

Build Your Own Tripod-Mounted Camera Dolly

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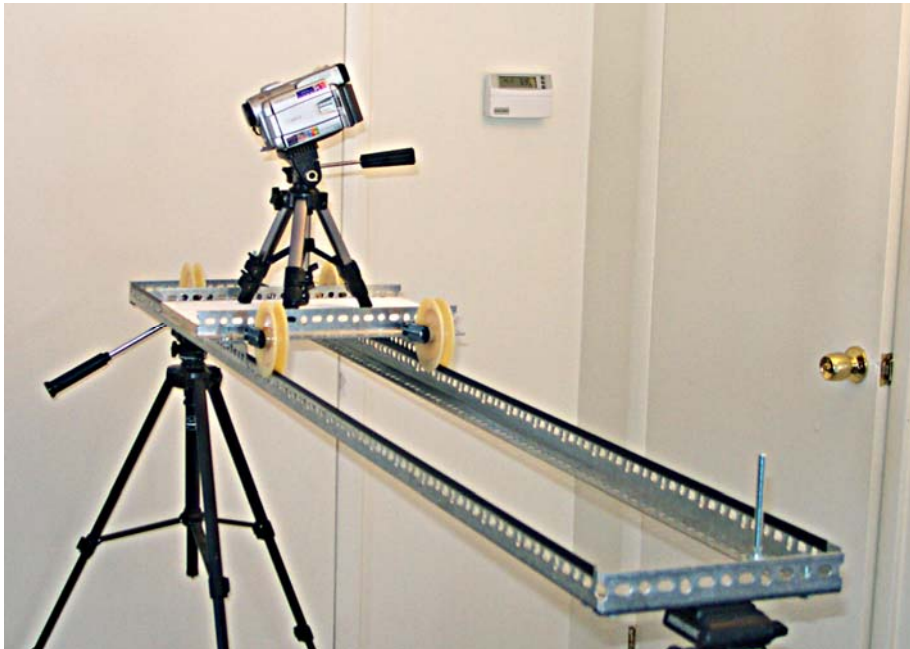
If you want to do moving-camera shots, but are getting tired of trying to do shoulder-mounted shots or trying to use jerry-rigged camera stabilizers, here's a nice alternative. We will describe how to make a small camera dolly that you can mount on two tripods, or whatever else happens to be handy, to make nice smooth motions.

The parts for this project are available from Home Depot and should be available from hardware stores as well, though the wheels may be less widespread.

Note: this is a great project, but it does involve putting your camera on a moving platform. Be careful that it does not fall and get damaged, or damage something or someone else.

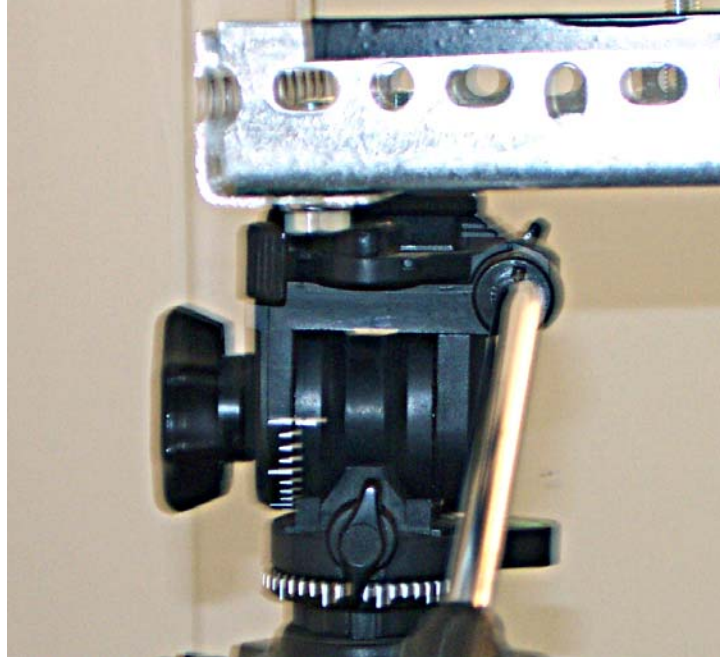
Overview

Here's a picture of the overall system, with a Canon Optura Pi on it:



The dolly system consists of the rectangular track, 6' long with about 4 ½' of usable travel, plus the dolly carrying the camera. Despite its humble origins, the track and dolly are very rigid; carrying large HD cameras of 15-20 lbs (5-10kg) should be straightforward, though so far the heaviest objects carried have been cats.

