LSC Use Only
Number: ______
Submission Date: ______
Action-Date: ______

UWUCC USE only
Number: 01-38c
Submission Date: ______
Action-Date: UWUCC App. 3/12/02
Senate App 4/2/02

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Lon Ferguson Phone 357-3019

Department Safety Sciences

II. PROPOSAL TYPE (Check All Appropriate Lines)

XX COURSE Construction Safety
Suggested 20 character title

XX New Course* SAFE 443 Construction Safety
Course Numvber and Full Tilte

____ Course Revision ______
Course Number and Full Title

Rev.

____ Liberal Studies Approval+ for new or existing course ______
Course Number and Full Title

____ Course Deietion ______
Course Number and Full Title

____ Number and/or Title Change ______
Old Number and/or Full Old Title

______
New Number and/or Full New Title

____ Course or Catalog Description Change ______
Course Number and Full Title

____ PROGRAM: ____ Major ____ Minor ____ Track

____ New Program* ______
Program Name

____ Program Revision* ______
Program Name

____ Program Deletion* ______
Program Name

____ Title Change ______
Old program name

______
New Program Name

III. Approvals (signatures and date)

Lon H. Ferguson 10/22/01 — Department Curriculum Committee
Lon H. Ferguson 10/22/01 — Department Chair

Mary E. Sula 10/29/01 — College Curriculum Committee
Carleen A. Zoni 31 Oct 01 — College Dean

______ +Director or Liberal Studies (where applicable)
______ *Provost (where applicable)

Undergraduate Distance Education Review Form

(Required for all courses taught by distance education for more than one-third of teaching contact hours)

Existing and Special Topics Course

Course: SAFE 443 Construction Safety

Instructor of Record: Dr Lon Ferguson **phone:** 7-3019 **e-mail:** ferguson@iup.edu

Step One: Department or its Curriculum Committee
The committee has reviewed the proposal to offer the above course using distance education technology, and responds to the CBA criteria as follows:

1. **Will an instructor who is qualified in the distance education delivery method as well as the discipline teach the course?** X Yes ___ No

2. **Will the technology serve as a suitable substitute for the traditional classroom?** X Yes ___ No

3. **Are there suitable opportunities for interaction between the instructor and student?** X Yes ___ No

4. **a. Will there be suitable methods used to evaluate student achievement?** X Yes ___ No

   b. Have reasonable efforts been made to insure the integrity of evaluation methods (academic honesty) X Yes ___ No

5. **Recommendation:**

   X **Positive** **(The objectives of the course can be met via distance education.)**

   ___ **Negative**

Robert L. Soule — 19 Mar 02
signature of department designee — date

If positive recommendation, immediately forward copies of this form and attached materials to the Provost and the Liberal Studies Office for consideration by the University-Wide Undergraduate Curriculum Committee. Dual-level courses also require review by Graduate Committee for graduate-level offering. Send information copies to 1) the college curriculum committee, 2) dean of the college, and 3) Dean of the School of Continuing Education.

Step Two: UNIVERSITY-WIDE UNDERGRADUATE CURRICULUM COMMITTEE

X **Positive recommendation**

___ **Negative recommendation**

Gail S. Sechrist — Mar 19, 2002
signature of committee chair — date

Forward this form to the Provost within 24 calendar days after review by committee.

Step Three: Provost

___ **Approved as distance education course**

___ **Rejected as distance education course**

signature of Provost — date

Catalog Description

SAFE 443 Construction Safety
Prerequisites: SAFE 211 and Junior Standing or Permission (3c-0l-3sh)

This course is designed to provide an in-depth coverage of hazard recognition, evaluation, and control principles for the variety of phases of construction. Information regarding the development of a construction safety program along with extensive coverage of federal standards related to the construction industry is also provided.

I. Catalog Description

SAFE 443 Construction Safety

3 credits
3 lecture hours
0 lab hours
(3c-0l-3sh)

Prerequisites: SAFE 211 and Junior Standing or Permission

This course is designed to provide an in-depth coverage of hazard recognition, evaluation, and control principles for the variety of phases of construction. Information regarding the development of a construction safety program along with extensive coverage of federal standards related to the construction industry is also provided.

II. Course Objectives

Students completing this course will:

A. identify and evaluate specific hazards associated with the following phases of construction: site selection and preparation, concrete formwork and foundations, steel erection, mechanical and electrical systems, and interior and exterior finishing work.
B. develop control strategies to eliminate or reduce the risk associated with the specific hazards associated with the following phases of construction: site preparation, concrete foundations, steel erection, mechanical and electrical systems, and interior and exterior finishing work.
C. demonstrate competency in using the Federal Standards 29 CFR to identify specific violations.
D. explain at least two strategies that can be used to qualify and select sub contractors.
E. list the minimum requirements for a contractors' Corporate Safety Program.
F. conduct an on-site safety and health survey of a construction site.

III. Course Outline

A. Construction Preplanning & OSHA Standards (6 hours)
- Overview OSHA construction standards
- Qualifying sub contractors
- Elements of a construction safety program

B. Site Preparation (6 hours)
- Site Security
- Identifying and marking utilities
- Operation of heavy equipment

C. Concrete Formwork and Foundations (9 hours)

- Excavation and trenching
- Concrete and masonry construction
- Pedestrian traffic

D. Steel Erection (9 hours)

- Material handling – cranes
- Rigging
- Fall protection
- Floor and wall openings

E. Mechanical and Electrical Systems (6 hours)

- Scaffolding
- Stairways and ladders
- Self propelled elevated work platforms
- Material hoists
- Welding and cutting
- Fire prevention practices
- Electrical hazards and controls

F. Finishing Work (6 hours)

- Portable power tools
- Ergonomics
- Housekeeping & sanitation
- Illumination

H. Culminating Activity (2 hours)

- Final Exam Week

IV. Evaluation Methods

The faculty person assigned to teach this course could be one of several faculty within the Safety Sciences Department. What follows is an example of the evaluation methods and weighting used for this course.

A. Quizzes	15 %
B. Case Studies	40 %
C. Homework Activities	40 %
D. Participation	5 %

Note: The above percentages may change slightly based on course developments and instructor needs.

Quizzes: The six quizzes will be multiple choice, matching and true/false. When offered via distance education the quizzes will be available on-line with appropriate security.

Homework: Homework activities will include: construction scenarios which require the student to evaluate and develop control strategies to address the hazard, short projects involving the use of websites such as www.osha.gov, and accident investigations related to actual fatalities that have occurred on construction sites.

NOTE: Late homework will be penalized 10% per day and will not be accepted after the instructor has returned it. Quizzes will not be made up unless prior arrangements have been made with the instructor.

Case Studies: One case study will be at the beginning of each of the six units/modules. The cases will be based on construction scenarios, which require the use of safety standards to identify, evaluate and control the specific hazards associated with the various phases of a construction job.

The following scale will be used:

A	90 - 100%
B	80 - 89%
C	70 - 79%
D	60 – 69%
F	< 60%

V. Required Text

MacCollum, D. Construction Safety Planning. John Wiley & Sons, Inc., New York, NY, 1995.

Supplemental Readings:

Additionally, appropriate current, primary literature, readings, and other course support materials will be provided by the instructor for use by the students during the course.

VI. Special Resource Requirements

Distance Education Offering: When this course is offered on-line, 100% of the content will be delivered on-line. Students must have access to a computer, which is connected to the Internet. It is recommended the computer have the minimum technical specifications as outlined on the IUP Website (www.iup.edu) within the School of Continuing Education Section.

VII. Bibliography

Clarke, Tony. Managing Health and Safety in Building and Construction. Butterworth-Heinenmann, Woodburn, MA. 1999.

Code of Federal Regulations 29 Part 1926 Construction Standards. U.S. Government Printing Office, Washington, D.C. current edition.

Eidson, J. and Reese, C. Handbook of OSHA Construction Safety and Health. Lewis Publishing, New York, NY. 1999.

Ferry, T. and Kohn, J. Safety & Health Management Planning. Government Institutes, Rockville, MD. 1999.

Spellman, F. and Whiting, N. Safety Engineering: Principles and Practices. Government Institutes, Inc., Rockville, Md. 1999.

Stuart, R. and Moore, C. Safety and Health on the Internet. Government Institutes, Inc., Rockville, Md. Third Edition. 1999.

