

STEADISEG

USER MANUAL



STEADISEG™

(patent pending)

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1 ABOUT THE STEADISEG

The Steadicam® Segway® is instantly available to create anything from a subtle perspective change to a dramatic traveling shot. The Steadiseg modification replaces the conventional Segway handlebars with a control-stick module between the knees, freeing the rider's arms to operate camera stabilization systems. The addition of the hard-mount assembly eliminates carrying strain, permitting bulky camera setups (IMAX, 3D rigs, etc.), to be flown for extended periods without fatigue. The Steadiseg is intuitive to ride, and entirely fluid in its movement, allowing dynamic and complex moves to be executed with precision. Stability at all speeds is excellent: ramping effortlessly from a slow interior architectural track to a fast outdoor chase scene, it offers rapid set-ups and delivers stunning results.

Ulik Kahlert, the inventor of the Segway handsfree-steering system, and Steadicam operator and instructor, Chris Fawcett, are pleased to announce this entirely redesigned Steadicam Segway, engineered specifically for improved ergonomics and safety. New features include:

The **Control-Stick Module** is divided into separate 'accelerator' and 'braking' components, each configured for enhanced interaction with the rider, with full 'set and forget' adjustability in 4 linear and 2 rotational axes. The pads are formed with triple-layer cushioning and finished in a mix of normal and reversed full-grain leathers to facilitate degrees of slide and traction where necessary, making the new Steadiseg nimble and responsive, and exquisitely comfortable. The entire module swivels to aid cornering and balance via an adjustable, self-centering mechanism. When operating soft-mount, you can face into the rig, bringing it closer to your centre of gravity, diminishing load and twisting strain on your back.

The **Hard-Mount Assembly** is especially versatile in its placement possibilities. A precision-steel articulated arm with 1 translational and 5 rotational degrees of freedom delivers the hard-mount block to any usable position, including extreme high and low- mode possibilities, without obstructing the operator. It's also exceedingly strong, so you can fly heavy camera packages with confidence.

The **Fender System** works with the narrow i2 wheels in their normal configuration, allowing for a svelte 66 cm (26 in) profile in conjunction with the new hard-mount assembly, while the overall height from the ground is low to maximize Steadicam boom-range. The new system projects no sharp edges, and the outer fender sections wrap around the wheels to safeguard against accidental contact with the surroundings.

2 FOREWORD

The material presented here is informational, and is not intended as guidance or advice. It is designed, instead, to get you off to a start from which your personal experience will broaden our understanding of the Steadiseg's capabilities—and of its limitations. Join the mailing list at info@steadiseg.com to contribute your ideas, and to keep up to date with revisions. This manual is intended for use with the new Camera Kinetics Steadiseg, though some of it applies to the 1st, 2nd, and 3rd generation Handsfree-Transporter models as well.

3 SAFETY

This manual assumes that you have had training and extensive experience in operating Steadicam, and that you are familiar with the Segway manuals, including the safety warning: **RISK OF DEATH OR SERIOUS INJURY. Whenever you ride the Segway PT, you risk death or serious injury from loss of control, collisions, and falls.** It also assumes that you know how to switch the machine off and on, how to actuate 'Balance Mode,' and that you understand the various display and warning signals. For installation and set-up of the Steadiseg, refer to the Installation Manual.

If your Segway shows any signs of malfunction, or if during any operation, you feel that the speed limiter is activated (the base tilts back) without reason, have it tested before you continue to work with it.

While shooting, you must exercise the same caution as you would with any camera vehicle. You must also be responsible for any decision you make that puts yourself or others in danger, not to mention that risks damaging expensive equipment. Steadicam Segway operation is a complicated and tricky, and is recommended only for people with great balance, reflexes, spacial awareness, and peripheral vision. If you are the kind of person that falls off things, you'll fall off this too. Having said that, the Steadiseg is easier to ride than a bicycle, and possibly a lot safer. Work within that safety envelope. If you are not in complete and confident control of your equipment, your work will be compromised anyway.

