be aware of: N/A

Lane closures allowed during peak hours: □ Yes ☐ No If yes, document approval

RIGHT OF WAY – THIS SECTION IS NOT APPLICABLE
ROW Acquisition Anticipated: ☐ Yes □ No Estimated Number of Tracts_____ Permanent Easements Anticipated: ☐ Yes □ No Estimated # of Tracks_____ PE Only Temporary Easements Anticipated: ☐ Yes □ No Estimated # of Tracts_____ TE Only Relocations Required: ☐ Yes □ No * Tracts + PE Only + TE Only Replacement of Utility Easements*: ☐ Yes □ No ^See Stakeholder Checklist for Specifics
PROJECT DESIGN INFORMATION MEMO - Roadway

Project Number 700028
Project Name Old Cheney Road, 70th to 84th Streets
Prepared By Engineering 720
Reviewed By Karen Schurr
Last Update By:

Date: March 1st, 2013
Date: February 27th, 2013

PROJECT SCHEDULE
PS&E Plan Submittal: 30 Percent Plan Submittal on April 26th, 2013
Estimated Construction End Date: November 2014

PROJECT DESCRIPTION - Project Scope of Work, Location, and Limits:
The scope of the project consists of the reconstruction of Old Cheney Road from
approximately 70th Street to approximately 82nd St in the City of Lincoln, Nebraska.
The existing two-lane pavement will be removed and replaced with full depth concrete
pavement between end points where the full four-lane section of Old Cheney ceases to
currently exist. Old Cheney Road will have a median and left-turn lanes where
required. Old Cheney Road will be closed during construction. Access will be
maintained at all times through the use of alternate routes as needed for adjacent
residents and businesses. A 5-foot concrete sidewalk is proposed on the south side of
Old Cheney Road and a 10-foot hiker-biker trail is proposed along the north side for the
entire project corridor. An underpass for pedestrian crossing (or crossings) will be
provided at the most logical location(s) and shall connect to the hiker-biker trail system.
Stormwater facilities will be designed and constructed to maintain proper drainage. In
addition to the paving work, striping will be installed to facilitate traffic flow through the
project area. Retaining walls will be constructed where required and a full
environmental evaluation will be required including rain garden design where feasible
and a Storm Water Pollution Prevention Plan (SWPPP).

DESIGN CRITERIA City of Lincoln; AASHTO; and Nebraska Board of Public Roads Design
Standards will govern the design of this project. The following are the proposed roadway design
controls for the project:

City of Lincoln Classification: Urban minor arterial
AASHTO Classification: Urban minor arterial State: Other Arterial
Board of Public Roads Standard: Not applicable

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Old Cheney Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed:</td>
<td>45 mph</td>
</tr>
<tr>
<td>Posted Speed:</td>
<td>45 mph</td>
</tr>
<tr>
<td>Design Vehicle:</td>
<td>WB-50</td>
</tr>
</tbody>
</table>

Typical Section: See Attached Proposed Roadway Typical Section(s) labeled “Exhibit TYP-1: TYP-2”
(Sketch of lane width at end of memo (may be computed or hand drawn)
PROJECT DESIGN INFORMATION MEMO - Roadway

**Horizontal Parameters:**
Horizontal Alignment: Centered along the section line
Minimum horizontal curve radius: No curves, not applicable
Intersection Sight Distance: Dimension “A” = 700 ft
Curb Return Radii: Local residential streets - 20 ft
Roadway Transition Taper Rate: 1 ft lateral to 45 ft longitudinal
Lateral Obstacle / Clear zone requirements: 2 ft as measured from back of curb to face of obstacle

Superelevation: Yes X No Superelevation Transition Run-Out Method: Not applicable

**Vertical Parameters:**
Minimum vertical curve values: “K” Sag 68 “K” Crest 80 Mainline SSD 360 Ft (level conditions)
Minimum Profile Grade = ±0.5% Maximum Profile Grade = ±3.0% 4.0% for lengths ≤ 500’

**TRAFFIC**

<table>
<thead>
<tr>
<th>Description</th>
<th>Volume</th>
<th>Year</th>
</tr>
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<tbody>
<tr>
<td>Existing Average Daily Traffic (ADT)</td>
<td>To be determined</td>
<td>2011</td>
</tr>
<tr>
<td>Projected Average Daily Traffic (ADT)</td>
<td>To be determined</td>
<td>2030</td>
</tr>
<tr>
<td>Design Hourly Volume (DHV)</td>
<td>To be determined</td>
<td>2030</td>
</tr>
<tr>
<td>Percent Trucks (Existing / Future)</td>
<td>To be determined</td>
<td>2030</td>
</tr>
</tbody>
</table>

Through traffic to be accommodated during construction: Yes X No

If No, Possible Detour Route(s): Residential street network access to 70th and 84th Streets

Special access issues to be aware of:

Lane closures allowed during peak hours: X Yes No If yes, document approval

**Intersection Information** - See Attached Proposed Intersection sketches labeled "Exhibits INT- X & Y"

<table>
<thead>
<tr>
<th>Intersection Location</th>
<th>Signal with construction</th>
<th>Set up for future</th>
<th>RI</th>
<th>RO</th>
<th>LI</th>
<th>LO</th>
<th>Change from Existing? / Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 72nd St</td>
<td>No</td>
<td>No</td>
<td>RI</td>
<td>RO</td>
<td>LI</td>
<td>LO</td>
<td>Existing = RI, RO, LI, LO</td>
</tr>
<tr>
<td>Cross Creek Rd</td>
<td>No</td>
<td>No</td>
<td>RI</td>
<td>RO</td>
<td>LI</td>
<td>LO</td>
<td>Existing = RI, RO, LI, LO</td>
</tr>
<tr>
<td>77th St</td>
<td>Yes</td>
<td>No</td>
<td>RI</td>
<td>RO</td>
<td>LI</td>
<td>LO</td>
<td>Existing = RI, RO, LI, LO</td>
</tr>
<tr>
<td>80th St</td>
<td>No</td>
<td>No</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Existing = RI, RO, LI, LO</td>
</tr>
<tr>
<td>82nd St</td>
<td>No</td>
<td>No</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Existing = RI, RO, LI, LO</td>
</tr>
</tbody>
</table>

**STORM DRAINAGE**
Pavement Runoff Design Storm: 10-year return period

Old Cheney Road
700028

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2/22/2013

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**PROJECT DESIGN INFORMATION MEMO - Roadway**

Bridge/Culvert Design Storm: Not Applicable  
Hydraulic Design Method: Rational Method  
Flood Standard: New Growth  
X Existing Urban Area (as of 5/25/2004)  
Major Stream Crossing: Yes  
X No

**RIGHT OF WAY - NOT APPLICABLE**

<table>
<thead>
<tr>
<th>Proposed Right of Way Width:</th>
<th>Yes</th>
<th>No</th>
<th>Estimated Number of Tracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROW Acquisition Anticipated:</td>
<td></td>
<td></td>
<td>Estimated # of Tracts</td>
</tr>
<tr>
<td>Permanent Easements Anticipated:</td>
<td>Yes</td>
<td>No</td>
<td>Estimated # of Tracts PE Only</td>
</tr>
<tr>
<td>Temporary Easements Anticipated:</td>
<td>Yes</td>
<td>No</td>
<td>Estimated # of Tracts TE Only</td>
</tr>
<tr>
<td>Control of Access Required:</td>
<td>Yes</td>
<td>No</td>
<td>Estimated Total Tracts</td>
</tr>
<tr>
<td>Relocations Required:</td>
<td></td>
<td></td>
<td>* Tracts + PE Only + TE Only</td>
</tr>
<tr>
<td>Replacement of Utility Easements^</td>
<td>Yes</td>
<td>No</td>
<td>^See Stakeholder Checklist for Specifics</td>
</tr>
</tbody>
</table>

---

* Old Cheney Road  
700028  
Version 1.0  
2/22/2013  
Page 3 of 3
PROJECT DESIGN INFORMATION MEMO - Stormwater

Project Number: 700028
Project Name: Old Cheney Road, 70th to 84th Streets
Prepared By: Engineering 720
Reviewed By: Karen Schurr
Last Update By:

Date: March 1st, 2013
Date: February 27th, 2013

PROJECT SCHEDULE
PS&E Plan Submittal: 30 Percent Plan Submittal on April 26th, 2013
Estimated Construction End Date: November 2014

PROJECT DESCRIPTION - Project Scope of Work, Location, Limits and Key Issues
The scope of the project consists of the reconstruction of Old Cheney Road from approximately 70th Street to approximately 82nd St in the City of Lincoln, Nebraska. The existing two-lane pavement with turf shoulders currently drains in adjacent ditches with minor drainage structures under intersecting roadways and major drainage structures under Old Cheney Road at approximately Cross Creek Road and midway between 80th and 82nd Sts and under 77th St.

Major drainage structures will be used in place. New storm sewers will be built along the curbed four-lane roadway designed to maintain the existing drainage patterns established prior to construction.

There is anecdotal evidence that small return period storms cause excessive ponding along the north side of Old Cheney Road near Cross Creek Road. The storm sewer design and environmental erosion control design will consider ways to ameliorate this current issue.

DESIGN CRITERIA City of Lincoln Drainage Criteria Manual (current edition), City of Lincoln Flood Standards for New Growth Areas, previous Watershed Master Plan, City of Lincoln Standard Specifications for Municipal Construction, and City of Lincoln Standard Plans will govern the design of this project. The following are the proposed design controls for the project:

Classification:

Existing System or New System: New
Condition of Existing System: Primary roadside ditch drainage with three main undercrossings
Pipe, Open Channel, and/or Overland Flow: Combinations of all contribute to the drainage within the project limits
Watershed Name: Holmes Lake Watershed
Sub-Basin Name: Salt Creek
Drainage Area (acres): To be determined
Outlet Name/Location: Not applicable
Hydraulic Design Method: Open channel flow (Manning)
Design Storm: Not applicable
Culvert Analysis Method: Not applicable
Hydrologic Design Method: Rational Method
Pavement Runoff Design Storm: 10-year return period

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700028

Page 1 of 2
PROJECT DESIGN INFORMATION MEMO - Stormwater

Bridge/Culvert Design Storm: Not applicable
Watershed Master Plan: Yes  No  X

Major Crossings or Outlet Discharge (Streams, Drainage Ways, Railroad, Highway):

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Type of Crossing or Outlet</th>
<th>Issues/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCP</td>
<td>Cross Ck Rd</td>
<td>54&quot;</td>
<td>Existing</td>
</tr>
<tr>
<td>RCP</td>
<td>77th St</td>
<td>21&quot;</td>
<td>Existing</td>
</tr>
<tr>
<td>RCP</td>
<td>81st St</td>
<td>42&quot;</td>
<td>Existing</td>
</tr>
</tbody>
</table>

Roadway Parameters:

<table>
<thead>
<tr>
<th>Roadway:</th>
<th>Arterial or Residential:</th>
<th>Condition of Pavement and Curb:</th>
<th>Existing Utilities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overland Flow Path:
To be determined from USGS topographic maps

Downstream Impacts:
Increasing impervious surfacing will increase storm water runoff volumes. Impacts to adjacent residential neighborhoods will be considered and amelioration methods will be incorporated to minimize impacts in storm water outlet locations.

TRAFFIC
Through traffic to be accommodated during construction: Yes  X No

If No, Possible Detour Route(s): Residential street network access to 70th and 84th Streets

Special access issues to be aware of:
School at 84th and Old Cheney

Lane closures allowed during peak hours: X Yes  No If yes, document approval

RIGHT OF WAY - THIS SECTION NOT APPLICABLE
ROW Acquisition Anticipated: Yes  No  Estimated Number of Tracts
Permanent Easements Anticipated: Yes  No  Estimated # of Tracts PE Only
Temporary Easements Anticipated: Yes  No  Estimated # of Tracts TE Only
Relocations Required: Yes  No  * Tracts + PE Only + TE Only
Replacement of Utility Easements^ Yes  No  ^See Stakeholder Checklist for Specifics

Old Cheney Road
700028
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Page 2 of 2
Objectives:
- Professional guidance on SWPPPs and erosion control
- Discussion of feedback suggestions and ideas for improvements
- Weekly team performance review
- Finalization of Milestone (MS) #2
- Introduction of MS #3
- Discussion of functional design progress over the past week
- New content for structural and environmental engineers
- Introduction of project computer files
- Tentative schedule for remainder of semester
- Homework assignments for next week

Functional Design Speaker: Storm Sewer Design, Part 1
Kevin Donahoo, PE
Roadway Design Hydraulics Engineer
Nebraska Department of Roads

5-Minute Break

Google Docs Demo
- Volunteer Speaker: Patrick Malcolm ⭐

Feedback Survey, MS #1
- Provide agenda a day before class: PMs must still provide their own agenda to their team
- Clarify weekly individual/team assignments: Separate page after agenda each week
- Put PowerPoint presentations on Blackboard: Upload BEFORE presentation in class
- Too much paper and correspondence: “Welcome to My World”
- Weekly workload is too high: Less than/similar to other engineering capstone courses
- Website summary confusion: Karen should review websites URL annually prior to use and not assign this the same week as the proposal presentation.
- Suggestions for broader/better balanced civil engineering senior design projects

Weekly Team Performance Review
- Billable hours comparison
- Meeting minutes distribution deadline, 57% compliance with 6 pm Saturday deadline
- E-Week sign up complete?
- CIVE 489 grades to date

Update: CoL Design Memos
- Roadway
- Stormwater

NEW: Completion of MS #2, Gathering Design Criteria and Controls
Beginning of MS #3, Functional Design
- Introduction of Role and Task Guide (bright orange)
- MS #2 Teammate Evaluation (Page 6)

NEW: Functional Design Progress
- Vertical Profile Update, TRN Engineers
- Cross Section Design Update, TRN+ Engineers
- Traffic Count Projection and Left-turn Lane Determination Update, Support Engineers
- Methodology Documentation Update, GEO Engineers
NEW: Functional Design Additions:
- Structural engineers: Copy of 15’ x 10’ CBC plans
- Assumption Page Update (Page 3)
- Environmental engineers: Potential rain garden locations

NEW: This week’s Assumption List

NEW: Project Computer Files (Page 4)
- MicroStation
- AutoCAD
- USGS

NEW: Tentative Speaker Schedule for Remainder of Semester:

<table>
<thead>
<tr>
<th>Wk</th>
<th>Date</th>
<th>Topic</th>
<th>Speaker</th>
<th>Position, Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>March 1</td>
<td>Storm Sewer Design, Part 1</td>
<td>Kevin Donahoo, PE</td>
<td>Rdwy Des Hydr Engr, NDOR</td>
</tr>
<tr>
<td>9</td>
<td>March 8</td>
<td>Erosion Control Design</td>
<td>JB Dixon</td>
<td>Environmental Planner, FHU</td>
</tr>
<tr>
<td>10</td>
<td>March 15</td>
<td>LRFD Conventional Ret Wall Design</td>
<td>Jordan Larsen, PE</td>
<td>Geotechnical Engr, NDOR</td>
</tr>
<tr>
<td>11</td>
<td>March 22</td>
<td>Spring Break</td>
<td></td>
<td>Not Applicable</td>
</tr>
<tr>
<td>12</td>
<td>March 29</td>
<td>Structural Design of RCBox Culvert</td>
<td>Fouad Jaber, PE</td>
<td>Structural Engineer, NDOR</td>
</tr>
<tr>
<td>13</td>
<td>April 5</td>
<td>Storm Sewer Design, Part 2</td>
<td>Kevin Donahoo, PE</td>
<td>Rdwy Des Hydr Engr, NDOR</td>
</tr>
<tr>
<td>14</td>
<td>April 12</td>
<td>E-Week</td>
<td></td>
<td>Not Applicable</td>
</tr>
<tr>
<td>15</td>
<td>April 19</td>
<td>Estimating</td>
<td>Karen Schurr, PE</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>April 26</td>
<td>Final Presentation and Submittals</td>
<td></td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
Week 9 Homework Assignment due Friday, March 8th

Individual:
1) **Complete Milestone #2 Teammate Evaluation**
   - Fill out the form. Include your own name in the list of team mates. **Don’t** put your name anywhere else on the form!
   - Fold the form in half and submit it on Friday, March 8th at 12:30 pm

2) **Documentation of Support Engineering Roles**
   If you have completed a support engineering function such as 1) Traffic count project to 2030 or 2) Left-turn lane length determination, complete a Written Technical Report document through the “Recommendations” category for your contribution.
   - Submit the completed Draft Written Technical Report on Friday, March 8th at 12:30 pm.

3) **Continuing Progress on Written Technical Report**
   Review your own functional design written technical report document and add pertinent information you’ve learned over the past week. No submittal required.

Team:
1) Discuss the shift of roles to Milestone #3, Functional Design (four-person teams have the same roles for both Milestones #2 and #3).

2) Discuss the best way for your MS #3 PM to monitor and promote timely progress on each functional design assignment.

3) Discuss ways in which team members with **temporarily** low weekly responsibilities will be used to help members with **temporarily** high weekly responsibilities.

4) Discuss ways to resolve needs for resources or conceptual/design assistance.

5) Submit a written proposal for your team’s mutually agreed upon method of functional design team management on Friday, March 8th at 12:30 pm.
Jordan Dosta- Kingman Designs Project Manager
Design Team Management

To keep our team on track this semester, I will be making sure everyone stays on top of their tasks. Each Friday, everyone in the group must come to our meeting knowing what they will be working on that next week. They will put evidence of their completed tasks in our dropbox folder for me to check. Also in the meeting, we will talk about the previous week’s tasks as a group to make sure they were all completed. This will help me distribute assistance to engineers with a lighter workload so nobody gets too bogged down. It will also help keep me accountable, so the group knows what I’ve accomplished. Lastly, I have created an excel file which everyone can access to add questions they have for the city. I’ll check this weekly and pass those questions along and then put in the responses so we have a lasting log of needed information.
Team 2 Proposal for Functional Design Team Management

To ensure we communicate well and remain a high degree of quality for our project, we will continue methods of communication that we have used so far in the semester. Work completed by individuals will be uploaded to the team’s Dropbox folder. In addition to uploading work, team members will continue to communicate about what items have been completed and uploaded through the team’s Facebook page. Items to be completed by each member for the upcoming week will be discussed during class each week and recorded in the minutes to be referenced if needed.
Team 3 – KEMP Engineering

Tyler Kuper
Brett Priebe
Garret Menard
Taylor Eman

**Functional Design Team Management**

Any team members with temporarily high weekly responsibilities are to send the PM a request if they need help with any of their weekly responsibilities. The PM will then send an email to the rest of the team asking who will help complete these tasks. Each week when the billable hours are sent to the PM each team member will include the parts of the functional design that they worked on, which will allow for the PM to monitor the progress of the overall functional design.
Method of Functional Design Team Management

Milestone #3 will be the functional design of our project. Every discipline area will have at least one area to design. However, some areas will require more work while others require less work. Another challenge is that some areas’ work depends on the result of another discipline area. Our goal as a team is to work together and the members who have less work will be helping the ones with more work. As the project manager of Engineering 720 and after discussing with the professionals in the firm, I came up with a method to use to be able to accomplish our goals. I have divided the work load among the team members as it is explained in the following paragraph.

Every week the responsibilities will be divided in the following manner:

1) Design Engineer
2) Supporting Engineer
3) Software Engineer
4) Discipline Area Engineer

1) **Design Engineer:** This person is only involved with the Functional Design of the week. We have five functional design and five weeks to finish them. Every week we shall work mainly on one functional design and continue working on others. The assignment of the Design Engineer is listed in the table below:

<table>
<thead>
<tr>
<th>Functional Design</th>
<th>Design Engineer</th>
<th>Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway</td>
<td>Brent Ciecior</td>
<td>(Feb/22)-(Mar/1)</td>
</tr>
<tr>
<td>Storm Sewer</td>
<td>Stefan Schaepe</td>
<td>(Mar1)-(Mar/8)</td>
</tr>
<tr>
<td>Rain Garden</td>
<td>Kari Parke</td>
<td>(Mar8)-(Mar/15)</td>
</tr>
<tr>
<td></td>
<td><strong>Spring Break</strong></td>
<td></td>
</tr>
<tr>
<td>Retaining Wall</td>
<td>Sam Ghaleb</td>
<td>(Mar/22)-(Mar/29)</td>
</tr>
<tr>
<td>Under Pass</td>
<td>Caleb Peterson</td>
<td>(Mar/29)-(Apr/5)</td>
</tr>
</tbody>
</table>

2) **Supporting Engineer:** This person will be helping the Design Engineer. This person is the one with the least amount of responsibility for the week.

3) **Software Engineer:** This person will be helping the Design Engineer of the week or others with the part of work which involves software (AutoCAD, MicroStation, and USGS).

4) **Discipline Area Engineer:** This is everyone working on their area while helping the Design Engineer.

More details of the plan will be written on the agenda of each week and will be emailed a day before each team meeting.
Ben Jarrett  
Project Manager  
Fine Line Designs  
3/8/13

After our discussion last week, our group has agreed upon a few measures that the project manager will take in attempt to hold group members accountable. First off, during our Friday meetings we are going to discuss and show the team what we worked on the previous week. By presenting the materials we worked on, it should help prevent people from saying they worked on items that they really didn’t. As a team, we are also going to assign definite tasks during these meetings so everyone knows what it is they need to do that week. Another idea that we came up with to help hold us accountable is to actively update the billable hours. By updated the billable hours as we work on our assignments, it will help us keep better track of our hours instead of trying to guess or make up hours at the end of the week. A few last ideas we came up with to hold people accountable and make sure everything is getting accomplished is to ask for help if you need it, offer to help if you are having a slow week, and accept tasks that the project manager designates to you. The work load is going to change from week to week so everyone needs to realize who has a hard week and try to help them out as much as possible.
Last week in our Friday, March 1st meeting, we (JPAC Consulting) discussed a few different methods of functional design team management. We ultimately decided that the project manager (Cody Kimball) will oversee the progress of this project. Each sub-discipline engineer working on the renovation of Old Cheney Road will work on the support engineering functions for his/her discipline as well write a technical report upon completion. If the engineer is overwhelmed, he/she will ask the project manager to assign another engineer that has a relatively light workload for the week, unless another engineer volunteers in our weekly morning to help. Team members that do not have a functional design assignment due in the following week will continue working on his/her own written technical report for his/her sub-discipline. This includes research, listing assumptions for the project, and design calculations. Each Friday, team members will provide documents to the project manager to show what they have been working on and the progress they have made for the past week. If any questions arise, team members will e-mail Cody and Cody will e-mail Karen if he cannot answer the question.
Prime Engineering
Team #7
Project Manager: Andrew Toupin
Scribe: Scott Hrabik
Support: Jesse Sindelar
Support: Leah Kottwitz
Support: Mengnan Liu

Every team member will submit a copy of this progress report to the project manager each Friday. The report shall include tasks completed during the week and responsibilities for the following week, also list important information that could be useful to the other team members.