The tripods will be the weakest link. The tripods should have supports on both sides, as shown here:



Some tripods have a support on only the left side of this picture, making them rather floppy for a dolly track support.

Parts List

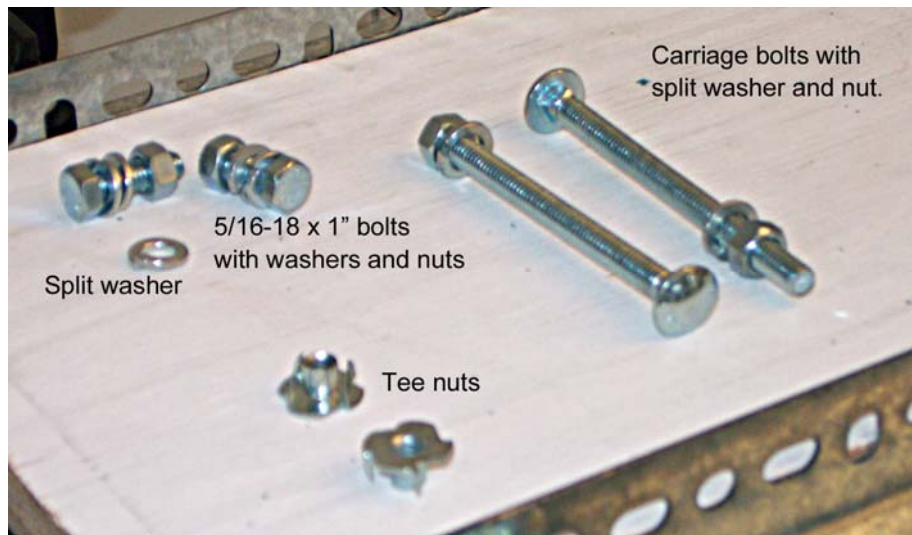
Below is a parts list including approximate costs as of late 2005. Refer to the parts identification section to see what the parts look like. You may find equivalents at other stores, or in your basement.

Item#	Qty	Description	~Cost	~Total
1	3	1 ½" x 1 ½" x 6" Stainless steel plated angle	13.27	39.81
2	4	4" Laundry wheels, with included fork and axle. SKU 201-069. Mfr: The Lehigh Group .	3.99	15.96
3	12	5/16"-18 x 1" bolts	0.23	2.76
4	2	5/16"-18 x 3" <u>carriage</u> bolts	0.40	0.80
5	16	5/16" split lock washers	0.07	1.12
6	10	5/16" flat washers		
7	14	5/16"-18 nuts	0.08	1.12
8	2	Very large washers, thick, approx 1" dia. The hole in the center must be big enough that they fit over top of the square portion of the carriage bolts.		
9	1	¾" plywood, 8 ¾" by 15" or larger		
10	4	#6 x 3/8" Wood screws		
11	4	#10 flat washers to fit wood screws		

12	12'	Electrical tape (price is for entire roll)	6.99	6.99
13	2	Tripods or an alternative mount, such as a table-top or two step-ladders.	80.00	160.00 if needed
14	1	Desirable: small table-top tripod, preferably with fluid head. See text for alternatives.	15.00	15.00
15	2	¼"-20 nuts, OR,	0.05	0.10
16	2	¼"-20 tee nuts, if tripod-mount screws are too short	0.15	0.30
17	1	Duct tape, if required to stabilize small tripod on top of dolly's decking.		