Though it's been tested over level ground to 200 kg (440 lb), the Segway is rated to carry 120 kg (265 lb). That's you and the gear. Exceeding this will not endear you to your insurance company.

The Steadiseg hard-mount assembly has been tested over level ground with a load of 100 kg (200 lb) extended 1.5 m (60 in) above the base, and cantilevered out 1m (40 in), and is rated to carry any Steadicam load over terrain within the capacity of current stabilizer arms, that's just over 30 kg (70 lb) including the rig. Exceed this at your own risk.

4 RIDING TECHNIQUE

Before attempting to shoot Steadicam using the Steadiseg, master the riding technique. There is no need to practice first with the conventional handlebar.

Crank the control-stick module all the way to the front on its front spindle, and mount the device as recommended in the Segway Manual. Take care to avoid the control stick as you step on. There is a risk of pushing it to one side, thus spinning the machine on the spot and twisting your knee, though this is minimized by the start-up routine that—*under most circumstances*—limits steering until the Segway is in motion. When you dismount, the steering is no longer limited, so the warning doubly applies.



Control-Stick Module



Correctly Adjusted

Place your feet squarely on the mats, and carefully raise or lower the control-stick module until the front (accelerator) pads are level with or just above the knees. The rear (brake) pads should now rest comfortably on the bulk of the calf muscle just below the hamstring tendons that run behind your knee. If not, dismount the machine, and adjust and refasten the rear pad assembly securely before remounting again. Now feel that the pads are contacting your legs at comfortable angles. If not, dismount and rotate them to fit. Lastly, check that the width of the pads between your legs is just wide enough that you can stand upright without their exerting undue pressure. If not, dismount and adjust.

Now crank the front spindle so that in a normal standing position, the Segway moves neither forwards nor backwards. Lastly, crank the rear spindle to narrow or widen the distance between the front and rear pads until they just contact your legs. For normal operation, you should be able to stand upright without their exerting pressure. For navigating terrain, or executing precision movements, tighten them further. Don't be too fussy about fine tuning at first. As you become familiar with the machine, your control preferences will become clear to you, and once set, you rarely need to touch them again.

4.1 Engage the Machine



Wrong

Right

Now practice moving forwards. To do this, don't just bend at the waist and lean over. Initiate all movements from the hips, engaging the machine through the control stick. Make a slight kneeling motion and incline your whole body forwards, keeping your feet evenly planted on the base, and pushing your knees against the forward pads. The self-balancing nature of the Segway now rolls the machine under your centre of gravity to prevent you from falling over.

To stop, or to go backwards, transfer your weight back—again not by leaning or bending backwards, but by sitting slightly as you would onto a stool, and engaging the rear pads with your calf muscles. In both these operations, your head, neck, and back maintain the same erect orientation.

The Steadiseg is a reactive device that gives you feedback about how it is coping with the ride. Don't just dump your weight into the control stick to pressure the machine forward, but do stay in contact with it. At times, usually during fast acceleration with a heavy load, the Segway pushes back slightly because it can't draw power quickly enough from the batteries. If you're not engaging the machine properly, you'll find it harder to sense what it is doing.

4.2 The Spiral

You may have already noticed how uncomfortable it is to steer the machine while moving backwards. Here is the solution—as with accelerating and decelerating, you must initiate turns from the head. The following text is demanding, but the technique it describes is simple. Master it now, and complicated maneuvers will come easily. If you don't, you'll constantly struggle to find your balance.