Vincoli, Jeffrey. Making Sense of OSHA Compliance. Government Institutes, Inc., Rockville, Md. 1997.

Historic References

Colvin, Raymond. The Guidebook to Successful Safety Programming. Lewis Publishers, Boca Raton, FL. 1992.

Ennis, Richard. Electrical Safety-Related Work Practices: Compliance Program Manual. Lewis Publishers, Boca Raton, FL. 1993.

Kase, D. and Wiese, K. Safety Auditing: A Managemnt Tool. John Wiley and Sons, New York, NY. 1990.

Levitt, Raymond. Construction Safety Management. John Wiley and Sons, New York, NY. 1993.

National Safety Council. 14 Elements of a Successful Safety & Health Program. National Safety Council, Itasca, IL. 1994.

Course Analysis Questionnaire

Section A: Details of the Course

A1. How does this course fit into the programs of the department? For what students is the course designed? (majors, students in other majors, liberal studies).

This course was developed as a professional elective for students within the safety sciences program. It incorporates an area "construction safety" which is recommended by the safety sciences' accrediting body, the Related Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

A2. Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements.

This course is being proposed as a dual-level offering. The graduate side of this course is an approved course SAFE 643 Construction Safety. This existing course will have changes in the course number (543), course description and content as well as changes to reflect the option to offer this course via distance education.

A3. Has this course ever been offered at IUP on a trial basis (e.g. as a special topic). If so, explain the details of the offering.

The undergraduate portion of this course has been offered previously as a Special Topics Course. Specifically the course was taught the following semesters:

SAFE 481	**Construction Safety**	**Fall**	**1989**	**28 students**
SAFE 481	**Construction Safety**	**Spring**	**1991**	**23 students**
SAFE 481	**Construction Safety**	**Summer**	**1994**	**6 students**
SAFE 481	**Construction Safety**	**Spring**	**1998**	**12 students**

A4. Is this course to be a dual-level course? If so, what is the approval status at the graduate level?

This course is being proposed as a dual-level offering, see A2 above. The graduate course revision is being reviewed at the same time as the undergraduate course approval process.

A5. If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures?

This course is not being offered for variable credit.

A6. Do other higher education institutions currently offer this course? If so, please list examples.

Yes, other higher education institutions do offer a similar course. However, only Murray State University in Murray, KY offers it as an undergraduate course. Within the IUP catchment area, West Virginia University is the only institution that offers a similar graduate level course. It should be noted that neither of these institutions offer this course via distance education.

A7. Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation. Explain why this content or these skills cannot be incorporated into an existing course.

The Related Accreditation Commission (RAC) of the Accreditation Board for Engineering and Technology (ABET) has as one of its curriculum outcomes that graduates shall demonstrate knowledge of construction safety. [Criteria for Accrediting Engineering Related Programs: Effective for Evaluations During the 2001-2002 Accreditation Cycle, pp. 30-31]

Section B: Interdisciplinary Implications

B1. Will this course be taught by one instructor or will there be team teaching? If the latter, explain the teaching plan and its rationale.

This course will be taught by one instructor. Department faculty want the option to offer this as a distance education course, attached is the Distance Education Authorization Form. When offered using distance education technologies, this course will be Internet based (WebCT) and will include the use of interactive modes such as videoconferencing, videotape, CD-ROM, slides, etc.

B2. What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments, which clarify their attitudes toward the proposed change(s).

There is no overlap and/or conflict of the content of this course with that of any other course offered by other departments.

B3. Will seats in this course be made available to students in the School of Continuing Education?

Students in the School of Continuing Education student who possess the prerequisites or acquire permission would be allowed to register for this course. There is no expectation of a need to reserve/hold seats for Continuing Education students.

<u>Section C: Implementation</u>

C1. Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedules of current faculty. What will be taught less frequently or in fewer sections to make this possible?

Faculty resources at this time are adequate to be able to offer this course within the rotation of courses offered as electives in the safety sciences program.

C2. What other resources will be needed to teach this course and how adequate are the current resources? If not adequate, what plans exist for achieving adequacy? Reply in terms of the following:

- Space
- Equipment
- Laboratory Supplies and other Consumable Goods
- Library Materials
- Travel Funds

Classroom space is available in Johnson Hall if the class is taught through traditional means. The department has allocated a small space in Johnson Hall as our Distance Education Computer Room. The College of Health and Human Services will provide the server and support that will be used for the course. There will need to be some money allotted for the initial development of course materials, especially when videotapes or CD-ROMs are needed. The School of Continuing Education along with the Instructional Design Center is providing the technical and financial support to complete the videotapes and CD-ROMs.

Resources available in all of the other indicated areas, i.e. laboratory supplies and other consumable goods, library materials and travel funds, are adequate to meet the needs of this course

C3. Are any of the resources for this course funded by a grant? If so, what provisions have been made to continue support for this course once the grant has expired? (Attach letters of support from Dean, Provost, etc.)

Resources for this course come from within the department's operating budget; none are provided by any external sources of funding. As mentioned previously the School of Continuing Education will develop any CD-ROMs needed for the class.

C4. How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?

This course will be offered within the framework of professional electives for safety sciences students and, as such, would be rotated in its offering among several other courses. On average, this course would be offered once every four semesters.

C5. How many sections of this course do you anticipate offering in any single semester?

One dual-level section of this course would be offered in a single semester, approximately once every two years.

C6. How many students do you plan to accommodate in a section of this course? Is this planned number limited by the availability of any resources? Explain.

When offered as a lecture based course on campus the anticipated maximum enrollment will be 30 students with essentially equal numbers of undergraduate and graduate students. This number is needed due to the seating capacity of the safety laboratory in Johnson Hall (room 112).

When offering the course as a distance education offering the maximum enrollment will be 20 students. The maximum size of the class is determined by the need for faculty feedback and the challenges faced with providing such feedback via distance education such as email, bulletin boards, telephone, etc.

C7. Does any professional society recommend enrollment limits or parameters for a course of this nature? If they do, please quote from the appropriate documents.

There is no indication by the Related Accreditation Commission (RAC) of the Accreditation Board for Engineering and Technology (ABET) of any limitation on enrollment for a course of this nature.

Section D: Miscellaneous

Include any additional information valuable to those reviewing this new course proposal.

Not applicable.

Distance Education Course Approval Questionnaire
(Attach to course proposal)

Course: SAFE 443 Construction Safety 3sh

Instructor of Record: Dr. Lon Ferguson

Criteria used for Department review of course format as listed under the CBA Article 42, Section B, 2.

1. Will a qualified instructor teach the course?

Dr. Lon Ferguson will be an instructor of this class. Dr. Ferguson is an Associate Professor with over 8 years of teaching experience in the Safety Sciences Department at IUP. Prior to IUP, Dr. Ferguson spent over 12 years as a safety and health consultant for the PA/OSHA consultation Program and Liberty Mutual Insurance. Dr. Ferguson has developed and taught two distance education courses in the Safety Sciences Department over the past three years. A resume for Dr. Ferguson is attached.

2. Will the technology serve as a suitable substitute for the traditional classroom?

Distance education technologies (the world-wide-web, video, audio, and printed media) have been compared to traditional classroom instruction. The research consistently shows that the quality of the course and student outcomes is not affected by the media. They are however affected by the activities and interactions built into the course experiences.

This course will use the following format to achieve the best balance for web based learning:

- Constructive activities embedded within the course notes.
- Students will also be required to actively participate in on-line discussions. There will be questions embedded in the notes as well as weekly postings by the instructor. Students will critique each other's work and the professor will manage the discussion.
- Students will participate in live chat room discussions within groups assigned to work on collaborative projects.
- Instructor will be available at regular times for contact via telephone, email, or chat room.

3. **Are there suitable opportunities for interaction between the instructor and student?**

   As mentioned above, there will be several on-going opportunities for the student to interact with the instructor. These include interaction through the use of a course bulletin board, email, chat room, and telephone contacts. Many of the assignments discussed below require student interaction with both the instructor and fellow students.

4. **Will there be suitable methods used to evaluate student achievement?**

   Multiple assessment techniques will be used to evaluate student achievement. They will include at a minimum the following:

   - Timed tests using WebCT with password protection
   - Weekly assignments posted to the bulletin board
   - Comprehensive collaborative projects
   - Individual projects assigned to students and submitted via email
   - Chat room contributions by students
   - Chapter summaries and synthesizing of content, posted to the database

5. **Describe the evaluation methods to be used?**

   Several different evaluation methodologies will be used to evaluate this course. The instructor will be evaluated following the criteria outlined in Articles 12 and 42 of the Collective Bargaining Agreement (CBA). Both the Student Evaluation Instrument for Distance Learning and the Student Evaluation of Technology for Web Based (on-line) Courses, which were approved by Meet and Discuss on March 18, 1998, will be used to evaluate the class.

