
Crane Tutorial

Version 1.1

Design Engineering Challenge 2007

Introduction

You are tasked with the construction of the crane structure and rigging. This document will give you the ground rules and provide some examples and hints. Remember, we are not telling you how to make your crane, because that is up to you!

Your kit includes the following structural and rigging materials:

- 8x 24" PVC lengths
- 36x 12" PVC lengths
- 8x 9" PVC lengths
- 16x 1.5" PVC lengths
- 2x 10' PVC lengths (can be cut at the cutting station)
- 20x PVC Tees
- 10x PVC Crosses
- 10x PVC 90 Elbows
- 10x PVC 45 Elbows
- 10x PVC Couplings
- Nylon string
- Zap straps
- Electrical Tape
- Tie wire
- Cardboard
- Ballast (weight)
- Motor and spool assembly
- 3 Pulleys
- More tie wire is available from the cutting station

Rules

There are only a few rules regarding your crane construction, but heed the following:

- The crane must not extend outside your taped construction area
- There is to be no alteration of the precut PVC pieces, PVC fittings or the motor assembly
- Cutting of the two 10' PVC lengths is to be done at the cutting station by design day staff
- The crane cannot be attached to the floor, wall, or any furnishings – it must be freestanding
- Hand-tighten the motor mount thumbscrew only (NO pliers!)

Structural Scoring

- For each foot of overhang (the shortest horizontal distance between the crane touching the ground and the lifting point) you will receive an extra 3 points.
- For each foot of lift (the distance between the ground and the highest point the magnet reaches during the lifting cycle) you will receive an extra 2 points.

- Only the PVC has a point cost associated with it. The cost per piece of PVC or fitting is 1/4 points except for the 10' lengths. The use of any part of a 10' length incurs a cost of 2 points. The point value of all PVC and fittings in the kits is 36.

Examples & Hints

A few possible crane configurations are as follows:



Bridge Crane



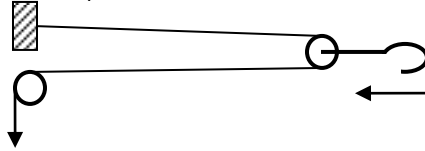
Luffing Crane



Tower Crane

Helpful hints:

- The motor mount can be slid onto any PVC pipe and tightened in place
- A speed reduction system can be made with the use of pulleys (makes the ascent/descent more controllable and increases the lifting force)



- Think about the centre of mass of the loaded crane to position ballast
- You can use tie wire like big twist ties to tension or securely attach things (cut off a short length twist with pliers)
- Use of string or wire stays reduces need for costly PVC and keeps down weight
- More tie wire is available at the cutting station
- Do not join PVC together with excessive force, as this makes removal difficult
- Remember the design objectives and try to optimize the cost
- Tie the end of the string in the little hole on the spool
- Have fun!