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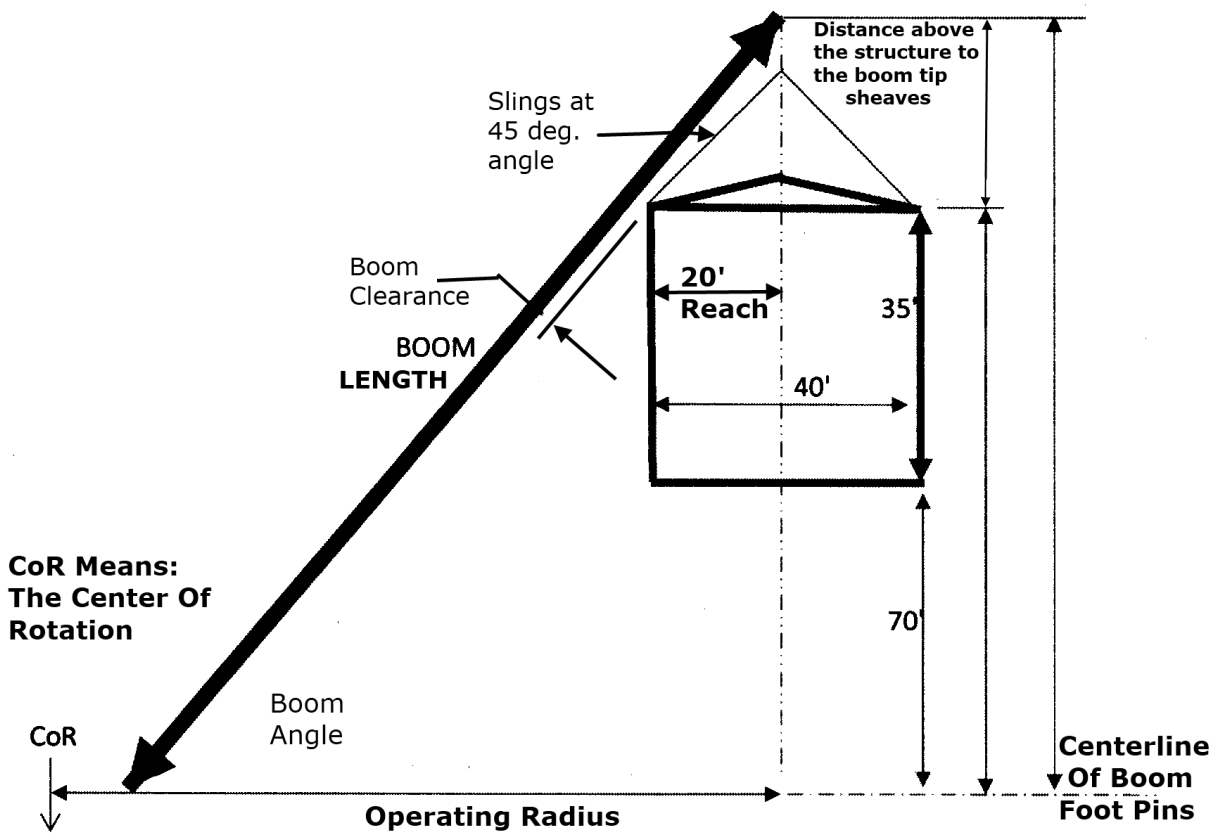
SOLUTIONS
TO
CRANE STUDY QUIZ

See page 2 for the answers
See pages 3 and 4 for the printouts

For your reference, the quiz that I thought you guys might be interested in solving is listed below. 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	180’
2.	Boom clearance	4’
3.	Distance from the structure to the center of rotation	80.59’
4.	Actual boom angle	57.90°
5.	Distance above the load to the boom tip sheaves	47.48’
6.	Operating radius of the boom	100.57’

CASE B:

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

Find:

1.	Boom length	180’
2.	Distance from the structure to the center of rotation	60.25’
3.	Actual boom angle	65.26°
4.	Distance above the load to the boom tip sheaves	58.47’
5.	Operating radius of the boom	80.26’

SOLUTIONS:

Case A:

To solve this quiz for case A, I used the following steps:

1. I went to the Maximum Reach Program on my website as I felt that case A would be a configuration where the maximum reach would occur for a structure of know height and a boom of known length and with a relative low boom angle.
2. Knowing that the structure height was 113.5', I started with a boom length of 150' and a boom clearance of 2'. This yielded a reach of only 7.54'
3. I then used 170' of boom for a head room of 41.24', but the reach was only 17.12'.
4. I then used 180' of boom for a reach of 22.35' and a head room of 47.0'.
5. By increasing the boom clearance up to 4.0', the reach was then reduced to 19.99' (close enough for bridge work), and the head room was 47.48' ➔ good.
6. The above steps took a maximum of 10 minutes.
7. See the printout below.

MAXIMUM REACH PROGRAM v0.1

COMPANY: Maximum Reach Student Quiz **PROJECT:**

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

INPUT:

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 the boom foot pins
4.30	Boom, centerline to bottom
0.00	Boom tip sheave offset
180.00	Boom length
4.00	Boom clearance
0.00	Jib length
0.00	Jib offset, degrees
113.50	Structure height

OUTPUT FOR THE BOOM:

80.59	Distance from structure to the center of rotation
19.99	Maximum Reach of the boom
57.90	Boom angle, degrees
47.48	Distance above the structure to the boom tip sheaves
100.57	Operating radius of the boom

OUTPUT FOR THE JIB:

0.00	Maximum Reach of the jib
0.00	Jib angle with the horizontal, degrees
0.00	Distance Above the structure to the Jib tip sheave
0.00	Operating Radius of the Jib

Case B:

To solve this quiz for case B, I used the following steps:

1. I went to the Reach Program on my website as I felt that the configuration would end up being with a short structure to center pin distance and a high boom angle .
2. Knowing that the structure height was 113.5', I again started with a boom length of 150', a minimum boom clearance of 2' and a distance from the center pin to the structure of 55'. This yielded a boom angle of 67.61°, a reach of only 7.07' and a distance above the structure to the boom tip of 33.69'.
3. I then used a boom length of 170' for a reach of 14.69' and a distance above the structure to the boom tip of 52.18'.
4. I then used a boom length of 180' for a reach of 18.5'.
5. I increased the distance from the structure to the center pin to 60.25' for a reach of 20.01', a distance above the structure to the boom tip of 58.47', a boom angle of 65.26° and an operating radius of 80.26'
6. The above steps took less than 10 minutes.
7. See the printout below.

REACH PROGRAM v0.1

COMPANY: Maximum Reach Student Quiz **PROJECT:**

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
0.00	Boom tip Sheave offset
180.00	Boom length
2.00	Boom Clearance
0.00	Jib Length
0.00	Jib Offset, degrees
60.25	Distance from Structure to Centerline of rotation
113.50	Structure height

OUTPUT FOR THE BOOM:

20.01	Reach of the boom
65.26	Boom angle, degrees
58.47	Distance above the structure to the boom tip sheaves
80.26	Operating radius of the boom

OUTPUT FOR THE JIB:

0.00	Reach of the jib
0	Jib angle with the horizontal, degrees
0.00	Distance above the structure to the Jib tip sheave
0.00	Operating radius of the Jib

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