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Tasks Completed</th>
<th>Future Responsibilities</th>
<th>Important Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scott Hrabik</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jesse Sindelar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leah Kottwitz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mengnan Liu</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Objectives:
- Professional guidance on LRFD retaining wall design
- Weekly team performance review
- Discussion of new assumptions
- Preparation for E-Week project displays
- Discussion of developing questions from ENV, GEO, STR, TRN, WTR Engineers
- Review of remainder of semester
- Homework assignments for next week

Functional Design Speaker: Environmental Engineering
Jordan Larsen, PE
Geotechnical Engineer
Materials and Research Division
Nebraska Department of Roads

5-Minute Break

Today's Deliverables
- IND: Evidence of progress
- TM: Progress report from PM

NEW: This week's Assumption List

Early Preparation Discussion for E-Week (Friday, April 12th)
- Poster
- Brochure
- Laptop slides
- Crowd attention getters
- Get support from available structural engineers

WTR: Discussion of recent documents e-mailed to WTR engineers

TRN: Discussion questions

ENV: Discussion questions

GEO: Discussion questions

STR: Discussion questions

OLD: Tentative Speaker Schedule for Remainder of Semester

<table>
<thead>
<tr>
<th>Wk</th>
<th>Date</th>
<th>Topic</th>
<th>Speaker</th>
<th>Position, Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>March 15</td>
<td>LRFD Conventional Ret Wall Design</td>
<td>Jordan Larsen, PE</td>
<td>Geotechnical Engr, NDOR</td>
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<td>March 29</td>
<td>Structural Design of RCBox Culvert</td>
<td>Fouad Jaber, PE</td>
<td>Structural Engineer, NDOR</td>
</tr>
<tr>
<td>13</td>
<td>April 5</td>
<td>Storm Sewer Design, Part 2</td>
<td>Kevin Donahoo, PE</td>
<td>Rdwy Des Hydr Engr, NDOR</td>
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<td>14</td>
<td>April 12</td>
<td>E-Week</td>
<td>Not Applicable</td>
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<td>15</td>
<td>April 19</td>
<td>Estimating</td>
<td>Karen Schurr, PE</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>April 26</td>
<td>Final Presentation and Submittals</td>
<td>Not Applicable</td>
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</tbody>
</table>

Week 12 Homework Assignment due Friday, March 29th

STR Engineers:

Team:
Written progress report for all engineering functions.
Week 10 Homework Assignment due Friday, March 15th

Individual:
- **ENV:** Preliminary design of rain gardens, location and typical cross sectional sketches
- **GEO:** Determine retaining wall locations and height profiles
- **STR:** Help GEO and finalize cross sections from new profile grade
- **TRN:** Draw lane edges, curb lines, sidewalk and bike path lines on computer file (TRN and/or CAD expert). Use line types and weights similar to example sheet.
- **WTR:** Determine watersheds for pavement drainage (depends on pavement cross slopes)
  Define locations of curb inlets (WTR)

**Major resources:**
CoL Storm Drainage System, 2-22-2000
HEC 22
Latest version of FHWA Hydraulics Toolbox at:

BRING EVIDENCE OF YOUR WORK TO CLASS ON MARCH 15TH!

Team:
Written progress report for all engineering functions.
Kingman Designs Progress Report

During this week, researched the annual precipitation in Lincoln. He then used the
known values to find the surface area size of the rain gardens to properly control the runoff
between 70th and 77th St. on Old Cheney. Currently he is making a top view of the rain gardens
in the islands on AutoCAD for the islands. Also, he will make a profile view of what the rain
garden will look like with a drain and the layers of soil to the correct depth.

For the transportation part of the project, has finished the vertical profile, added
the horizontal alignment onto AutoCAD and only have to tie the project into the ends and add
the taper for the medians. Also, she and have made the cross sections at 200 foot
increments. Next, plans on tying the cross sections into the existing roadway and put
the finishing touches on the horizontal profile. In addition to assisting with the cross
sections, has taken a look at our box culvert location and completed some preliminary
design of how to slope the bike path and sidewalk down to meet ADA standards.

has familiarized himself with the LRFD design and begun to look at retaining wall
heights. Now that cross sections are being finalized, he will be able to accomplish more work on
the design side of things.

As for water resources, has done the drainage area calculations and begun the
preliminary locating of inlets. Over spring break he plans on recompleting the drainage areas to
check them and finalize the rest of his design. In his managerial duties, has put together
MicroStation files with all the provided files and also with the city’s GIS files for the
surrounding streets and sewer systems.
Flat Water Engineering

Team 2 Progress Report (Updated 03/28/13)

– Environmental Engineer

Preliminary design for the rain gardens has begun. Pavement drainages from are still needed to be able to know exactly where the rain gardens should be placed, but since we are doing a constant slope for our pavement design from the South to the North side of the road we know that most of the water will drain to the North side of the road. Because of this we will be putting rain gardens on the North side of the road and in the center median to help retain water.

The SWPPP has also been worked on for this project. Not much has been completed as far as erosion control, since drainage patterns for the project area have not yet been determined. But project location and other important information have been filled in.

– Structure Engineer

I’ve started looking at the cross sections for box culvert. I will need updated vertical alignment and cross sections for the road to continue to look at how these will be altered with the placement of the bike trail. I have printed correspondence that is in the Dropbox folder and have placed it in a binder.

I looked at the arrangement of bike trails and sidewalks at the intersection of 77th Street and Old Cheney Road to accommodate pedestrians both passing under the road and accessing sidewalks at street level. I reviewed information concerning the design of the box culvert for the pedestrian crossing.

– Transportation Engineer

So far the Vertical Alignment has been completed on Microstation. The preliminary cross sections have been drawn by hand over the current cross sections, and the horizontal alignment involving the curb, hiking/biking trail, road, and median, has been started. The 2030 Traffic Volumes and storage lane lengths have also been calculated.

So far the Vertical Alignment has been completed on Microstation. The preliminary cross sections have been drawn by hand over the current cross sections, and the horizontal alignment has been completed. The 2030 Traffic Volumes and storage lane lengths have also been calculated.

– Geotechnical Engineer

For week 8 I have worked on the methodology of the LFRD method of designing the retaining walls on the project. Time was spent to work on calculations using the assumptions given in class. Also I have been working on putting together a spreadsheet in excel to help the simplicity of trying different base lengths to determine if the wall will hold up the soil load. The max and minimum heights have been determined and a good idea where the walls will be. I will continue working on this and will hope that this next class will answer some questions I have stumbled on as I have been working.
During the week of March 29, 2013 I was able to finish my tables in excel to design my retaining wall. The base length of my wall for the tallest section was determined and will be used throughout the whole project. I have also finished the calculations section of my technical report. I have started on determining where retaining walls will be placed and how high they will need to be.

— Water Resources Engineer

I’ve been working on determine the exact watersheds for pavement drainage and define the locations of curb inlets for the project. I also work alongside with [Redacted], our Environmental Engineer, to determine where the best locations for rain gardens are.

I’m doing the inlet location and Q value calculations for the drainage areas.
Objectives:
- Professional guidance on LRFD concrete box culvert design
- Discussion of preparation for E-Week
- Discussion of team management for the rest of the semester
- Week 12 Team Meeting Agenda Points
- Homework assignments for next week
- Discussion of developing questions from ENV, GEO, STR, TRN, WTR Engineers

Functional Design Speaker: Environmental Engineering
Fouad Jaber, PE
Structural Engineer
Bridge Division
Nebraska Department of Roads

5-Minute Break

Today's Deliverables
- TM: Progress report from PM
- PM: Billable hours report

E-Week (Friday, April 12th)
- Poster (must meet College of Engineering deadline to get free print)
- Discussion of positive and negative poster attributes from last year's posters
- Brochure: 20 color handouts (keep 4 for judges and Karen)
- Plan sheets of some sort?
- Laptop slides?
- Crowd attention getters?
- Judging criteria
- Develop attendance plan to man the display table
- Get support from available team member low on work and experts in CAD

OLD: Tentative Speaker Schedule for Remainder of Semester

<table>
<thead>
<tr>
<th>Wk</th>
<th>Date</th>
<th>Topic</th>
<th>Speaker</th>
<th>Position, Affiliation</th>
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<tbody>
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<td></td>
<td></td>
<td>Senior Sound Off</td>
<td>Dr Bruce Dvorak</td>
<td>Interim Chair, CIVE Dept</td>
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<td>E-Week (No class but must man display)</td>
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<td>16</td>
<td>April 26</td>
<td>Final Presentation and Submittals</td>
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TODAY: Management Transition from Milestone 3, Functional Design to Milestone 4, E-Week
See Page 2 for details

Friday, April 5th: Management Transition from Milestone 4, E-Week to Milestone #5, Final Presentation and Submittals by April 12th
Friday, March 29th Team Meeting

MS#3: Review a copy of the detailed written progress report that was submitted by the MS#3 PM to Karen at 12:30 pm, Fri March 29th.

- MS#3 PM leads the discussion to assess progress made since the last meeting.
- Discuss with your team how your mutually-agreed-upon method of making progress on the functional design of each sub-discipline is working.
- If progress is not significant in all or one sub-area, revise the plan and the MS#3 PM must e-mail the revised plan to Karen by Monday, April 1 at 5 pm. If you stay with the same plan, no submittal is required.
- MS#3 scribe must take notes related to MS#3 and send to all teammates and Karen by 6 pm Sat March 30th.

MS#4: E-Week preparation: Transition of management to MS#4 PMs and Scribes (see orange sheet)

- MS#4 PM leads the discussion for EACH aspect of the needs for E-Week Display.
- Poster (must meet College of Engineering deadline to get free print).
- Discussion of positive and negative poster attributes from last year’s posters (W302 NH).
- Brochure: 20 color handouts (keep 4 for judges and Karen).
- Plan sheets of some sort?
- Laptop slides?
- Crowd attention getters?
- Judging criteria.
- Develop attendance plan to man the display table.
- Get support from available team member low on work and experts in CAD.
- MS#4 scribe must take notes related to MS#4 and send to all teammates and Karen by 6 pm Sat March 30th.

Week 13 Homework Assignment due Friday, April 5th

Individuals:
ALL team members should be working on their functional designs, written technical reports or E-Week displays!

Team: DETAILED written progress report for all engineering functions submitted by MS#4 PM
Flat Water Engineering (Group #2)
CIVE 489 Project Schedule of Completion
PM: Ryan Ray
Scribe: Rachel Plessing
Support: Hayden DeLay, Lucas Frahm, & Tri Tran

Saturday April 20th
- Scribe Submits Minutes to Karen by 6pm

Sunday April 21st
- PM will write the Executive Summary
- Work on Individual Preliminary Plan Sheets
- Work on Individual Technical Reports
- Work on Individual Appendices

Monday April 22nd
- Work on Individual Preliminary Plan Sheets
- Work on Individual Technical Reports
- Work on Individual Appendices

Tuesday April 23rd
- Work on Individual Preliminary Plan Sheets
- Work on Individual Technical Reports
- Work on Individual Appendices

Wednesday April 24th
- Work on Individual Preliminary Plan Sheets
- Work on Individual Technical Reports
- Work on Individual Appendices
- Print off and Compile Correspondence Notebook

Thursday April 25th
- Submit Individual Technical Report Portion to PM by 6pm
- Submit Individual Appendices to PM by 6pm
- Practice Final Presentation @ TBA
- Compile Plan Sheets

Friday April 26th
- Final Presentations
Water Resources-
I have completed the calculations of inlet locations, surface water flows, and pipe sizes. I have also completed hydraulic grade line (HGL) calculations for option two of the project. I will complete manhole location calculations by April 21st, 2013.
Next I need to complete drawings of the storm sewer system. I will work on plan and profile drawings of the storm sewer system on April 18th, 2013.
I have the majority of the water resources technical report completed. I still need to complete the materials and construction costs estimate portion of the technical report. I will have the water resources technical report completed by April 21st, 2013.

Geotechnical-
The geotechnical part of this project is coming along decently. The retaining wall locations have been determined and the minimum retaining wall heights at each station were determined. From there the retaining walls were drawn on the vertical profile sheet where the maximum height was determined. The calculations for the maximum height of the retaining wall design are completed. I have a question about the sliding in the LRFD Design, but I made an assumption so I could move on for now.
The rough draft technical report is written with the design calculations clearly compiled and typed in the appendices. We currently have preliminary cross sections drawn with retaining walls shown if needed. The retaining wall locations are drawn on the plan view and the heights are drawn on the vertical profile. When I get these draft documents reviewed, I will be able to finish them by next Friday for the 30% submittal.

Environmental-
This week I have been wrapping up my rain garden calculations and dimensions. I have one question for Karen tomorrow that should give me the last piece of information that I need to create a cross section. I have started drawing some of the details in the CAD file. I don't have much left on that. I have also been working on the SWPPP form; filling in as much information as I can. I am going to be working on the technical report tonight in preparation for tomorrow's class.

Transportation-
Pertaining to the Transportation aspect, the Plan View/Vertical Profile sheets (rough drafts) are complete. They should be reviewed for misc details such as consistent text size, pen width, etc.
The typical cross section is complete and loaded onto a sheet template and is ready for review.
The cross sections are complete and loaded onto template sheets. Though a design change has been made, the geotechnical engineer is currently looking into alternative locations for the retaining walls that will be located on the North side of the roadway, where the existing terrain will be lower than our project. He may be modifying these as he sees fit.
The rough draft has been updated as the project has moved along. The items that are currently missing are the appendices with the design calculations. I've kept track of all of my design calculations on engineering paper, labeling what was done and when. I will have scanned copies of these ready to attach to the report by early next week.

Cost calculations will begin this weekend and will be complete early next week. These will be typed, and any equations needed will be typed in Microsoft Word's equation writer program.

The major aspect of my original design was the roundabout. I plan on updating what was presented during the original presentation with the changes that were made to the design. I.e. my focus will not be the roundabout, but the increase in lanes, choosing the widest lanes possible, minimizing locations of retaining walls by utilizing a continuous cross slope, and other ideas incorporated into this project.

**Structural**

I have all of my cross sections completed and a good chunk of the underpass design finished. The other structural people and I are meeting before class on Friday to finalize our design. My Technical report can be completed as soon as we finalize the design for the underpass and I already have a large amount of it completed. The structural people already have several appendices and design calculations that could be attached.

**Project Management**

I am thinking my group will have a meeting Monday or Tuesday next week to put together our final presentation and written report. I think we will probably meet again later in the week to practice our presentation and put the finishing touches on the report.

The executive summary will be written early next week.

Our group has been constantly updating our project correspondence folder throughout the semester so it is ready to be turned in.
Objectives:
- Professional guidance on hydraulic gradient determination
- Seniors provide feedback to CIVE administration
- Discussion of successfully meeting deadlines
- E-Week loose ends
- Schedule for the rest of the semester
- Homework assignments for remainder of semester
- Discussion of developing questions from ENV, GEO, STR, TRN, WTR Engineers

Functional Design Speaker: Environmental Engineering
Kevin Donahoo, PE
Hydraulic Engineer
Roadway Design Division
Nebraska Department of Roads

5-Minute Break

1:30-2 pm, Senior Sound Off
Dr Bruce Dvorak
Interim Chair
UNL Civil Engineering Department

Today's Deliverables
- TM: Detailed progress report from PM
- PM: Billable hours report
- Team Meeting Minutes and successfully meeting deadlines

E-Week (Friday, April 12th)
- Questions?

Friday, April 5th: Management Transition from Milestone 4, E-Week to Milestone #5, Final Presentation and Submittals by April 12th
- Distribution of sample plan sheets for all discipline areas and general teamwork sheets (also on Blackboard)
- Examples of technical written reports on Blackboard
- Example of final presentation slides on Blackboard
- MicroStation and AutoCAD border files on Blackboard

Q & A for ENV, GEO, STR, TRN and WTR
- GEO Hints: 3 Retaining Walls on CoL Plans, Sta 104+45 to 111+29 Rt, 684 ft long
  Sta 118+05 to 124+25 Rt, 620 ft long
  Sta 126+50 to 133+78 Rt, 728 ft long

- ENV Hints: SWPPP with highlighted entries that must be completed by the ENV team member on Blackboard.

- WTR Hints: Compute initial pipe sizes for all storm sewer pipe to meet minimum and maximum velocities. Compute the hydraulic grade line for only one storm sewer system (excluding the last short segments draining from east to west into the cross structure at Station 139+64).
Homework Outline for the Remainder of the Semester

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<thead>
<tr>
<th>Wk</th>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>14</td>
<td>April 12</td>
<td>E-Week (No class but your team must man the display)</td>
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<tr>
<td></td>
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<td>Milestone #4 ends at 3 pm, Milestone #5 begins</td>
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<tr>
<td></td>
<td></td>
<td>Milestone #5 Team Meeting</td>
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<tr>
<td>15</td>
<td>April 19</td>
<td>Estimating (Karen)</td>
</tr>
<tr>
<td>16</td>
<td>April 26</td>
<td>Final Presentation and Submittals</td>
</tr>
<tr>
<td>17</td>
<td>May 3</td>
<td>Reflection and Final Evaluation of CIVE 489 (100-point homework assignment)</td>
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</table>

Week 14 Homework Assignment due Friday, April 12th

Individuals:
ALL team members should be working on their functional designs, written technical reports or E-Week displays!

Team:
- **PREPARE FOR AND PARTICIPATE IN E-WEEK!**
- Karen will view your displays and take pictures of your teams about Noon.
- Karen will review and comment on your roadway cross sections (2 Station increments)

While waiting for your project to be judged have a Milestone #5 team meeting...

Team management will transition from Milestone #4 (E-Week) to Milestone #5 (Final Presentation and Submittals)
- The PM conducting the meeting will be MS#5.
- The scribe taking notes will be MS #5. Meeting minutes must be distributed to the team members and Karen by 6 pm on Saturday, April 13th.

Week 15 Homework Assignment due Friday, April 19th

Individuals:
- **Draft** written report should be complete (bring copy to class)
- **Draft** plan sheets should be in progress (bring copies to class)

Team:
- PM submits detailed progress report and schedule for completion of:
  - executive summary (two page summary of existing conditions and issues, proposed solutions and short descriptions of designed systems to meet needs),
  - technical written reports,
  - appendices (extensive calculations used to determine designs, neatly compiled and written or typed, other supporting materials),
  - preliminary plan sheets, and
  - project correspondence notebook (meeting minutes, design memos, other team notes)

<table>
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<tr>
<th>Course Element</th>
<th>Percent of Final Grade</th>
<th>Grade Based on Individual Performance or Group Performance (all team members receive the same grade)</th>
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<tbody>
<tr>
<td>Oral Proposal Presentation</td>
<td>5</td>
<td>Group</td>
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<tr>
<td>Written Proposal Document</td>
<td>10</td>
<td>Individual</td>
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<td>Written Design Criteria Report</td>
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<td>Group</td>
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<td>Displays for E-Week/Hearing Rpt</td>
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<td>Group</td>
</tr>
<tr>
<td>Misc Individual Assignments</td>
<td>10</td>
<td>Individual</td>
</tr>
<tr>
<td>Written Draft Report</td>
<td>15</td>
<td>Individual</td>
</tr>
<tr>
<td>Oral Final Presentation</td>
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<td>Group</td>
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<tr>
<td>Written Final Report &amp; Notebook</td>
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<td>Individual</td>
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<tr>
<td>Preliminary Project Plans</td>
<td>15</td>
<td>Individual</td>
</tr>
<tr>
<td>Team Participation</td>
<td>5</td>
<td>Individual (based on weekly progress reports and team evaluations)</td>
</tr>
</tbody>
</table>
Objectives:
- Collect draft deliverables for review
- Feedback on E-Week
- Last Individual Assignment
- Discussion of Final Submittals
- Estimating
- Final Presentation Discussion
- Semester Review
- Evaluation Surveys

Today's Deliverables:
- IND: Draft technical written report
- PM: Billable hours report
  - Draft plan sheets
  - Detailed progress report and schedule for completion of remaining tasks
- Success in Week 14 Meeting Minute Distribution?

E-Week Review

Grading Criteria:

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Last Individual Assignment:
- Essay

Example Project Deliverables on Blackboard:
- Distribution of sample plan sheets for all disciple areas and general teamwork sheets
- Examples of technical written reports
- Example of final presentation slides
- MicroStation and AutoCAD border files

Detailed Deliverables Discussion

Estimating

Final Presentation Details:
- April 26th agenda
- Hints
- Professional evaluation forms

Lessons Learned

Peer Review Teaching Project Surveys

Questions
**CIVE 489 SENIOR DESIGN PROJECT**  
Spring 2013

Professional Reviewer Evaluation of Student Team Presentation

**Group Name:** Kingman Designs (Team 1)  
**Reviewer Name:** Holly Lommberger

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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</thead>
<tbody>
<tr>
<td>1. The presentation was well organized with objectives and recommendations clearly stated.</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>2. The speakers maintained reasonable eye contact and minimally relied upon notes or the laptop screen.</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>3. The visuals were well prepared, readable, and appropriate for the subject.</td>
<td>10</td>
<td>9</td>
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<td>7</td>
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<tr>
<td>4. The speakers answered questions adequately and/or spoke clearly.</td>
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**Notes/Questions/Comments/Suggestions:**  
Great job! Excellent thoughts on balancing public interest, property rights, aesthetics and goal of moving traffic (and cost). Remember, sometimes property purchase is necessary for the greater community interest (although not easy).
**CIVE 489 SENIOR DESIGN PROJECT**  
Spring 2013  

Professional Reviewer Evaluation of Student Team Presentation  

**Group Name:** Kingman Designs  
**Reviewer Name:** Kris Humphrey  

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**Notes/Questions/Comments/Suggestions:**  

Your firm did a great job balancing all aspects of design — roadway alignment, drainage, earthwork, etc.