Parts Identification

Here's what some of the parts look like:

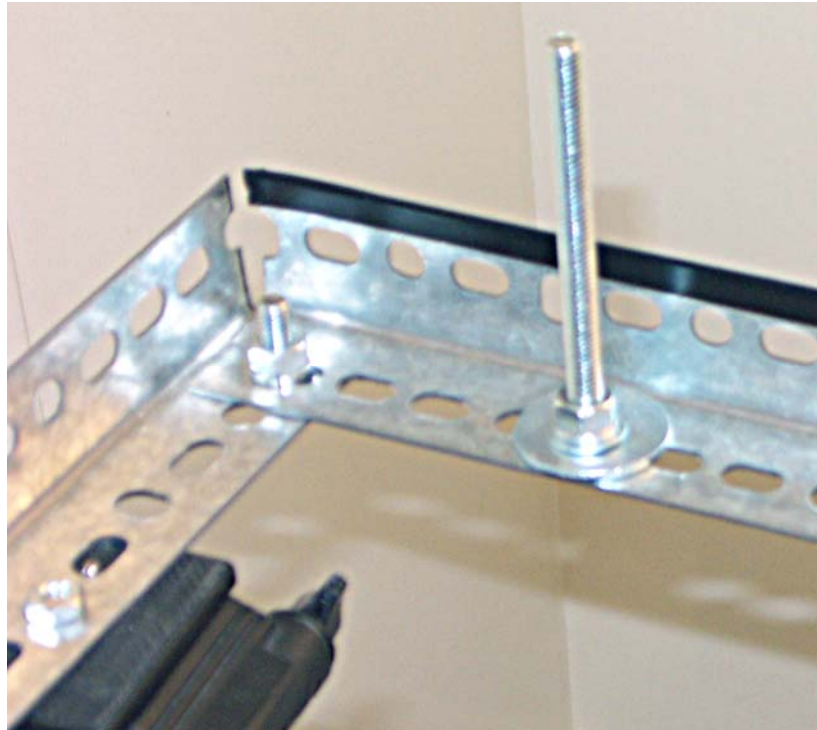


Tools

- Hacksaw for cutting the steel angle pieces
- Sawhorses, workbench, table, or buddy to hold the steel angle during cutting
- Two wrenches, either ½" fixed or adjustable
- Carpenter's hand saw or electrical saber saw (if available), if the plywood is larger than specified.
- Screw driver matching the wood screws
- Tape measure
- Pocket knife

