MAXIMUM REACH ENTERPRISES
1853 Wellington Court
Henderson, NV 89014
Ph: 702 547 1564
kent.goodman @ cox.net
www.maximumreach.com

24 August 2012

CRANE STUDY PROGRAMS

Usually, before a Rigging Engineer or a Designer starts an ACAD rigging drawing, he wants to know what cranes will work for a certain lift and which one will work best. This is why I developed the four crane study programs on my website. By making a simple sketch of the lift, not necessarily to scale, several cranes can be compared in a few minutes by using the appropriate crane study program. After a crane is selected as the lift crane, then the elevation view on the rigging drawing can be completed using the results from the crane study printout. The rest of the rigging drawing can also now be completed.

When I finished the two Off Center Reach programs, one of the drawings that I used as a check print to make sure that the two programs were giving good answers, was from an actual project.

Drawing number 1 shows setting the nacelle for a Wind Turbine on a 65 m tower using a Liebherr LR 1400 Luffing crane. The chart showed that the lifting capacity was at about 80% at a 55’ radius and with the boom positioned at an 87 ° angle. Note that the height from the ground to the top of the nacelle was 225’ and the distance from the front face of the nacelle to the CG was 8’.

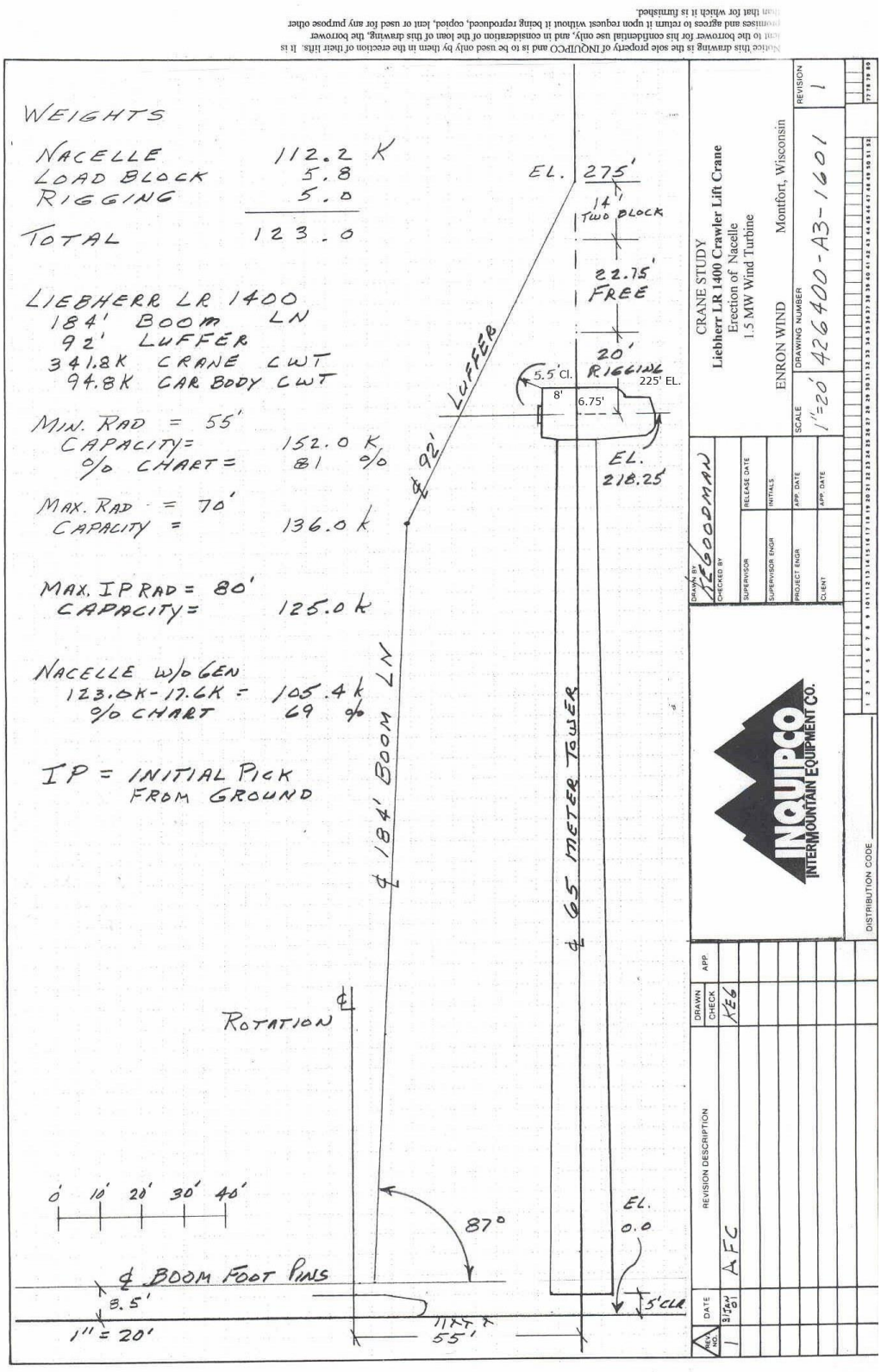
I first made a run using the Off Center Reach program for Tower & Luffing Cranes by setting the boom at a 87 degree angle, setting the structure height to 225’, the distance from the structure to the center pin to 47’ and the depth of the structure to 8’. I then changed the 92’ jib offset **angle** until the boom length was approximately 184’. The program then calculated the reach for both the boom & jib, the boom & jib clearances, the distances above the structure, etc. See printout number 1.