Helpful hint is to show on a map areas that you are talking about and show a picture of typical section/cross section while you are explaining it. Also keep in mind maintenance of items incorporated into project — budgets are tight. Great job!
CIVE 489 SENIOR DESIGN PROJECT
Spring 2013

Professional Reviewer Evaluation of Student Team Presentation

Group Name: Flat-Water Engineering (Group 2)
Reviewer Name: ERIKA NUNES

<table>
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Notes/Questions/Comments/Suggestions:

Good decision to use precast boxes for pedestrian underpasses to shorten construction time.

Group did a great job presenting *not* reading from notes, don’t be afraid to use slides to illustrate points such as erosion control measures.

Sliders were easy to read & follow.

Great idea to use the native grasses in rain garden (not only as construction cost savings but future maintenance as well).
CIVE 489 SENIOR DESIGN PROJECT
Spring 2013

Professional Reviewer Evaluation of Student Team Presentation

Group Name: FLAT WATER Engineering (TEAM 2)
Reviewer Name: Thomas SHAFFER

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Notes/Questions/Comments/Suggestions:

Very well organized and good group dynamic in speaking to us. Can help sell this to a member of the public, by including and emphasizing the safety factors for transportation. Really all paths and properties impact is 3" pipe is a big jump from 24". I'd want to see more information on that if you were bringing it to me. Jumping completely past 30' step on below. Bottom of pg 5 = slide too cluttered. Also one slide was changed from hand out bad from a client view point. Overall: Excellent presentation. Very good project might and effort.
Professional Reviewer Evaluation of Student Team Presentation

Group Name: Kemp Engineering
Reviewer Name: Erika Nunes

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Notes/Questions/Comments/Suggestions:
- Good identification of project stakeholders
- Good use of pictures & model outputs to illustrate topics & enhance discussion
- Group members appeared confident & comfortable with material being presented
- Good discussion of design considerations (cost phasing impacts to schools, retaining walls - weep holes & aesthetics)
**CIVE 489 SENIOR DESIGN PROJECT**  
Spring 2013  

Professional Reviewer Evaluation of Student Team Presentation  

**Group Name:** Kemp Engineering (Team 3)  
**Reviewer Name:** Thomas Shafer  

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**Notes/Questions/Comments/Suggestions:**  

Good organization and well thought out solutions. Good attention to stakeholder concepts. The sidewalk could be bold with the idea (picture) of school children walking together in the 3-4 person clump they normally do. While I felt it was hard to read on slide good photo subjects in the presentation help clump.  

Overall: Very good, good project might need excellent effort.
CIVE 489 SENIOR DESIGN PROJECT  
Spring 2013

Professional Reviewer Evaluation of Student Team Presentation

Group Name: Engineering 720 (Team 4)
Reviewer Name: Holly Liebarger

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Notes/Questions/Comments/Suggestions:

Well thought out ideas on solving lots of issues in a small area. I loved your comment on using sustainability to lengthen the useful life of the project. More info on aesthetics would be nice.
CIVE 489 SENIOR DESIGN PROJECT
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Professional Reviewer Evaluation of Student Team Presentation

Group Name: Engineering 720
Reviewer Name: Kris Humphrey

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Notes/Questions/Comments/Suggestions:

- Nice job you did a great job incorporating the sustainability into the project as well as the aesthetics (balancing design with the surrounding neighborhood).
- You did a nice job introducing your team and your approach to the project.
- Typical sections would help as you discuss it.
- If drainage trunk is on one side or other, especially in tight P.O.W. just need to be mindful of other private or public utilities.
**CIVE 489 SENIOR DESIGN PROJECT**  
Spring 2013

**Professional Reviewer Evaluation of Student Team Presentation**

**Group Name:** Fine Line Designs (Team S)

**Reviewer Name:** Holly Lumberger

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**Notes/Questions/Comments/Suggestions:**

I also loved the bow ties! Well thought-out, comprehensive solution, but you also maintained individual, unique thoughts and didn't just present the "standard." You thought past what may have just been required to get by.
CIVE 489 SENIOR DESIGN PROJECT  
Spring 2013  

Professional Reviewer Evaluation of Student Team Presentation  

Group Name: **Fine Line Designs**  
Reviewer Name: **Kris Humphrey**

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**Notes/Questions/Comments/Suggestions:**

1. Very nice presentation. Good job starting off with the location map.
2. I enjoyed your slide on the multi-modal transportation aspect. This will definitely be a challenge in coming decades to balance the needs of the travelling public with budgets.
3. You did a good job balancing all aspects of design features. As a group (i.e., thinking of planting heights so driver visibility isn’t compromised)
4. Great presentation - like how you tied together your realities.

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Professional Reviewer Evaluation of Student Team Presentation

**Group Name:** JPAC  
**Reviewer Name:** Erika Nunes

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**Notes/Questions/Comments/Suggestions:**

- Good discussion of const. phasing, project stakeholders, & access; alt. access during construction.
- Good discussion of drainage design criteria.
- Good use of renderings to show proposed conditions.
- Good job maintaining eye contact & comfortable with material presented; did not read from a script; well prepared to answer questions.

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CIVE 489 SENIOR DESIGN PROJECT  
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Professional Reviewer Evaluation of Student Team Presentation

Group Name: J-PAC (Team 6)  
Reviewer Name: THOMAS SHAFFER

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Notes/Questions/Comments/Suggestions:

Very good presentation and good eye contact. Solutions seemed to have been very well researched and thought out. Very good graphics and design. Good recognition of the issues such as the 30" plant height, drainage issues related to cross-slope changes.

Overall, very good, excellent project report and superb effort.
CIVE 489 SENIOR DESIGN PROJECT
Spring 2013

Professional Reviewer Evaluation of Student Team Presentation

Group Name: Prime Engineering (Team 7)
Reviewer Name: Holly Lumberger

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Notes/Questions/Comments/Suggestions:

Great comprehensive solution covering multiple disciplines. Even though I know you've looked at the details, make sure to mention during your presentation.
### CIVE 489 SENIOR DESIGN PROJECT
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Professional Reviewer Evaluation of Student Team Presentation

Group Name: **Prime Engineering**

Reviewer Name: 

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CIVE 489 SENIOR DESIGN PROJECT  
Spring 2013

Professional Reviewer Evaluation of Student Team Presentation

Group Name: **PRIME ENGINEERING**

Reviewer Name: **Kris Humphry**

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Notes/Questions/Comments/Suggestions:

- Great presentation. You did a good job preparing for this final presentation.
- Nice job looking at documents such as 2040 comp plan.
- Nice job thinking of shy distance retaining wall. Just keep in mind clear zones and sight distances since it was 42.5' from Q.
- Nice job doing a SWPPP and incorporating BMP's.
APPENDIX D

STUDENT COURSE CONTENT REVIEWS, REFLECTIONS ON THEIR WORK AND RETHINKING THEIR APPROACH FOR FUTURE FRAME OF REFERENCE
Review, Reflection and Rethinking

The senior design capstone course in civil engineering required the use of a wide variety of skills that I have learned while at the University of Nebraska-Lincoln. Engineering and technical skills were needed to perform the design of my sub-discipline area, water resources. Team skills were needed to effectively work together with my four teammates and complete a project that none of us could have completed on our own. Communication skills were necessary to convey our proposed design to the client of the project, the City of Lincoln. In the following paragraphs I will discuss how each of these skills enabled my team and myself to complete our senior design project.

The process I used to complete the preliminary design of the water resources aspect of the project was straightforward. I would attend lecture on Friday and receive information on the new assignments and new information specific to water resources. I would then meet with my team to discuss what we needed to get done for the following week. Next I would work on my sub-discipline over the weekend and on any group assignments. Starting on my work on the weekend helped me stay on top of assignments and allowed me time to resolve any problems I ran into.

One area of the water resources aspect of the project that needs further refinement is the hydraulic grade line (HGL) and pipe slope calculations. In order to complete these calculations I used the City of Lincoln’s Drainage Criteria Manual (DCM). The DCM outlines the calculations necessary for determining HGL and pipe slope. Unfortunately the process was not clear enough for me to fully understand the calculations. My lack of understanding of the DCM procedure required me to make assumptions in my calculation of the HGL and pipe slope. If I had more time to work on this project I would further research the DCM process by visiting a City of Lincoln Engineer familiar in the area of water resources. Again, the feature of my design that I would like to most rethink is the HGL and pipe slope calculation.

The modern engineering tools that I used to complete the water resources design include software products and internet resources. The software products I used include Excel and AutoCad. Excel was used to run calculations for determining inlet locations, pipe slopes, and HGLs. AutoCad was used to draw the plans showing inlet, manhole, and pipe locations. The internet resource I used most often was the City of Lincoln’s Drainage Criteria Manual (DCM). The DCM has a wealth of information on exactly what the City of Lincoln requires in the design of its storm sewer system. The DCM contains all the required equations and figures necessary for storm sewer design calculations.

As I mentioned previously team skills were essential to the completion of this project. Our team started out as most teams do, awkward and unsure of how we would work together. I personally only knew one of my team members at the start of this project and I didn’t know how our team would fare. After the first couple of meetings our team started building confidence. Once we realized each member was going to put forth a quality effort we started trusting each other more and communicating more
openly, I would say our team has continued development throughout the semester and would continue if the project had not come to an end.

I greatly enjoyed trying out the three different roles of project manager, scribe, and functional support engineer. The best way to learn about something is to try it out for yourself and this was very evident with each of the three roles. For the first two milestones I was a functional support engineer, which is the easiest of the three roles because this role has no specific duties. For the third milestone I was the scribe for our team and was responsible for recording meeting minutes. Acting as a the scribe was not hard, yet I am glad each of us had to do it, because keeping track of what is being decided at the meeting takes concentration and is very important. For the fourth milestone I was the project manager. Acting as the project manager I definitely felt the increase in responsibility, because while my team cared about the project, I could tell they felt I would make sure everything came together well. I have much more appreciation for those individuals in project management roles after my rather short time as a project manager.

My communication skills were improved on multiple levels during this past semester. Presenting our proposal and final 30 percent designs was a great opportunity to work on speaking in front of groups. Working as part of a team allowed me to work on presenting my viewpoint, even if it is not the most popular view. The various assignments and reports allowed me to work on my technical writing and proofreading skills. Areas where I could still use improvement include all of the areas I mentioned that I have made improvements in. I would like to increase my excitement when speaking publicly, be more willing to disagree with team members, and improve upon the readability of my technical writing.

I have learned a great deal from my senior design experience. I learned that staying ahead of schedule is very important, as unexpected problems naturally will arise, I learned that I will come across things I don’t understand and that when I do I need to be willing to put in extra time to figure out these issues. Most importantly I learned that clear and constant communication with your team members is critical to completing a project with the least amount of headaches possible.

In closing, thank you for all of your hard work Karen. Your constant improvements to the senior design class are clearly evident, as I had a great experience with senior design.
Engineering and Technical Skills

The first step in the design process for me was to review the RFP for the project and take from it all the relevant points that I might need later in the design. The next step was to do research and gather as much information and as many resources as possible and use that information to ensure that I understood the design process sufficiently enough that I could perform it. Following that, I began to design a typical retaining wall without plugging in any of the dimensions or other parameters. As I performed the design, I set up a spreadsheet to perform the calculations I was making, so that I could quickly design retaining walls for different cases. Once this step was complete, I needed to determine the required heights based on the proposed roadway section. This was done by using AutoCAD to cut a profile along the alignment at the offset where the retaining walls would be located and plotting the proposed surf ace elevation based on the roadway profile provided by the transportation engineer. I then calculated the minimum elevation difference between the two profiles which would not permit proper side-sloping within the right-of-way and placed retaining walls at those locations where the elevation difference was greater than this value. Finally, these retaining walls were designed using the spreadsheet I created, quantities were calculated, and an opinion of cost was created.

In hindsight, and given more time, I would have determined the retaining wall locations and heights by using the corridor feature in AutoCAD Civil 3D, as it would provide much more accurate results than the approximate method which I used. In fact, one of the biggest things I would change about the overall design of the project would be to utilize AutoCAD (or MicroStation) from the very beginning. Some of my motivation for this approach may come from familiarity, as this is the approach that we follow at my job, but I believe that the problems of communication and coordination could have been solved by using an organized technology-centered approach from the beginning. This may be unrealistic, though, given that only two of our team’s four members knew CAD (and both knew different software suites, to further complicate things).

Despite the less-than-optimal integration of CAD into the design process, technology was a key part of our team’s process. In particular, we utilized Google Docs (recently renamed Google Drive) to create almost all of our documents as well as to upload and share files. We also used the City of Lincoln’s GIS viewer and other online resources to find information. I also had the opportunity to practice some of my SketchUp skills to create 3D models to help visualize certain aspects of the project and to communicate our ideas to others. This software is fantastic for the conceptual phase of design since it is extremely easy to use and allows very fast editing of 3D models which in other software would take much longer.

Team Skills

I feel that I am extremely lucky to have been assigned to the team to which I was. All four of us knew each other quite well and we had worked with each other successfully and efficiently in group projects for other classes. From the first meeting, we communicated well, had good discussions, and for the most part worked efficiently. I can’t think of any changes I would make to our team dynamic which would have any definite positive impact.

While a project manager, I never felt that I had to push anyone to contribute to the group’s efforts. The primary focus of my efforts during this phase was to ensure that all of the required tasks were fairly and effectively delegated. While being a project manager was certainly the most stressful, being a scribe was for me perhaps the most difficult. Taking notes of an evolving discussion while also participating in that discussion does not come easily to me.
Communication Skills

This course has afforded me an opportunity to practice my speaking skills during both the proposal phase and the final presentation phase. Public speaking is one area where I am aware that I can use much improvement, at least while speaking about technical topics. I was actually a member of my high school's speech and one-act teams and was much more proficient in those than I ever have been for school presentations. I think it ultimately comes down to comfort with the subject about which I am speaking and sufficient practice. I am optimistic that I will be able to improve my speaking abilities as a professional for this reason, as I will (hopefully) be more knowledgeable about the topics about which I speak and I will have more time to practice.

Writing, on the other hand, has always been one of my relatively stronger suits, at least compared to the conventional stereotype of the 'typical' engineer. This class has given me an opportunity to further practice my writing skills, which is a rare thing for an undergraduate in civil engineering.

I have also had the opportunity to do a significant amount of graphic design for this class, which I enjoyed greatly, as it is among my many interests. My graphic design abilities definitely improved throughout the semester as I had opportunities to practice them.

Enduring Understanding

While I don't expect to perform many designs in the geotechnical area, as it is not one of my primary interests, I did expand my understanding of the topic in case I am ever required to do such a design.

The most important thing which I have taken away from this class is much more abstract. No class can fully simulate the professional design process, and it is impossible to know what little bits of information and learning you will find useful in the future. However, this class gave me a better understanding of what goes into working, not only as a team, but on a multidisciplinary project.
Garret Menard  
Senior Design Project  
CIVE 489  
4/23/13

Review, Reflection, and Rethinking

The objective of the senior design class was to complete research and preliminary design work for the reconstruction and expansion of Old Cheney Road from 70th to 84th Streets needed for the City of Lincoln Public Works and Utilities Department. I worked on this project with a design team and developed my technical, communication, and leadership skills that will benefit me throughout my career. The following paragraphs summarize my project development as the transportation engineer.

First, the project required extensive engineering and technical skill. Before determining anything, I identified the stakeholders of the project and developed a project understanding, project approach, and project scope. Then, I researched technical documents, including the City of Lincoln Design Manual and the AASHTO Green Book, to come up with minimum and maximum design limits. We then determined the traffic control for each intersection and whether left- or right-turn lanes should be added at each intersection. More research for left- and right-turn lane warrants would be needed to be looked into, as well as traffic signal warrants. Next, I acquired vehicle volume data for the four intersections within the project limits. With the data, I projected the volumes to the design year of 2030 using an assumed 2 percent annual growth factor. This annual growth factor could be better calculated with planning data from the city of Lincoln. I then used the projected volumes and the NDOR Roadway Design Manual to determine the lengths of the left-turn lanes.

Creating the plan and profile plan sheets using MicroStation was the next step. First, the horizontal alignment was kept the same as existing, which was straight. Then, the vertical alignment was changed in order to reduce the cost of earthwork, yet keeping the intersections throughout the project close to the existing elevation. More knowledge of earthwork costs and more trials of different vertical alignments would have been good to decrease earthwork cost and impact of right-of-way. The plan sheets were created using the cross sections that we determined as a team. As a professional engineer, I would try to work more with the other engineers working on the project in order to come up with a solution that solves multiple issues. For example, my vertical alignment, horizontal alignment, and cross sections will effect where the retaining walls and storm sewer systems will go. Discussing and working with the geotechnical engineer and water resources engineer will result in a more efficient overall roadway. Finally, the preliminary research, technical calculations, and plan sheets were all documented so everything can be looked back upon and checked if necessary.

The use of engineering software was very handy for the work on this project. I used MicroStation for the roadway plan and profile plan sheets. The use of MicroStation results in more accurate calculations and a cleaner display for the design elements. The use of Microsoft Office and PowerPoint helped make visually appealing presentation slides for the proposal presentation, as well as brochures and a poster board for the simulated public meeting at E-Week. These visual aids helped clearly depict the project needs and solutions that we believe were the most important. Finally, the use of standards and technical documents on-line provided for quick analysis and determination for different design elements.

Second, I gained many team skills throughout this project. As a design team, we gelled pretty quickly and started out with open-mindedness. This created unique design suggestions. Near the end of the semester, we all started to focus on our sub-disciplinary, but we were still open to helping each other out when necessary. As a functional support engineer, I made sure to get my work done on time and keep in touch with the group, especially the project manager, on my progress. As a scribe, I
improved my listening skills and note-taking skills. As a project manager, I enhanced my leadership skills. However, there are team skills I need to improve on. I need to speak up when I am the most knowledgeable of a certain topic and trust others to finish their tasks on time.

Third, my communication skills enhanced tremendously throughout this semester. First, the proposal and E-Week presentations helped make me a more confident public speaker. Second, the group meetings and e-mail correspondence caused me to become a more confident team member. Finally, the technical report and plan sheets resulted in my improvement of my technical writing and graphic skills.

All that I have learned from this class will help me in the future throughout my career. Now I know about the process of a multi-disciplinary project and the many steps it entails. I will now know how to better work as a team throughout a project and I will be more confident in my technical skills and speak up when I have any advice.
Name: Sam Ghaleb
Title: Review, Reflection and Rethinking
Project: Widening of Old Cheney Road, from 70th to 84th Streets

The overall objective of senior design project was to solve a real world problem in the area of my specialty. It was a semester long activity involving teams of students to gain career related experience prior to graduation. The preliminary design steps included a number of activities to gather information and identify issues. This paper summarizes my role as the geotechnical engineer of the project and the process I used to complete the preliminary design assignment.

The actual preliminary design of my sub-disciplinary assignment started after our responsible transportation engineer developed a typical cross section. While I was waiting for the cross section to be developed, I gathered information about the soil. The safe and economic design of a retaining wall depends on the appropriate mobilization of strength in the adjacent soil. The main purpose is to eliminate the various safety factors against sliding, overturning, and bearing resistance.

Geotechnical drilling and laboratory testing is a vital predecessor to the design and construction of a project. Identifying and classifying subsurface soil, rock and ground water conditions play as important a role in a project as the structural design above ground. But since we had limited time and capability to gather adequate data from the site, we had to make some assumptions. The assumed values were given to us by the instructor. However after I researched on the internet, I found out that the City of Lincoln uses the same assumed values for the project site on Old Cheney Road. The only big assumption we made was that the slope behind the wall is not inclining. And when I visited the site, I found out that the backfill surface above the wall is inclining. If the City of Lincoln were to use my design, they will have to consider the inclination of the backfill.

I used Microsoft Excel and the LRFD Method to design the retaining wall. I used the methodology, criteria, and equations for design from an example that was provided in the LRFD Method packet. I was glad that I used Microsoft Excel to make separate tables to calculate the required values. As soon as I received the cross section of the road from the transportation engineer, I figured out the wall height. Then I only needed to change the height value and the software recalculated the overturning, bearing resistance, and sliding.

Geotechnical engineer shares common interests with other sub-discipline areas of civil engineering as nearly all structures are supported on or built into the ground. It was important for me to work on the preliminary design as a team. At the beginning it was difficult to work collaboratively but over time and practice I developed such skills. I think the only way I improved team-working skills was due to the type of work we were involved in and the way the project was outlined which encouraged collaboration and sharing. Being as a supporting member then becoming scribe and finally the leader of the team, I learned how important it is to listen, feel and respond to the needs of other. It reminded me of my first days in the United States when I went through a painful period while trying to communicate with others. I went through a
similar period in the first presentation but after the second presentation I think I can do it again and again without being nervous.

The knowledge I gained for the past five years was purely academic but the knowledge I gained from the capstone design course was from experience. I think attending school for the past five years was not enough for me to achieve success in my real life in which practical skills are essential. These skills were easily obtained from experience in capstone design course. I gained skills of working in group and problem solving skills through the experience of working and discussions. I will be left with two very fond memories from this course. First, I will always remember how prepared and organized the instructor was for the course; second, I will always remember how the instructor prepared us to use our learned skills in classroom to use in the real world. The latter memory, in my opinion, is extremely valuable and unforgettable. I want to personally thank the instructor for passion of educating and nurturing her students.
Jordan Dostal
Review, Reflection, and Rethinking Essay
May 1\textsuperscript{st}, 2013

Anybody who has made it through the Civil Engineering program at the University of Nebraska-Lincoln knows the single greatest feeling they had throughout the process was walking out of Senior Design for the last time. The class has a way of sitting in the back of one’s mind as if he/she is forgetting something. Despite this, throughout the class much is learned related to the engineering profession, relationships are built, and communication skills are improved, all of which will last long after commencement.

The process for going through preliminary design took me over a lot of the early hurdles in winning projects and ended up giving me a taste of putting plans together and developing my own storm sewer system. The first step was reading through the RFP and scoping documents to see exactly what the City of Lincoln needed us to accomplish. It became clear in these documents that, as the water resources engineer, I would be developing a curb and gutter system along the length of the project. Poring through pages and pages of the Drainage Control Manual and other city standards, an extremely hazy picture began to form on how the design would actually happen.

With some standards in my back pocket, a draft technical written report came to life. The purpose of this was to make sure we had a better idea of what needed to be done by the end of the semester, but what I really got out of it was an increased understanding of what standards would be important for my design. After Mr. Donahoo’s first presentation, the design process began by calculating runoff for various drainage areas found based on different high points along the project and a contour map brought in from the City of Lincoln. The designing halted for a bit until a very useful session on how to locate curb inlets. After that, calculations were completed and I was able to put everything into Microstation and complete my design portion.