   The Student Evaluation of Technology for Web-Based (on-line) Courses form is specifically directed at the evaluation of technology. Research studies on web-based courses show a direct correlation between student satisfaction and the effectiveness of the technology used in the course. Therefore, an important part of the evaluation of this course is the evaluation of the technology.

   The second form, Student Evaluation Instrument for Distance Learning, has five separate sections. Section B "About the Course" and Section C "Student Satisfaction" are specifically directed at course items such as grading, course objectives, workload, and student learning.

   This individual course will also be evaluated internally by faculty and externally by the Safety Sciences Advisory Panel. The advisory panel meets on a semiannual basis and one of their responsibilities is evaluation of courses and overall programs. This committee is composed of twenty safety, health, and educational professionals, including four IUP faculty from outside the department.

RESUME

LON FERGUSON

260 Grandview Avenue
Indiana, PA 15701
(724) 463-6395

EDUCATION

Doctor of Education, University of Pittsburgh, graduated December 1994 with an overall QPA of 3.90. Dissertation: "An Examination of the Major Content Topics Included in Baccalaureate Safety Curricula".

M.S. Degree in Safety Sciences, Indiana University of Pennsylvania (IUP), graduated December,1986. Overall QPA 4.0 on a 4.0 grading scale.

B.S. Degree in Safety Management, IUP, graduated May, 1981 with an overall QPA of 3.36.

PROFESSIONAL POSITIONS

1/99-Present: **Indiana University of Pennsylvania (IUP):** Chairperson of the Safety Sciences Department. As the Department Chairperson, I am responsible for managing the Safety Sciences Department which includes nine teaching faculty and fifteen consultants in the PA/OSHA Consultation Program. The department offers three degrees, a B.S. and M.S. in Safety Sciences and a Certificate of Recognition in Safety Sciences. There are currently 175 students in the B.S. Program, 60 students in the M.S. Program and 15 students in the COR Program.

5/98-1/99: **Indiana University of Pennsylvania (IUP):** Director of the PA/OSHA Consultation Program which is administered by the Safety Sciences Department through a grant with the U.S. Department of Labor. Responsible for managing the program which included ten safety and health consultants providing OSHA Consultation Services to small businesses in Pennsylvania. Consulting services provided include mock OSHA inspections, safety training, accident investigations, safety program audits, etc. Formal reports including findings and recommendations are submitted following each consultation visit. As Director, I was responsible for reviewing all reports and for managing the budget that was slightly over one million dollars.

8/94-5/98: **Indiana University of Pennsylvania (IUP):** Associate Professor, Safety Sciences Department. Teach undergraduate classes in Introduction to Occupational Safety & Health, Principles of Industrial Safety I & II, Evaluation of Safety Program Effectiveness, Risk Management, Electrical

Safety, Principles of Fire Protection, Training Methods and Safety Internship. Teach graduate classes in Quantitative Methods in Safety Management, Principles of Occupational Safety and in Applied Ergonomics.

8/92-8/94: **Millersville University:** Assistant Professor, Industrial Technology Department – Occupational Safety and Health Program. Taught undergraduate classes in Principles of Industrial Safety, Fire Protection, Legal Aspects of Safety and Safety Program Management.

4/90-8/98: **IUP:** Safety Consultant for the PA/OSHA Consultation Program which is administered by the Safety Sciences Department. I was a full-time consultant from 8/90 through 8/92 and part-time consultant during the summers of 1994 – 2000. Consulted with small businesses in Pennsylvania to provide a variety of safety services such as mock OSHA inspections, safety training, accident investigations, and safety program audits.

4/81-4/90: **Liberty Mutual Insurance:** Technical Consultant, Loss Prevention Department - Pittsburgh, PA. Consult with policyholders to identify loss areas and provide recommendations to reduce or eliminate these areas. Evaluations in safety, health, and fire related areas were made in the following industries: machining, forging, steel mills, transportation, fabricating, construction, plastics, and powder metals.

MEMBERSHIPS AND CERTIFICATIONS

- Certified Safety Professional (CSP) by the Board of Certified Safety Professionals of the Americas, January 1986-Present.
- Professional member of the American Society of Safety Engineers, May 1979 – Present.
- Member of the Related Accreditation Commission which is part of the Accreditation Board of Engineering and Technology, January 1998 - Present.
- Professional Inductee to Rho Sigma Kappa, IUP Safety Sciences Honor Society, inducted December of 2000.
- Member of Phi Kappa Phi, a National Honor Society, April, 1997 – Present.
- Certified OSHA 500 Trainer for Construction, March 2001.

- Member of the National Fire Protection Association International, August 2000 – Present.

- America's Registry of Outstanding Professionals, Feb. 2001.

- Strathmore's Who's Who, June 1998.

PUBLICATIONS

Ferguson, L.H. (2001), Marketing the occupational safety and health profession, Professional Safety, American Society of Safety Engineers, Des Plaines, IL, November.

Ferguson, L.H. & Wijekumar, K. (2000), Design and use of web-based distance learning environments, Professional Safety, American Society of Safety Engineers, Des Plaines, IL, December.

Contributing Author to Career Guide to the Safety Profession (2000) Joint publication of the ASSE and BCSP. Wrote the "Loss Control" section of the Chapter titled "Areas Where Safety Professionals Can Specialize."

Ferguson, L. H. (1999). An introduction to safety research. Professional Safety, ASSE, Des Plaines, IL, November.

Ferguson, L. H. (1998). Guidelines for a safety internship program in industry. Professional Safety, ASSE, Des Plaines, IL, April.

Ferguson, L. H. (1995). Evaluating baccalaureate safety curricula. Professional Safety, ASSE, November, 1995.

Ferguson, L. H. (1994). An examination of the major content topics included in undergraduate safety curricula. Dissertation - University of Pittsburgh, UMI Dissertation Services.

PRESENTATIONS (1997 - 2001)

Ferguson, L.H. and Wijekumar, K., "Using Chat Rooms as more than Social Gathering Places in Web-Based Learning," presented at the Penn State Faculty Academy Conference, June 19, 2001, State College, PA.

Ferguson, L. H. and Specht, P., "ABET Program Evaluator Training," presented at the ASSE Professional Development Conference in Anaheim, CA, June 12, 2001.

Ferguson, L.H., “Faculty Innovations in Teaching and Learning,” presented at the IUP University Libraries Annual Spring Planning Day, May 10, 2000, Indiana, PA.

Ferguson, L.H., “Accident Investigation,” presented at the Western PA Safety Council, March 29, 2000, Monroeville, PA.

Ferguson, L.H., “Ergonomics”, presented at the International Management Council, January 25, 2000, Indiana, PA.

Ferguson, L. H., “Accident Investigation” and “Safety Inspection” training seminars at Femco Machine Company in Punxsutawney, Pa on October 5, 1999. Approximately 25 plant supervisors and safety committee members attended this training presentation.

Ferguson, L. H., “Safety Audits” presented at the Western Pennsylvania Safety Council in April 1999. Approximately 25 Safety Professionals attended this presentation.

Ferguson, L.H., “Developing Effective Safety Training,” presented at the BarTech/BCI Safety Conference, September 21, 1998, Johnstown, PA.

Ferguson, L.H., “Ergonomics Workshop,” presented at VF Corporation, July 1998, Tampa, FL.

Ferguson, L.H., “Hazardous Conditions,” presented at the Joint Safety Committee Workshop, Sponsored by the Pennsylvania Center for the Study of Labor Relations, September 30, 1997, New Cumberland, PA.

Ferguson, L.H., “Organization/System Deficiencies,” presented at the Safety Pays Conference sponsored by the IUP Department of Safety Sciences and the Pennsylvania Center for the Study of Labor Relations, May 23, 1997, Indiana, PA.

Ferguson, L.H., “Guidelines for a Safety Internship Program,” presented at the Occupational Safety and Health Educators Conference, March 14, 1997, Los Vegas, NV.

