DEPARTMENT OF
FACILITIES MANAGEMENT

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Landscape Services

Safety Standard Operating Procedure

(Revised 1/2023)

Bollard installation

This Standard operating procedure is for installing bollards on campus. As with any equipment or tools, the most basic premise for safe operation is reading and adhering to the manufacturer's instructions and warnings. This SSOP is not a substitute for the owner's manual produced by the manufacturer.

Schedule- TBD upon needs of the campus and project scheduling.

PPE Required- Safety Glasses, ear plugs, long pants, closed toed shoes, high vis safety vest, barricades/ cones, warning signage.

Safety Requirements- Follow all Silica control guidelines, Setup barricades around work site with signage indicating area is closed off. Make sure to not block ADA access points. Water hoses and extension cords must be kept orderly to prevent a trip hazard.

Safety Hazards: Vehicle and pedestrian traffic, Underground and overhead Utilities, lifting, bending, overhead objects, dust, noise, sharp objects, blind spots, equipment malfunction, pinch points, hot or cold temperatures, and inclement weather.

Tools/ materials- Core drill with 12" bit, Concrete saw, two 5 gallon buckets, post hole diggers, Hex wrench set, ½" drive SAE socket set, 2lb shop hammer, concrete anchor set, hand tamper, torpedo level, concrete trowel, rebar packing rod, Ready mix concrete.

Standard locations- No vehicular areas, Utility protection, any areas determined by management.

We have 5 bollard types currently on campus. Each one mounts differently and requires different steps to install, remove, replace, or repair. Purpose of this SOP is to give a baseline expectation for how to properly perform these tasks and safely.

Campus Standard Bollard- Purchased from Reliance Foundry in British Columbia Canada. These are all painted black with 1" reflective tape around the bottom of the cap rim covering the set screws.

R-7539-RE Architectural Removable Bollard, Model R-7539, Round Ball Top Style, with or without chain eyes,36" high, 10" dia base.Material: ASTM A536, Grade 65-45-12 Ductile IronPowder Coated Textured Blackand 10" mounting Pin**Material:** Ductile Iron ASTM A536 Grade 65-45-12

These particular bollards have two different mounting styles. Removable pin and Non removable.

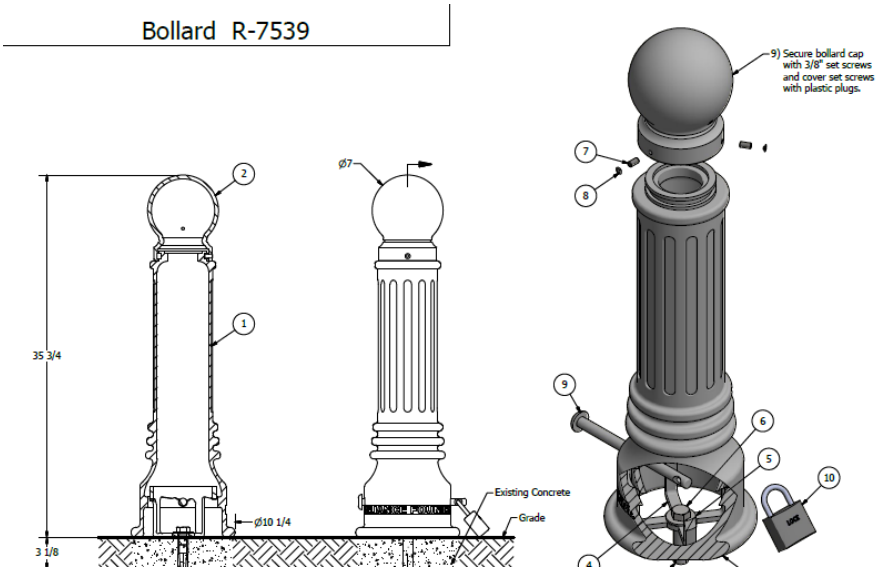
1. **Removable Bollards-** Used in areas for emergency vehicle access and/ or areas we deem as common access entry points.
    - **Anchor base-** Base sets on top of the hardscape by means of drilled in anchor point. Mounted with a single ½"by 2 ½" bolt and washer.
    - **Pop up base-** This base is set in the concrete and pulls up twist lock when in use. It unlocks and drops back even with the concrete. Main purpose is to prevent a trip hazard and also to prevent damage to vehicles and passing over equipment.