Many assumptions were made during design, most prominently that the existing pipes crossing Old Cheney Road could handle the flow of a 10-year storm from our pipes. In future stages of design, the flow to these pipes should be analyzed and they should be resized as necessary. Another detail that would require further design is the overflow inlets from the rain gardens. Our design team kept the rain gardens and storm sewers separate during the preliminary phase for simplicity. Lastly, I located an inlet west of 72\textsuperscript{nd} street to limit runoff across the intersection, but the amount of flow is fairly miniscule. This would likely need to be removed, saving one inlet and a lot of piping.

As referenced earlier, Microstation was used for the storm sewer design. This program has great synergy with doing plan and profile sheets because it allows the designer to scale the vertical without scaling the horizontal. Additionally, I was able to bring in files from the City of Lincoln that had contour lines and information on existing storm sewer systems. Using Excel for calculations was very effective because I could make changes to one thing (the pipe slope) and all other affected variables would change accordingly (hydraulic grade line).

Of course, a large part of this course was to learn more about working together as a team. From the outset, our group got along well, but too much time was spent kidding around rather than getting work done. As the semester progressed, our group learned to understand and trust each other better as well as work more efficiently in meetings. I appreciated that we functioned highly independently yet were still very quick to help each other out if needed. By the end of the semester, most people had themselves taken care of with extra time to help out members less
familiar with the computer programs. The only negative thing about our group was that our schedules did not match up very well outside of class.

It was great to have a chance to fulfill different roles throughout the semester. The project manager had to be more accountable for other group members during their tenure and also ended up putting in those extra couple hours making sure everything was prepared for class. I liked being scribe because, as the first one, I was able to establish a template for note-taking everyone else could follow.

In Senior Design, each group had to give two presentations in order to improve on our weaknesses from the beginning of the semester to the end. This helped me grow as a presenter some, but it mostly reinforced what I already knew about myself- practice makes perfect. More helpful for me was constantly communicating with my peers, discussing ideas and issues. I still need to work on listening to other people and striving to find a solution rather than battling ideas.

Much of what I learned this past semester will carry on for years. Next time I work on a roadway and need to develop a storm sewer, I will know many of the standards and the steps to be taken to complete a preliminary design. Second, continuing to grow in areas of communication and team skills will be vital to my career. Most importantly, though, the relationships I built with classmates will make work conferences better for years to come.
Class Understanding and Ongoing Inquiry

Senior design was an interesting class to end an undergraduate career with. It was like no other class before it, but at the same time somehow tapped into knowledge of the previous classes before it. The class challenged to work as a team like a consulting firm would in the real world and seemed to have much more of a real world application focus than other classes. As mentioned before the class challenged individuals to apply their knowledge to a real world problem, but at the same time to quickly learn on the go and how to diligently work as a team to achieve one goal. The goal in this class was to complete 30% plans on the widening of Old Cheney Road from 70th to 84th streets.

As the semester started, teams were assembled and everyone slowly got to know each other to see how they would fit in to the group. The first task at hand was to prepare for a presentation as a response to the Request for Proposal (RFP). Engineering sub-disciplinary roles were determined early on and a Project Manager (PM) was put in charge of making sure all the other engineers do their necessary work. A “Scribe” was also assigned to take minutes during the weekly progress meetings after class to document what important design criteria or assumptions would be made by the group. For each milestone in the project, the roles of the PM and Scribe were changed so that everyone in the group had a chance to be in each role. The group initially did not know much about the project so a lot of data and useful information needed to be determined early on before anyone could start anything.

Going out to the project site was the first step in gathering information. Being physically out at the site helps an engineer to instantly see who constituents are, what the obvious problems are that need to be fixed, and to see first-hand that Karen mentioned in class. The road was obviously too narrow and could not sufficiently handle traffic volumes at peak times. Flooding was happening on the north side of Old Cheney that needed to be addressed and there were absolutely no side-walks at all, making the whole section very unfriendly to pedestrians. We could easily see that the constituents for the project would be the residents whose backyards faced Old Cheney road as the project would likely encroach onto their back lawn. After the main constituents and visible problems were taken into account each engineer on the team came up with ideas on how they were going to address the problems on the project site. If anything was learned at all from taking this class, it’s that your first design idea probably won’t work. And then your next plan of action, probably won’t completely work either. Each team member had a general idea of what we wanted to do, but as the semester progressed and new things were learned about the project every day, designs were constantly changing or needed to be readjusted.

From the start of the semester to the end of the semester my designs for rain gardens changed at least 3 total times. For the SWPPP form that was completed, not much was known about the project in the preliminary stage to fully fill the SWPPP document out. Erosion control was easily determined because the only needed information was the drainage patterns of the terrain. Rain garden design changed the most out of all my designs. Initially, it was planned to put rain gardens on both sides of the road. After determining the road would slope from north to south at a constant slope, the rain gardens moved to the future median and the north side of the
Hayden DeLay  
Senior Design  
Final Assignment

road. After the rain gardens were properly sized for the project area, it was determined that rain gardens only needed to be placed on the north side of the road in different sections. Some of the most critical assumptions made were deciding that the rain gardens would only be designed for the first inch of storm water runoff. The other assumption made was that grass would be sufficient enough vegetation for these particular rain gardens and that the rain garden under drain system would easily tie into the storm sewer system and that that system would adequately be able to support the additional flow. In fact, if there were things I would like to rethink for my design if I had more time, I would want to delve deeper into the under drain system flow and be able to add inlets from the road to the rain gardens. I would also want to know if the rain gardens designed would adequately prevent flooding from happening on the north side of Old Cheney through some type of modeling system.

Being the PM for my milestone was not fun. It was hard keeping everyone in check and making sure their work was in on time. My team skills definitely improved as a result of this class. Scribe helped me to be more attentive to others during team meetings. But homework or proof of progress should be turned in to keep everything rolling. My communication skills definitely improved with having to give formal presentations but I still need to work on filler words and being more enthusiastic. This class has taught me there is always work to be done and designs constantly change. It also taught me that there is always new things about engineering to be learned and that my education does not end with graduation.
The preliminary design for the environmental sub-discipline involved continuously reworking the problem and analyzing it from varying perspectives. The design process began by doing an extensive amount of general research. Having never designed a rain garden before, there was a lot of material that was researched and did not apply to the design. I have found this to be similar to my experience at work. When working on something new you are often less efficient in regards to your research. As time progresses it becomes easier to know what type of material needs to be found and what type of information is valuable. I also reworked my calculations and across section a couple times as new information was discovered and new assumptions were made.

Taking the design from the 30% plans to the final plans for the rain garden would require further investigation on the specific types of vegetation to be used in the rain garden. I would also need to figure out what size to make the overflow. When considering the final design, I would also reanalyze the cost of the design. Our team’s rain garden was larger than many of the other teams’ rain gardens, causing it to be significantly more expensive. When preparing the final plans I would look for ways to reduce the costs associated with the rain garden. This could involve changing the rain garden’s size or doing a more thorough analysis on the cost of excavation because this is where a majority of the cost came from. I would also consider designing culvert inlets into the median so that it can more directly alleviate the burden on the storm sewers. Additionally, I would explore the effects on making the median rain garden smaller and putting small rain gardens in other locations.

I personally did not use any software products to complete my sub-disciplinary design. My calculations were fairly straightforward and did not require any special engineering tools. I do wish that I was able to contribute more in the area of CADD. Scott Hrabik did a majority of the CADD work, and was overall very proficient at it because of his experience at his current job. I would have liked to have more of a CADD background so that I could lighten the CADD related burden he had, especially because my rain garden design was less involved than his storm sewer design.

The team dynamics changed as the weeks progressed. Initially everyone mostly kept to themselves and contributed what I would consider an equal amount. As the weeks progressed it became apparent that everyone had different working styles. Scott and I had the most similar style because we both tend to be very thorough and like to plan ahead. Consequently, I found myself often doing tasks that a project manager would do, even if I was not the project manager. I like being organized, keeping everyone on task, and being comprehensive. Unfortunately, sometimes that makes others feel as if they do not have to do as much because they know that someone else will take care of it. Eventually I made a point to try to control less and give others the opportunity to make mistakes and be a project manager without me trying to help.

The main struggle we had as a group was the communication barrier between us and Menghen. We would often think that he understood what we were doing and what was expected of him, only to find out later that he did not. Obviously, there is not much that could be done about this, but we made a point to be patient and encourage him to contribute. Unfortunately, I believe that
the language barrier made it intimidating for him to do so. I really wish that we could have heard more of his ideas and what he had to offer the group and ultimately the project design.

While my presentation skills are not perfected, I do believe that they were improved throughout the duration of the class. Watching the recorded presentations definitely helped me gain insight on my presentation style and ways in which it could be improved. My main problem is that I do not present in an enthusiastic manner. This is something that I really need to continue to work on, especially because I will likely be presenting in front of cities, villages, colleagues, and others throughout my career.

Overall, this class has helped me gain experience in working through the process of solving an engineering design problem. There are many aspects to this process that were replicated within this class. These aspects included meetings, correspondence, research, proposal preparation, design calculations, technical writing, and plan preparation.
Our project is reconstructing Old Cheney Road, 70th to 84th streets. I did the Structural Engineering part. According to our plan, I will design the pedestrian crossing. We decide choose the underpass through our consideration. Then, we began to prepare the proposal. Why we chose the underpass for our plan and preliminary determine its material. And underpass can bring us what advantage, such as: the new underpass can ensure the safety of residents of the neighborhood. It will reduce possible accident from pedestrian crossing. Traffic will not to be stopped for pedestrian to cross. This design is more convenient for hiker and bikers. The underpass is also a part of the plan of Lincoln 2040. Uses the underpass, we can eliminate the use of traffic light. The neighborhood will save the electricity. The box culvert is very economical for structure. Its have long life span and easily adaptable to many different condition and so on. Next, I did many online researches and look for some information about this aspect like reference guides. And we can did some assumption for our design. Determine the appropriate location for underpass, prepare special CAD plan sheet showing underpass details and summary of quantities for structural items. Through the preparation, we can got a preliminary design. Then, according to PE's presentation we did more details for underpass design-box culvert. First step is get different types of load in each section. Divide box culvert into nine sections. For each section, I use load combination, and add moment and shear to each section of box culvert. By doing that, each section's moment and shear is used to determine reinforcement, which used in box culvert. Abaqus is using to simulate the box culvert, by add shear and moment to each section of box culvert, and boundary condition is applied to the bottom of box culvert, strain and stress of box culvert under the load can be get by doing that. I can determine whether box culvert can take the load or not, even the critical part of box culvert can be determine, which can help to further improve structure design of box culvert. Follow these steps, I finished most of the box culvert design. I did many assumptions such as: A minimum of one feet of earth cover shall be between the bottom of the driving lane pavement and top edge of underpass structure. Soils are Peorian Loess which under drained conditions will have little or no cohesion, hence cohesion, c=0 psf. Foundation Soil Characteristics: f′=27 degrees, c=0 psf, g=110 pcf. Retained Soil Characteristics: f′=30 degree, c=0 psf, g=114pcf. Drainage of underpass will not be considered. Underpass will be a trench installation. Utility issues will be ignored. I think I can improve some point of design. I think use prestressed reinforcement is better, because the top of the box undergoes bending due to soil stress and vehicle loads; the top of the box is in a state of tension. And recommend the application of a protective layer on the reinforcement to prevent it from erosion, because the box is in the underground. For my design processing, I learned new software—Abaqus. It can simulate the box culvert and determine whether box culvert can take the load or not. The
Abaqus help me to check my box culvert design.

I think I can joy in our team for group study of whole semester. Although I was a foreigner, they were very nice for me. We can discuss problem and solve it together. I can learn a lot of things from each one, that their positive attitudes also make me nose to the grindstone. As a leader, I can exercise my leadership skills. Record weekly tasks are duties of scribe. Support guys need did their tasks and help leader did well each part. Although the role of each person is not the same, but are indispensable. I improved my oral skills for this semester. We need to discuss a lot of problems each week. I need more communication opportunities to improve my ability, which a very important part of the future jobs. I think I have improved self-learning ability. I did not know how to design the box culvert before this semester. By the time of the semester, I figure out how to design it and its advantages and so on. And I also learned a new engineering software-Abaqus. This is very valuable experience, which can helpful for my future. I hope I can learn more professional skills in the different types of challenges.
APPENDIX E

FINAL ASSIGNMENT SUBMITTALS FROM BEST TEAM AND WORST TEAM
30% Design Report

Old Cheney Road Reconstruction,
70th Street to 84th Street
Lincoln, Nebraska
Project Control No. 700028

Prepared for:
City of Lincoln

Prepared By:
EINE
Fine Line Designs

April 26th, 2013
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Executive Summary

This report concerns the widening of Old Cheney Road between 70th Street and 84th Street in Lincoln, Nebraska from two lanes to four lanes. Currently, this section of road is a two-lane facility with no left turn lanes or medians. Furthermore, there is no sidewalk or bike path through this corridor. Old Cheney Road is already a four-lane facility to the East and West of the project area. Since this roadway is surrounded by four-lane facilities on both sides it has a tendency to act as a bottleneck for drivers. Currently, this section of road is operating at a level of service that is not satisfactory. Traffic frequently gets backed up and delays are common during peak hour traffic. Widening the roadway to four lanes and adding left turn lanes and a median will improve the level of service and alleviate congestion throughout this section.

In addition to widening the roadway, several other features have been designed which include: Construction of a bike path on the north side of the road and sidewalk on the south, a pedestrian underpass below Old Cheney Road, retaining walls where necessary, rain gardens contained within the median, and a new storm sewer system.

This corridor has a very narrow right of way, which presents challenges when trying to fit everything within the project limits. In order to maximize the amount of ground to work with, retaining walls have been designed. Utilizing retaining walls allows us to not grade pass the limits of construction. In certain places, permanent easements may be required for maintenance of the retaining walls.

A new bike trail through the project corridor will serve the surrounding neighborhoods and provide a safe passage for cyclists and pedestrians alike. A pedestrian underpass has been designed to safely move hikers and bikers from one side of the road to the other. A reinforced concrete box culvert has been selected and designed to accomplish this goal. Along with safety benefits, the pedestrian underpass will also encourage better traffic flow on the roadway due to the fact that drivers will not have to stop for pedestrians crossing the street.

In order to control erosion and environmental issues brought about by construction, a Storm Water Pollution Prevention Plan (SWPPP) has been completed with consideration to Best Management Practices. These practices include silt fences, to help maintain the current soil conditions and prevent sediment from washing away and polluting downstream drainageways.

The result of the project is going to produce a much higher volume of runoff. As a result, rain gardens have been designed to help control the runoff as well as help eliminate the amount of pollution and sediment that ends up in the creek. Another way to control runoff is to utilize permeable pavements on the bike trail and sidewalk. However, specific details regarding permeable pavement will not be available until the sixty-percent plans stage.

For drainage of the improved facility a new storm sewer system has been designed in accordance with the City of Lincoln’s Design Criteria Manual. The storm sewer consists of inlets to allow removal of rain water from the roadway, manholes for access points to
the sewer, and reinforced concrete pipes to drain the water collected by the inlets. The storm sewer system was designed to maintain the natural watershed boundaries and to convey rain water in an efficient manner.

For Stake-holders, such as the City of Lincoln and local residents, consideration has been and will continue to be the greatest priority with this design. Stake-holders will be consulted through the entirety of the project all the way to completion of construction. Fine Line Designs strives to meet and surpass client expectations in every situation.
Technical Report for Transportation Sub-Disciplinary Area

Subject:
Roadway Design for Old Cheney Road, 70th to 84th Streets

Designer:

Reference Guides:
   http://www.transportation.nebraska.gov/gov-aff/pdfs-docs/MinDesStds.pdf
2) A Policy of Geometric Design of Highways and Streets 2004 (AASHTO)
3) State of Nebraska 2006 Roadway Design Manual
4) Nebraska Department of Roads’ Bridge Office Policies and Procedures Manual
   http://www.transportation.nebraska.gov/design/bridge/downloads-manuals.html#bopp
6) NDOR, Standard Specifications for Highway Construction 2007
7) NDOR Policy for Accommodating Utilities on State Highway Rights-of-Way
8) An Informational Guide for Roadway Lighting (AASHTO)
9) Roadway Lighting Handbook (USDOT, FHWA)
10) Manual on Uniform Traffic Control Devices (FHWA)
    http://www.mutcd.fhwa.dot.gov/kno-mellennium.htm

Design Criteria:

- Design speed is 45 mph. Posted speed is 45 mph.
- Max slope on vertical profile is 3%.
- 11 foot lane widths.
- Median width will be 13’ (2’ slab both sides, 9’ landscaped center)
- At turning lanes, the lanes will be 11’ and the median reduced to 3’ (2’ median with 2-6” integral curbs)
Copies of Methodology, Criteria, Equations or Policies:

- Vertical Curves

Slope – Intercept: \[ x_{\text{int}} = \frac{-m_2 p_{x2} + p_{y2} + m_1 p_{x1} - p_{y2}}{m_1 - m_2} \]

\[ y_{\text{int}} = m_1 (x_{\text{int}} - x_1) + y_1 \]

\[ r = \frac{A}{L}; \ A=\text{absolute difference of slopes, } L=\text{length of curve} \]

Elevation along vertical curves

\[ g_1 = \text{left slope} \quad x=\text{distance from BVC} \]

Elevation at any point along a vertical parabolic curb

\[ ELEV_x = \frac{r}{2} x^2 + g_1 x + ELEV_{BVC} \]

List of Assumptions:

- Utilities may be ignored
- The bike path location will be on the north side of Old Cheney Road.
- The minimum width of the bike path will be 10 feet. An additional 2 ft of width should be added to any side of the path adjacent to a retaining wall or underpass wall.
- Old Cheney will be closed from 72nd to 82nd Streets.
- There must be a median break at 77th Street and Old Cheney Road. The intersection will be a traditional style and will be signalized.
- The intersection at 72nd Street and Old Cheney Road will be closed permanently.
- The design traffic volume year is 2030.
- A taper of 8:1 will be used in changing lane widths, and also for the turning lane transition.
- The project will begin at Sta 103+25, and end at Sta 143+00. The new roadway will match with the existing roadway outside of scope of the project.
- The bike path and sidewalk will be construction beyond the scope of the project, spanning from 70th street to 84th street.
- Integral curbs will be used in construction.
Design Calculations:

- See Appendix A for more involved he attached engineering paper for calculations.

Recommendations:

- Ben Jarrett and Trey Rinne recommend that the minimum lengths of left turn lanes are as follows:
  - **Cross Creek Road**
    For cars traveling **Westbound** on Old Cheney and making a left turn onto Cross Creek road the minimum left turn lane storage length shall be 75 feet.
  - **77th Street**
    For cars traveling **Westbound** on Old Cheney and making a left turn onto 77th Street the minimum left turn lane storage length shall be 75 feet.
    For cars traveling **Eastbound** on Old Cheney and making a left turn onto 77th Street the minimum left turn lane storage length shall be 125 feet.
  - **80th Street**
    For cars traveling **Westbound** on Old Cheney and making a left turn onto 80th Street the minimum left turn lane storage length shall be 100 feet.
    For cars traveling **Eastbound** on Old Cheney and making a left turn onto 80th Street the minimum left turn lane storage length shall be 100 feet.