CONFERENCES (1997 - 2001)

- Fifth Annual Occupational Safety and Health Educators Conference in Anaheim, CA on June 14-15, 2001, sponsored by the ASSE Practice Specialties Division.

- 40th Annual American Society of Safety Engineers (ASSE) Exposition and Conference in Anaheim, CA on June 11-13, 2001.

- Academic Department Chair Workshop at Slippery Rock University on May 16-17, 2001, sponsored by the SSHE.

- Graduate School Workshop, "Evaluating International Applicant Credentials" on April 5, 2001, sponsored by the IUP Graduate School.

- Western PA Safety Council in Monroeville, PA on March 27-29, 2001, sponsored by the National Safety Council.

- "Developing Your Own Rubric Guaranteed" IUP Reflective Practice Workshop, on March 31, 2001.

- OSHA 500 Trainer Course for Occupational Safety and Health Standards for the Construction Industry, sponsored by West Virginia University in Pittsburgh, PA on March 5-8, 2001.

- ABET Train the Trainer Workshop in Baltimore, MD on December 1, 2000, sponsored by ABET.

- Designing and Using Rubrics to Assess Student Learning, sponsored by the Reflective Practice Group at IUP on September 23, 2000.

- NFPA 202 Life Safety Code Seminar, sponsored by National Technology Transfer in Harrisburg, PA on August 17, 2000.

- 39th Annual American Society of Safety Engineers (ASSE) Exposition and Conference in Orlando, FL on June 25-28, 2000.

- Faculty Evaluation Seminar sponsored by the IUP School of Continuing Education on October 2, 1999 at the HUB Program Lounge.

- Teaching Philosophy: A Guide for Faculty Work sponsored by the Reflective Practice Group on September 24, 1999 in Sutton Hall.

- Web CT Training Seminar sponsored by the Instructional Design Center in August 1999.

- 38th Annual American Society of Safety Engineers (ASSE) Exposition and Conference in Baltimore, MD on June 13-16, 1999.

- 37th Annual American Society of Safety Engineers (ASSE) Exposition and Conference in Seattle, WA on June 14-16, 1998.

- Western PA Safety Council's Safety and Health Conference in Monroeville, PA on April 1-2, 1998.

- Second Annual Occupational Safety and Health Educator's Conference in Las Vegas, NV on March 11-12, 1998.

- Attended the Federal OSHA Consultation Conference in Albuquerque, NM on May 4-7, 1998.
- SPSS for Windows Workshop sponsored by the IUP Institute for Research & Community on January 15, 1998 and January 10, 1997
- Measuring Departmental Productivity, IUP Workshop on October 10, 1997
- Safety and Health Programs Assistance, training course sponsored by the University of Alabama on September 23-25, 1997.
- Teaching Teachers to Teach with Technology, IUP Instructional Design Center Workshop on August 25-29, 1997.
- Cooperative Learning in the Classroom, IUP Reflective Practice Workshop on May 30-31, 1997.
- Classroom Assessment Techniques in Active Learning, IUP Workshop on April 12, 1997.
- Western PA Safety Council's Safety, Health & Security Conference in Monroeville, PA on March 25-27, 1997.
- Instructional Technology: Creating Visions for the Future, IUP Workshop, on January 10, 1997.

Grants

- PA/OSHA Consultation Program, US Department of Labor – OSHA grant for $923,000, October 1998.

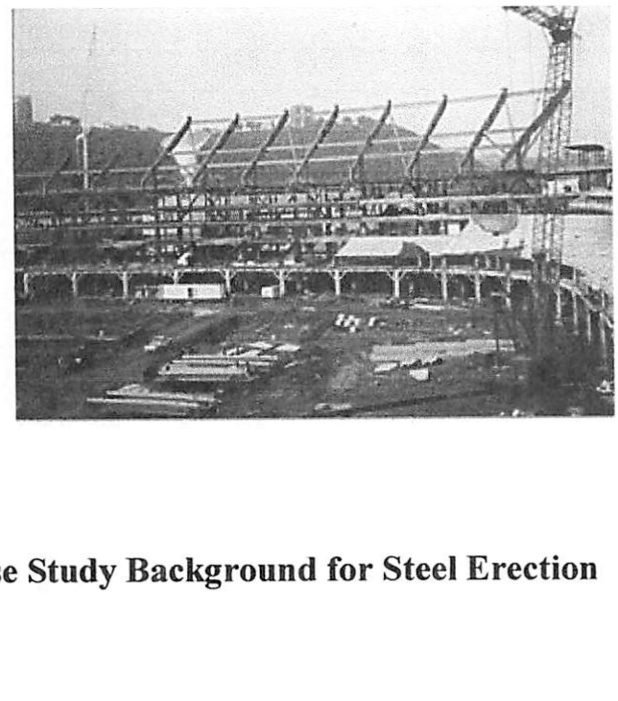
Module 4
Steel Erection

Introduction to the Module

Objectives and Scope for Module 4

After completing this module the student should be able to:

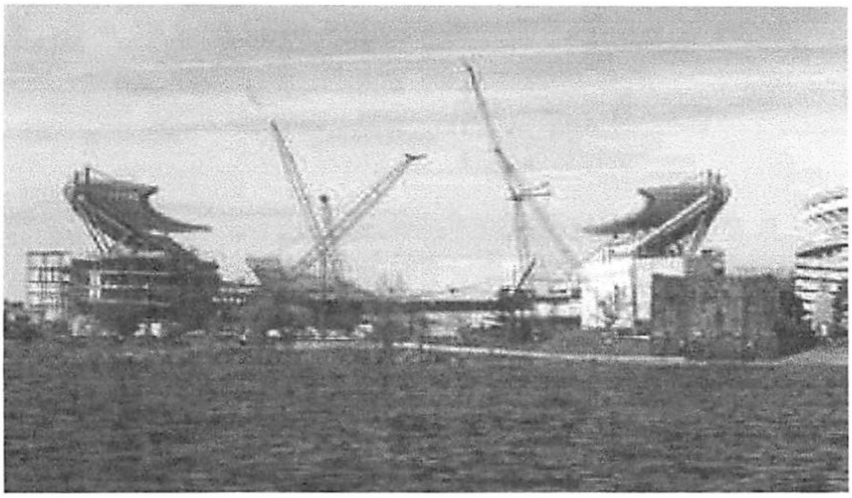
1. Describe the hazards involved in steel unloading and material handling and the controls that are necessary.
2. Identify the various causes of crane failure.
3. Discuss the proper safety procedures for crane use.
4. Evaluate the advantages and disadvantages of the three categories of rigging.
5. Determine the load and rigging requirements for a crane lift.
6. Discuss the new requirements of the revised OSHA Steel Erection Standard.
7. Describe the eight types of fall protection systems which meet the requirements of the OSHA Fall Protection Standard.
8. Identify the components that can be used in a personal fall arrest system and their maximum load limits.



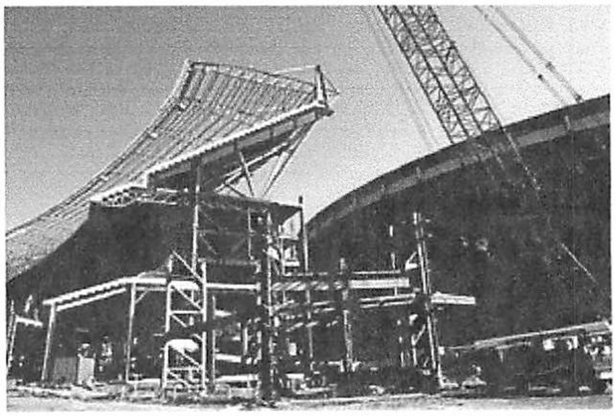
This module will cover steel erection. The scope of work completed during this phase of the construction job includes:

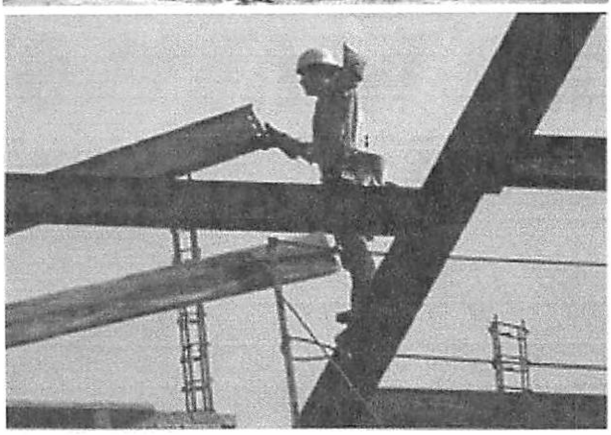
- Steel Unloading
- Material Handling including operation of cranes
- Steel Erection
- Decking

Case Study Background for Steel Erection



The construction site has become a lay-down yard full of structural steel, connecting bolts and slip connections. There are three cranes in operation at the site; a Triple 8, a 4100 Manitowoc with a Luffing Jib and a 65-ton hydraulic assist crane. All of the projects 12,000 tons of structural steel, 280 columns and 5200 beams have been delivered. Some of the longer beams are 10 - 12 feet in diameter with the heaviest beams weighing 70,000 lbs. These columns and tie beams are going to be erected onto the newly finished concrete footers. The footers were completed when the cement was poured through by the addition of long sill anchor bolts. These bolts were wired into place into the concrete forms by the iron workers. The goal is to match the bolt placement with the designed base plate of the columns. Once the column and beam steel is connected the forces are dispersed throughout the structural members.





