ITI TOOLBOX TALKS

ITI salutes National Safety Week with this informative series on Crane & Rigging Safety

Sometimes 4 = 2

When making lifts using various pick points on a load, the rigger must review the weight and the location of the load's center of gravity (CG) to determine the amount of load he can anticipate at each pick point. The distribution of the load's weight to the pick points is dependent on the proportional split north:south and west:east (how close or far the "pad eyes" are from the CG) and if the slings are equal or unequal in length (especially a 4-leg bridle assembly).

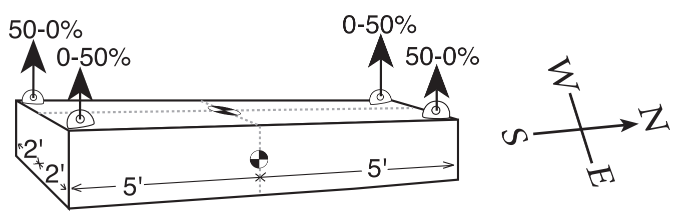

Fig. 1

When using a 4-leg bridle on a load with a concentric CG (Fig. 1), we should always assume that only 2 legs are making the lift. The chance is great that 1 of the 4 slings is shorter or longer than the other 3, which will cause the shortest crosscorner pair (A/C or B/D) to lift the load first, resulting in one pair carrying 100% of the load's weight. The remaining cross-corner pair may look tight, but in reality have 0% load. If we rig this load with a 4-leg bridle sling assembly expecting each leg to carry only 1/4 of the load, and that's all the slings can legally carry, two slings may actually be carrying double their anticipated load **-OVERLOAD!**

An element which complicates the rigger's life is a load with an eccentric or offset CG. If we plan to attach four slings to the offset CG load in Fig. 2 below and the sling at pick point D is shorter than the one at C, then the load will be carried by slings A, B & D (3-leg lift).

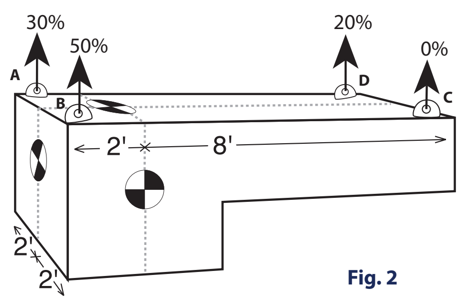

Fig. 2

On the North side of the load, the sling attached at D will carry approx. 20% of the load's weight (inverse proportion to distance) and the sling at C will have 0% load.

Pick point B will carry 50% of the load's weight since B & C (East) are equally spaced from the CG, as are A& D (West). Since C has 0 load, then B must carry the entire East portion of the load, in this case 50%. With D carrying 20% and B 50%, that leaves the remaining 30% to A. Should the sling at C happen to be shorter than D's, then the load distribution would be: C = 20%, D = 0%, A = 50% and B = 30%. If the slings used at points A & B (South) are equal length and the slings at C & D (North) are equal length (converging over the CG), only then would the distribution of weight be: A= 40%, B = 40%, C = 10% and D = 10%. We should realize the possibility of the different loading at A, B, C & D. Pick points A & B can have 30-50%, and C & D 0-20% each.

Think of the potential for overloaded rigging gear!

Rigging Workshop Assignment

Try your hand at determining the minimum and maximum loads that we could expect for the following load's pick points. For this workshop, the sling length-to-height ratio is not a concern. ***(Solution on Page 2)***

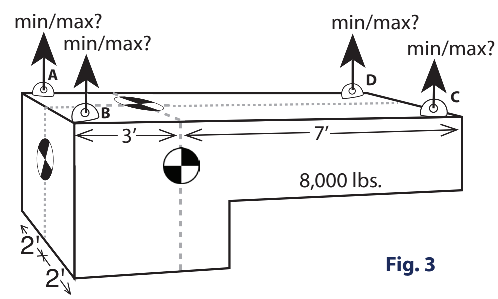

Fig. 3

Mike Parnell

- Technical Director/CEO at ITI
- Former Vice Chairman, ASME B30
- Chairman, ASME P30
- Associate Member, CSA Z150

Mike holds 34 years of progressive experience in wire rope, rigging, and crane operations in various industries including mining, maritime, electric utility, pulp and paper, manufacturing, nuclear, oil & gas, and construction. He has developed innovative training techniques, resource materials, workbooks, videos and reference cards which are widely used in the rigging industry today. Through ITI Field Services, Mike and his team provide consulting, accident investigation, and expert witness services.