Pricing of Construction Materials and Equipment:

Values from English AUP Summary For July 1, 2011 thru June 30, 2012 Lettings


(3075.52): 10” Concrete Pavement, Class 47B-3500 - $37.10/SQ YRD
(3016.23): 6” Concrete Sidewalk, Class 47B-3500 - $54.15/SQ YRD
(3075.52): 6” Concrete Median, Class 47B-3500 - $54.50/SQ YRD
Estimate Calculations:

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<th>Item</th>
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<th>$/Qty</th>
<th>Material Cost</th>
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<td><strong>$1,271,771</strong></td>
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Quantity calculations can be found in Appendix A
Technical Report for Water Resources Sub-Disciplinary Area

Subject:
Storm Sewer Design for Old Cheney Road, 70th to 84th Streets

Designer:

Reference Guides:
1) Chapter 2.05, City of Lincoln Design Manual, Stormwater Drainage Design Standards
2) City of Lincoln Drainage Criteria Manual
3) Flow Systems Design Notes (prepared by Dr. Adimaraal)

Design Criteria:

Stormwater Drainage Design Standards (SDDS)

Drainage Criteria Manual (DCM)

- “For the downtown areas, industrial/commercial areas, and arterial roadways the drainage system shall be designed for the 10-year storm.” Page 2.05-4 SDDS
- “The 100-year return frequency storm shall be the major drainage system design storm for all new developments.” Page 2.05-4 SDDS
- The Rational Method shall be used for estimating peak stormwater flows and hydrographs. Page 2-2 DCM
- The Rational Method may be used if the drainage basin is 150 acres or less. Page 2-2 DCM
- “The cross drainage facilities shall be designed to convey (at a minimum) the 50-year runoff event without overtopping the roadway.” Page 2-5 DCM
- “Detention facilities shall have release rates that do not exceed the predevelopment peak discharge rates for the 2-year, 10-year, and 100-year storms.” Page 2.05-4 SDDS
- “In the Existing Urban Area, the preservation of a Minimum Flood Corridor is required along all channels outside the FEMA-mapped floodplain which drain greater than 150 acres or have a defined bed and bank.” Page 2.05-5 SDDS
- “The width of minimum flood corridors shall be equal to the channel bottom width, plus 60 feet, plus six times the channel depth, and the corridor shall be centered on the channel or aligned such that the corridor follows the natural flow of flood waters.” Page 2.05-5 SDDS
- For a minor storm the maximum encroachment on an arterial is: “No curb overtopping. Flow spread must leave at least one lane free of water in each direction.” For a major storm: “The depth of water at the street crown shall not exceed 6 inches.” Page 2.05-9 SDDS
- Stormwater design inlets must meet the following criteria: 72-inch straight and canted curb inlets shall be used in the public street system, grate inlets may be used for parking
lot. Drains, area drains, etc., flow in the gutter should not exceed five (5) inches, and inlets should be placed at the low points in the street grade. Page 2.05-10 SDDS

- Manholes shall be installed at the upper end of all storm drain lines and at all changes in grade, size, or alignment. The recommended maximum spacing is 600 feet for storm drain lines, 36 inches and less in diameter. Greater spacings than this will require approval by the Director of Public Works and Utilities. Pg 2.05-11 SDDS

- The minimum size of the storm drain pipe shall be 15" in diameter. Pg 2.05-11 SDDS

- For ordinary conditions, drain pipes should be sized on the assumption that they will flow full or practically full under the design discharge but will not be placed under pressure head. Pg. 2.05-11 SDDS

- The hydraulic grade line shall be 0.75 feet below the intake lip of any affected inlet, any manhole cover, or any entering nonpressurized system. Pg. 2.05-11 SDDS

- The energy grade line shall not rise above the intake lip of any affected inlet, any manhole cover or any entering nonpressurized system. Pg. 2.05-11 SDDS

- The maximum hydraulic gradient shall not produce a velocity that exceeds 20 feet per second. Pg. 2.05-11 SDDS

- The minimum desirable physical slope shall be 0.5 percent or the slope that will produce a velocity of 3.0 feet per second when the storm drain is flowing full, whichever is greater. Pg. 2.05-11 SDDS

- All easements for storm drain pipe should be a minimum of 30 feet wide. Page 2.05-12 SDDS

- In new subdivisions the center of the street is reserved for storm drain system. Page 2.05-12 SDDS

- The desired depth of cover above a storm drain pipe shall be 2 to 3 feet, with 1.5 feet being the absolute minimum at an inlet location. Depth of cover greater than 3 feet shall be avoided due to the possibility of the storm drain blocking access of sanitary sewer service lines to the main sanitary sewer lines. Page 2.05-12 SDDS

- Only reinforced concrete storm drain pipe shall be used for public storm drain systems within the City limits, unless approved by the Director of Public Works and Utilities. Page 2.05-12 SDDS

- Open channels shall be sized to convey the 100-year storm. Page 2.05-12.2 SDDS

**Copies of Methodology, Criteria, Equations or Policies:**

**Inlet Location and Flow Value Determination**

- **Velocity Equation**

  \[ V = \frac{L}{T} \]

  \( V = \text{Velocity (ft/s)} \quad L = \text{Length (ft)} \quad T = \text{Time (s)} \)
• **Rational Formula**
  \[ Q = CIA \]
  
  \( Q \) = Flow Rate (ft\(^3\)/s)
  \( I \) = Intensity (in/hr)
  \( A \) = Area (ft\(^2\))

• **Manning’s Equation Modified for Curb and Gutter Flow**
  \[ Q = \left( \frac{K_u}{n} \right) S_x^{1.67} S_L^{0.5} T^{2.67} \]
  
  \( Q \) = Flow Rate (ft\(^3\)/s)
  \( K_u = 1.486 \) for English Units
  \( n \) = Manning’s roughness coefficient
  \( S_x \) = Cross slope (ft/ft)
  \( S_L \) = Longitudinal slope (ft/ft)
  \( T \) = Width of flow, spread (ft)

**Storm Sewer Pipe Design**

• **Continuity Equation**
  \[ Q = VA \]
  
  \( Q \) = Flow Rate (ft\(^3\)/s)
  \( V \) = Velocity (ft/s)
  \( A \) = Area (ft\(^2\))

• **Manning’s Equation**
  \[ Q = \left( \frac{K_u}{n} \right) A R_h^{2/3} S_f^{0.5} \]
  
  \( Q \) = Flow Rate (ft\(^3\)/s)
  \( K_u = 1.486 \) for English Units
  \( n \) = Manning’s roughness coefficient
  \( R_h \) = Hydraulic Radius (ft)
  \( S_f \) = Friction Slope (ft/ft)

• **Tailwater (TW) Elevation**
  \[ TW = \frac{D + d_c}{2} \]
  
  \( TW \) = Tailwater (ft)
  \( D \) = Pipe Barrel Height (ft)
  \( d_c \) = Critical Depth (ft)

**List of Assumptions:**

• Storm return period of 10 years
• Started runoff calculations at station 105+29.35 because it is the crest of the first hill on the west end of the project
• Ended runoff calculations at station 143+00.00 because it is the eastern boundary of the project
• Runoff was calculated for a distance of 100 feet north of the north edge of the roadway and 100 feet south of the south edge of the roadway
• The landscaped center median will not contribute runoff to the roadway
• Pavement C value = 0.90
• For calculation of the storm sewer pipes all of the runoff directed to rain gardens is considered to go into inlets and enter the storm sewer system
• Inlet eight was deleted due to a conflict with a left turning lane. Inlet eight was only to be used for overflow from a rain garden. If the rain garden near inlet eight overflows the water will now travel to inlet two. The omission of inlet eight does not change storm sewer design calculations.
• Inlet ten was deleted due to a conflict with a left turning lane. Inlet ten was only to be used for overflow from a rain garden. If the rain garden near inlet ten overflows the water will now travel to inlet four. The omission of inlet ten does not change storm sewer design calculations.
• Inlet seven was moved 20.17 feet to the west of its planned position due to a conflict with an intersection. Moving inlet seven 20.17 feet will not affect storm sewer design calculations.

Design Calculations:
• See Appendix B for handwritten calculations
• See Excel files labeled “Inlet Calculations” and “HGL”

Recommendations:
• The necessity of inlets placed in the median should be checked for 60 percent plans. The use of overflow pipes for the rain gardens may be more economical.
• The hydraulic grade lines and pipe slopes for the project should be analyzed using a hydraulics computer program such as EPANET.
• A retention pond north of the roadway at the Cross Creek Road outlet should be considered. A retention pond at this location could help reduce flooding of adjacent apartments, reduce stream velocity, and allow for sedimentation settlement.
• Due to the significantly higher cost of 15-inch reinforced concrete pipe compared to 18-inch reinforced concrete pipe, 18-inch pipe may be used in place of 15-inch pipe. New calculations will need to be done if pipe sizes are changed.
Pricing of Construction Materials and Equipment:

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<th>Standard Item Number</th>
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Estimate Calculations:

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$217,251.68
Technical Report for Geotechnical Sub-Disciplinary Area

Subject:
Geotechnical Design for Old Cheney Road, 70th to 84th Streets

Designer:

Reference Guides:
1) Example Retaining Wall Plans
2) Geotechnical Policies and Procedures Manual
3) LRFD Conventional Retaining Wall Design Guide
4) AASHTO LRFD Bridge Design Specifications, Chapter 10: Foundations

Design Criteria:

- “All exposed edges of concrete shall be chamfered ¾”. “ Page 1 - Example Retaining Wall Plans
- “All concrete shall be class 47-B-3000” Page 1 - Example Retaining Wall Plans
- “All reinforcing steel shall be epoxy coated and shall conform to the requirements of A.S.T.M. A615 Grade 60.” Page 1 - Example Retaining Wall Plans
- “Control joints shall be placed at a maximum spacing of 15 feet on center. Field cut alternate longitudinal reinforcement is to remain continuous through the control joint.” Page 1 - Example Retaining Wall Plans
- “Expansion joints shall be placed at a maximum spacing of 60 feet on center.” Page 1 - Example Retaining Wall Plans
- “Provide continuous weld at all barrier rail joints. Grind smooth, clean, prime, and paint in accordance with the special provisions.” Page 1 - Example Retaining Wall Plans
- “Preliminary exploration depths should be estimated from the review of available data, the field reconnaissance, and local experience. The borings should penetrate through unsuitable foundation materials (soft clays, loose sands, etc.) and terminate in competent material capable for support of the proposed foundations.” Page 24 - Geotechnical Policies and Procedures Manual
- “Borings should be spaced at intervals of 500 ft (150 meters) or less depending upon degree of variation in soil properties. Boring intervals may be reduced to as little as 25 ft (8 m) in areas where a high water table exists or where a complex subsurface profile exists. The soil surveyor will determine all drilling locations.” Page 26 - Geotechnical Policies and Procedures Manual
• “Design the planned structure according to limitations imposed by the soil on site. The solution will depend upon performance criteria specified, which may include bearing capacity, embankment stability, subgrade stability, settlement and/or seepage.” Page 52 - Geotechnical Policies and Procedures Manual

• “AASHTO M 147 (Table 6) specifies various particle size gradations for material that can be used for construction of sub-bases, base courses and surface courses.” Page 53 - Geotechnical Policies and Procedures Manual

• “Soil used in most highway construction applications should have a minimum dry unit weight of 90 pounds per cubic foot, an organic content less than 2%, a liquid limit of less than 50% and 70% maximum by weight passing the No. 40 sieve. Soils outside of these limits will normally require some type of modification to alleviate adverse characteristics” Page 53 - Geotechnical Policies and Procedures Manual

• “For most Nebraska soils, a minimum design factor of safety of 1.25 will be required against slope or bearing failure.” Page 68 - Geotechnical Policies and Procedures Manual

• “There a several analysis methods available to evaluate the stability of a cut slope. For most types of soils found in Nebraska, a minimum design factor of safety of 1.5, based upon laboratory tests of undisturbed samples, is required.” Page 71 - Geotechnical Policies and Procedures Manual

Copies of Methodology, Criteria, Equations or Policies:

The LRFD design procedure will be used for retaining wall calculations. The overall retaining wall stability was checked by calculating any forces seen by the retaining wall and comparing them to the bearing resistance, overturning or eccentricity resistance, sliding resistance, and wall foundation settlement. The first step of retaining wall design is to evaluate the load factors to be applied to the wall to ensure the wall passes all criteria. LRFD design of retaining walls uses maximum and minimum load factors for earth, dead, and surcharge loads. Live loads will not be used in this design. Conventional retaining wall design seems to be the most applicable style of retaining wall for this project, but LRFD design will be used to check all conditions to ensure this style is feasible. Stability for the wall will be calculated based on a per foot basis using maximum height and slope.

Before further analysis, the foundation materials must be identified. Existing soils are Peorian Loess which under drained conditions will have little or no cohesion. Soil characteristics for retaining wall are as follows: \( f' = 30 \) degrees, \( c = 0 \) psf, \( k = 114 \) pcf. Bearing resistance of the soil must be calculated based on the maximum height of retaining wall. Engineering judgment must be applied to determine which scenarios should be used for each project. Tables, similar to the ones in the LRFD example should be developed to show that factored loads are less than calculated design loads for bearing resistance, sliding, overturning or eccentricity, and settlement.
List of Assumptions:

- Utility issues may be ignored.
- A minimum of one foot of earth cover shall be between the bottom of the driving lane pavement and the top edge of underpass structure.
- Soils are Peorian Loess which under drained conditions will have little or no cohesion, hence cohesion, $c = 0$ psf.
- Foundation soil characteristics: $f' = 27$ degrees, $c = 0$ psf, $g = 110$ pcf
- Retained soil characteristics: $f' = 30$ degrees, $c = 0$ psf, $g = 114$ pcf
- Geotechnical engineers will only design retaining walls for roadside, NOT roadway.
- Three feet horizontal distance from end of retaining wall foundation to property line if possible. Permanent easement from adjacent property owners may be required.
- Underpass wall adjacent to driving lanes will be flush with the face of curb.

Design Calculations:

See Appendix C for calculations for retaining LRFD wall design for maximum retaining wall height.

Recommendations:

Several retaining walls should be placed throughout the project area. On the south side of the roadway, retaining walls should be placed from Stations 105+00 to 110+50, 115+25 to 116+00, 121+00 to 122+75, 129+00 to 133+00, and 137+00 to 139+00. On the north side of the roadway, retaining walls should be placed from Stations 111+25 to 118+25, 128+75 to 133+50, and 136+25 to 141+50.

Quantity Determinations:

Concrete 47B-4000 for Retaining Walls (CU YDS)

Pricing of Construction Materials and Equipment:

(4102.03): CONCRETE 47B-3000 FOR RETAINING WALLS = $319.26 PER CU YD
## Estimate Calculations:

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<th>Side of Roadway</th>
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<th>Height of Wall (ft)</th>
<th>Cross Sectional Area of Wall (ft²)</th>
<th>Volume of Concrete (Cubic Yards)</th>
<th>Cost at $319.26 Per CY</th>
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<tr>
<td>Sta. 133+00 - 133+50</td>
<td>North</td>
<td>50</td>
<td>7.1</td>
<td>10.6</td>
<td>19.7</td>
<td>$6,288</td>
</tr>
<tr>
<td>Sta. 137+75 - 138+00</td>
<td>North</td>
<td>25</td>
<td>7.4</td>
<td>11.1</td>
<td>10.3</td>
<td>$3,281</td>
</tr>
<tr>
<td>Sta. 138+00 - 138+50</td>
<td>North</td>
<td>50</td>
<td>9.9</td>
<td>14.9</td>
<td>27.5</td>
<td>$8,780</td>
</tr>
<tr>
<td>Sta. 138+50 - 139+00</td>
<td>North</td>
<td>50</td>
<td>10.4</td>
<td>15.6</td>
<td>28.9</td>
<td>$9,223</td>
</tr>
</tbody>
</table>

Sum = 1248.5 $398,605
### Table 2: Volume of Concrete for Retaining Wall Footing

<table>
<thead>
<tr>
<th>Location</th>
<th>Side of Roadway</th>
<th>Length (ft)</th>
<th>Cross Sectional Area of Footing (ft^2)</th>
<th>Volume of Concrete (Cubic Yards)</th>
<th>Cost at $319.26 Per CY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sta. 105+00 - 110+50</td>
<td>South</td>
<td>550</td>
<td>16.75</td>
<td>341.2</td>
<td>$108,933</td>
</tr>
<tr>
<td>Sta. 115+25 - 116+00</td>
<td>South</td>
<td>75</td>
<td>16.75</td>
<td>46.5</td>
<td>$14,854</td>
</tr>
<tr>
<td>Sta. 121+00 - 122+75</td>
<td>South</td>
<td>175</td>
<td>16.75</td>
<td>108.6</td>
<td>$34,660</td>
</tr>
<tr>
<td>Sta. 129+00 - 133+00</td>
<td>South</td>
<td>400</td>
<td>16.75</td>
<td>248.1</td>
<td>$79,224</td>
</tr>
<tr>
<td>Sta. 137+00 - 139+00</td>
<td>South</td>
<td>200</td>
<td>16.75</td>
<td>124.1</td>
<td>$39,612</td>
</tr>
<tr>
<td>Sta. 128+75 - 133+50</td>
<td>North</td>
<td>475</td>
<td>16.75</td>
<td>294.7</td>
<td>$94,078</td>
</tr>
<tr>
<td>Sta. 136+25 - 141+50</td>
<td>North</td>
<td>525</td>
<td>16.75</td>
<td>325.7</td>
<td>$103,981</td>
</tr>
<tr>
<td><strong>Sum =</strong></td>
<td></td>
<td></td>
<td></td>
<td>1488.9</td>
<td><strong>$475,343</strong></td>
</tr>
</tbody>
</table>

Total volume of concrete = 2737.4 CU YDS

Total price of retaining walls = $873,948
Technical Report for Structural Sub-Disciplinary Area

Subject:
Pedestrian Underpass design for Old Cheney Road, 70th to 84th Streets

Designer:

Reference Guides:
- AASHTO LRFD Bridge Design Specifications, Chapter 10
- AASHTO LRFD Bridge Design Specifications, Chapter 12
- City of Lincoln, Design Standards for Hiker-Biker Trails
- Bridge Evaluation, 2nd Edition, Appendix A
- Fouad Jaber, NDOR, Assistant State Bridge Engineer

Design Criteria:
- The structure shall be designed for HL-93 Live Loading
- Strength of concrete used will be 3500 psi.
- Yielding strength of reinforcing steel will be 60 ksi.
- The width of the inside of the structure shall be 15 feet.
- Minimum overhead clearance of the structure is 10 feet.
- Must be 13 feet between the centerline of the road way and floor of the underpass.
- If the height of the fill is less than 2 feet, the minimum cover of the reinforcing steel shall be greater than 2 inches.

Copies of Methodology, Criteria, Equations or Policies:

Step 1) Analyze 11 load cases
- Case 1: DC – Concrete self weight - \( \gamma_{\text{concrete}} = 150 \text{ lb/ft}^2 \)
- Case 2: DW – Wearing surface of 6 inches of concrete - \( \gamma_{\text{concrete}} = 150 \text{ lb/ft}^2 \)
- Case 3: Axle from truck at midspan
- Case 4: Two axles from truck
- Case 5: Critical shear at “d”
- Case 6: Tandem at midspan
- Case 7: Critical shear at “d” – Tandem
- Case 8: Lateral Earth Pressure – \( P = k_o \gamma s Z \) \( k_o = 1 - \sin \Phi \) assume \( \Phi = 30^\circ \) \( \gamma_s = 60 \text{ pcf} \)
- Case 9: Live Load Surcharge (max, min) – \( \Delta P = k_o \gamma s h_{eq} \) \( h_{eq} = 2' \) for \( 10' < H < 20' \)
- Case 10: Live Load Surcharge (min, max) – \( \Delta P = k_o \gamma s h_{eq} \)
- Case 11: Live Load Surcharge (max, max) – \( \Delta P = k_o \gamma s h_{eq} \)
- Note: Cases 3, 4, and 5 can be omitted from analysis because Case 6 and 7 will control.
Step 2) Find critical location of selections used in design for moment and shear. Create table for loads. Diagrams for all 11 load cases as well as the table of calculated values can be found in Appendix X.

Step 3) Design for flexure based on steel reinforcement and concrete compression.

- Reinforced Concrete: Mechanics and Design Sixth Edition

- \[ A_s = \frac{M}{\varphi f_y + jd} \]
  - M: Calculated Moment kips-in
  - \( \varphi = .9 \)
  - \( f_c' = 3,500 \)
  - \( jd = h * .7 = 8.3125 \)

- Number of required bars size #8: \[ \frac{\text{Required } A_s}{A_{yg}} = \frac{A_s}{\text{1in}} \]

- \[ S_{\text{flexural}} = \frac{12 \text{ in} - \# \text{ of Bars} \times \text{Diameter of Bars}}{\# \text{ of Bars} + 1} = \frac{12 - \# + 1}{\# + 1} \]

- \( V_u = \eta(1.25 DC + 1.5DW + 1.75LS + 1.75LL) \)

- \( V_c = 0.0316 * \beta * \sqrt{f_{c'}' * b_v * d_v} \)

- \( V_s = V_u - V_c \)

Step 4) Design for shear.

- Fouad Jaber PE and Reinforced Concrete: Mechanics and Design Sixth Edition

- \( V_u = \eta(1.25 DC + 1.5DW + 1.75LS + 1.75LL) \)

- \( V_c = 0.0316 * \beta * \sqrt{f_{c'}' * b_v * d_v} \)

- \( V_s = V_u - V_c \)

- \[ S_{\text{shear}} = \frac{A_{\text{bar}} * f_y * 12 \text{ in}}{V_s} \]

List of Assumptions:

- Utility issues may be ignored
- A minimum of 1 foot of earth cover shall be between the bottom of the driving pavement and the top edge of the underpass structure.
- Soils are Peorian Loess which under drained conditions will have little or no cohesion, hence cohesion, \( c = 0 \) psf.
  - Foundation soil characteristics: \( f' = 27 \) degrees, \( c = 0 \) psf, \( g = 110 \) pcf.
  - Retained soil characteristics: \( f' = 30 \) degrees, \( c = 0 \) psf, \( g = 114 \) pcf.
- A 15 ft span will be used for the underpass.
- Underpass wall adjacent to driving lanes will be flush with the face of the curb.
- Drainage of underpass will not be considered

Design Calculations:

- See Methodology and Appendix D.
Recommendations:

- Top slab and side slab will use #8 bars at 10 inch spacing.
- Bottom slab will use #5 bars at 12 inch spacing.