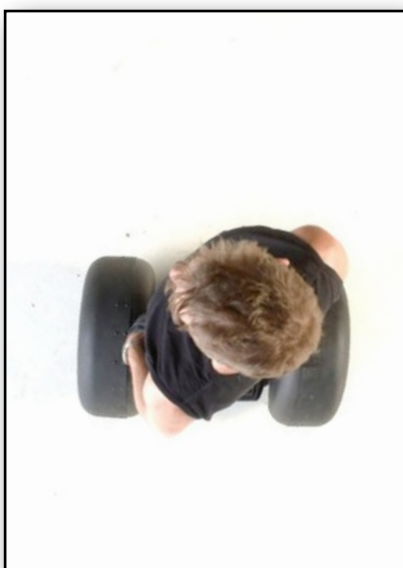
Rotating out of Balance



Rotating In Balance



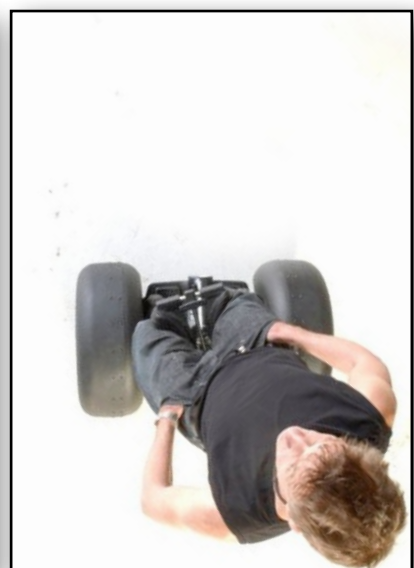
First practice turning 360s: bend your knees slightly, and look over your left shoulder. This will turn your entire body—from the knees up—45 degrees to the machine. The control stick will rotate on its swivel to accommodate this movement (if the swivel centering feels too light or too heavy for your preference, dismount and adjust it to taste). Lean neither left nor right. Push your right knee into the stick, moving it to the left, and the Steadiseg will rotate anti-clockwise on the spot. If you do this correctly, you'll be completely upright and in balance—arms, shoulders, hips and knees parallel—facing towards the direction of rotation. Your weight will be distributed equally on both feet. Practice this to clockwise.



360s



**ANTI-CLOCKWISE:
Spiraling Forwards
(lifting left heel)**



**Spiraling Backwards
(lifting right heel)**

Now the forward spiral: turn anti-clockwise again, by looking over your left shoulder, and lifting the heel of your left foot while inclining slightly forwards. The Steadiseg will spiral slowly outwards from the spot. Inclining forwards at this 45 degree angle moves your centre of gravity to the left, so you are leaning into the turn, and you are in balance. Practice this to clockwise.

Only when you are very comfortable with this, try the much harder backward spiral: turn anti-clockwise again, lifting the heel of your right foot while inclining slightly backwards. The Steadiseg will spiral slowly outwards from the spot. Inclining backwards at this 45 degree angle moves your centre of gravity to the right, so you are leaning into the turn, and you are in balance. Practice this to clockwise.

Apply the spiral technique to slaloming on a good surface. Extend your arms, and rotate your whole body—with the control stick—to face the direction into which you are turning. It is imperative that your weight goes into the outside foot on any turn; doing so will make the Steadiseg very responsive to your movements (lifting the heel of the inside foot, as above, helps you to learn this). Try making the turns tighter by pushing down even harder on the outside foot to whip the Steadiseg around. If you are a skier, this will feel familiar. Engage the machine. If you lift weight off your outside foot in a turn, the Segway will bleep petulantly (see Rider Detect Error). When you get the hang of rotating your whole body into the turns, relax your arms and continue. Don't get overconfident at this stage. Corner only at slow speeds for the present.

4.3 Terrain

Even in good conditions, you should ride the Steadiseg with slightly bent knees. This is not so tiring as it sounds since the control stick lends some support. If you hit a bump with straight legs, you are likely to be pitched off to the side. If you go down even a slight step with straight legs, you will jar your spine. Having your legs bent allows you to maintain level while the machine accommodates the terrain below. On very uneven ground, tightening the rear spindle further encourages you to crouch down—again as in skiing—and allows for the Steadiseg to buck beneath you, yet remain under precise control. It's exhilarating. Bumps and drops may cause you to lose contact. To minimize this, clench the control stick between your knees, and brace your feet outwards against the inner fenders when necessary.