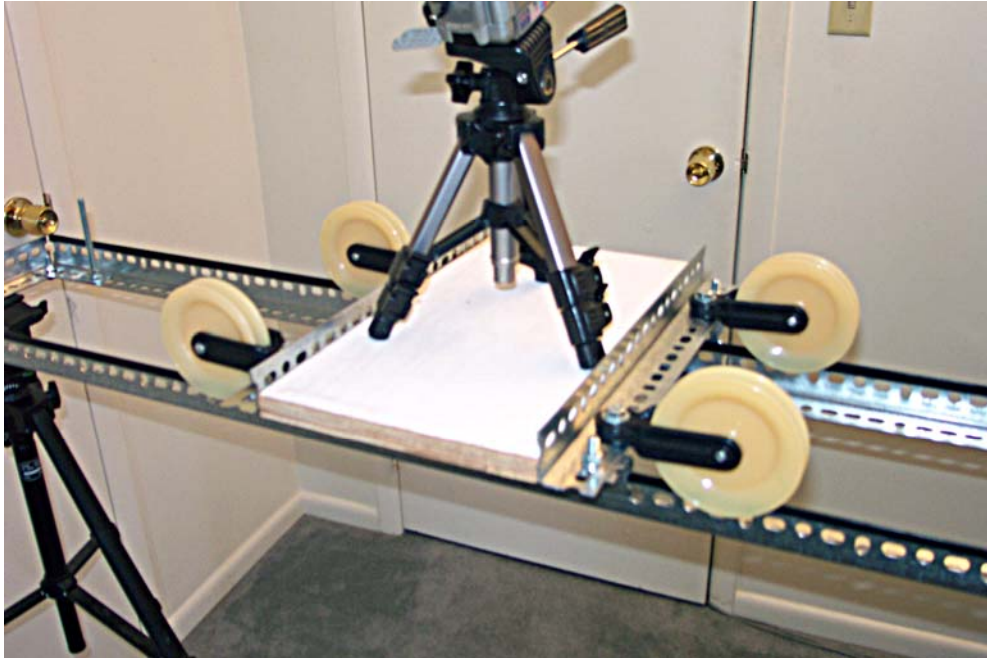
Assembly

1. Grab one piece of steel angle to be cut up. Lay it on the floor or workbench with the open side facing down (both “legs” touching the floor), and the pointy spine facing straight up.
2. Along the top of the spine, mark the steel angle into lengths of 9”, 9”, 12”, 12”, 15”, and 15”. No tape measure is needed: the steel angle’s hole pattern repeats every 3”. If you add up the lengths, you get 60”, which is the length of the steel angle, so if you think you have extra or not enough, try counting it out again.
3. Cut the steel angle in the 5 places marked. Unless you have clamps available, keeping it with the legs down and spine up will be easiest to hold during cutting. These cuts are the hardest part of the project, and take a minute or two and a little exertion each. Save the 15”/15” cut for last to make it easier to hold.
4. Prepare to assemble the main rail: grab the two uncut 6’ steel angles, the two 9” sections just cut, four 5/16”-18 x 1” bolts, eight 5/16” split washers, and four 5/16”-18 nuts.
5. Assemble the main rails and two 9” cross pieces with the bolts, washers and nuts, referring to the following picture for details of the corner. Keep the rails on top of each end cross piece. A split washer goes on each side. Ignore the vertical post (stopper) for now. Do not tighten screws completely yet.

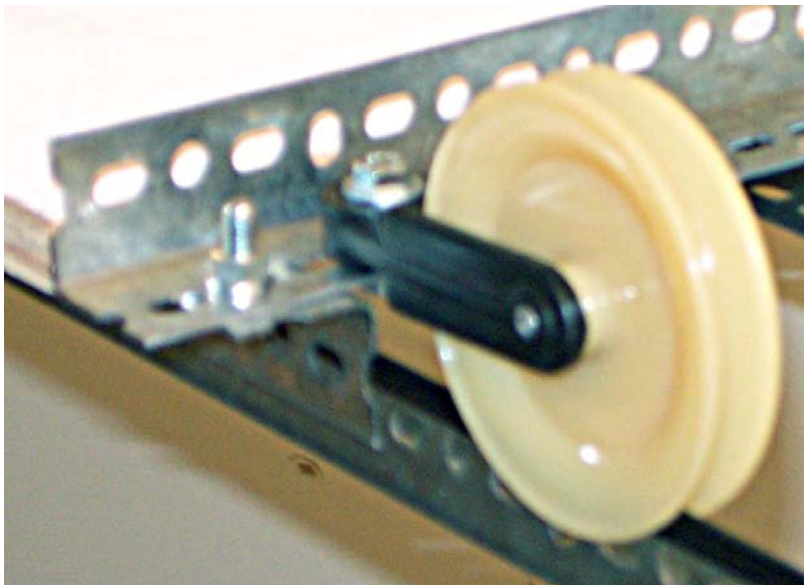


6. Square up the rails, using a T-square if available, or maybe the corner of a table if possible, or eyeball it if necessary. Try to keep the two long rails as close together as possible. Tighten screws hard using two wrenches!