Pricing of Construction Materials and Equipment:

- 47B-4000 Concrete = $603.75/cy
- Reinforcement Steel = $0.98/ft

Estimate Calculations:

**Table 1: Quantity and Cost Estimate of Reinforcing Steel**

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Length</th>
<th>Qty</th>
<th>Lbs/ft</th>
<th>Total Weight</th>
<th>Cost/lbs</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>16.17</td>
<td>172</td>
<td>2.67</td>
<td>7425.911</td>
<td>0.98</td>
<td>7277.393</td>
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<tr>
<td>8</td>
<td>6.42</td>
<td>172</td>
<td>2.67</td>
<td>2948.321</td>
<td>0.98</td>
<td>2889.354</td>
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<tr>
<td>8</td>
<td>13.17</td>
<td>172</td>
<td>2.67</td>
<td>6048.191</td>
<td>0.98</td>
<td>5927.227</td>
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<tr>
<td>8</td>
<td>57</td>
<td>20</td>
<td>2.67</td>
<td>3043.8</td>
<td>0.98</td>
<td>2982.924</td>
</tr>
<tr>
<td>8</td>
<td>11.58</td>
<td>170</td>
<td>2.67</td>
<td>5256.162</td>
<td>0.98</td>
<td>5151.039</td>
</tr>
<tr>
<td>8</td>
<td>4.54</td>
<td>112</td>
<td>2.67</td>
<td>1357.642</td>
<td>0.98</td>
<td>1330.489</td>
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<tr>
<td>8</td>
<td>11.125</td>
<td>172</td>
<td>2.67</td>
<td>5109.045</td>
<td>0.98</td>
<td>5006.864</td>
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<tr>
<td>8</td>
<td>16.5</td>
<td>58</td>
<td>2.67</td>
<td>2555.19</td>
<td>0.98</td>
<td>2504.086</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>58</td>
<td>2.67</td>
<td>1703.46</td>
<td>0.98</td>
<td>1669.391</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
<td>42</td>
<td>1.043</td>
<td>2496.942</td>
<td>0.98</td>
<td>2447.003</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$37,185.77</strong></td>
</tr>
</tbody>
</table>

**Table 2: Quantity and Cost Estimate of Class 47B-4000 Concrete**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>47B-4000 Concrete</td>
<td>CuYd</td>
<td>116</td>
<td>603.75</td>
<td><strong>$70,035</strong></td>
</tr>
</tbody>
</table>

**Table 3: Total Cost of Pedestrian Underpass**

| Cost of Steel     | 37185.77 |
| Cost of Concrete  | 70035.00  |
| **Total**         | **$107,220.77** |
Technical Report for Environmental Sub-Disciplinary Area

Subject:
Environmental Aspects for Old Cheney Road, 70th to 84th Streets

Designer:

Reference Guides:
1. Designing Rain Gardens (Bio-Retention Areas); North Carolina State University
2. ENV-WTR Rain Garden Considerations

Design Criteria:
- Rain garden should be large enough to handle a 1-inch rainfall
- Depth of rain garden should be between 6 and 12 inches, with 9 inches as a standard
- Minimum requirements for soil layers (pg 5 of NCSU Rain Garden Guide)
  - Top: 9 inches for allowable ponding level
  - 2nd: 3 inches of sandy loam mix with organics
  - 3rd: 3 feet of sandy loam – loamy sand fill soil
  - 4th: 2 inches of washed gravel
  - 5th: Corrugated plastic underdrain (typically 4-inch diameter)
  - 6th: 2 inches of washed gravel
- Rain garden should vary between 5 percent and 7 percent of the drainage area depending upon the percentage of impervious surface
- For more information on the design of rain gardens see NCSU Rain Garden Guide

Copies of Methodology, Criteria, Equations or Policies:
- Refer to the NCSU Rain Garden Guide for methodology
- Equations for calculating required surface area of rain gardens:

- **Runoff depth (in inches)**

\[
\text{Runoff depth} = \frac{(P - 0.2S)^2}{(P + 0.8S)}
\]

P = Precipitation (typically use 1 inch)
S = 1000÷CN-10
CN = Curve Number (see Appendix E)
• **Runoff Volume (cubic feet)**
  
  Runoff volume = Area x Runoff depth

• **Rain garden surface area**
  
  Rain garden surface area = rain garden volume x average depth of water

**List of Assumptions:**

• Make rain gardens at least large enough to hold runoff for the first inch of rainfall
• Land use/cover = open space with grass cover 50-75%
• Use Soil Group D
• Assume all runoff flowing into the rain garden from the road enters directly into the overflow drainage.
• A 4-inch pipe will be used for the underdrain
• Permeability of 2 inches per hour
• Slope of drainage pipes is 0.5%

**Design Calculations:**

• See attached calculations in Appendix E
• See SWPPP form in Appendix F

**Recommendations:**

• Place silt fence along Old Cheney from 70th to 84th during construction to prevent runoff from entering onto the road, into the storm sewers and creeks, and into residents yards.
• Use appropriate seeding techniques such as open-fielding or seed bedding for disturbed areas on the north and south sides of Old Cheney to stabilize the soil and slow the erosion process. (Sometimes hay can be used to cover seed to ensure that it isn’t washed away)
• Place rain gardens in all center medians to help decrease amount of runoff and sediments entering the storm sewers.
• Use native plants in the rain gardens to ensure a better survival rate of the plants.
• Based on height, shade/sun requirements, water requirements, and life span, some good plant options are:
  o Longhair Sedge
  o Gray’s Sedge
  o Palm Sedge
  o Canada Wildrye
  o Common Rush
  o Autumn Red Miscanthus
o Dewey Blue Switchgrass
o Sweet Flag
o Nodding Pink Onion
o Asclepias incarnate
o Prairie Jewel Eupatorium
o Prairie Smoke
o Monkey Flower
o Pickerel Rush
o Stoke's Aster

**Estimate Calculations:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Amount</th>
<th>Unit Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabric Silt Fence</td>
<td>LF</td>
<td>8697</td>
<td>$2.00</td>
<td>$17,394</td>
</tr>
<tr>
<td>Cover Crop Seeding</td>
<td>Acres</td>
<td>1.5</td>
<td>$147.65</td>
<td>$222</td>
</tr>
<tr>
<td>Seeding (permanent)</td>
<td>Acres</td>
<td>3.1</td>
<td>$750.00</td>
<td>$2,325</td>
</tr>
<tr>
<td>Erosion Control</td>
<td>SQ YD</td>
<td>4988</td>
<td>$1.40</td>
<td>$6,983</td>
</tr>
<tr>
<td>Excavation</td>
<td>CY</td>
<td>4970</td>
<td>$9.50</td>
<td>$47,215</td>
</tr>
<tr>
<td>Hauling</td>
<td>N/A</td>
<td></td>
<td>Included in excavation</td>
<td>N/A</td>
</tr>
<tr>
<td>Mulch</td>
<td>SF</td>
<td>23680</td>
<td>$0.30</td>
<td>$7,104</td>
</tr>
<tr>
<td>Vegetation</td>
<td>SF</td>
<td>23680</td>
<td>$0.30</td>
<td>$7,104</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$88,347</strong></td>
</tr>
</tbody>
</table>
Transportation Calculations and Details

Determination of Left- and Right-Turn Lane Storage Lengths

Attachments include:
- Turn Lane Guidelines, City of Lincoln:
  "At intersections of local or collector streets with major streets, additional right or left turning lanes, medians, tapered roadway sections or other special features may be required to accommodate anticipated traffic. At the intersection of two major streets, additional lanes, larger radii, three-centered curves or other special features may be required. The Public Works and Utilities Department will provide the specific design requirements at these locations on an individual basis.

- Preliminary turn lane length method, Nebraska Dept of Roads Roadway Design Manual (3 pages)

Left- and Right-Turn Lane Storage Lengths

Using the Year 2030 peak volumes for turning movements and the NDOR method, determine if the storage lengths must be longer than the minimums.

At unsignalized intersections, the City of Lincoln often uses one foot of storage length per peak hour turning vehicle for a ballpark figure which seems to work fairly well, assuming truck percentages are low.

Since the senior design project doesn't require a traffic analysis, the NDOR estimation method will be used instead of SYNCHRO recommendations.

NOTE: Normally, the City would use predicted queue lengths for designing storage lengths at signalized intersections from the software program SYNCHRO, since the actual length depends upon the signal cycle length, phasing, and rates of arrivals and departures of turning vehicles. If through speeds are high, an effort is made to provide additional length for deceleration but that is considered on a case-by-case basis and doesn't always get added due to the additional costs.
1.0.2 Turn Lane Length

Turn lane length is a function of the:

- Through traffic volumes;
- Turning traffic volumes;
- Required storage length;
- Approach design speed;
- Length required to decelerate from the approach design speed to a stop; and
- Type of intersection control.

Turn lane length has three components: entering taper, deceleration length, and storage length. Whenever feasible, a deceleration length should be provided for motorists to slow from the highway design speed to a comfortable stop, based on a comfortable deceleration rate of 11.2 ft/sec.

In urban areas, with lower design speeds and more closely spaced intersections, it may not be practicable to provide full-length deceleration. In these areas, deceleration must take place prior to entering the auxiliary lane. The storage length should provide sufficient space so that neither turning nor through traffic blocks the other. Storage space for at least two passenger cars should be provided. If truck traffic exceeds 10%, storage for at least one car and one truck should be provided (e.g., 25 ft (7.5 m) for each car and 75 ft (22.5 m) for each truck). At signalized intersections the required storage length depends on the signal cycle length, phasing, and rates of arrivals and departures of turning vehicles. The roadway designer should consult with the Traffic Engineering Division to determine the required storage length at an intersection.

Storage Lane Length - The following procedure for determining turn lane storage length is provided for the designer’s information and for use during the preliminary design of intersection geometrics. The storage length of a turn lane should be designed so that the number of vehicles desiring to make a turn during any interval will exceed the turn lane capacity only 5% of the time without reducing the safety or capacity of the approach. A procedure for determining the storage length (L) of a turn lane, based on a Poisson probability distribution, is as follows:
Step 1:

Calculating:

\[ m = \frac{D 	imes I}{(3600)} \]  

where:
- \( m \) = the average number of vehicles per interval,
- \( D \) = design hourly volume (veh/h) of vehicles making the turn,
- \( I \) = interval, 60 seconds in rural areas, 60 seconds in urban and suburban areas.

**Eq. 4.1**

Step 2:

Enter Exhibit 4.11 with the calculated value of "m" and read off the corresponding value of "x," the probable maximum number of vehicles approaching during the given interval. Appropriate values of "x" have been obtained from a Poisson distribution so that the probability of "x" being exceeded is 0.05 or 5%.

Step 3:

Allowing a distance of 25 ft. (7.5 m) for each stored vehicle, multiply "x" by 25 (7.5) to obtain "L," the required turn lane storage length, in ft. (meters).

Example:

Given a DVRV of 488 left turning vehicles in an urban area and using Eq. 4.1, the average number of vehicles per interval, \( m \), equals 488 x 90 x \( \frac{1}{3600} \) or 12.2.

From Exhibit 4.11, with an average number of vehicles per interval of 12.2, the number of vehicles arriving during the given interval will exceed 19 only 5% of the time.

The storage length of the left turn lane should be:

- in English, \( L = 25 \text{ ft} \times 19 = 475 \text{ ft} \)
- or in metric, \( L = 7.5 \text{ m} \times 19 = 142.5 \text{ m} \) (say 143 m)

Designers should confirm the length of turn lanes with the Traffic Engineering Division.
### Nebraska Department of Roads - Roadway Design Manual

**Chapter Four: Intersections, Driveways and Channelization**

### Exhibit 4.11 Turn Lane Length

<table>
<thead>
<tr>
<th>Average Number of Vehicles per Interval (m)</th>
<th>95% Probable Maximum Number of Vehicles during the Same Interval (L)</th>
<th>Length of Turn Lane, ft. (m) (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 to 0.3</td>
<td>2</td>
<td>50 (15)</td>
</tr>
<tr>
<td>0.4 to 0.8</td>
<td>3</td>
<td>75 (23)</td>
</tr>
<tr>
<td>0.4 to 1.1</td>
<td>3</td>
<td>100 (30)</td>
</tr>
<tr>
<td>1.3 to 1.9</td>
<td>5</td>
<td>125 (38)</td>
</tr>
<tr>
<td>2.0 to 2.6</td>
<td>6</td>
<td>150 (45)</td>
</tr>
<tr>
<td>2.5 to 3.3</td>
<td>7</td>
<td>175 (53)</td>
</tr>
<tr>
<td>3.4 to 4.0</td>
<td>8</td>
<td>200 (60)</td>
</tr>
<tr>
<td>4.1 to 4.7</td>
<td>9</td>
<td>225 (68)</td>
</tr>
<tr>
<td>4.8 to 5.4</td>
<td>10</td>
<td>250 (75)</td>
</tr>
<tr>
<td>5.5 to 6.3</td>
<td>11</td>
<td>275 (83)</td>
</tr>
<tr>
<td>6.3 to 7.0</td>
<td>12</td>
<td>300 (90)</td>
</tr>
<tr>
<td>7.1 to 7.8</td>
<td>13</td>
<td>325 (99)</td>
</tr>
<tr>
<td>7.9 to 8.6</td>
<td>14</td>
<td>350 (107)</td>
</tr>
<tr>
<td>8.7 to 9.4</td>
<td>15</td>
<td>375 (115)</td>
</tr>
<tr>
<td>9.5 to 10.2</td>
<td>16</td>
<td>400 (123)</td>
</tr>
<tr>
<td>10.3 to 11.0</td>
<td>17</td>
<td>425 (131)</td>
</tr>
<tr>
<td>11.1 to 11.8</td>
<td>18</td>
<td>450 (139)</td>
</tr>
<tr>
<td>11.9 to 12.6</td>
<td>19</td>
<td>475 (147)</td>
</tr>
<tr>
<td>12.7 to 13.3</td>
<td>20</td>
<td>500 (155)</td>
</tr>
<tr>
<td>13.5 to 14.2</td>
<td>21</td>
<td>525 (153)</td>
</tr>
<tr>
<td>14.3 to 15.0</td>
<td>22</td>
<td>550 (161)</td>
</tr>
</tbody>
</table>

### 1.0.3 Left Turn Radii

A typical all-grade intersection does not have a continuous edge of pavement delineating the left turn path. The motorist has a guide at the beginning and at the end of the left turn movement provided by pavement markings or channelization. The turning maneuver is accomplished across the open space of the intersection. In some instances, pavement markings are provided to guide lanes across wider intersections.

The design values for left turn radii are a function of the design vehicle, angle of intersection, number of lanes and median width. Generally, left turn radii should be larger than the minimum design vehicle turning radius since the turning radius is based on a 10 mph (16 km/h) operating speed, and this speed can often be exceeded in actual operations. For midways intersecting at right angles, left turn radii that range between 60 and 75 ft (18 and 23 m) will normally satisfy all of the controlling factors. For two lane turning movements, a desirable minimum radius of 90 ft. (28 m) should be applied to retain a satisfactory capacity in the outer lane.
Construction Materials Estimations

Cost Of Material:

Values from English AUP Summary For July 1, 2011 thru June 30, 2012 Lettings


(3075.52): 10” Concrete Pavement, Class 47B-3500 - $37.10/SQ YRD

(3016.23): 6” Concrete Sidewalk, Class 47B-3500 - $54.15/SQ YRD

(3075.52): 6” Concrete Median, Class 47B-3500 - $54.50/SQ YRD

Length Of Project:

\[ \text{Sta}143 + 00.00 - \text{Sta}103 + 25.00 = 3975 \text{ ft} = 1325 \text{ yards} \]

Qty of 10” Pavement Including Integral Curb:

\[ 4 \text{ lanes} @ 11'each * \frac{1}{3} = 14 \frac{2}{3} \text{ yards per linear yard of project} * 1325 \text{ yards} \]
\[ = 19,433 \text{ yd}^2. \quad 19,433 + 10\% = 21,377 \text{ yd}^2 \]

Qty of 6” Sidewalk:

\[ 1 \text{ sidewalk} @ 5'each * \frac{1}{3} = \frac{5}{3} \text{ yards per linear yard of project} * 1325 \text{ yards} \]
\[ = 2208 \text{ yd}^2. \quad 2208 + 10\% = 2430 \text{ yd}^2 \]

Qty of 6” Bike Path:

\[ 1 \text{ sidewalk} @ 10'each * \frac{1}{3} = \frac{10}{3} \text{ yards per linear yard of project} * 1325 \text{ yards} \]
\[ = 4416 \text{ yd}^2. \quad 4416 + 10\% = 4860 \text{ yd}^2 \]

Qty of 6” Median:

\[ 2100 \text{ linear yards} * \frac{2}{3} \text{ yards wide} = 1400 \text{ yd}^2. \quad 1400 + 10\% = 1540 \text{ yd}^2 \]
Total Cost:

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty $yards^2$</th>
<th>$/Qty</th>
<th>Material Cost</th>
</tr>
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</table>
30% DESIGN REPORT

IMPROVEMENTS FOR OLD CHENEY ROAD,

70TH TO 84TH STREETS

Project Control No. 200028

Submitted to:

City of Lincoln, Nebraska

Submitted by:

PRIME ENGINEERING

April 26, 2013

DESIGN REPORT Contributors:
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Executive Summary

The following proposal describes the reconstruction of Old Cheney Road from S 70th to S 84th Streets in Lincoln, Nebraska. This project is in the preliminary design stage of development and is continuously being researched by Prime Engineering to develop the optimum final product for the city of Lincoln. The area surrounding the reconstruction consists of residential housing, utilities owned by the city of Lincoln, and a parking lot owned by the Lincoln Christian Elementary School. The project consists of improving the current two-lane roadway to a four-lane roadway consisting of two lanes of traffic traveling in the east and westbound directions as well as left turn lanes. Adding more lanes will ease the already congested roadway as well as accommodate the increased traffic flow due to Lincoln’s continuous expansion. Plans also include the addition of a pedestrian underpass that spans the 77th Street intersection connecting the north and south sides of the intersection. A bike path will be added to the north side of the roadway as well as the implementation of retaining walls when deemed necessary.

Many potential issues were researched for this project and some were found to be inconsequential. The area does not lie in a floodplain. There is no bus route within the project limits and according to the LPlan 2040 there will not be one in the near future. Though the LPlan 2040 does not show a bus route for the project area, due to Lincoln’s continual expansion, potential bus turnout footprints will be left free of potential conflicting elements.

Some of the issues that were investigated were found to be key issues for an optimal design. There is currently very little pedestrian access along the project which causes pedestrians to either find an alternative route or walk in the grass that parallels the roadway. A hiker-biker trail on the north side of the roadway as well as a sidewalk on the south side has been designed to mitigate this problem. This coincides with the City of Lincoln’s LPlan 2040 to add a trail along this section of Old Cheney. Another key issue for the area is the large slope change within a relatively short cross-sectional distance, thus we designed several retaining walls along the south side of the roadway. With the increase of impervious surfaces into the area additional drainage systems will be needed to reroute the excess water and prevent flooding of nearby properties. Additional storm sewers were designed to reroute the excess water as well.

The finished product will improve safety for both drivers and pedestrians that use this facility as well as improve the aesthetics of the surrounding area. Prime Engineering took into consideration the LPlan 2040 which guarantees a long lasting and sustainable solution to the existing problem.
Technical Subject Report (Roadway Design)

Subject:
Roadway Design for Old Cheney Road from 70th to 84th

Designer:

Reference Guides:
1) AASHTO guidelines
2) NDOR pavement designs
3) NDOR guidelines

Design Criteria:
- Traffic volume year is 2030
- Design speed and posted speed are 45 mph
- Four lane roadway
- 10ft inner lanes
- 11ft outer lanes
- 17 ft medians at widest
- 3 ft medians at narrowest
- Left turn lanes
- 100 feet right of way
- Signaled intersection at 77th street

Copies of Methodology, Criteria, Equations or Policies:
- FHWA guidelines
- NDOR guidelines

List of Assumptions:
- Utilities issues may be ignored
- The bike path is located on the north side of the roadway
- The minimum bike path width is 10 feet
- No separate right-turn lanes will be allowed
- The design traffic volume year is 2030
- Use 2% constant traffic growth
- Use 90 second signal cycle to determine left-turn storage length
- Maximum vertical grade is ±3% but a grade of ±4% may be used for lengths ≤ 500 ft of horizontal distance
- The existing grade line of Old Cheney Road in the 100-ft length prior to the beginning of the project will be extended at least 100 ft beyond the beginning of the project before the beginning of a vertical curve. The same requirement will apply to the end of the project only in reverse order.
- The Peak Hour Volume projected to the year 2030 is equal to the future year Design Hourly Volume for use in left-turn lane length calculations.
• If adjacent left-turn storage lanes overlap, a flush median with a two-way-left-turn lane may be used.

Design Calculation:
• See Appendix 1 for left turn storage lengths
• See Appendix 2 for minimum length of curves
• See Appendix 3 for volume projections

Recommendations:
• 11 ft outer lanes
• 10 ft inner lanes
• Left turn lanes with 3 ft medians
• Access to Old Cheney from S72nd street will be closed
• 10 ft hiker/biker trail on North side of roadway
• 5 ft sidewalk on south side of roadway

Quantity Determinations:
• See table below for quantity of materials

Pricing of Construction Materials and Equipment:

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<th>Total</th>
<th>Average</th>
<th>Total</th>
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$1,497,900.09
Technical Subject Report (Storm Sewer Design)

Subject:
Storm Sewer Design for Old Cheney Road, 70th to 84th Streets

Designer:

Reference Guides:
1) Chapter 2.05, City of Lincoln Design Manual, Stormwater Drainage Design Standards
2) Chapter 2.07, City of Lincoln Design Manual, Flood Design Standards for New Growth Areas
3) The City of Lincoln’s Drainage Criteria Manual
4) The City of Lincoln’s Floodplain Standards
5) Hydrology, Federal Highway Administration, HEC No. 19, 1984
8) Handout from class from Karen: Appendix A – Inlet Location and Q Value Determination
9) Power Point slides from Kevin Donahoo
10) Video lecture from Kevin Donahoo

Design Criteria:

- “For the downtown areas, industrial/commercial areas, and arterial roadways the drainage system shall be designed for the 10-year storm.” Ch. 2.05, pg. 4
- “The 100-year return frequency storm shall be the major drainage system design storm for all new developments.” Ch. 2.05, pg. 4
- “The calculation of runoff magnitude shall be by either the rational method, the Soil Conservation Service” Ch. 2.05, pg. 4
- “The cross drainage facilities shall be designed to convey (at a minimum) the 50-year runoff event without overtopping the roadway. The flow rate shall be based on upstream ultimate build out land use conditions. In addition, the 100-year frequency storm shall be routed through all culverts to be sure structures are not flooded or increased damage does not occur to the roadway or adjacent property for this design event.” Ch. 2.05, pg. 7
- “Inlets
  - 72-inch straight and canted curb inlets shall be used in the public street system
  - Grate inlets may be used for parking lot drains, area drains, etc.
  - Flow in the gutter should not exceed five (5) inches.
  - Inlets should be placed at the low points in the street grade.” Ch. 2.05, pg. 10
- “The Manning Formula is recommended for capacity calculations.” Ch. 2.05, pg. 11
- Culverts shall be designed to convey (at a minimum) the 50-year runoff event without overtopping the roadway.” Ch. 2.05, pg. 13
- “The minimum culvert size shall be 18 inches for roadways and 15 inches for driveways.” Ch. 2.05, pg. 13
- “The maximum hydraulic gradient shall not produce a velocity that exceeds 20 feet per second.” City of Lincoln-Standards for Storm Sewer Pipe Design 5.5.1
- “The minimum size of the storm drain pipe shall be 15” in diameter.” City of Lincoln-Standards for Storm Sewer Pipe Design 5.5.1
• “The minimum desirable physical slope shall be 0.5 percent or the slope that will produce a velocity of 3.0 feet per second when the storm drain is flowing full, whichever is greater.” City of Lincoln-Standards for Storm Sewer Pipe Design 5.5.2

Copies of Methodology, Criteria, Equations or Policies:
• Manning’s Equation: \( Q = (Ku/n)^*A^1.67*S_2^{0.5}*T^{2.67} \)
• Barrel Size Continuity Equation: \( Q = V*A \)
• \( Q = C*I*A \)
• \( Q_{bypass} = Q_d - Q_{intercepted} \)
• \( Q_{total} = Q + Q_{bypass} \)
• Velocity (V) = Length/time
• Area = Length * Width
• Composite C value = \((\text{Area}_1/\text{Area}_{total})^*C_{\text{area}1} + (\text{Area}_2/\text{Area}_{total})^*C_{\text{area}2}\)
• \( K_r = 1.486/n * A * R^{2/3} \)
• \( TW = (D + d_c)/2 \)
• \( S_1 = (Q/K_r)^2 \)
• Friction Loss = \( S_1*L \)
• Entrance Head Loss = \( K_e * \text{Barrel Velocity Head} \)