2. **No removable-** Bollards are set and not meant to be pulled. Uses a inground set base or drilled in concrete anchor. 1" by 36" all thread runs vertical through the top of the bollard. Uses a 3" by 1" washer and nut that tightens down on the main bollard sleeve. The bollard cap covers the nut and all thread so it isn't seen.

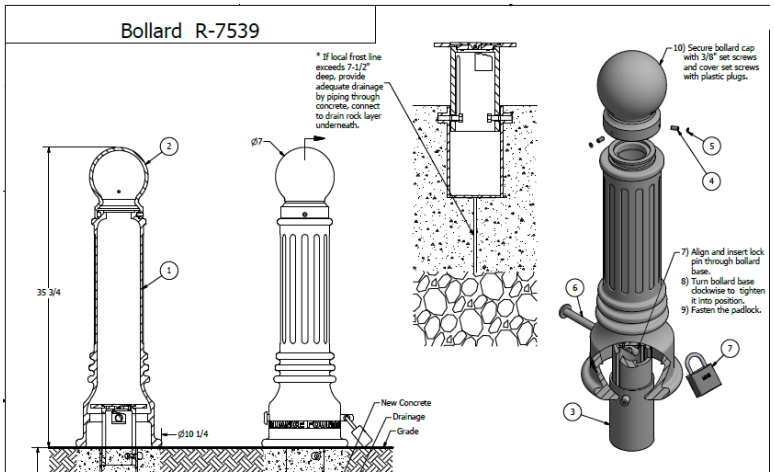
Solid Pipe bollards- In particular areas we have selected to install a solid pipe bollard. These are set in the ground to not be removed. Particularly found along roadways, parking lots, above ground utilities. Purpose to protect signs, gas meters, etc. from vehicle collision.

1. **Solid mount standard-** 4" schedule 40 steel pipe with weld on cap. Set 24" in the ground with 26" above ground. Total length before installed is 5' including cap.
    - **Painting-** The bollards must be visible to pedestrian vehicular traffic. They are painted yellow if installed in a roadway, parking lot, or building protection. Painted black if outside a parking lot or roadway. Black bollards must have 2 strips of 1" reflective tape at the base of the cap and 4" below base of cap.