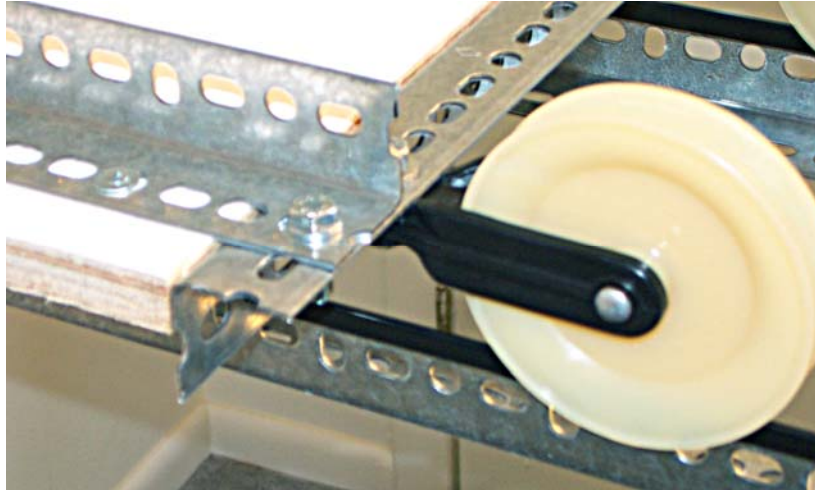
7. Apply a strip of electrical tape down the entire length of each rail for sound reduction. Center the tape on the rail, patting it down onto each side. Use one continuous length, and don't leave any air bubbles or wrinkles. If at first you don't succeed...
8. Time for the dolly. Grab the two 12" rails and the two 15" rails, plus four 5/6"-18 x 1" bolts, eight 5/16" split washers, and four 5/16" nuts. The overall effect desired looks as such:



9. Assemble the four steel angles as shown above. The bolts are in the second hole from the end on the 15" pieces, and the last hole on the 12" pieces. The 15" pieces are **across** the rails on top, while the 12" pieces are parallel to the track rails. A fuzzy view of a corner is shown below. As with the main track, after assembling the four steel angles for the dolly, square it up before tightening completely.



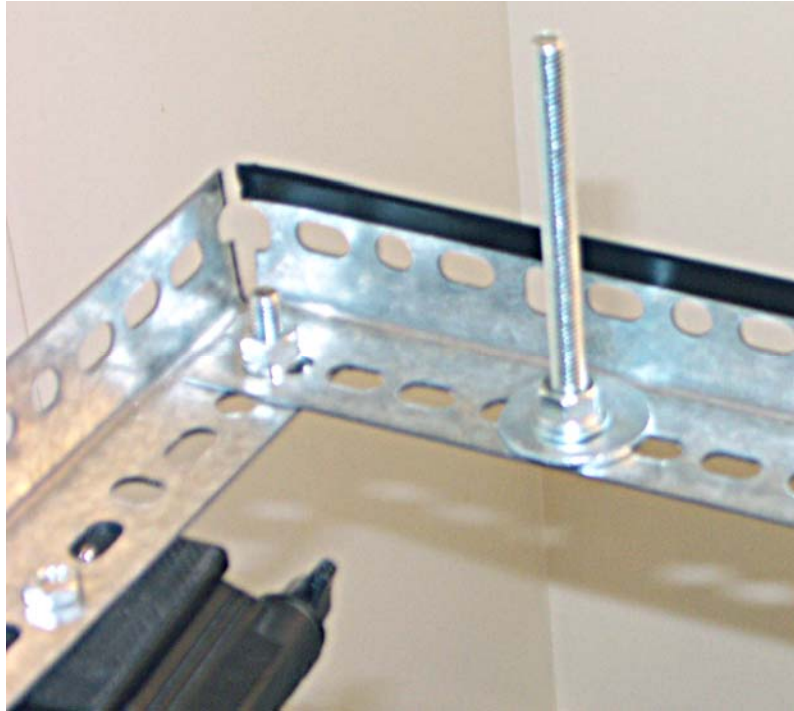
10. Cut the $\frac{3}{4}$ " plywood to the $8\frac{3}{4}$ " by 15" size. Note that thinner plywood could be used, but decent-quality $\frac{3}{4}$ " plywood is quite flat. The plywood is painted in the pictures because the piece that was handy was already painted.
11. Place the plywood between the rails of the dolly, it should be a nice tight fit.
12. Turn the dolly upside-down, resting the plywood on a stack of books or wood.
13. Using the four wood screws and their associated washers, attach railing to the underside of the plywood. See the picture, where the **dolly is shown inverted** on the track. One of the wood screws and washers is at left.