List of Assumptions:
• Use group D soils when determining runoff coefficient values
• Assume an average slope (2%-6%) for C values
• Lawn C value = 0.25 and Pavement C value = 0.90
• The hydraulic grade line shall be 0.75 feet below the intake lip of any affected inlet, any manhole cover or any entering non-pressurized system
• The energy grade line shall not rise above the intake lip of any affected inlet, any manhole cover or any non-pressurized system
• Use the Preliminary Pipe Sizing Calculations sheet on Page 3-29 Design Manual
• Compute pipe sizes for all storm sewer pipes to insure the velocities are within the range required by the City of Lincoln Drainage Criteria Manual (minimum of 3 ft/sec to 20 ft/sec)
• Assume Ku = 1.486 and n = 0.016 and Sx = 0.025
• Use a desired velocity of 10 ft/sec when initially determining a pipe size
• Use the Hydraulic Grade Line Calculation Sheet on Page 3-38
• Select one storm sewer trunk line segment to compute the hydraulic grade line through one iteration
• For determining time of concentration for water to inlets, I assumed that the area contributing to the inlet only reached out to where the 2:1 grade line met up with the existing ground unless the 2:1 sloped ground did not contribute to the watershed towards the roadway. This point is essentially the limits of construction
• I did not account for retaining walls when considering drainage areas or time of concentration. I assumed a 2:1 slope broke from the edge of turf shoulder to connect with the existing ground
• When determining drainage areas for runoff coefficients, I assumed there was no break in the drainage areas due to intersections
• I did not account for change in lane widths when determining drainage areas and time of concentration. I assumed a typical cross section with a 17’ median along the centerline and an equal amount of pavement width on both sides of the centerline.
• When computing the water flow to the inlets located at Sta. 143+00 (low point), I did not account for the flow coming from the east side of the project where the facility is already built to four lanes. I only accounted for the flow coming from our project.
• I only determined the hydraulic grade line for the storm sewer system starting at Sta. 113+80 and connecting to the 54" culvert at Sta. 114+55. The other pipes were sized using the equation $Q = V^*A$.
• $K_a = 0.5$

**Design Calculations:**
• See Appendix 4 for design calculations

**Recommendations:**
• Sta. 113+80 RT: Build one Standard 72” Canted Inlet
• Sta. 114+50 LT: Build one Standard 72” Straight Inlet
• Sta. 115+25 RT: Build one Standard 72” Canted Inlet
• Sta. 125+30 RT: Build one Standard 72” Canted Inlet
• Sta. 125+30 LT: Build one Standard 72” Canted Inlet
• Sta. 134+75 RT: Build one Standard 72” Canted Inlet
• Sta. 134+75 LT: Build one Standard 72” Canted Inlet
• Sta. 143+00 RT: Build one Standard 72” Straight Inlet
• Sta. 143+00 LT: Build one Standard 72” Straight Inlet
• Sta. 113+80 RT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 115+25 RT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 114+50 LT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 125+30 RT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 125+30 LT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 134+75 RT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 134+75 LT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 143+00 RT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 143+00 LT: Build 15” RCP storm sewer pipe that taps into centerline pipe
  - $L = 29.5’$
• Sta. 113+80 to Sta. 114+50: Build 15” RCP centerline pipe
  o L = 70’
• Sta. 114+50 to Sta. 114+55: Build 18” RCP centerline pipe
  o L = 5’
• Sta. 114+55 to Sta. 125+30: Build 15” RCP centerline pipe
  o L = 1075’
• Sta. 134+75 to Sta. 139+63: Build 15” RCP centerline pipe
  o L = 488’
• Sta. 139+63 to Sta. 143+00: Build 15” RCP centerline pipe
  o L = 337’
• Sta. 113+80: Build manhole
• Sta. 114+50: Build manhole
• Sta. 119+30: Build manhole
• Sta. 125+30: Build manhole
• Sta. 134+75: Build manhole
• Sta. 139+63: Build manhole
• Sta. 143+00: Build manhole

**Quantity Determinations:**
• 15” Reinforced Concrete Sewer Pipe – 2,235.5 LF
• 18” Reinforced Concrete Sewer Pipe – 5 LF
• Inlet-72” Straight – 3 EACH
• Inlet-72” Canted – 6 EACH
• Manholes – 7 EACH

**Pricing of Construction Materials and Equipment:**
• 15” Reinforced Concrete Sewer Pipe – $87.51 per LF
• 18” Reinforced Concrete Sewer Pipe – $25.08 per LF
• Inlet-72” Straight – $2,449.09 EACH
• Inlet-72” Canted – $2,470.63 EACH
• Manholes - $3,856.78 EACH

**Estimate Calculations:**
• 15” Reinforced Concrete Sewer Pipe – $195,628.61
• 18” Reinforced Concrete Sewer Pipe – $125.40
• Inlet-72” Straight – $7,347.27
• Inlet-72” Canted – $14,823.78
• Manholes – $26,997.46
• TOTAL = $244,922.52
Technical Subject Report (Geotechnical Design)

**Subject:**
Retaining Wall Design for Old Cheney Road, 70th to 84th Streets

**Designer:**

**Reference Guides:**
1) GEO-LRFD Conventional Retaining Wall Design
2) Table 11, GEO-NDOR Geotechnical Manual
3) GEO-Example Ret Wall Plans

**Design Criteria:**
- Build retaining walls that can withstand the shear forces caused by the existing material
- To keep private property as it is so no erosion occurs over time
- Build retaining walls to required height based on the vertical placement of the roadway and the top of the existing terrain

Generally, ultimate bearing capacity, resistance to sliding, overall stability, wall foundation settlement, and lateral deflection limits are checked. Total as well as differential settlements are major criteria for determining wall type.

The loads and resulting moments due to structure components, earth pressures and live load surcharge are calculated; and the appropriate load factors and combinations are determined and multiplied by the unfactored loads and moments to determine the factored loading conditions.

**Step 1: Calculate the Unfactored Loads**

*Dead Load of Structural Components and Nonstructural Attachments*

*Vertical Earth Pressure*

*Live Load Surcharge*

*Horizontal Earth Pressure*

*Summary of Unfactored Loads*

**Step 2: Determine the Appropriate Load Factors**

**Step 3: Calculate the Factored Loads and Factored Moments**
Step 4 Stability Analyses

Overturning or Eccentricity

- That the eccentricity of each factored group does not reach the maximum eccentricity of the wall
- e<emax

Bearing Resistance

- The bearing resistance of the wall needs to be greater than the bearing that the wall causes due to dead loads and earth pressures
- qr>σ

Check sliding

- Make sure the horizontal earth pressure is not greater than the torque on the wall for each case
- Σ Horizontal earth pressure < fr

List of Assumptions:

- Use of cantilever retaining wall
- The total height of the wall will be difference in height elevation of proposed roadway and existing terrain multiplied by 1.1 plus an additional 3 feet
- Do not have to worry about live loads or loads due to the roadway
- Do not have to design retaining walls along the north side of the road
- There will be a minimum distance between the retaining wall and sidewalk
- The front of the wall will be placed 50 feet from the centerline of the roadway. Any additional land past this point will require purchase of permanent easement
- The wall will have a constant width with varying bases and heights depending on depth of earth
- Retaining wall can come up to an intersection as long as it’s not obstructing view of traffic to commuters turning into traffic
- A retaining wall will be used if the elevation difference is greater than three feet, if it is less than a 3 foot slope may be used to connect the existing terrain with the proposed roadway
- The differences in height elevation will be taken 50 feet from the centerline of the roadway, not the center line of the roadway.
- The retaining wall will run parallel with the sidewalk
- If the roadway is above the existing terrain the correct amount of land will be purchased so that a slope may be used to connect the existing with the roadway. If the roadway is below the terrain and a height difference of 3 feet or greater a retaining wall will be used
- Soils are Peorian Loess which under drained conditions will have little or no cohesion, hence cohesion, c= 0 psf
- Foundation soil characteristics: f’= 27 degrees, c=0 psf, g= 110 pcf
- Retained soil characteristics: f’ = 30 degrees, c= 0 psf g= 114 pcf
To make sure the correct wall is constructed a stability analysis will be done on bearing resistance, overturning, and sliding for the wall. This will be determined so the wall does not fail under the current loads and current surrounds of the environment.

The following dimensions will need to be determined from the stability analysis.

Wall Geometry
H₁ = The total height difference in elevation of the existing terrain to proposed roadway
H₂ = The height of the heel of the retaining wall
B = The total width of the base of the retaining wall
B₁ = The width of the wall that will hold back earthwork
B₂ = The width proportional to 0.1xH – B₁
B₃ = The width of the of the heel of the retaining wall

![Figure 1. Dimensions Retaining Wall]

The Dead loads (weight) of each section numbered in the diagram will need to be determined to continue with stability analysis.

\[
W₁ = B₁ * H₁ * γc \\
W₂ = 0.5 * B₂ * H₁ * γc \\
W₃ = B * H₂ * γc
\]

These dead loads include how much the retaining wall will actually weigh. The variables needed to calculate these loads are shown in table 1.

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<tr>
<td>H₂</td>
<td>1.53</td>
<td>1.60</td>
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</table>

Table 1. Dimensions of Retaining Wall
Now using equations 1-3 the unfactored dead loads of concrete may be calculated where \( \gamma_c \) is the specific weight of concrete which equal to 150 lb/ft\(^2\).

\[
W_1 = B_1 * H_1 * \gamma_c = 1.00ft * 13.80ft * \frac{150lb}{ft^2} = 2070 lb
\]
\[
W_2 = 0.5 * B_2 * H_1 * \gamma_c = 0.5 * 1.00ft * 13.80ft * \frac{150lb}{ft^2} = 1160 lb
\]
\[
W_3 = B * H_2 * \gamma_c = 11.50ft * 1.60 * \frac{150lb}{ft^2} = 2760 lb
\]

Other dead loads that still must be calculated is the vertical and horizontal earth pressures. The vertical earth pressure can be described as:

\[
PEV = W_4 = B_3 * H_1 * \gamma_1
\]  
(4)

Where \( \gamma_1 \) is the specific weight of the retained soil behind the wall, and is equal to 114 lb/ ft\(^2\)

The unfactored vertical earth pressure is:

\[
W_4 = B_3 * H_1 * \gamma_1 = 8.00ft * 13.80ft * \frac{114lb}{ft^2} = 12586 lb
\]

The horizontal earth pressure can be described in equation 5.

\[
PEH = W_5 = 0.5 * 0.33 * \gamma_2 * H_1^2
\]  
(5)

The unfactored horizontal earth pressure is:

\[
W_5 = 0.5 * 0.33 * \gamma_2 * H_1^2 = 0.5 * 0.33 * \frac{114lb}{ft^2} * 15.40ft^2 = 4506 lb
\]

Thus the following loads can be shown in table 2.

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<td>1160</td>
<td>2760</td>
<td>12586</td>
<td>4506</td>
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</table>

Table 2. Loads of concrete and soils
The appropriate load factors need to be determined by the controlling limit states which are:

- Strength 1-a & 1-b (max and min)
- Strength IV
- Service I

<table>
<thead>
<tr>
<th>Group</th>
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<th>W5</th>
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<td>1.50</td>
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<td>1.00</td>
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Table 3. Load factors of limit state function

*DC is the dead load of concrete

Applying the load factors to the unfactored loads table 4 shows the loads for each group

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</tbody>
</table>

Table 4. Factored Loads

Where $k_a = \tan^2 \left(45 - \frac{\phi'}{2} \right)$ and $\phi'$ is the friction angle between the wall and backfill of retained soil and equals 27 degrees; and $\gamma_2$ is the specific weight of the soil under the wall, and is equal to 110 lb/ft$^3$. 
Next the moment that is caused by the loads is determined as well as the moment arms of each load. Each load can be treated as a single force point and then a moment can be taken at a specified point. The moment is needed to determine overturning or eccentricity of the wall which is if the fail will fail as a result of pressure of the earth, which overcomes the stability of the wall. The resistance is directly proportional to the weight of the wall and the width of its base. Overturning can be described as the following:

\[ e = \frac{g}{2} - X_0 \]  

(6)

Where \( X_0 \) is the difference in sum moment of vertical dead load minus the sum moment of horizontal load all divided by the sum vertical dead load.

\[ X_0 = \frac{\Sigma M_{vd} - \Sigma M_{wz}}{\Sigma v_{dl}} \]  

(7)

Like mentioned before each moment arm needs to be determined for each load before a moment can be calculated; each arm from the center of gravity of each load to moment point will have the variable \( X_n \).

The moment arm for W1 is:  

\[ X_1 = B - B3 - 0.5 \times B1 \]  

(8)

The moment arm for W2 is:  

\[ X_2 = B - B3 - B1 - \frac{B2}{3} \]  

(9)

The moment arm for W3 is:  

\[ X_3 = 0.5 \times B \]  

(10)

The moment arm for W4 is:  

\[ X_4 = B - 0.5 \times B3 \]  

(11)

The moment arm for W5 is:  

\[ X_5 = \frac{H}{3} \]  

(12)
Executing equations 8-12 give the following moment arms

\[
X_1 = B - B_3 - 0.5 \times B_1 = 11.50\text{ft} - 8.00\text{ft} - 0.5 \times 1.00\text{ft} = 3.00\text{ft}
\]

\[
X_2 = B - B_3 - B_1 - \frac{B_2}{3} = 11.50\text{ft} - 8.00\text{ft} - 1.00\text{ft} - \frac{1.00\text{ft}}{3} = 2.17\text{ft}
\]

\[
X_3 = 0.5 \times B = 0.5 \times 11.50\text{ft} = 5.75\text{ft}
\]

\[
X_4 = B - 0.5 \times B_3 = 11.50\text{ft} - 0.5 \times 8.00\text{ft} = 7.50\text{ft}
\]

\[
X_5 = \frac{H}{3} = \frac{15.4}{3\text{ft}} = 5.13\text{ft}
\]

<table>
<thead>
<tr>
<th>Moment Arm</th>
<th>X1 (ft)</th>
<th>X2 (ft)</th>
<th>X3 (ft)</th>
<th>X4 (ft)</th>
<th>X5 (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.00</td>
<td>2.17</td>
<td>5.75</td>
<td>7.50</td>
<td>5.13</td>
</tr>
</tbody>
</table>

Table 5. Moment arms of loads

Now each moment can simply be calculated by taking the load multiplied by the moment arm for each load

\[
M_1 = W_1 \times X_1
\]

\[
M_2 = W_2 \times X_2
\]

\[
M_3 = W_3 \times X_3
\]

\[
M_4 = W_4 \times X_4
\]

\[
M_5 = W_5 \times X_5
\]

\[
M_1 = 2070\text{lb} \times 3.00\text{ft} = 6210\text{lb} \times \text{ft}
\]

\[
M_2 = 1155\text{lb} \times 2.17\text{ft} = 2507\text{lb} \times \text{ft}
\]

\[
M_3 = 2400\text{lb} \times 5.00\text{ft} = 12000\text{lb} \times \text{ft}
\]

\[
M_4 = 10226\text{lb} \times 6.75\text{ft} = 69026\text{lb} \times \text{ft}
\]

\[
M_5 = 4506\text{lb} \times 5.13\text{ft} = 23116\text{lb} \times \text{ft}
\]

The table 6 shows the unfactored moments as well as factored moment for each group

<table>
<thead>
<tr>
<th>Group</th>
<th>M1 (lb*ft)</th>
<th>M2 (lb*ft)</th>
<th>M3 (lb*ft)</th>
<th>M4 (lb*ft)</th>
<th>M5 (lb*ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfactored</td>
<td>6210</td>
<td>2507</td>
<td>15870</td>
<td>94395</td>
<td>23116</td>
</tr>
<tr>
<td>Strength I-a</td>
<td>5589</td>
<td>2257</td>
<td>14283</td>
<td>94395</td>
<td>34674</td>
</tr>
<tr>
<td>Strength I-b</td>
<td>7763</td>
<td>3134</td>
<td>19838</td>
<td>127433</td>
<td>34674</td>
</tr>
<tr>
<td>Strength IV</td>
<td>9315</td>
<td>3761</td>
<td>23805</td>
<td>127433</td>
<td>34674</td>
</tr>
<tr>
<td>Service I</td>
<td>6210</td>
<td>2507</td>
<td>15870</td>
<td>94395</td>
<td>23116</td>
</tr>
</tbody>
</table>

Table 6. Moments due to loads
Summing up the moments and vertical loads, equation 7 can be calculated for each group

<table>
<thead>
<tr>
<th>Group</th>
<th>$\Sigma V_{dl}$ (lb)</th>
<th>$\Sigma M_{vd, l}$ (lb·ft)</th>
<th>$\Sigma M_{w, S}$ (lb·ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfactored</td>
<td>18571</td>
<td>118975</td>
<td>23131</td>
</tr>
<tr>
<td>Strength I-a</td>
<td>17927</td>
<td>116516</td>
<td>34697</td>
</tr>
<tr>
<td>Strength I-b</td>
<td>24472</td>
<td>158157</td>
<td>34697</td>
</tr>
<tr>
<td>Strength IV</td>
<td>25968</td>
<td>164303</td>
<td>34697</td>
</tr>
<tr>
<td>Service I</td>
<td>18571</td>
<td>118975</td>
<td>23131</td>
</tr>
</tbody>
</table>

Table 7. Sum of moments and vertical loads

Before equation 8 may be used to find the eccentricity for each group, the maximum eccentricity $e_{max}$ needs to be calculated. This is the value where the eccentricity cannot be greater than of each limit state group. If it is then the wall will fail.

$$e_{max} = \frac{B}{4}$$  \hspace{1cm} (18)

$$e_{max} = \frac{B}{4} = \frac{9.5ft}{4} = 2.375ft$$

Equations 6, 7, and 18 can be calculated and show in table 8

<table>
<thead>
<tr>
<th>Group</th>
<th>$X_c$ (ft)</th>
<th>$e$ (ft)</th>
<th>$e_{max}$ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfactored</td>
<td>5.16</td>
<td>0.59</td>
<td>2.875</td>
</tr>
<tr>
<td>Strength I-a</td>
<td>4.55</td>
<td>1.20</td>
<td>2.875</td>
</tr>
<tr>
<td>Strength I-b</td>
<td>5.05</td>
<td>0.71</td>
<td>2.875</td>
</tr>
<tr>
<td>Strength IV</td>
<td>4.99</td>
<td>0.76</td>
<td>2.875</td>
</tr>
<tr>
<td>Service I</td>
<td>5.16</td>
<td>0.59</td>
<td>2.875</td>
</tr>
</tbody>
</table>

Table 8. Eccentricity of loads

As it can be seen from table 8, $e_{max} > e$ for all limit states; the retaining wall will not fail due to the soil pressure and it will not overcome the stability of the structure.
Soil bearing resistance or ultimate bearing capacity needs to be determined for each limit state function. This is based on a rectangular distribution of soil pressure over the reduced effective area. This can be shown in equation 19 and 20.

\[
q_R = \phi_b \cdot q_n
\]  

\[
q_n = c \cdot N_{cm} + g \cdot \gamma_2 \cdot D_f \cdot N_{qm} \cdot C_{wq} + 0.5 \cdot g \cdot \gamma_2 \cdot B' \cdot N_{yn} \cdot C_{wy}
\]  

Where:
- \( g \) = gravitational acceleration (\( ft/s^2 \))
- \( c \) = cohesion
- \( N_{cm} \) = \( N_{csc}, \) bearing capacity factor for cohesion
- \( N_{qm} \) = \( N_{qsc}, \) surcharge bearing capacity factor
- \( N_{ym} \) = \( N_{yym}, \) unit weight bearing capacity factor
- \( \gamma_2 \) = specific weight of foundation soil (\( lb/ft^2 \))
- \( D_f \) = footing embedment depth (ft)
- \( B' = B-2e \) (ft)
- \( C_{wq}, C_{wy} \) = correction factors for water table

| Bearing Resistance Variables |  
|-----------------------------|---|
| \( c \) | 0.00 |
| \( N_{cm} \) | 23.90 |
| \( \gamma_2 \) | 110.00 |
| \( D_f \) | 3.00 |
| \( N_{qm} \) | 26.10 |
| \( C_{wq} \) | 1.00 |
| \( N_{yn} \) | 35.20 |
| \( C_{wy} \) | 0.50 |
| \( \phi_b \) | 0.50 |

Table 9. Bearing resistance variables

The bearing resistance needs to be determined this is the pressure caused by the loads of concrete and soils. This can be shown with equation 21. The soil bearing resistance \( q_R \) needs to always be greater than the bearing resistance \( \sigma_v. \)

\[
\sigma_v = \frac{\Sigma V}{B'}
\]  

The unfactored bearing resistance is:

\[
\sigma_v = \frac{\Sigma V}{B'} = \frac{18571lb}{11.50ft - 2 \cdot 0.59ft} = \frac{1799lb}{ft}
\]

While the unfactored soil resistance is:

\[
q_R = \phi_b \cdot (c \cdot N_{cm} + g \cdot \gamma_2 \cdot D_f \cdot N_{qm} \cdot C_{wq} + 0.5 \cdot g \cdot \gamma_2 \cdot B' \cdot N_{yn} \cdot C_{wy})
\]

\[
= 0.5 \cdot \left( 0 \cdot 23.90 + 110 \cdot \frac{lb}{ft^2} \cdot 3.00 \cdot 26.10 + 0.5 \cdot 110 \cdot \frac{lb}{ft^2} \cdot (10.00ft - 2 \cdot 0.80ft) \cdot 35.20 \cdot 0.50 \right) = \frac{9302lb}{ft}
\]
<table>
<thead>
<tr>
<th>Group</th>
<th>$\sigma_v$ (lb/ft)</th>
<th>$q_v$ (lb/ft)</th>
<th>CDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfactored</td>
<td>1799</td>
<td>9302</td>
<td>5.17</td>
</tr>
<tr>
<td>Strength I-a</td>
<td>1974</td>
<td>8713</td>
<td>4.41</td>
</tr>
<tr>
<td>Strength I-b</td>
<td>2425</td>
<td>9190</td>
<td>3.79</td>
</tr>
<tr>
<td>Strength IV</td>
<td>2602</td>
<td>9138</td>
<td>3.51</td>
</tr>
<tr>
<td>Service I</td>
<td>1799</td>
<td>9302</td>
<td>5.17</td>
</tr>
</tbody>
</table>

Table 10. Bearing pressures caused by loads

*CDR(Capacity to Demand Ratio) = $q_v / \sigma_v$

For all loading cases $q_v > \sigma_v$, therefore, the footing design is adequate.