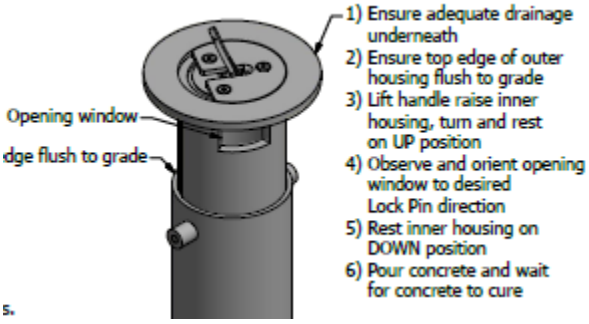
Removable bollard with anchor base



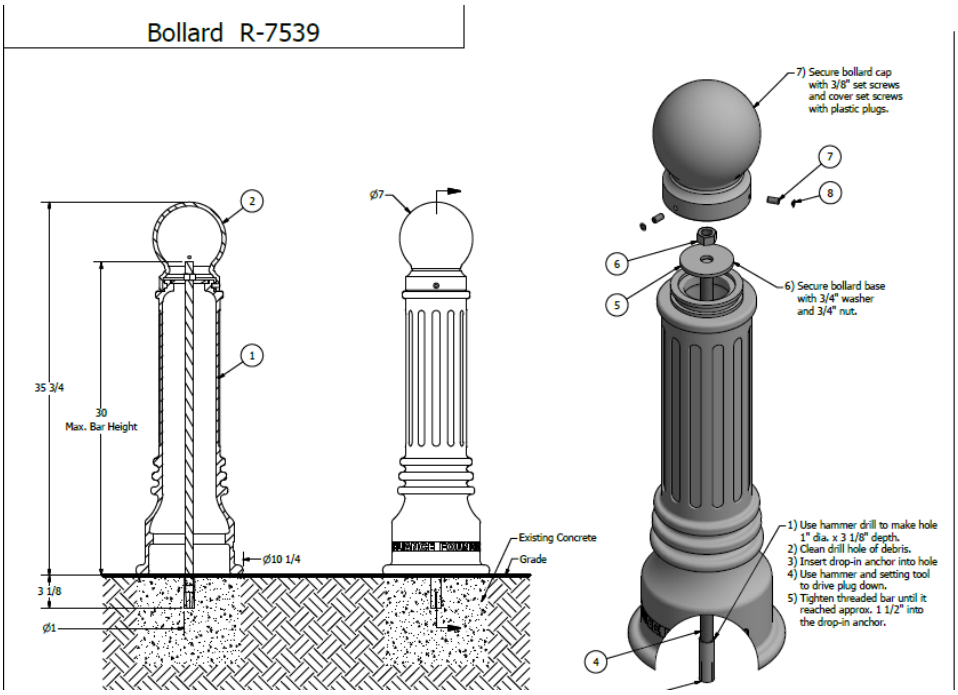
Removable bollard with Pop up base



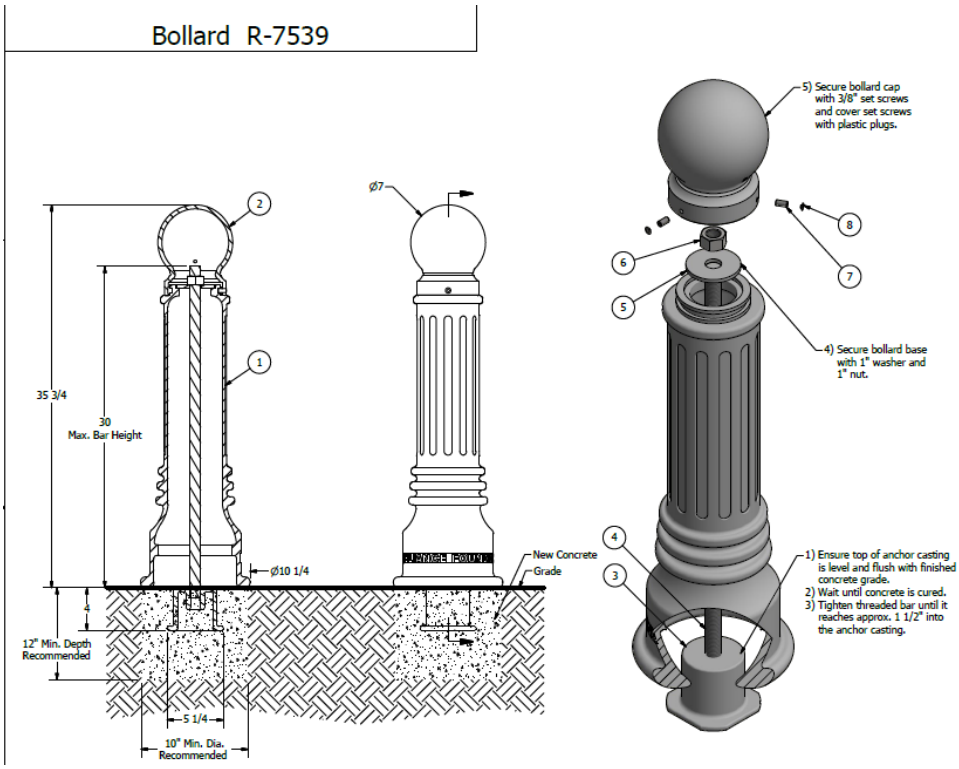
Pop up base



Non-Removable bollard with anchor base



Non-Removable bollard with set base



<u>Removable Campus Standard bollard installation using anchors-</u>

Area of need is identified. Measure area out to determine how many bollards are needed. Bollards are set on 6’ centers to prevent vehicle traffic fitting between them. With outside bollards being no more than 3’ from edge of concrete/ Hardscape.