Try bumping into obstacles, gently of course, to learn how the machine reacts to different collision scenarios. If the object is low enough to pass under the safety fenders, the Segway will attempt to climb it. If higher, the Segway will either push the object away, or stop against it. The Steadiseg will not attempt to climb an object that is higher than its own clearance, so if you remain calm, it will too. However, if you ride on sand—or any other loose or slippery surface—sufficiently vigorously as to lose traction, the Segway is likely to fall. If unsure of the terrain, accelerate, decelerate, and corner gently. Ascend and descend slopes with caution. Know the limits of the machine, and learn to anticipate problems.

Once you are comfortable on the Steadiseg, ride on a variety of surfaces while watching the InfoKey face. If you do something the Segway doesn't like, the InfoKey will show a straight face, and the speed limiter will kick in. The next stage is the unhappy face, which may be accompanied by control-stick shake, some serious beeping, and a Safety Shutdown. Learn its likes and dislikes, so you both stay happy.



Happy



Straight-Faced



Unhappy

5 SOFT-MOUNT STEADICAM OPERATION

Crank the control stick some turns back on its front spindle, and mount the Steadiseg, wearing a nice light Steadicam, and being careful not to nudge the pads. Unless you are remarkably confident, avail yourself of an experienced spotter. Find your balance by cranking the control stick backwards or forwards: the heavier the rig, the further back. This does not mean that you stand further back on the base (See Rider Detect Error). Stand with your feet planted properly on the mats, and adjust the front spindle to allow your centre of gravity to move backwards just far enough to balance the weight of the rig so the Segway stands still. Now avail yourself of the self-centering pivot to rotate your body into your normal operating stance facing into the rig.



Moving with the Rig

Using the same riding techniques as before, you now have the Steadicam to help you. Push it out to initiate moving forwards, but follow it to keep your masses, as much as possible, together. If you feel the base tilting back, cut your speed and review your situation. If you were operating at maximum speed, back off. You should operate the Segway below its maximum speeds. Tripping the speed limiter compromises your shot anyway. To stop, pull the Steadicam towards you again.

You'll want to wait a while before attempting 360s or turning while going backwards, but these are essentially no different with the Steadicam on. Always point your hips into the direction of the turn, and bear down on your outside foot. If you find yourself out of balance, you're doing it wrong. Practice the spiral.

5.1 Steps Off and On

The beauty of soft-mount is that you can work the Steadiseg into a longer shot by mounting or dismounting while continuing to film. Easiest is stepping off. Usually, you'll step off forwards, though some shots may demand that you step off the back. This is obviously best practiced first without the Steadicam. Tip: narrow the control-stick width slightly at the front to help you avoid nudging the pads, and tighten the swivel slightly.



Stepping Off

Sometimes, you can step off and leave the Steadiseg to come to rest, but usually, you'll want someone to hold it for you. This will stop the machine from running off, and give you a more stable platform from which to alight. Whoever is going to hold the machine needs to be familiar with it. Don't just co-opt some poor grip. If s/he is not familiar with the Steadiseg, grabbing it during a clumsy step-off is intimidating. Kill the machine's forward motion by shifting your weight to your heels—or its backward motion by shifting your weight to your toes—as you step off. Practice makes perfect.



Stepping On

Stepping on is trickier though perhaps easier to manage without an assistant. Stepping on from the rear is straightforward. Backing on from the front is onerous, though using an apple box the same height as the base can help. Again, avoid the control stick. Tip: once the machine is positioned, switch it off and on (remembering to engage Balance Mode), so that the start-up routine, mentioned on page 3, limits the steering until the Segway is in motion.

6 HARD-MOUNT STEADICAM OPERATION

Hard-mount is the obvious choice for shots not requiring a step on or off. While set-up time is negligible, operating time is greatly extended.