Case Study for Module 4

Based on the above information and using the preplanning report format and the Word Document template provided, develop a report that identifies all major hazards and their corresponding controls for the work involving steel erection. The following text,

your assigned readings and assignments will assist you in developing this preplanning report which is due by noon Friday of the last week of this module.

NOTE: In the third section of this preplanning report focus on the "MAJOR" hazards during this phase not all the possible hazards that could exist. I would strongly encourage you to focus on say 5 major hazards rather then try and cover 10 hazards briefly!

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Module 4-Text

1. Steel Unloading

1.1 Hazards & Controls

One of the first things that happens on site during this phase of construction is the unloading of the steel . The placing of steel members should be designed so as to keep all elements organized based on their need in the schedule of erection. Often ironworkers and others become injured needlessly when they are fighting a pile of steel to reach a beam that has been placed at the bottom of the pile. Scheduling and an organized lay down area can greatly reduce this type of injury.

Industrial trucks are the primary mover of equipment on site. These machines will be in continuous motion to keep all tradesmen supplied with needed materials. The potential for both workers and pedestrians to be struck by these trucks is a hazard that must be evaluated. The controls for industrial trucks and their operation are detailed in Module 2.

2. Material Handling

2.1 Hazards

Iron workers and other tradesmen may occasionally have to move materials by hand without the use of an industrial truck. They are then exposed to all the hazards involved with the manual lifting of heavy steel, see photo.

The most common type of injury associated with manual lifting is a back strain or sprain.

2.2 Controls

A training program should be established to inform all employees of the hazards and injuries that occur from manual material handling. Employees are to be trained on the following:

- Alerting employees to the dangers of manual lifting
- How to avoid unnecessary bodily stress and strain through proper body mechanics.
- Teaching comfortable lifting weights.
- Proper use of equipment where applicable
- An awareness to recognize potential hazardous conditions and how to prevent or reduce them.

Proper lifting technique is a vital element of the training program due to the frequency of back injuries on construction sites. The employee shall be trained on the basic anatomy of the body, physical limitations, individual body strengths, the recognition of physical pains or warning signs that could indicate injury, and the safe use of handling devices.

Additional information on training workers in sage lifting and manual material handling on construction sites is available in Module 4 of your course packet.

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3. Crane Inspection and Use Requirements

3.1 Pre-Work Crane Inspection

Module 2 discussed the importance of hiring a reputable heavy equipment rental company to supply the equipment needs on the job site. This is also true for the rental of all cranes and industrial trucks. The contractor superintendent must ensure that all equipment on the site has been thoroughly inspected and maintained by the rental company. If the equipment is owned by the construction company then that company's equipment/maintenance department must be held to the same standards as applied to the rental companies. The construction superintendent is also responsible in the hiring of trained and competent operating engineers to operate, inspect and maintain this equipment.

OSHA requirements stated in 29 CFR 1926.550 (5) (A):

The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, during use, and be sure it is in safe operating condition. Any deficiencies will be repaired, or defective parts replaced, before continued use..

The equipment is inspected:

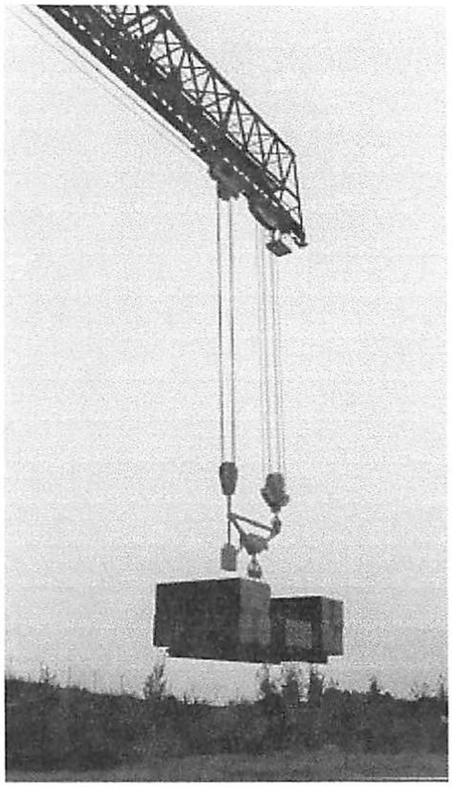
- Daily before each shift by the operating engineer
- Prior to any large or unusual lifts that place mass load on the crane
- When required due to conditions outside of normal operations
- When required due to wear or maintenance deficiency
- Monthly, with a closer look at all mechanical elements

These daily, shift and monthly inspections are tracked through the use of a Crane Inspection form that is either job made or available from the rental company. Crane manufacturing companies can be contacted and an inspection form can be requested for a specific type of equipment. The Operating Engineer (OE) Foreman shall be made responsible for enforcing the inspection of all equipment from his crew. OE Foreman shall be responsible for collecting the daily inspection sheets and submitting them to the project safety coordinator. All inspection sheets become project records and shall be saved through the completion of the construction project.

OSHA 29CFR 1926.550 (A) (6) requires:

A thorough annual inspection of the hoisting machinery shall be made by a competent person or by a government or private agency recognized by the U.S. Department of Labor. The employer shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

The attached examples of crane inspection forms list what items are inspected.



3.2 Requirements for a Crane Operator

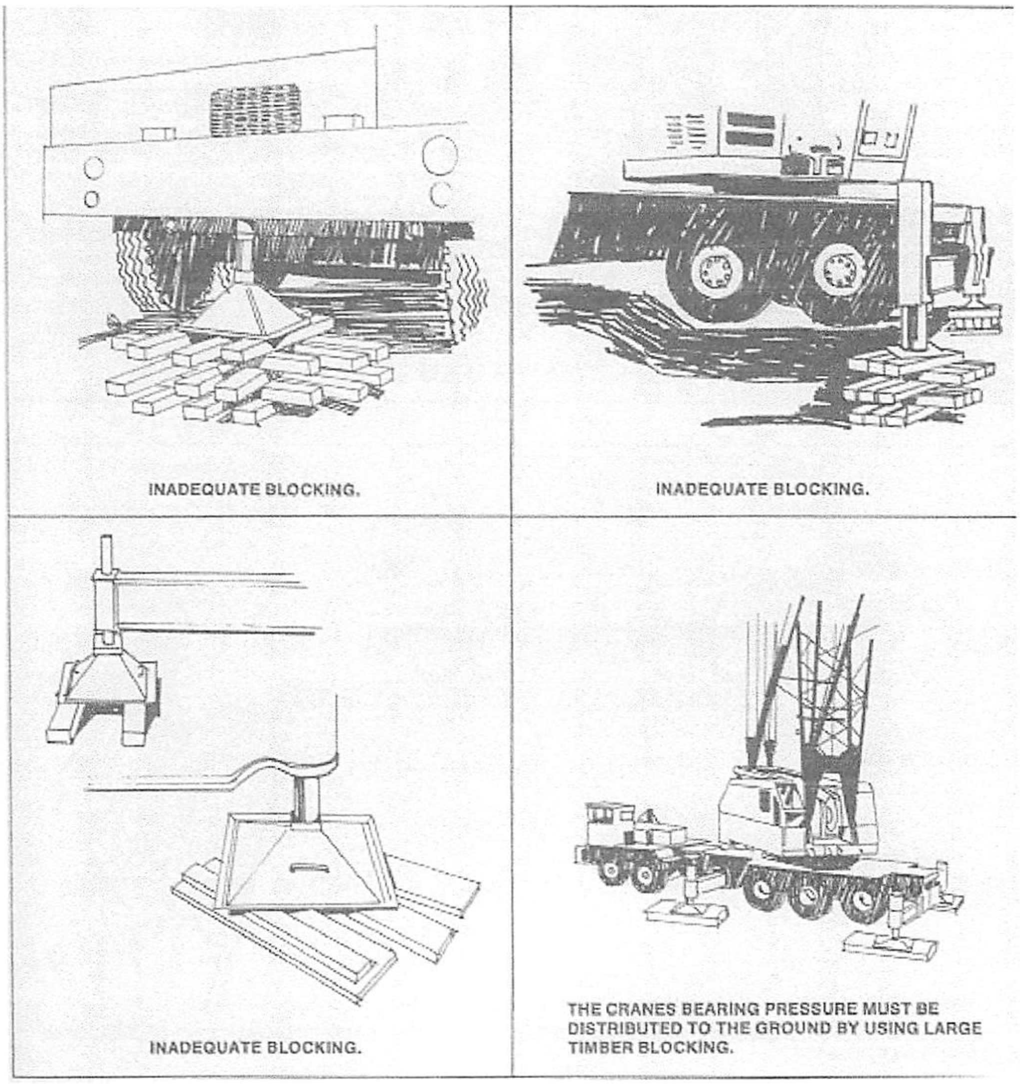
The crane and all heavy equipment have passed pre-work inspection and are on site. The construction superintendent has contacted the Operating Engineers Union and requested employees. It is important that the union be made aware of the equipment to be used on site and the scope of its use. The union will then select employees with skills and experience to match the work projected. As the Safety Coordinator, it is your responsibility to require the Operating Engineer Foreman to verify the training, experience and ability of all hired OE's.