1. PPE- High vis vest, safety glasses, ear plugs, gloves,
2. Cone off and put-up signage blocking the work area. Make sure to leave and indicate a safe path for pedestrians to still move freely.
3. Working along a roadway, cone off around work area leaving room for vehicles to get by. If needed a flagger will be needed to direct traffic.
4. Pull string line across are to indicate center line. (Make sure to use your knees and not your back for any bending over during the process)
5. Measure and mark center of where bollard base will be.
6. Use a 5/8” concrete drill bit on a drill equipped with hammer action.
7. Measure the inground anchor length.
8. Measure that length from tip of drill bit up and mark with tape. This gives you the exact depth the hole needs to be.
9. (Follow all Silica protocols when drilling concrete) Use vacuum equipped with proper Hepa Filter indicated for concrete or use continues water if drill is equipped. Using water with a drill that is not water equipped can lead to electrical shock causing injury or death. Follow manufactures guidelines with each tool.
10. Drill hole to depth. Then use vacuum to clean out any dust from bottom of hole
11. Push anchor into the hole and use a small punch with hammer and insert into the anchor. Tap down softly to set anchor.
12. Set bollard base with pin holes running the same direction as sidewalk. This prevents the lock getting struck by people pr objects passing by.
13. Use ½” bolt and washer that covers the bollard base center hole.
14. Run bolt through center hole of base into anchor and tighten until firmly tight.
15. Lift bollard bending at the knees not the back grabbing it firmly with both hands. (Do not try to lift any higher than what is needed for installation)
16. Set bollard over base and align pin holes. You may have to get down low to see through the pin holes.
17. Push 10” bollard pin trough the holes. If it is hard to get through yu may have to adjust the base. This is done by loosening the bolt and putting washers under and edge and retightening bolt.
18. All high traffic areas use a Sargent lock number 79 X04. The keys must be checked out from key shop. Bollards in non-high traffic areas use a master lock numbered 3252
19. Install bollard cap using a hex head wrench to tighten the three set screws. Install plastic set screw covers provided with bollard cap.
20. Install 1” reflective tape evenly and connecting around the cap bae covering the set screws.
21. After installation is complete, cleanup all debris, put away tools, look over project and double check work for completion.
22. Last thing to perform is opening the area back up and removing cones/ barricades.

23. If the site required a traffic flagger, after all other staff are in the vehicle and seat belted in, they may leave post to enter the vehicle for departure. All seat belts must be fastened before the vehicle is put into gear and moving.

Removable Campus Standard bollard installation using in ground bases-

Area of need is identified. Measure area out to determine how many bollards are needed. Bollards are set on 6' centers to prevent vehicle traffic fitting between them. With outside bollards being no more than 3' from edge of concrete/ Hardscape.