Resistance to sliding needs to be checked if not sliding failure is a result of excessive horizontal earth pressures with relation to retaining wall resistance thereby causing the retaining wall system to move away or slide from the soil it retains. Resistance to Sliding can be described by equation 22.

$$R_T = \phi_T (0.9 \times \Sigma VDC + W4) \times \tan(\phi_r)$$

(22)

The unfactored resistance to sliding is:

$$R_T = \phi_T (0.9 \times \Sigma VDC + W4) \times \tan(\phi_r) = 0.8 \times (0.9 \times 5625lb + 10226lb) \times \tan(27) = 6232lb$$

This value needs to be greater than the horizontal earth pressure applied on the wall. From before this was calculated from equation 5 and is $W_5 = 4510lb$.

Table compares the unfactored as well as factored sliding resistance force and the horizontal force applied to the wall.

<table>
<thead>
<tr>
<th>Group</th>
<th>$R_T$ (lb)</th>
<th>$W_5$ (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfactored</td>
<td>7326</td>
<td>4506</td>
</tr>
<tr>
<td>Strength I-a</td>
<td>7106</td>
<td>6759</td>
</tr>
<tr>
<td>Strength I-b</td>
<td>9670</td>
<td>6759</td>
</tr>
<tr>
<td>Strength IV</td>
<td>10219</td>
<td>6759</td>
</tr>
<tr>
<td>Service I</td>
<td>7326</td>
<td>4506</td>
</tr>
</tbody>
</table>

Table 11. Resistance of wall and horizontal load of soils

As shown in table 11 the resistance is greater than the horizontal force applied on the wall.
Cost Estimate for total concrete of retaining walls is shown in table 12.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>575.00</td>
<td>6.60</td>
<td>3.65</td>
<td>4.20</td>
<td>14.45</td>
<td>8308.75</td>
<td>307.73</td>
<td>$319.26</td>
<td>$98,246.35</td>
</tr>
<tr>
<td>2</td>
<td>400.00</td>
<td>7.50</td>
<td>4.20</td>
<td>8.10</td>
<td>19.80</td>
<td>7920.00</td>
<td>293.33</td>
<td>$319.26</td>
<td>$93,649.60</td>
</tr>
<tr>
<td>3</td>
<td>862.50</td>
<td>13.80</td>
<td>7.70</td>
<td>18.40</td>
<td>39.90</td>
<td>34413.75</td>
<td>1274.58</td>
<td>$319.26</td>
<td>$406,923.48</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>34572.45</strong></td>
<td><strong>1284.91</strong></td>
<td></td>
<td><strong>$598,819.43</strong></td>
</tr>
</tbody>
</table>

Table 12. Cost of concrete for retaining walls

Figures calculated in be seen in tables in Appendix 5 for retaining walls at station 104+50 to 110+25 and at station 120+00 to 124+00. While the third wall was placed at Station 125+50 to 134+12.
Technical Subject Report (Structural Design)

Subject:
Box culvert Design for Old Cheney Road, 70th to 84th Streets

Designer:

Reference Guides:
2) ACI Concrete Design
3) AASHTO LRFD Culvert Design
4) AASHTO Foundation Design
5) AISC Steel Construction Manual

Design Criteria:
1. The box culvert will be 15ft wide
2. The box culvert will be 10ft tall to allow for required minimum 10ft height for bike paths.
3. Design 1 feet thick concrete on all sides of the box culvert.
4. Design of structure for HL-93 Live Load
5. Strength of concrete f'c=3500psi, strength of steal fy=60000 psi
6. Design 1 feet fill above the box culvert

Copies of Methodology, Criteria, Equations or Policies:
1. AASHTO LRFD bridge Design Specifications, 5th Edition
2. LRFD
3. HL-93
4. Fouad Jaber PE of NDOR instructional guide

List of Assumptions:
1. A minimum of one feet of earth cover shall be between the bottom of the driving lane pavement and top edge of underpass structure
2. Soils are Peorian Loess which under drained conditions will have little or no cohesion, hence cohesion, c=0 psf
3. Foundation Soil Characteristics: f'=27 degrees, c=0 psf, g=110 pcf
4. Retained Soil Characteristics: f'=30 degree, c=0 psf, g=114pcf
5. Drainage of underpass will not be considered
6. Underpass will be a trench installation
7. Utility issues will be ignored
Design Calculation:

Design Factored Moment at Section 1

Positive Moment
\[ M_u = \gamma(1.25C + 1.5D + 1.75L + 0.5E) \]

Negative Moment
\[ M_u = \gamma(0.9C + 0.9D + 1.35E) \]

- Pick maximum LL and maximum EH from table for different sections.
- Axial force is negligible except for deep fill

Design Factored Moment

Negative Moment, Section 3
\[ M_u = \gamma(0.9C + 0.9D + 1.75L + 1.35E + 1.75S) \]

- At corner, top slab

Negative Moment, Section 4
\[ M_u = \gamma(1.25C + 1.5D + 1.75S + 1.75L + 1.35E) \]

- At top corner of wall
Design Factored Moment (cont.)

• Positive Moment, Section 6  
  \( M_u = \eta(0.9DC + 1.75LS + 1.35EH) \)

• Negative Moment, Section 6  
  \( M_u = \eta(1.25DC + 1.5DW + 1.75LL + 0.5EH) \)

• Negative Moment, Section 8  
  \( M_u = \eta(1.25DC + 1.5DW + 1.75LL + 1.35EH + 1.75LS) \)

Design Factored Moment (cont.)

• Negative Moment, Section 9  
  \( M_u = \eta(0.9DC + 0.9DW + 1.75LS + 1.35EH) \)

• Positive Moment, Section 11  
  \( M_u = \eta(1.25DC + 1.5DW + 1.75LL + 0.5EH) \)
Design Factored Shear

- Top slab, Section 2
  \( V_u = \eta(1.25DC + 1.5DW + 1.75LS + 1.75LL) \)
- Walls, Section 5 & 7
  Minimum shear is due to axial thrust due to earth pressure. (negligible)
- Bottom slab, Section 10
  \( V_u = \eta(1.25DC + 1.5DW + 1.75LS + 1.75LL) \)

** \( V_s = V_u - V_c \)**

All the calculations see the Appendix 6.

**Recommendation:**
Recommend use epoxy coated reinforcing steel that the epoxy coated reinforcing steel resisted corrosion better than regular reinforcing steel.

Recommend the application of a protective layer on the reinforcement to prevent it from erosion, because the box is in the underground.

Recommend use prestressed reinforcement, because the top of the box undergoes bending due to soil stress and vehicle loads, the top of the box is in a state of tension;
**Quantity Determinations:**
The ordinary concrete = 4320 lb
Structural steel of box culvert = 6693.211 lb

**Pricing of Construction Materials and Equipment:**
The ordinary concrete is $12.219 per $/ft^3
The structural steel is $0.9 per lb

**Estimate Calculations:**

<table>
<thead>
<tr>
<th>Structural Materials</th>
<th>Cost</th>
<th>Quantity</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ordinary concrete ($/ft^3)</td>
<td>12.319</td>
<td>4320</td>
<td>53220.05</td>
</tr>
<tr>
<td>prestressed concrete ($/ft^3)</td>
<td>24.356</td>
<td></td>
<td></td>
</tr>
<tr>
<td>structural steel ($/pound)</td>
<td>0.9</td>
<td>6693.211</td>
<td>6023.890</td>
</tr>
<tr>
<td>reinforcing steel ($/pound)</td>
<td>0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>prestressing steel ($/pound)</td>
<td>2.630</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Work</td>
<td>1.444</td>
<td>20160</td>
<td>29118.097</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Totals</td>
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<td>88362.038</td>
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</tbody>
</table>
Technical Subject Report (Environmental Design)

Subject:
Rain Garden Design for Old Cheney Road 70th to 84th Streets

Designer:

Reference Guides:
2) G1759, University of Nebraska-Lincoln’s NebGuides, Plant Selection for Rain Gardens in Nebraska
3) G1758, University of Nebraska-Lincoln’s NebGuides, Rain Garden Design for Homeowners
4) North Carolina State Guidelines for Rain Garden Design
5) Nebraska Plant List

Design Criteria
- The rain garden is sized to hold runoff from the first inch of rainfall in the contributing drainage area
- Average depth of water is to be the standard of 9 inches
- The fill soil layer is to be 3 inches
- The underdrain pipe system is designed to carry at least 10 times the minimum amount

List of Assumptions
Rain Garden Assumptions:
- Runoff/watershed area is the usable area of the newly constructed median which is 52,100 ft²
- Land Use/Cover is open space with grass cover 50-75%
- Soil type is Soil Group D
- Corresponding Curve Number is 84
- Conservative hydraulic conductivity of 2 in/hr
- Manning roughness coefficient of .014 (4” single-wall corrugated plastic) is used
- Slope of site is 0.5%

Environmental Protection and Control Assumptions
- The reconstruction of Old Cheney Road from 70th to 84th Street will include the following environmental problems.
  1) Fertilizers runoff from seeding and other construction site pollutants
  2) Oils and metals from streets and parking lots
  3) Sediment from construction activities including vehicle track out, ditch excavation and grading, and soil stockpiling.
Design Calculation:
Complete design calculations for the rain garden can be found in Appendix 7.

Rain Garden Calculations:
The following equation from the Natural Resources Conservation Service was used to calculate the runoff and ultimately size the rain garden.

- Runoff depth in inches = \((P - 0.2S)^2 / (P + 0.8S)\),
  \(P\) = Precipitation
  \(S\) = \((1,000/CN) - 10\)
  \(CN\) = Curve Number

- Runoff Volume \((\text{ft}^3)\) = Watershed Area \(*\) Runoff Depth

- Rain Garden Surface Area = Rain Garden Volume / Average Depth of Water

Darcy’s Law is used to size the underdrain pipes within the rain garden.

- \(q_p = K \Delta H / L\)
  \(q_p\) = peak inflow
  \(K\) = hydraulic conductivity
  \(L\) = thickness of soil layer

- \(Q = q_p \ast A\)
  \(Q\) = total flow
  \(A\) = surface area of rain garden

Manning’s equation is used to determine the number of pipes and their associated diameter.

- \(N \times D = 16 \times \left(\frac{(Q \times n)}{s^{0.5}}\right)^{3/8}\)
  \(N\) = number of pipes (inches)
  \(Q\) = flow to be carried (cfs)
  \(n\) = Manning coefficient
  \(s\) = slope of pipe

Environmental Protection and Control Calculations:
The SWPPP is shown within Appendix 8.
Recommendations:

1) Silt fence should be used as perimeter control and within ditches to limit the transport of sediment. Silt fencing should be additionally used on an as-needed basis.

2) Appropriate seeding techniques should be used for disturbed areas along the north and south side of Old Cheney to stabilize the soil and slow the erosion process.

3) If soil is tracked onto adjacent streets the contractor should clean the streets in a way that achieves soil removal. If soil tracking is observed, it should be removed twice a day at a minimum.

4) Vegetation native to Nebraska such as the Canada Wildrye, Indian Steel Indiangrass, Thomahawk Indiangrass, Prairie Jewel Eupatorium, and other comparable vegetation should be planted within the median rain garden.

Rain Garden and Erosion Control Cost Estimates:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Units</th>
<th>Unit Cost</th>
<th>Unit Amount</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>L006.00</td>
<td>Cover Crop Seeding</td>
<td>ACRES</td>
<td>$147.65</td>
<td>11</td>
<td>$1,620</td>
</tr>
<tr>
<td>L003.03</td>
<td>Seeding (permanent)</td>
<td>ACRES</td>
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<td>1</td>
<td>$750</td>
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<tr>
<td>L010.00</td>
<td>Sodding</td>
<td>SQ YD</td>
<td>$3.68</td>
<td>12,759</td>
<td>$47,000</td>
</tr>
<tr>
<td>L020.00</td>
<td>Erosion Control</td>
<td>SQ YD</td>
<td>$1.40</td>
<td>23,552</td>
<td>$33,000</td>
</tr>
<tr>
<td>L022.10</td>
<td>Fabric Silt Fence</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>7,932</td>
<td>$15,900</td>
</tr>
<tr>
<td></td>
<td>Excavation &amp; Hauling (including labor</td>
<td>CUBIC YD</td>
<td>$9.50</td>
<td>12,313</td>
<td>$117,000</td>
</tr>
<tr>
<td></td>
<td>&amp; equipment rental)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>Importing rock &amp; soil</td>
<td>CUBIC FT</td>
<td>$0.40</td>
<td>225,549</td>
<td>$90,200</td>
</tr>
<tr>
<td>N/A</td>
<td>Mulch</td>
<td>SQ FT</td>
<td>$0.30</td>
<td>52,100</td>
<td>$15,600</td>
</tr>
<tr>
<td>N/A</td>
<td>Vegetation</td>
<td>SQ FT</td>
<td>$0.30</td>
<td>52,100</td>
<td>$15,600</td>
</tr>
</tbody>
</table>

TOTAL: $337,000
Summary of Positive Aspects

Prime Engineering knows that we are capable of bringing many positive aspects to this project. The following tables display the positive aspects of our 30% plans.

### Roadway

<table>
<thead>
<tr>
<th>Design Element</th>
<th>Positive Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Foot Inner Lanes</td>
<td>Fits the roadway into the narrow right of way.</td>
</tr>
<tr>
<td>11 Foot Outside Lanes</td>
<td>Accommodates truck traffic and maximize the distance between oncoming truck traffic.</td>
</tr>
<tr>
<td>17 Foot Wide Left Turn Lanes</td>
<td>Provides safe and efficient left turns for motorist.</td>
</tr>
</tbody>
</table>

### Hiker/Biker Trail and Sidewalk

<table>
<thead>
<tr>
<th>Design Element</th>
<th>Positive Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Foot Wide Hiker/Biker Trail</td>
<td>Promotes healthy activities such as jogging and bike riding.</td>
</tr>
<tr>
<td>Sidewalk</td>
<td>Improved pedestrian facilities for improved safety when traversing the area.</td>
</tr>
</tbody>
</table>

### Storm Sewer System

<table>
<thead>
<tr>
<th>Design Element</th>
<th>Positive Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 72” Straight/Canted Inlet</td>
<td>Diverts runoff from the roadway to a storm sewer system as well as prevents standing water.</td>
</tr>
<tr>
<td>15”-18” Storm Sewer Pipes</td>
<td>Collects runoff from the roadway and surrounding areas and disperses it into appropriate watersheds.</td>
</tr>
<tr>
<td>Manhole</td>
<td>Allows for quick and easy access to the storm sewer system.</td>
</tr>
<tr>
<td>10 Year Design Storm</td>
<td>The storm sewer system is designed to convey water from the roadway for a 10 year storm.</td>
</tr>
<tr>
<td>Maximum Spread Width of 12”</td>
<td>Provides at least one lane of through travel during a storm event.</td>
</tr>
</tbody>
</table>

### Box Culvert

<table>
<thead>
<tr>
<th>Design Element</th>
<th>Positive Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box Culvert Underpass</td>
<td>Ensures the safety of pedestrians and reduces pedestrian related traffic accidents.</td>
</tr>
</tbody>
</table>

### Environmental Protection and Control

<table>
<thead>
<tr>
<th>Design Element</th>
<th>Positive Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Rain Garden</td>
<td>Enhance water quality and help control stormwater runoff.</td>
</tr>
<tr>
<td>Erosion Control Measures</td>
<td>Reduce impacts on surrounding environments.</td>
</tr>
</tbody>
</table>
## Opinion of Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Class 47B-3000 Sidewalks</td>
<td>SY</td>
<td>8,365</td>
<td>$54.15</td>
<td>$452,965</td>
</tr>
<tr>
<td>10&quot; Concrete Pavement Class 47B-3500</td>
<td>SY</td>
<td>16,613</td>
<td>$37.10</td>
<td>$616,332</td>
</tr>
<tr>
<td>6&quot; Concrete Class 47B-3000 Median Surfacing</td>
<td>SY</td>
<td>7,864</td>
<td>$54.50</td>
<td>$428,604</td>
</tr>
<tr>
<td>15&quot; Reinforced Concrete Sewer Pipe</td>
<td>LF</td>
<td>2,236</td>
<td>$87.51</td>
<td>$195,629</td>
</tr>
<tr>
<td>18&quot; Reinforced Concrete Sewer Pipe</td>
<td>LF</td>
<td>5</td>
<td>$25.08</td>
<td>$125</td>
</tr>
<tr>
<td>Inlet-72&quot; Straight</td>
<td>EA</td>
<td>3</td>
<td>$2,449.09</td>
<td>$7,347</td>
</tr>
<tr>
<td>Inlet-72&quot; Canted</td>
<td>EA</td>
<td>6</td>
<td>$2,470.63</td>
<td>$14,824</td>
</tr>
<tr>
<td>Manholes</td>
<td>EA</td>
<td>7</td>
<td>$3,856.78</td>
<td>$26,997</td>
</tr>
<tr>
<td>Retaining Wall Concrete</td>
<td>CUBIC YD</td>
<td>1,876</td>
<td>$319.26</td>
<td>$598,932</td>
</tr>
<tr>
<td>Ordinary Concrete</td>
<td>CUBIC FT</td>
<td>4,320</td>
<td>$12.32</td>
<td>$53,222</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>LB</td>
<td>6,693</td>
<td>$0.90</td>
<td>$6,024</td>
</tr>
<tr>
<td>Site Work</td>
<td>EA</td>
<td>20,160</td>
<td>$1.44</td>
<td>$29,030</td>
</tr>
<tr>
<td>Cover Crop Seeding</td>
<td>ACRES</td>
<td>11</td>
<td>$147.65</td>
<td>$1,620</td>
</tr>
<tr>
<td>Seeding (permanent)</td>
<td>ACRES</td>
<td>1</td>
<td>$750.00</td>
<td>$750</td>
</tr>
<tr>
<td>Sodding</td>
<td>SQ YD</td>
<td>12,759</td>
<td>$3.68</td>
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**Total** | **$2,800,000** |
City of Lincoln, Nebraska (2013)
Construction of Old Cheney Road from 70th to 84th Streets
30% Plans

Summary of Quantities:

TRN:
(3075.52): 10" CONCRETE PAVEMENT, CLASS 47B-3500 (SQ YDS) = 21,377
(3016.23): 6" CONCRETE CLASS 47B-3000 SIDEWALKS (and pike paths) (SQ YDS) = 7,290
(3017.43): 6" CONCRETE MEDIAN SURFACING (SQ YDS) = 1,540

WTR:
(4600.15-4600.48): 15" CONCRETE SEWER PIPE (LIN FT) = 1,589
(4600.15-4600.48): 18" CONCRETE SEWER PIPE (LIN FT) = 562
(4600.15-4600.48): 24" CONCRETE SEWER PIPE (LIN FT) = 60
(4011.14): INLET-72" STRAIGHT (EACH) = 3
(4012.12): INLET-72" CANTED (EACH) = 8
(4016.00): MANHOLES (EACH) = 9

STR:
(4115.28): CLASS 47B-4000 CONC FOR BOX CULVERTS (CU YDS) = 116
(4151.00): REINFORCING STEEL FOR BOX CULVERTS (LBS) = 37944.66

GEO:
(4102.03): CONCRETE 47B-4000 FOR RETAINING WALLS (CU YDS) = 2737.4

ENV:
(L006.00): COVER CROP SEEDING (temporary) (ACRES) = 1.5
(L003.03): SEEDING (permanent) (ACRES) = 3.1
(L020.00): EROSION CONTROL (SQ YD) = 4988
(L022.10): FABRIC SILT FENCE (LIN FT) = 8697
VEGETATION (SQ FT) = 7104
MULCH (SQ FT) = 7104
EXCAVATION (CU YDS) = 47215
RAIN GARDEN CROSS SECTION

PROJECT CENTER LINE

6" MEDIAN CURB

OVERFLOW STRUCTURE WHERE REQUIRED

2' CURB BORDER

3:1 (H:V) MIN SLOPE

DRIVING LANE

6" MEDIAN CURB

3" SANDY LOAM MIX WITH ORGANICS

4" SANDY LOAM, LOAMY SAND FILL SOIL

4" CORRUGATED PLASTIC UNDERDRAIN

2" WASHED GRAVEL

1.25' MIN DIAMETER RCP

0.5% SLOPE

9'

9" ALLOWABLE PONDING

Scale: N/A

Project Number: 700026

Drawn by: BJ

Date: 4-25-13

Checked by: TR

Date: 4-25-13

Sheet: E-4/24
Normal Crown, CL to Boc = 26.5 ft, Underpass

Cross Sectional View of Pedestrian Underpass

(to scale) 1" : 2
CONTROL NUMBER: 700028
OLD CHENEY ROAD, 70TH ST. TO 84TH ST.
CITY OF LINCOLN, NE (2013)
SUMMARY OF QUANTITIES

18.76 CF
25,000 sq. ft.
250,000 sq. ft.
225'594'-0" FT.
12'-3" SY
9'-9" SY
2'-3" SY
1'-10" ACRE
1'-10" ACRE

Concrete Retaining Wall
Vegetation
Mulch
Improving Rock and Soil
Excavation and Hauling
Fencing/Slit Fence
Erosion Control
Soil Sodding
Seeding (Permanent)
Cover Crop Seeding

Pre stressing Steel
Reinforcing Steel
Structural Steel
Prestressed Concrete
Ordinary Concrete

6" Concrete Class 47B-3000 Medium Surfacing
10" Concrete Pavement, Class A-88-3650
Concrete Class 47B-3000 Sidewalks

7 EACH
6 EACH
3 EACH
5 LIN. FT.
2'-3" LIN. FT.

Manholes
Inlet-72" Contract
Inlet-72" Straight
18" Reinforced Concrete Sewer Pipe
15" Reinforced Concrete Sewer Pipe

20'-160' LB
6'-99' LB
4'-320' CF
4'-320' CF
16'-61'-35'-8'-36' SY

2'-36' SY
5'-8'-45'-4' SY
5'-8'-45'-4' SY

ML
LS
SH
BOX CULVERT/PEDESTRIAN UNDERPASS
Cross Section View of Pedestrian Underpass
shift

BOX CULVERT/PEDESTRIAN UNDERPASS
CROSS SECTIONS

sta. 142+00
sta. 140+00
sta. 138+00
sta. 136+00

LOC 47'
LOC 63'
LOC 52'
LOC 80'
LOC 51'
LOC 47'
 LOC 79'