Only a trained and authorized operator shall be permitted to operate a crane. The following criteria are used to evaluate the ability of all hired crane operators:

- Physically - good vision, hearing, coordination, and capable of safely performing all crane functions required in the operation of selected machine. An element of the physical ability is the successful completion of a pre-hire substance test.
- Mentally - able to understand and apply established rules, regulations, and safe practices. Be alert, using good judgment for safety to themselves and others. A desire to perform the job correctly and in a responsible manner.
- Emotionally - be calm and capable of withstanding stress. The ability to make judgments concerning their own physical and mental conditions.
- Trained - Operators are to have read and understand the specific crane's operation manual, load rating chart, hand signal chart, warning decals. Operators are to be skilled and knowledgeable in all operational and maintenance aspects of the machine.
- Licensed - Some states require the Operating Engineer to pass a state administered test and become licensed.

3.3 Crane Operations

The operator is in charge of the crane, management can force an operator to make a lift but the professional operator can stand down from the crane and refuse if the lift appears to dangerous. The operator watches the iron workers rig the load and gauges the size of all slings, chokers and attachments for appropriateness for mass of load. The crane operator must inspect the site to locate utilities, adjourning structures or surface encumbrances. The operator must be aware of vehicular traffic and railroad activity. Soil and ground conditions are to be evaluated prior to driving or erecting a crane on a specific piece of land. The supporting surface underneath the crane or any heavy equipment must be level, firm, and stable to support the weight of the machine and suspended load. Conditions are to be evaluated so as to predict soil changes that could result in unsafe conditions. Timber mats and steel plate are often used to establish a safe surface to mount or establish the crane.



INADEQUATE BLOCKING.

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THE CRANES BEARING PRESSURE MUST BE DISTRIBUTED TO THE GROUND BY USING LARGE TIMBER BLOCKING.

The crane must be made level prior to any lifting activity. Often the crane cab has a level indicator mounted with the instrument panel. This displays the horizontal level of the equipment, and a red zone where no lifts shall be attempted until the crane is more level according the crane manufacturer's specifications.

A crane is rated by the Maximum amount of weight it can lift at a Minimum radius and with Minimum boom length. An example of this is a 30-ton mobile hydraulic crane having the capacity to lift 60,000 pounds approximately ten feet from the center pin radius of the crane. A distance that close means that the weight would most likely be sitting on the crane decking, not the ground.

Capacities are based on ideal conditions such as the crane being on level ground, with out riggers fully extended placing the crane fully off of the tires, no wind or side loads. If the boom length is 80 feet with the load at a distance of 25 feet from the center pin the lifting capacity is greatly reduced to 14,950 pounds. This same crane can only lift 4800 pounds with the load 74 feet from the center pin and the boom extended 80 feet. When selecting a crane or designing a lift this simple rule applies: "The farther the load from the center pin, the less the crane can safely lift."

Other factors that can reduce a crane's lifting ability or safety features include the following:

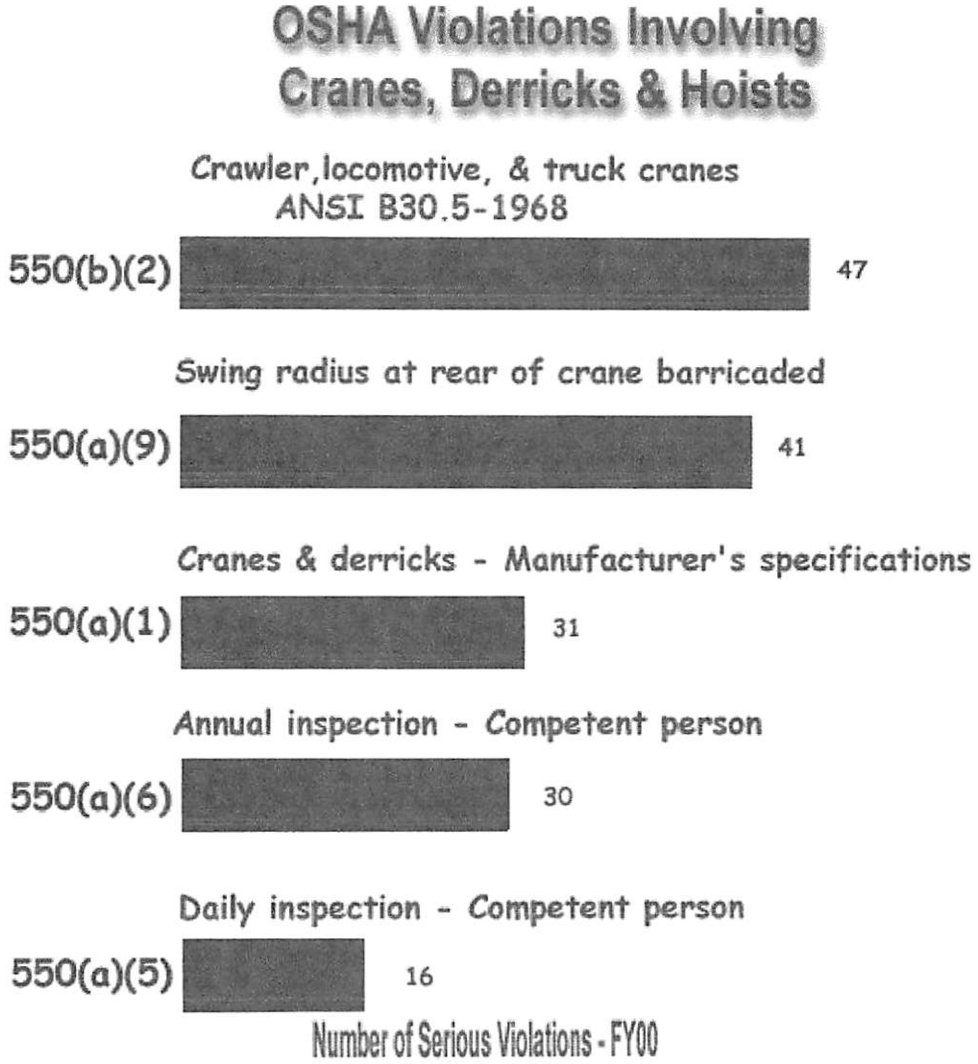
- Cranes not using outriggers can lift less and be influenced to fall due to side loads being greater.
- Side lifting greatly reduces the lifting ability.
- The use of jibs or boom attachments can reduce lifting capacity.
- The wire rope and the number of lengths in use play an important role in lifting capability. A crane hook that runs several lengths of cable through the block has much greater lifting capability than a single cable hook. The rigging elements of crane work always play a role in safe lifting. Chokers, slings, lifting beams and shackles all are integral in performing safe lifts.