1. PPE- High vis vest, safety glasses, ear plugs, gloves,
2. Cone off and put-up signage blocking the work area. Make sure to leave and indicate a safe path for pedestrians to still move freely.
3. Working along a roadway, cone off around work area leaving room for vehicles to get by. If needed a flagger will be needed to direct traffic.
4. Pull string line across are to indicate center line. (Make sure to use your knees and not your back for any bending over during the process)
5. Measure and mark (using a waterproof marker) center of where bollard base will be.
6. Using a stand-alone core drill and bit. In ground set anchors and pop-up bases use a 12" core bit.
7. Set core drill with bit centered over center mark for the bollard.
8. Level Drill base using a wrench on the adjusting screws on each corner of the base.
9. Core drill must use water. If water connection is not available, a pull tank or tote must be used. Gravity feed only. Do not use the pump on the tank or tote.
10. Make sure any water hoses are marked for visibility and will not cause a trip hazard.
11. Core drill requires 120 volt electric. Either pulling from a receptacle close by on a building or may need a generator. Make sure extension cords are marked for visibility and will not cause a trip hazard.
12. Loading the generator. Get help- do not try to pick up a generator on your own. Or use equipment provided, operated by a staff member approved to run the particular piece of equipment.
13. Check oil and fuel before leaving storage to the jobsite. Should not be making trips back for fuel or oil.
14. Make sure drill bit is clear of loose clothing, obstacles, personnel, etc. before starting.
15. Turn water supply on. Open valve on drill to alleviate air pockets in line. Close water valve back off once water is running steadily. Open valve back up just to where water is starting to run out of the bit.
16. Drill operator should be standing on the back base of the drill. Using the hand crank let the drill bit down slowly. When the bit makes contact, let the weight of the bit do the cutting. Do not put pressure down using the crank handle.
17. Caution- your pant legs will get wet. Use either water/ rain pants to prevent getting wet.
18. Once core drill has gone all the way through the concrete, raise the drill slowly using the crank handle.
19. Once the drill bit has reached the surface turn the drill and water off. Caution- the concrete plug could stay in the core bit. When turning the machine off it can fall back out. Watch for this before moving the drill.
20. Move the drill by leaning it back onto the wheels and rolling. Do not drag it across the concrete scaring the surface.

21. If the core plug stayed in the hole, leave it until you are ready to set the base.
22. To remove the plug- Use a hammer drill with the 5/8" bit. Drill into the center of the plug about an inch deep. Stop the drill while drilling and you can use the bit as a handle to pull the plug out.
23. Check your depth of the hole, the hole should be 1" Deeper that the base is tall. Dig out excess material to achieve proper depth. If over deep that is fine.
24. Mix in a bucket a quarter 60lb bag of ready-mix concrete. Mix concrete fairly dry.
25. Using a small trowel place enough concrete and pack in the bottom of the hole for the base to set on.
26. Place base in hole at the proper depth. Place more of the dry set concrete around the base to hold it firmly in place leaving about an inch still below finished concrete grade.
27. Mix a little bit of water with remaining concrete in bucket to make it self leveling.
28. Fill the last inch around base to finished concrete grade. Smooth evenly with trowel.
29. Let set for about an hour and check how the concrete has setup. At this point on a popup base check for proper operation. Pull up and twist into lock state, then unlock and push back down. If it does not work properly it will have to be pulled and redone.
30. Once the concrete is firm- follow the same directions for setting the pin styler bollard as before.

In ground pipe bollard Installation

Area of need is identified. Measure area out to determine how many bollards are needed. Bollards are set on 6' centers to prevent vehicle traffic fitting between them. With outside bollards being no more than 3' from edge of concrete/ Hardscape.

1. PPE- High vis vest, safety glasses, ear plugs, gloves,
2. Cone off and put-up signage blocking the work area. Make sure to leave and indicate a safe path for pedestrians to still move freely.
3. Working along a roadway, cone off around work area leaving room for vehicles to get by. If needed a flagger will be needed to direct traffic.
4. Metal 4" schedule 40 weld cap and pipe is sold through supply in 7' lengths.
5. Get help- pipe is heavy to carry into shop. Measure 5' from the clean-cut end of the pipe.
6. Use large electric bandsaw in the shop to cut the pipe.
7. Set pipe on saw using the pipe stands on each end to balance it. Place a bucket (located by the saw) under each end of the pipe. Align blade with 5' marking and set clamp on saw platform.
8. Turn on the saw and make sure water is running lined up with the blade. Make adjustments before starting the saw. Once everything is clamped, turn saw blade on. Use lever with red knob to start blade movement. The blade will automatically start moving down to make the cut. Watch for blade jams and water spills from the saw during the process.
9. Once cut is finished- turn off the saw. Unclamp the pipe, pickup from one end to drain any water residue out of pipe into a bucket.
10. Stand pipe up against bench and clamp in the vice located by the saw.
11. Welder- Use welding gloves, safety glasses, and welding helmet to perform this task. Also, a long sleeve shirt to prevent slag burns. A leather apron is also available in the welding supply cabinet.
12. Turn on MIG welder. Turn on gas cylinder. (Regulator is set to 8psi. Do not adjust)