Typical Hard-Mount Position (Regular-Side)

6.1 Adjusting the Hard-Mount

The Steadiseg hard-mount is strong and adaptable, and is designed to work in either regular or goofy orientation. You can adjust the assembly such that the block is in a variety of positions, but unless you are shooting a simple tracking shot over a smooth surface, you must leave leaning room between yourself and it. If the block is too close to your hip, you cannot turn effectively towards the hard-mount side. Worse, if you are on a rough surface, or traversing an incline, the hard-mount can shove you off. You can place the block forward, but this limits shooting off to the hard-mount side. If you place it to the rear, you limit the reach and the boom range of the arm, and therefore your acceleration and cornering (see Rider Detect Error). Probably the best position is to have the block level with where it would be on the vest, but extended out to the side for clearance. To achieve this, rotate the foot joint back 45 degrees, incline the ankle joint out in the same direction, then angle the knee joint to bring the upper section to the vertical. Adjust the height of the hard-mount black to taste.



Leaving Room to Maneuver

6.2 Mounting the Steadicam

Orient the hard-mount block such that the mating hole points forward and inward (315° or 45° for goofy), with the fore-aft adjustment knobs on the inside, as in the photo on the previous page. If you are a back-mount vest user, you need to invert the arm block to match. If you use a combination of back-mount vest and an arm that does not readily disassemble, invert the hard-mount block instead, though this is less satisfactory because the arm-block spring now rotates the arm towards you, encouraging arm blocking (see section 6.3.1).

Now fix the arm to the hard-mount, switch on the Segway, and—maintaining control of the arm—step on. Ride around to get used to the arm range before having your assistant pass you the rig. You can't bow as you would to undock from a stand, as this is the Segway's cue to race off like a wild thing. The rig must be passed up to you, or you must push the arm down to meet the rig. In time (and with strong arms), you will be able to undock and dock unaided, but until you are one with the machine (I'm talking weeks of practice), you should not attempt to do so. When the Steadiseg is resting on a stand, or leaning against an object, the arm may be left attached, if tethered by a short lanyard (right).



Riding technique is much the same as for solo and soft-mount. Check that your feet are properly positioned on the mats. Move the rig first, and follow with your body, as you would on foot. Work below the capability of the Segway. Hard-mounting can restrict your range of movement, because the arm is tied to one place instead of moving with your body. If the shot requires faster acceleration and cornering than the hard-mount allows (see Rider Detect Error), or if the hard-mount bumps you or obstructs you in any way, go soft-mount.

6.3 Arm Considerations

6.3.1 Arm Blocking



Arm Blocking

Certain hard-mount configurations encourage the arm to get blocked by folding towards your body instead of away from it, as is usual. Others limit traversing the rig across your body to shoot off the hard-mount side, because the arm is blocked by the hard-mount.

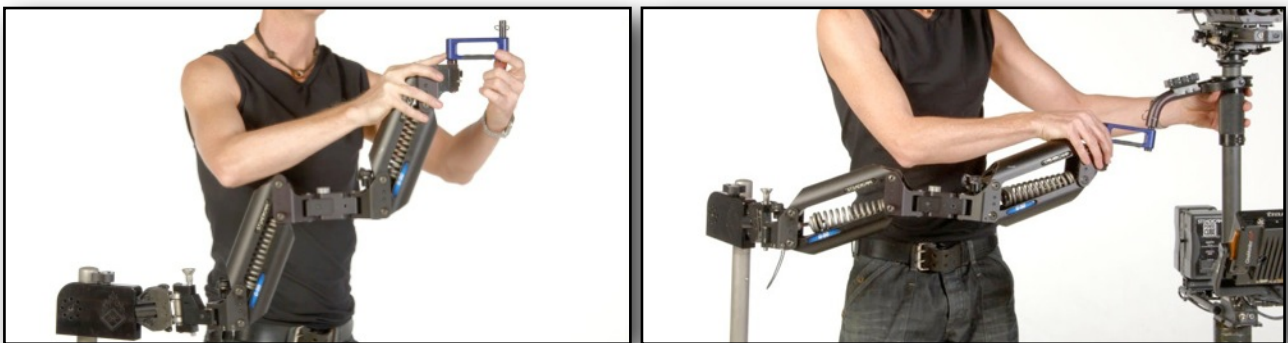
There are too many combinations of hard-mount positions, and of types of arms and socket blocks to detail, but the solution lies in tweaking the following variables.