The cranes typically will unload the delivery of structural steel from the flat bed trucks and then hoist the columns and beams into place where they are connected by iron workers. This operation sounds simple but in fact involves many hazards to personnel and materials. The mass of these steel members and the proximity of iron workers to the steel creates a situation where if an accident were to occur the likelihood of an injury or fatality is great.

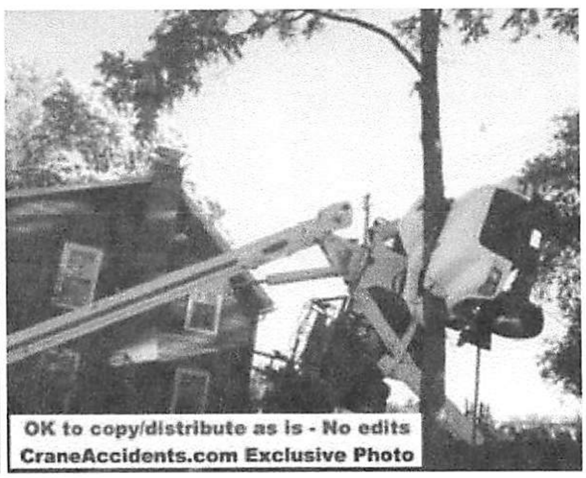
Proper safety procedures require that the 'swing radius' of the counter weight be barricaded to ensure that personnel are not injured when the cranes rotates. When barricading is not performed, too often personnel are injured or fatally crushed when the operator rotates the crane. Load Swing Out occurs when the lift is made too quickly and the load swings away from the crane and causes the load force to shift away from the safe zone of the crane. This is to be avoided, results include boom collapse or the crane tipping forward.

An illustration of the components for several different types of cranes is attached.

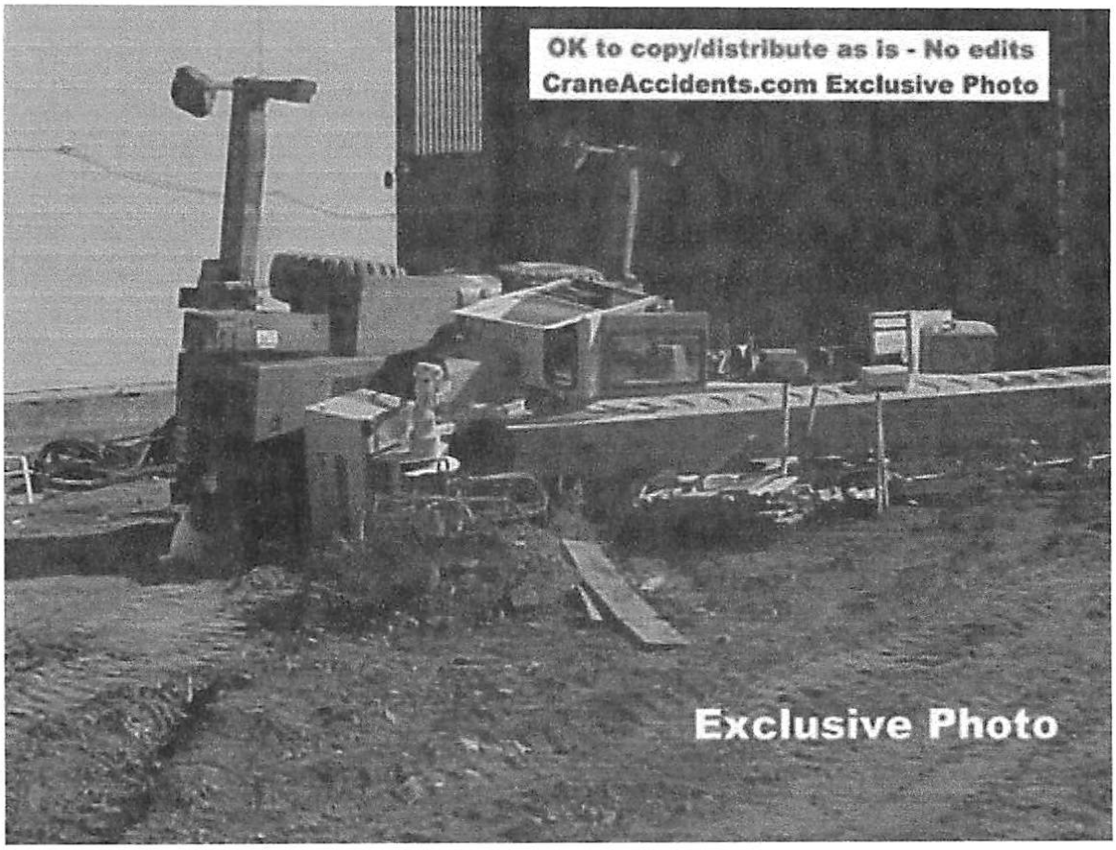
3.4. OSHA Violations - Cranes and Hoists



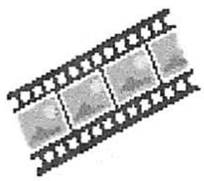
Dramatic failure such as load shifting that results in a dropped load is always a potential on a construction site. Aside from acute failure, most crane incidents caused from equipment problems can be prevented through a complete system of inspection, maintenance and auditing of work performed.



Crane stability is of utmost importance. If a crane is out of level and a lift is attempted, the suspended load will cause side-load on the crane boom and can result in boom collapse or crane tip over. Lesser damage can occur such as weakening the structural integrity of the boom and components. This damage is hard to detect and might result in a failure at some future time.



Case in Point: What happened on July 14,1999?



Click here to see video

The collapse of "Big Blue", the Lampson Trans-Lift 1500 series crane at Miller Park in Milwaukee, Wisconsin on July 14, 1999 resulted in the deaths of three iron workers. Big Blue measured 467 feet in height and had a lifting rating of 1500 tons. Known as the "mother of all cranes", Big Blue was one of only six cranes of this class in use in the world. Big Blue was attempting to position a 400-ton right field roof panel into place. The roof section was elevated and was in the process of being lowered into place when failure occurred.

The accident, aside from the fatalities, resulted in awarding a $1.87 million contract for demolition and debris removal from the site and the fabrication of 1500 tons of replacement steel. A new crane, a Demag CC-12600 crane with an overall height of 557 feet, a weight of 2,400 tons and a load rating of 1,600 tons arrived on site on November 10, 1999 to complete construction of the stadium. The scheduled date for the ball park to open was moved from April 2000 to one year later with a new date of April 2001.

On January 12, 2000, The Federal Occupational Safety and Health Administration issued 20 citations for safety violations against three construction companies involved in the fatal Big Blue accident. OSHA levied fines totaling $539,800. On December 1, 2000 the three widows of the deceased iron workers were awarded $99 million as a result of legal action.

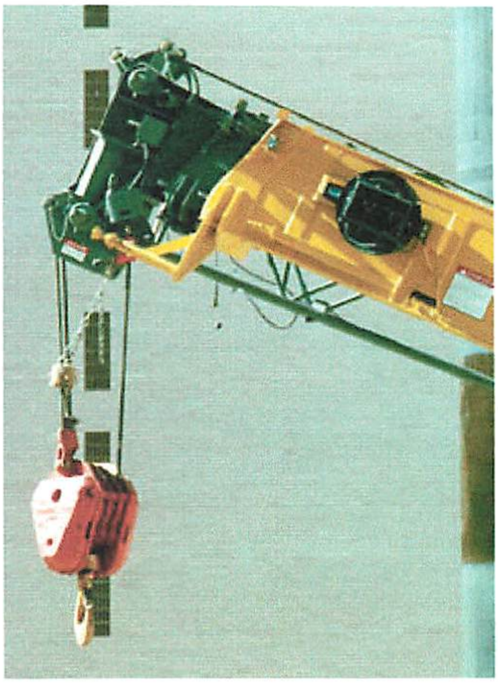
Assignment 1

Do a search of the Internet and review information about the "Big Blue" collapse. List three possible causes for this accident. Then list three corrective measures that could have prevented this accident. Email your answers to your professor by noon Friday of this week. If you attach a Word document to the email, remember to include your name in the document file name.