13. Set cap on smooth end. Using the welder make 4 tacks around cap connecting it to the pipe. Once it is tacked securely and straight, start making welds using a circular motion across seam of cap and pipe.
14. After welding is done- use 4” angle grinder with tiger paw disc to grind weld smooth. Safety glasses, ear plugs, gloves.
15. Clean pipe and cap with rag and degreaser. Paint bollard using spray paint proper color for area. Flat black or safety yellow.
16. Get help- load the pipe bollard into the work vehicle. Secure and haul to location.
17. Pull string line across are to indicate center line. (Make sure to use your knees and not your back for any bending over during the process)
18. Measure and mark (using a waterproof marker) center of where bollard base will be.
19. Identify hardscape material to determine methods of installation.
20. Concrete- following core drilling procedures as before. 6” bit may be used for in ground set non removable bollards.
21. Asphalt- Using Concrete saw (quicky saw) with diamond blade intended for the type of material following silica protocols must use water. Follow the water guidelines as listed before.
22. Check saw over- blade shield must be in place, not damaged, and operational. Blade installed in the proper operating direction. Handles in good proper working order.
23. Saw has a water connection along the right side.
24. Always keep two hands on the saw for operation.
25. Proper PPE must be used by operator and others within the work site.
26. Mark a 12” x 12” square around bollard center point.
27. These saws are heavy and can kick back on you while cutting.
28. Make sure to keep the saw just right of body and stay behind the blade.
29. Best practice I to kneel on one knee. Set saw down flat on solid surface, keep two points of contact while starting and operating.
30. Align saw with cut line and lean saw forward slowly until blade makes contact. Let the weight of the saw do the work.
31. Cut passed the lines three inches since the rounded blade will not cut full depth at the front edge.
32. After finishing with each cut, let off the throttle trigger while pulling the blade from the cut. These saw blades reach extreme RPMS and take a little while to quit moving. Keep two points of contact until the saw blade comes to a complete stop.
33. Turn off and disconnect water from saw. Put saw away into the back of the working vehicle to eliminate a tripping hazard.
34. Use hammer impact drill with spade on hammer setting only. Or use a rock bar to remove/ breakup asphalt.
35. Collect spoils into a 5-gallon bucket to be discarded of in a dumpster or spoils pile to be hauled off.
36. Using handheld post hole diggers. Keep handles closed while jabbing into the soil. Rotate the direction of the spades as you jab into the soil in a up and down motion.
37. Once soil is breaking up enough, jab into soil and open handles. Pull up using your knees keeping the handles pulled apart. Dump spoils into a 5-gallon bucket.
38. Good method is to mark the handle of the post hole diggers at the desired depth. This allows you to know when you are getting close.

39. Repeat this motion until required depth is met. Sides of the hole should be even top to bottom and round in shape. (shaped like a cylinder)
40. Once you reach required depth, put the post hole diggers away properly in the work vehicle.
41. Using both hands pick up pipe bollard. Set in hole with open end down. Remember to lift with your knees and not your back.
42. Use a torpedo level to check for vertical level all the way around.
43. Pour a cup water into base of hole. Then pour ¼ bag of concrete ready mix into hole. Use a 3/8" rebar to compact concrete around post. Check level on post during process.
44. Add another cup of water and concrete mix. Repeat this until you reach 3" from ground level.
45. Once concrete and post is firm and level. Use asphalt cold patch to fill in rest of hole.
46. Spread cold patch material to 1/2 "above existing grade.
47. Use hand compactor to tamp asphalt down level and compacted hard. (You may need to add cold patch and repeat compaction process to meet existing grade)
48. Once everything is setup- clean area, wash bollard, and remove barricades, cones, signs.
49. Put all materials back in proper location and neatly.
50. Make notes on work order for work performed and charge time appropriately.