- 1/ If the arm block contains a stopper to limit its outward rotation, remove it. If you are a front-mount vest user, leave it off, the arm works better without it.
- 2/ Rotate the hard-mount block to a different angle.
- 3/ Move the hard-mount position forwards or backwards.
- 4/ Use the hard-mount block fore–aft adjustments to bias the arm to fall outwards.
- 5/ Use a small shock-cord to encourage the arm to bend outwards.
- 6/ Invert both the hard-mount block and the arm block, and start again.

6.3.2 Excessive Cantilever

Most socket blocks are designed for use with front-mount vests. When the distance between the centre of gravity of the rig and the attachment point of the arm block is increased—as with a back-mount vest—blocks are subjected to forces beyond their design specifications. This has led to failure of, specifically, titanium blocks. It is recommended that steel blocks are used, and that the lineal distance between the centre of gravity of a heavy rig and the block is minimized.

6.3.3 Restoring Lost Arm Reach



Restoring Lost Arm Reach

As mentioned, hard-mounting limits the arm's reach to some extent. Certain types of (low-mode) F-bracket may be used to restore some of this reach. The F-bracket can be used in its usual configuration, or preferably, the yoke mounting pin may be inverted, so the yoke remains in its usual orientation.

6.4 Switching Hard-Mount Sides

The hard-mount fender is configured for either regular or goofy operation. For the occasional shot, fender sides can be switched; but because fore and aft fender profiles are different, collision protection is diminished, and you cannot descend drops. If you switch sides often, you require two hard-mount fenders.

7 RIDER DETECT ERROR



If 2 or more of the 4 Rider Detect Sensors on the Segway base are not depressed, the InfoKey shows a straight-face with these shoe symbols—and the speed limiter kicks in suddenly. Riding solo, you experience an immediate deceleration as the base tilts back. The effect this has on a Steadicam is to throw it backwards. It is imperative you avoid Rider Detect Error by taking the following precautions:

- 1/ When adjusting the leg saddle backwards to accommodate the Steadicam, ensure that your feet stay properly positioned on the mats.
- 2/ Follow the rig, so you stay in balance, and your footing remains solid.
- 3/ Push down with your outside foot during turns.
- 4/ If the hard-mount is all the way to the back, arm range is limited. Therefore, when you accelerate hard by moving the rig and yourself forward, you get stopped by length of the arm. If you push against this, your weight falls into your heels, and the two forward Rider Detect Sensors are disengaged. When the speed limiter trips in this situation, the rig will push you abruptly back. Adjust the hard-mount to leave yourself room to maneuver. The lighter the rig, the worse the problem. A heavy rig need not be moved so far to achieve the same acceleration.

If for whatever reason, the base tilts back when you are operating, understand that this is not a malfunction. The Segway simply wishes to slow you down. Although the sensation of the rig pushing you back combined with the backward tilt of the base feels like an impending disaster, stepping off makes the situation worse. Decelerate smoothly, and you will come safely to rest.

8 NAVIGATION

Once you get confident, try a switch. Ask someone to walk directly towards you, then back away from them, shooting in Missionary, before switching to Don Juan. Initiate the switch by turning your hips away from the rig, and bearing down on your outside leg, (to switch back, turn towards the rig). Practice the line dance. If you've mastered the riding technique, switches will come naturally, and the Steadiseg will feel like an extension of your body. If you feel off balance, you're doing it wrong—go back to the spiral exercise. After only a little practice, you'll notice a steadiness in your shots you never achieved on foot, and Don Juan will become a pleasure.

Don't fall into the monitor. Cycle your attention. For an experienced Steadicam operator, glances at the monitor are sufficient, and a Steadiseg operator must give priority to the outside world. When filming in unfamiliar territory, or in grass, scout on foot, then practice the shot without Steadicam. Have a spotter at least to

shout **stop!** if s/he sees anything untoward about to happen. Try not to deviate from the plan—you might feel confident, but others may not share your confidence. Never approach anyone you are not in eye contact with, unless you have a well-rehearsed arrangement with a reliable person in an unstressed situation. Be predictable. Be safe. If in doubt, just stop. Don't take risks, and refuse to be talked into taking risks. You are the expert. No one should overrule you on these matters.

