Design for Constructibility

Course Number: ST-02-205

PDH: 3

Approved for: AK, AL, AR, FL, GA, IA, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WI, WV, and WY

State Board Approvals

Florida Provider # 0009553 License #868
Indiana Continuing Education Provider #CE21800088
Maryland Approved Provider of Continuing Professional Competency
New Jersey Professional Competency Approval #24GP00025600
North Carolina Approved Sponsor #S-0695
NYSED Sponsor #274

Course Author: Mathew Holstrom

How Our Written Courses Work

This document is the course text. You may review this material at your leisure before or after you purchase the course.
After the course has been purchased, review the technical material and then complete the quiz at your convenience.
A Certificate of Completion is available once you pass the exam (70% or greater). If a passing grade is not obtained, you may take the quiz as many times as necessary until a passing grade is obtained).
If you have any questions or technical difficulties, please call (508) 298-4787 or email us at admin@PDH Pro.com.

1.0 INTRODUCTION

As time has passed, technological advancements and heightened environmental awareness have led bridge designers to increase the maximum span lengths typically associated with a particular bridge type. For example, with the introduction of High-Performance Steels over the last decade, steel plate girder bridges are becoming the structure of choice for spans up to 500 feet in length. The use of these higher strength steels in obtaining such long spans creates the need for designers to consider additional aspects associated with the construction of the bridge. All too often, bridge designers concern themselves only with checking the stability and member stress levels in the structure for the in-service condition after erection of the entire superstructure is complete. But many times, the critical stress in a particular component is encountered during the erection of the bridge where large unbraced lengths affect the stability of the partially completed structure. This course describes typical erection methods and procedures and highlights some of the aspects that should be considered by the designer. With this basic knowledge, the bridge designer can determine which, if any, of these aspects are a concern for his/her particular design situation.

2.0 GENERAL

Bridge erection takes on many forms based on the site, the complexity of the structure, the availability of equipment, and the expertise of the erection contractor. In the following paragraphs, basic erection equipment is discussed with specific examples shown for different bridge types including considerations regarding the access to and topography of the construction site.

2.1 Equipment

Cranes come in various types and sizes. Each type of crane has specific advantages and disadvantages depending on numerous variables such as pick weight, pick height and radius, number of picks, site access, site location, constraints, etc. The following crane types are used in typical bridge erection:

Mobile hydraulic cranes are used for light- to medium-weight picks up to 650 tons. These cranes are used where the site is readily accessible via existing roadways, where pick heights are relatively low, and where crane area is limited. A typical application would be in the replacement of an existing grade separation bridge. These cranes come in a wide variety of sizes such that the appropriate crane can be used for the given pick weight and space availability. The set-up and tear down is quick through the use of telescoping hydraulic outriggers. In addition, the mobility and reach is versatile due to the telescoping boom and 360 degree rotational capability.

Figure 1 Photograph of a mobile hydraulic crane

Mobile lattice boom cranes are used for light-to medium-weight picks up to 300 tons. These cranes are used when the site is accessible via existing roadways and where pick heights are high. Through the use of telescoping hydraulic outriggers and self-assembly capabilities, the set-up and tear down is quick compared to other crane types, generally one to two days for assembly of multiple trailer loads. In addition, the reach is versatile with 360-degree rotational capability. It should be noted that mobile lattice boom cranes and mobile hydraulic cranes cannot move once the pick is lifted.

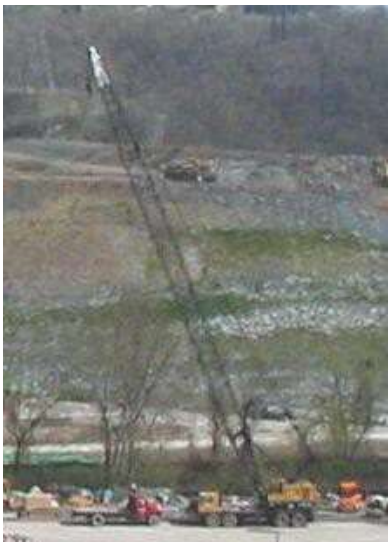

Figure 2 Photograph of a mobile lattice boom crane

Lattice boom crawler cranes are used for light-to medium-weight picks up to 300 tons. These cranes are used where the site is typically unfinished terrain and where pick heights are high (up to 400 feet). A typical application would be in the erection of a new bridge over a stream valley. These cranes come in a wide variety of sizes such that the appropriate crane can be used for the given pick weight and height requirements. The set-up and tear-down is long and labor intensive due to the number of components that must be site-assembled to meet hauling and site access restrictions. Once assembled, the mobility and reach is versatile with 360 degree rotational capability. In addition, crawler cranes are able to travel with the load lifted.

Figure 3 Photograph of a lattice boom crawler crane

Lattice ringer cranes are used for heavyweight picks up to 1,400 tons. These cranes are used where the site is typically unfinished open terrain and where pick heights are high (up to 400 feet). Typically, once assembled the crane is immobile due to the track work used to support the massive counterweights. A typical application would be the erection of a new bridge over a wide river or bay where the crane could be mounted onto a barge. By mounting the crane on a

barge, it becomes mobile increasing its versatility and ultimately making it more productive. The set-up and tear-down is long and labor intensive due to the number of components that must be site-assembled to meet hauling restrictions.

Figure 4 Photograph of a lattice ringer crane

Tower cranes are used for lightweight picks up to 20 tons. These cranes are used where no mobility is required and excessive vertical heights must be overcome. A typical application would be in the construction of a tower for a suspension or cable stayed bridge. These cranes come in a wide variety of sizes to meet the need for a particular height and reach. The setup and tear-down are extremely long due to the assembly process. Quite often, a separate foundation must be constructed to support the base of the tower leg. Once in place the crane can be highly productive in delivering materials to the elevation required. Some models come with self-jacking tower legs that allow the crane to adjust its height as construction progresses.

Figure 5 Photograph of a tower crane

Purchase this course to see the remainder of the technical materials.