I then made a second run using the Off Center Reach program for Conventional & Hydraulic cranes, but instead of being able to set the boom angle with the other input information, I had to change the clearance between the bottom of the boom and the structure until the boom angle was 87 degrees. Then I changed the jib offset angle until the boom length was 184’. The program then calculated the same output as the TOWER CRANE program. See printout number 2.

Drawing number 2 is a marked up drawing showing the dimensions from the printouts verse the scaled dimensions on the drawing. The calculations on the drawing are for checking the clearance between the bottom of the boom and the structure (the load in this case) and the bottom of the jib and the load. I found that the scaled dimensions and the calculated dimensions were very close, close enough for bridge work. From this

comparison, I am confidante that the programs are more accurate than my scale drawings. No matter how good a drawing is made to scale, the width of a pencil line can be several tenths of a foot one way or the other.

DRAWING NUMBER 1



PRINTOUT NUMBER 1

OFF CENTER REACH FOR TOWER & LUFFING CRANES v0.1

COMPANY: Maximum Reach **PROJECT:** MontfordNacelleErection65mTow

CRANE MAKE AND MODEL: Liebherr LR 1400-crawler crane **All values are in FEET**

4.92	Distance from Centerline of rotation to boom foot pins
8.50	Distance from bottom of tracks or tires to boom foot pins
4.30	Boom, centerline to bottom
8.60	Boom width
87.00	Boom angle, degrees
2.00	Clearance between the side of the boom and the structure
6.94	Jib Depth
92.00	Jib Length
23.083	Jib Offset, degrees TIP: Change jib offset to increase/decrease boom length
225.00	Structure height
47.00	Distance from the structure to centerline of rotation
8.00	Depth of the structure
0.00	Off Center Width

OUTPUT FROM THE PLAN SKETCH:

8.00	Reach across the structure
47.00	Diagonal distance from structure to the centerline of rotation
55.00	Operating Radius: This is the same operationg radius as the jib

OUTPUT FOR THE BOOM IN COMBINATION WITH A JIB:

184.01	Boom length required
-32.45	Reach across the structure for the boom
-32.75	Distance Above Structure to boom tip sheaves
14.55	Operating Radius for the boom
26.39	Clearance between the bottom of the boom and the structure

OUTPUT FOR THE JIB:

8.00	Reach of the jib
63.92	Jib angle with the horizontal
49.88	Distance above the structure to the Jib tip sheave
11.28	Clearance between bottom of jib and structure
55.00	Operating Radius of the Jib

Calculated by www.maximumreach.com 8/13/2012

PRINTOUT NUMBER 2

OFF CENTER REACH FOR CONVENTIONAL & HYDRAULIC CRANES
v0.1

COMPANY: Maximum Reach **PROJECT:** MontfordNacelleErection65mTow

CRANE MAKE AND MODEL: Liebherr LR 1400-crawler crane **All values are in FEET**

4.92	Distance, Centerline of rotation to boom foot pins, enter negative value for hydraulic cranes
8.50	Distance from bottom of tracks or tires to boom foot pins
4.30	Boom, centerline to bottom
8.60	Boom width
0.00	Boom tip Sheave offset
2.00	Clearance between the side of the boom and the structure
26.39	Clearance between the bottom of the boom and the structure
6.94	Jib Depth
92.00	Jib Length
23.083	Jib Offset, degrees TIP: Change jib offset to increase/decrease boom length
225.00	Structure height
47.00	Distance from the structure to centerline of rotation
8.00	Depth of the structure
0.00	Off center width

OUTPUT FOR BOOM ONLY:

8.00	Reach across the structure for the boom
47.00	Diagonal distance from structure to the centerline of rotation
55.00	Operating Radius of the boom. This is the same operating radius as the jib
87.00	Boom angle, degrees
956.76	Boom length required
738.95	Distance above the structure to boom tip sheaves

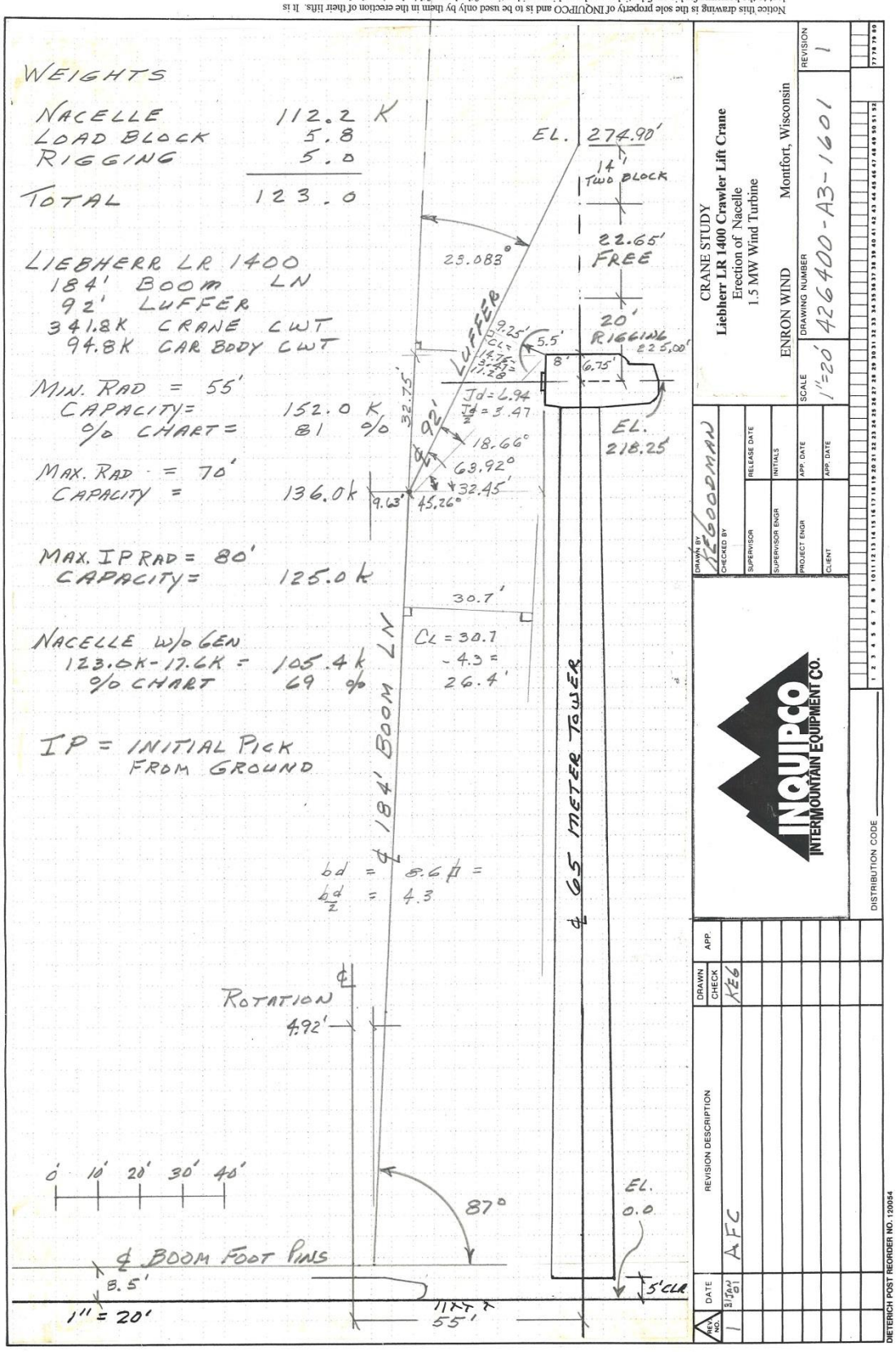
OUTPUT FOR BOOM IN COMBINATION WITH A JIB:

183.97	Boom length required
-32.45	Reach across the structure for the boom
-32.79	Distance above the structure to the boom tip sheaves
14.55	Operating radius of the boom

OUTPUT FOR THE JIB:

8.00	Reach of the jib
63.92	Jib angle with the horizontal, degrees
49.84	Distance Above the structure to the Jib tip sheave
11.26	Clearance between bottom of jib and structure
55.00	Operating Radius of the Jib

DRAWING NUMBER 2



CRANE STUDY
Liebherr LR 1400 Crawler Lift Crane
Erection of Nacelle
1.5 MW Wind Turbine
ENRON WIND Montfort, Wisconsin

DRAWING NUMBER 426400-A3-1601
SCALE 1"=20'
REVISION 1

DRAWN BY JEGOODMAN
CHECKED BY
SUPERVISOR RELEASE DATE
SUPERVISOR ENGR INITIALS
PROJECT ENGR APP. DATE
CLIENT APP. DATE

INQUIPCO INTERMOUNTAIN EQUIPMENT CO.

DISTRIBUTION CODE

REV. NO.	DATE	REVISION DESCRIPTION	DRAWN	APP.
1	3/12/01	AFC	CHECK	

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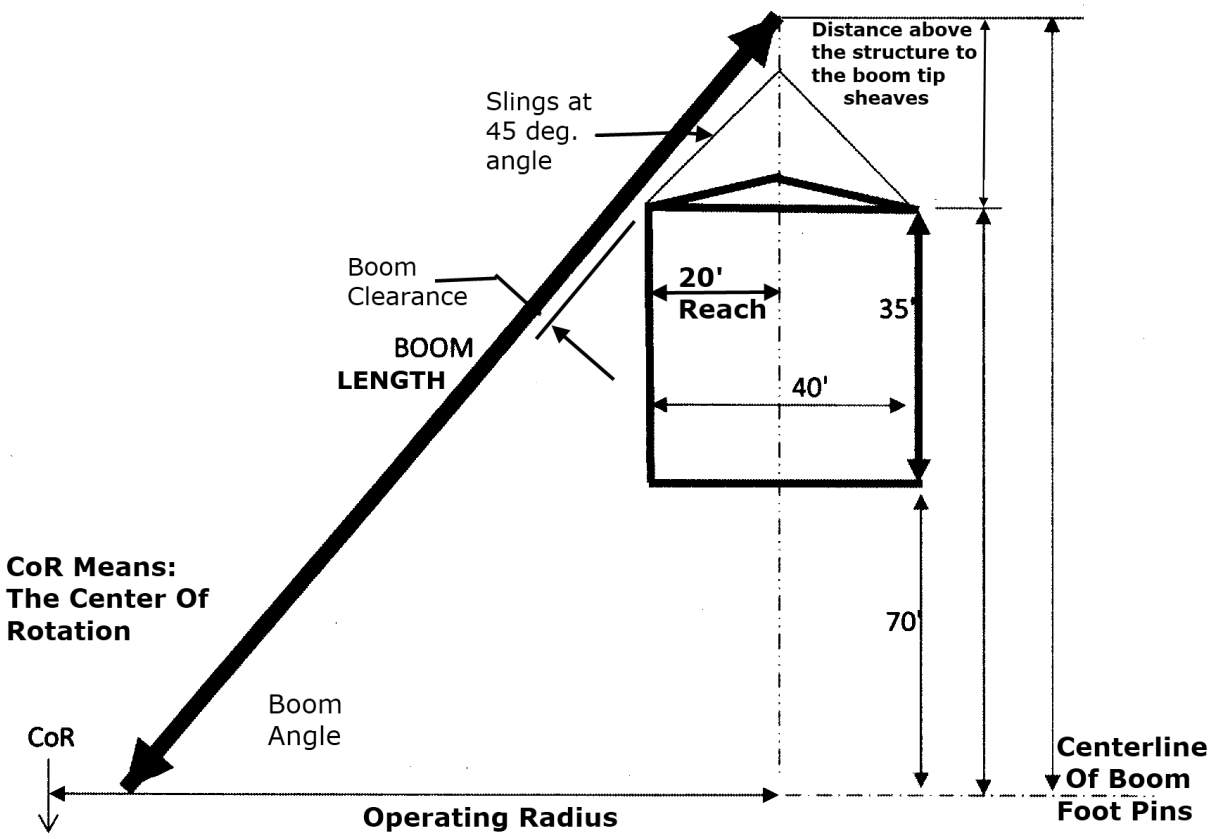
CRANE STUDY QUIZ

Attached is a quiz that I thought you guys might be interested in solving. Some of the dimensions have been left off on purpose, so it will be up to you to solve for the missing dimensions. There are actually two solutions for this crane and load, ie, case A and case B.

CRANE STUDY

With Missing Dimensions



Use the following **general** parameter's for both cases:

1. Use a Liebherr LR 1400 as the lift crane where:
   a. The distance from the centerline of the rotation to the boom foot pins is 4.92'
   b. The distance from the bottom of the tracks up to the boom foot pins is 8.5'
   c. The distance from the centerline of the boom to the bottom is 4.3'
2. Use the shortest boom length possible
3. Use a structure height or load height of 35' + 70' + 8.5' = 113.5'
4. Use a rigging height of 20'
5. Use a two block distance of 20'. Therefore, the vertical distance from the top of the load to the point sheaves must be at least 40'
6. The reach over the load is 20'

Use the following **specific** parameter's for each case:

CASE A:

Given:
1. Use a boom clearance greater than 2'. This is the clearance between the bottom of the boom and the load
2. Use a boom angle less than 60°

Find:
1. Boom length
2. Boom clearance
3. Distance from the structure to the center of rotation
4. Actual boom angle
5. Distance above the load to the boom tip sheaves
6. Operating radius of the boom

CASE B:

Given:
1. Use a boom clearance of 2'
2. Use a boom angle greater than 60°

Find:
1. Boom length
2. Distance from the structure to the center of rotation
3. Actual boom angle
4. Distance above the load to the boom tip sheaves
5. Operating radius of the boom

Send me your solution's and I will send you mine.

The End

PS: Thanks to Mick Podolski for sending me the quiz.