9 WHEEL CONFIGURATIONS

There are two basic Steadiseg configurations The wide, high-traction x2 Turf and the narrow, low-traction i2. Top speed for all configurations is around 20 kph (12.5 mph), and battery life is sufficient for a good day's shoot.

9.1 x2T

The Segway x2 Turf is the standard Steadiseg configuration. The wide wheelbase gives stability, and the broad tires makes for a smooth and comfortable ride. The Turf is designed for golf courses, so won't damage delicate surfaces such as feet or carpets, and they'll take you anywhere you could expect a normal bicycle to go. You can mount low pavements, providing there is fender clearance, and drop from slightly higher than you can climb. You can even manage a few drops in succession, though descending stairs is not practical. Range is about 20 km (12.5 miles).

9.2 i2

The Segway i2 tires are higher pressure and lower traction, and in the right conditions can double your range. They also facilitate the Steadiseg's narrowest configuration, thus are well-suited to set or interior location work. They are next to useless on terrain. Range is just under 40 kms (25 miles).

9.3 x2

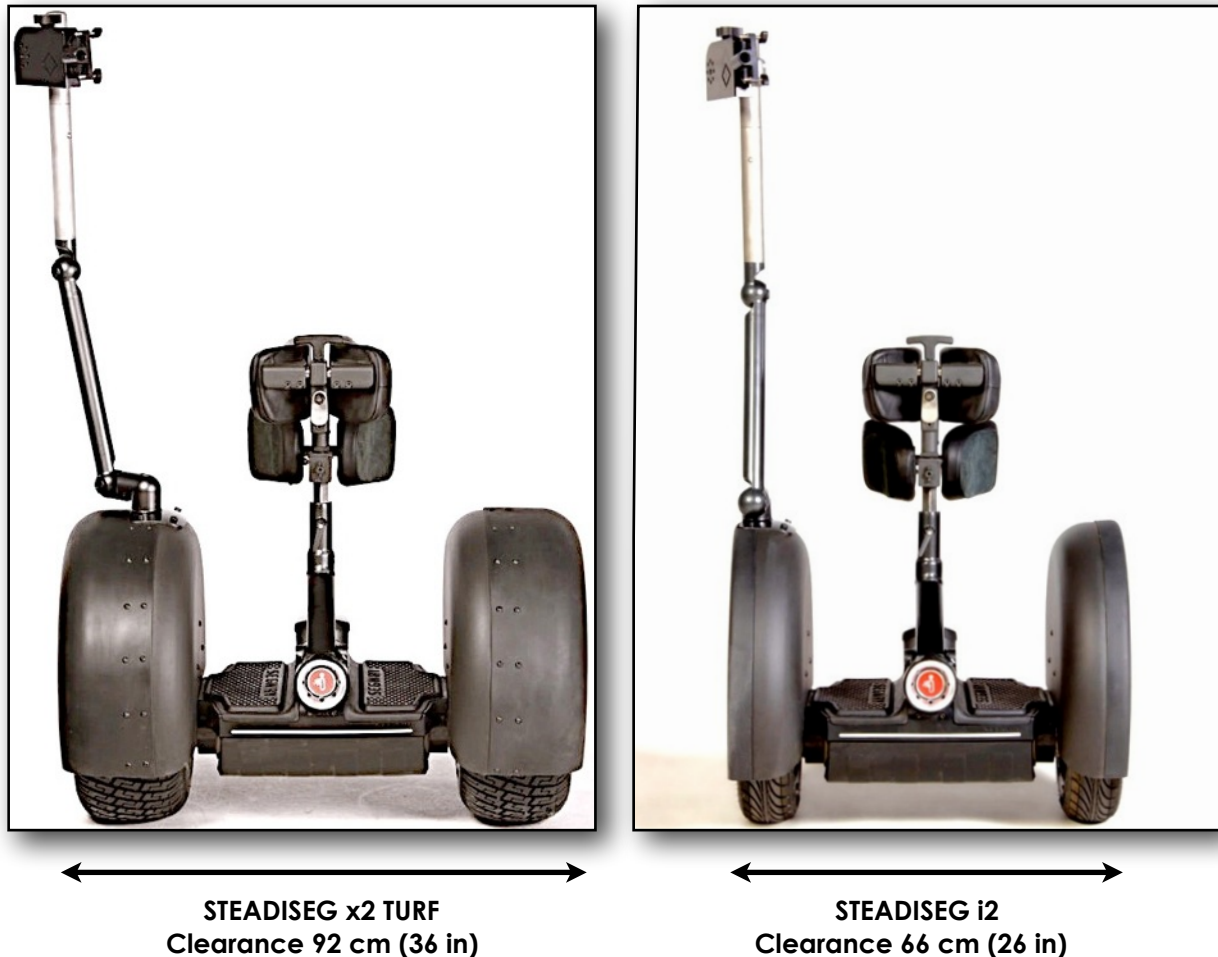
We no longer recommend the Segway x2 tires for Steadicam use. Their rugged tread sets up a resonant vibration that is virtually impossible to eliminate from the shot.