Crane Tipped Forward

3.5 Two Blocking

The term 'Two Blocking' is used when the hook block collides with the crane main boom head. A safety device is required on all cranes that stops operations when the block touches the instrument, this is called the 'anti two-block' by tradesmen. This device prevents the wire rope being damaged from acute impact, which could result in a dropped load. The safety professional should be sure the anti two-blocking device receives proper attention during inspections and maintenance.



Anti- Two Block Device

3.6 Electrocution

Electrocution is a serious hazard associated with crane use, Module 2 covered this topic in detail.

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4. Rigging

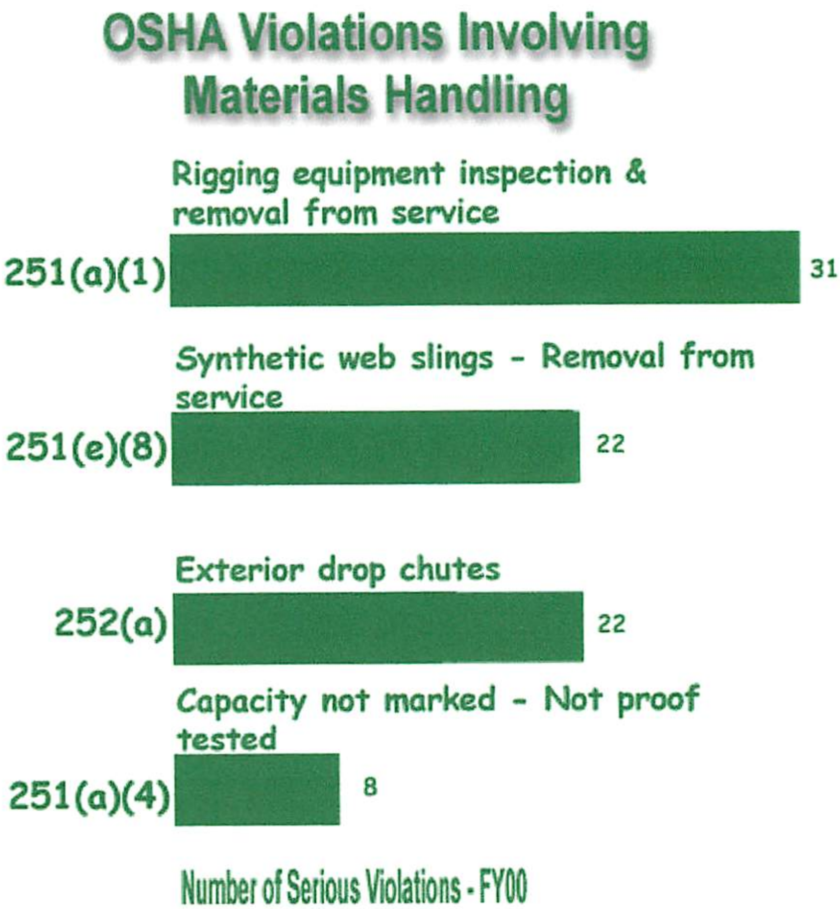
4.1 Rigging Responsibilities

The iron workers are the primary trade for rigging and crane work. Union locals often want the rigging responsibilities and argue with management to shift such responsibilities. The riggers are in charge of every load when on the ground. As the lift goes airborne, the IW is situated in such a way that visual, radio or both means of contact are established with the operator.

Only one signal man should be designated and used to prevent conflicting signals when lifting the load. Never leave a suspended load in the air, and never allow work to be performed under a suspended load. Use the following link to review the most common lifting hand signals in use in the United States, established by the American National Standards Institute (ANSI).

4.2 Types of Rigging

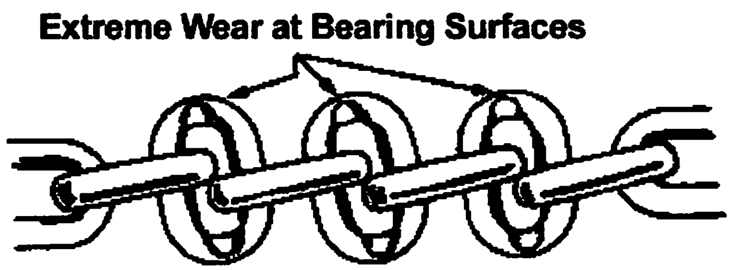
Rigging is defined as the crane hook and all lifting devices below the hook and is a common failure point for falling loads. The inspection of all rigging and lifting equipment is of utmost importance. Damaged equipment must be destroyed promptly to eliminate possible future use. Factors such as fatigue, wear, abrasion, corrosion, and kinking lead to rigging degradation and increase the associated risk. All slings, shackles and rigging equipment must have a capacity tag.



Rigging is comprised of six types of slings: chain, wire rope, metal mesh, natural fiber rope, synthetic rope, and synthetic webs. The tradesmen on a construction site will ask for a sling and in those times are mostly referring to a synthetic sling. For inspection purposes these slings are categorized into three groups; they are chains, wire and fiber rope and synthetic webbing. These categories are informally established based upon wear resistance, corrosion resistance, and longevity.

4.3 Chains

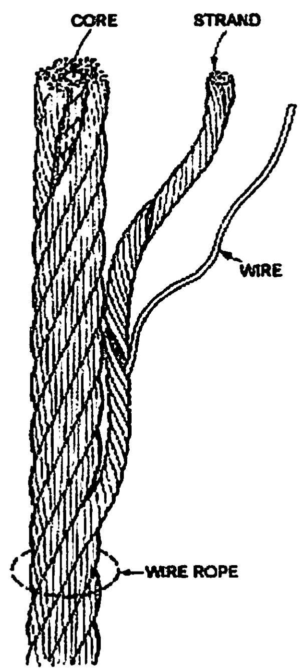
Chains are commonly used because of their durability, ability to adapt to the shape of the load, and for loads or environments where extreme temperatures are present. Chains can become damaged from shock loads that could damage the 'weakest link' by stretching the link leading to failure. Chain links are also susceptible to wear due to their longevity.



Worn Chain Link

4.4 Wire Ropes

Wire ropes are composed of individual wires that have been twisted into strands. The strands are then twisted to form a wire rope wrapped around a core fiber. The lay of a wire rope is defined by the direction in which the strands are laid into the rope, and also by the direction in which the wires are laid into the strands.



Wire ropes slings are selected based upon four criteria.

- Strength
- Ability to bend without distortion
- Ability to withstand abrasive wear
- Ability to withstand abuse.

Strength

Strength of a wire rope is a function of size, steel grade and construction. The wire rope sling will be assigned a maximum load limit. This maximum load limit is determined by a multiplier, which is used to divide the maximum load down to a working load limit. For example if a wire rope sling has a strength of 10,000 pounds and a design multiplier of 5, the working load limit would be 2000 pounds. A design factor of five is common for wire rope slings.

Fatigue

Wire rope has the ability to withstand repeated bending up to a limit. Excessive bending can result in fatigue failure especially when a rope makes a small radius bend. This fatigue breaks individual wires that can call for the destruction of the sling after inspection. The best way to prevent this fatigue is to use 'softeners' or padding to increase the bend radius around the load. 'Softeners' are often segments of discarded automobile tires cut into one to two foot sections.

Abrasive Wear

The ability of a wire rope to withstand abrasion is based upon the size, number of wires and construction of the wire rope. Smaller wires bend more readily, offering greater flexibility but have a lesser ability to withstand wear. Conversely, larger wires resist wear better but lack bending properties.

Abuse

Abuse and misuse are the leading factors that result in wire rope slings becoming unsafe. Abusing the wire rope can cause structural damage. This can cause 'bird cages' which reduce the lifting strength. Bird caging is when the outer strands of the wire rope are forcibly untwisted and spread outward.

Bird Cage

Wire ropes must be inspected daily, before each shift. Length, ends and couplings must be inspected. Many operation forces affect wire rope life such as bending, stresses, loading and coupling, jerking, and history of previous use.

OSHA has stated the following guideline:

"A wire rope fails the inspection if ten (10) randomly distributed wires in one lay are broken or if five (5) wires in one strand of rope lay are damaged."

Additional information about wire rope lays can be found in the Wire Rope Discussion Guide in your Course Packet under Module 4. End fittings and couplings must also be inspected. It is important that all tradesmen are involved in this inspection process. Damaged slings and lifting devices must be removed from