14. Time for wheels. Grab the four wheels, four $\frac{5}{16}$ "-18 x 1" bolts, eight $\frac{5}{16}$ " flat washers, and four $\frac{5}{16}$ " nuts.
15. Each wheel is installed in a 15" cross piece, two holes in from the bolt in the corner, in the first hole that is not blocked by the 12" piece. A flat washer goes at each end of the assembly. The picture above shows the wheel attachment from below, the picture below shows the detail from above. Got that? **IMPORTANT**: do not over-tighten these bolts, at risk of cracking the plastic.



16. Install the stoppers per the picture below, consisting of a 5/16" x 3" carriage bolt, 5/16" split washer, 5/16" flat washer, really big washer, and 5/16" nut. The stoppers should be 3 1/2 to 4" from the end, such that wheels can not roll off the end. Only one stopper is required at each end, it will hit the 15" crossbar of the dolly.



17. You're ready to begin testing. Set up the two support tripods to be level and at the same height from the floor, using the tape measure. This doesn't have to be exact, but you don't want your camera rolling downhill. You can also use a table as a support, instead of tripods; you may want to improvise a way to prevent it from sliding around.
18. Mount the track onto the two tripods. The tripods will have a 1/4-20 screw sticking up to go through the holes in the track. You should just be able to get a 1/4-20 screw to bite and hold the track in place. Alternatively, you can use the 1/4-20 tee nut, which will probably need to have its prongs flattened with pliers.
19. Place the dolly on the track. If you are confused about which side goes up—place it so that the platform is as low down, close to the track, as possible.
20. Adjust the alignment of the wheels to match the track.
21. The wheels are molded in two halves, so there are two spots, 180 degrees apart from one another, where there may be a little "flashing" left over from molding. If necessary, use the pocketknife to scrape it off. This will remove any little "tic" as the flash contacts the track.
22. Pushing down gently on the dolly, roll it back and forth. Listen for any rubbing sound, which may occur if the wheels are out of alignment. If this is happening, the wheel is contacting a black piece up at the top of the fork, which is intended to help

keep a laundry line in place on the pulley. In extreme cases, you may need to cut down this black piece to prevent rubbing, using a Dremel or small coping saw.

Usage

Mount your camera on the dolly deck using a table-top tripod or perhaps a bean-bag made of packaging peanuts. Or you might improvise the mounting of a fluid tripod head directly to the deck. Make sure it is secure, using duct tape as needed.

If you have a fluid head, you will be able to move the camera along the dolly while keeping a stationary or moving target centered, though it may take some practice. With a fixed mount, you have a more limited shot selection, but you can mount the track and camera diagonally to make things more interesting.

In any case, to keep the camera stable, mount it as close as possible to the dolly's deck. Do not stand a tall tripod on the deck, it will not be stable and you will put your camera at risk. Achieve the height you require by raising the track.

With a table-top tripod mounted on the deck, move the dolly by placing your hand on the center of the platform and rolling it left and right, rather than pushing the camera.

Limitations and Improvements

The dolly is remarkably stable. There can be some slight flexure up and down in the image, due to rotation around an axis parallel to the track. If you look carefully, you will see that the tripod heads are the part that deflects. By pushing the dolly from the center of the deck, this should not be a problem. If you need a more rigid solution, consider using two stepladders, clamping each end of the track to one of the steps.

If you will be using the live sounds from shots filmed with the dolly, you will want to pay special attention to reducing the sounds made by the dolly as it rolls. Though they are small, they might be audible. Make sure the two ends of the track are level front/back, so that the track is not twisted. Consider additional layers of electrical tape, and further sanding or trimming of the flashing on the wheels. Also, note that while the dolly noise is very quite at low speeds, it is noticeably louder at higher speeds.

You may wish to create a longer dolly track. If you can locate a supply of longer steel angle, that would certainly be easy. Alternatively, you may be able to bolt some pieces together, ie add another 6' length to form a 12' track. To do this, you will need a third short section at each junction; bolt both of the rails to that section along the bottom of the steel angle, so that the wheels do not clunk into the bolts as they pass by. Even with a continuous length of electrical tape over the junction, you'll still need careful alignment to minimize any clicks and bumps as the wheels pass over the junction.

There are distinct advantages to being able to make curved track, as you can stay focused on a single target as the camera moves. A curved track should prove possible, perhaps in a future installment.