9.4 Clearances

The Steadiseg Turf (with or without hard-mount assembly) is 92 cm (36 in) wide. This configuration offers exceptional stability, and is fine for many purposes, but when working in confined locations and sets, you'll need something narrower. The Steadiseg i2, including hard-mount, gets down to a svelte 66 cm (26 in). A further 3 configurations are possible using the same wheels and fenders. Please refer to the Installation Manual provided with the conversion kit, sections 8 & 9, Wheel Configurations, for details.

Because the Steadiseg behaves differently in each configuration, you should accustom yourself to the divergent handling characteristics before attempting to make a shot.

Flip the Steadiseg onto the opposite wheel from the one you wish to work on. For each side, allow 5 minutes to change wheels and fenders. It takes 10 minutes to switch configurations.



10 SOUND

Steadisegs are not silent. At low speeds, with i2 wheels, they are quiet, but not so quiet as a dolly. At high speeds, with Turf wheels, they are noisier, though way less so than other camera vehicles. On polished surfaces, the tires may squeak when cornering. You should advise the sound department of this at the earliest opportunity.

11 SEGWAY CONVERSION

The Steadiseg conversion kit includes everything required to convert a Segway x2 Turf, or a Segway i2. We advise you to buy your Segway locally. Contact us for dealers in your area.

For general use, we recommend the Segway x2 Turf, but if you intend to use the Steadiseg exclusively indoors—on set or in cramped locations—you should purchase a Segway i2. Most customers purchase the x2 Turf, and a set of i2 wheels. Wheels and fenders are interchangeable between the 2 models.

The conversion kit comes with fenders for both models, plus a hard-mount extension, as standard. The hard-mount fender comes as right-sided (regular) and left-sided (goofy). Rental houses can configure their Steadiseg with 2 hard-mount fenders, so operating side may be switched quickly.

The Steadiseg modification does not support the standard x2 wheels, because their tread is too rugged for Steadicam use. If you have a standard x2, you must purchase a set of either x2 Turf, or i2 wheels, or both.

Converting a Segway to a Steadiseg takes between 30-90 minutes, depending on practice. If you prefer to use rental Segways, Steadisegs can be converted back to regular Segways at any time. See the Installation Manual supplied with the conversion kit for details.

12 TOOLKIT

Recommended:

- 4 mm allen key
- 5 mm allen key
- 6 mm allen key
- 10 mm allen key
- 13 mm tire wrench, or socket wrench with extender for reaching wheel nuts.
- 7/32" allen key (for re-orienting Klassen vehicle mount)
- Tire-pressure gauge
- Foot-pump

Optional:

Torx 27 (for switching hard-mount fender sides—see section 6.4).

Important Note: Fully-charged batteries will deteriorate to the point of no return in one month, if not connected to an electrical outlet. When it's not in use, keep your Segway plugged in.