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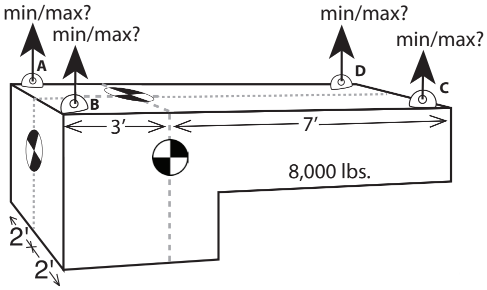
Rigging Workshop Assignment Solution



Min./Max. load at pick point D =

- 3 + 7 = 10, 7/10 =.70(inverse =.30) .30 x 8,000 = 2,400 lbs (D's sling may be shorter than C and lift the whole "north end" (30%), by itself.)
- The possibility also exists that the sling at C is shorter than D's sling, hence D may see 0 lbs of load.

D: min. = 0 lbs., max. = 2,400 lbs.

Min./Max. load at pick point C =

- 3 + 7 = 10, 7/10 =.70(inverse =.30) .30 x 8,000 = 2,400 lbs (C's sling may be shorter than D and lift the whole "north end" (30%), by itself.)
- The possibility also exists that the sling at D is shorter than C's sling, hence C may see 0 lbs of load.

C: min. = 0 lbs., max. = 2,400 lbs.

Min./Max. load at pick point B =

- 2 + 2 = 4, 2/4 = .50(inverse =.50] .50 x 8,000 = 4,000 lbs (If C's sling is slack, B lifts entire "east" portion.)
- The possibility exists that C will have 30% or 2,400 lbs., and A will have 50% or 4,000 lbs., so the remaining 1,600 lbs. of load is at B.

B: min. = 1,600 lbs., max. = 4,000 lbs.

Min./Max. load at pick point A =

- 2 + 2 = 4, 2/4 = .50(inverse =.50] .50 x 8,000 = 4,000 lbs (If D's sling is slack, A lifts entire "west" portion.)
- The possibility exists that D will have 30% or 2,400 lbs., and B will have 50% or 4,000 lbs., so the remaining 1,600 lbs. of load is at A.

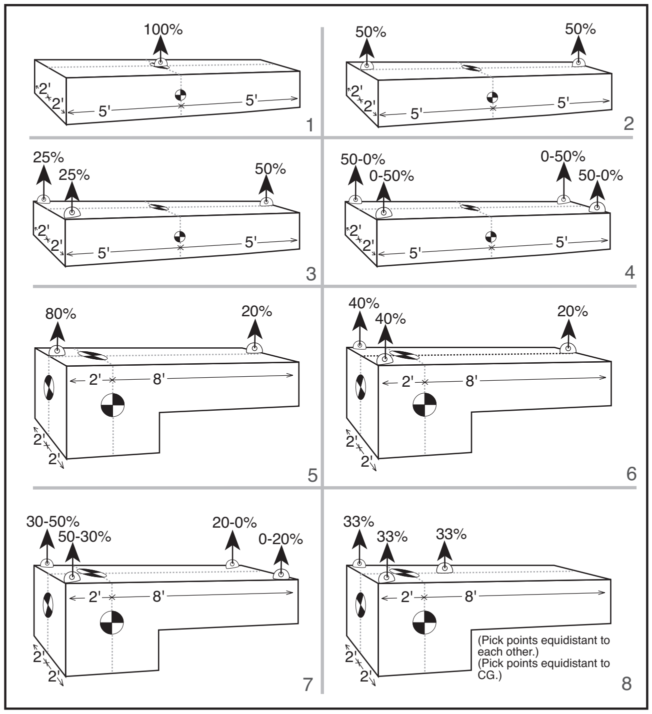
A: min. = 1,600 lbs., max. = 4,000 lbs.

A = 20-50%, 1,600 - 4,000 lbs.
B = 20-50%, 1,600 - 4,000 lbs.
C = 0-30%, 0 - 2,400 lbs.
D = 0-30%, 0 - 2,400 lbs.

Bonus excerpt from the **ITI Master Rigger Reference Card** available at **store.iti.com**

Pick Points / CG & Sling Leg Loading (4 & 5)

1) 1-leg bridle = 1 leg lift	**2)** 2-leg bridle = 2 legs lift
3) 3-leg bridle = 3 legs lift	**4)** 4-leg bridle = 2 legs lift
5) 2-leg bridle = 2 legs lift	**6)** 3-leg bridle = 3 legs lift
7) 4-leg bridle = 3 legs lift	**8)** 3-leg bridle = 3 legs lift



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