

ACPA SAFETY BULLETIN

SETTING OUTRIGGERS TO PREVENT ACCIDENTS

January 22, 2010

Safety Bulletin # 05001

Background information

Tipping accidents have occurred as a result of:

- Inadequate cribbing
 - Misjudging the soil
 - Soil not compacted
- Setting up too close to excavations or backfilled areas
- Hidden voids
 - Wash outs
 - Natural or man-made voids

Setting the outriggers of a concrete pump with placing boom is one of the most critical jobs of the concrete pump operator and should always be done in accordance with the manufacturer's recommended procedure. If not done properly, it can lead to a serious accident.

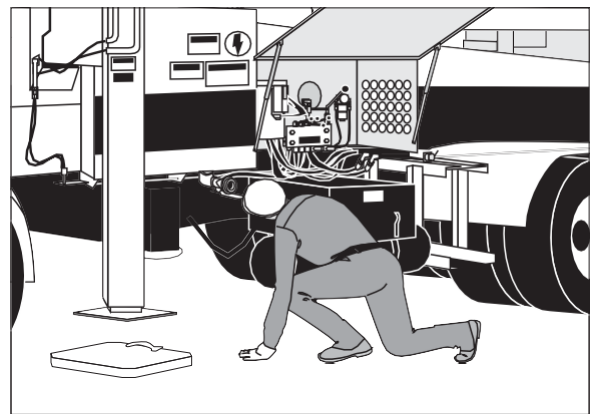
Setting outriggers

When arriving at the jobsite, always check-in with the contractor. Talk with the superintendent or foreman regarding where to set up safely. The contractor needs to supply a safe set-up area where the soil is capable of supporting the outriggers and there are no voids, pipes, or other hidden dangers.

Always use the factory-supplied cribbing pads or more, no matter what the surface, even if it is on concrete. If jobsite conditions do not allow full extension of all outriggers and you are required to shortrig, be sure that you understand all of the rules. If you do not understand the rules, **do not set up!**

When laying cribbing, spread the load. Use as practical, especially on the side that will feel the weight of the boom. Walk around the unit and center the outrigger pads and cribbing directly under each outrigger foot pad.

Before jacking the first outrigger, look under the truck to be sure that no one has approached the pad on the opposite side (Figure 1). When possible, use a spotter. As an outrigger is jacked, the entire unit tips the opposite direction. This tipping causes the outrigger on the opposite side to become closer to the ground. The weight and force of this movement could easily crush anything that comes between the outrigger and the ground. **Be careful when jacking the outriggers!**



lookingunder.eps

Figure 1
Look under

There are some additional do's and don'ts of outrigger stabilization:

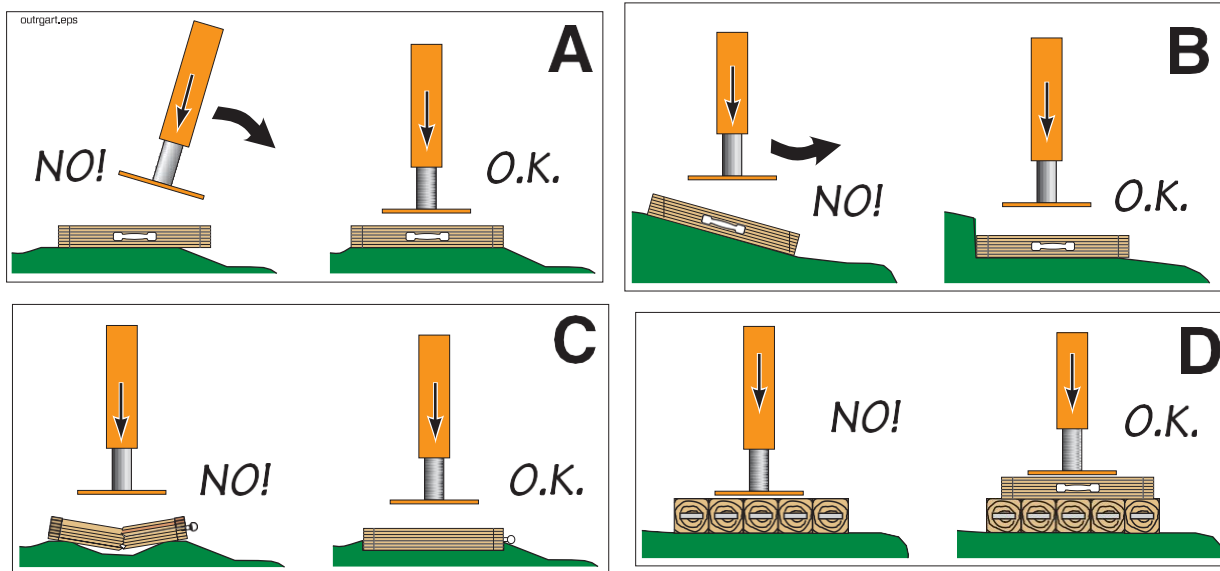


Figure 2
Dos and don'ts of outrigger stabilization

- Do not set the outrigger on uneven soil (Figure 2 A). If necessary, reposition the unit or level the soil.
- Do not set the outrigger on a hill (Figure 2 B). The force of the machine weight must be transmitted straight down. If you were to set up as shown in this example, the outrigger load would be partially down and partially sideways, putting undue strain on the outrigger leg.
- Do not bridge a hole with outrigger cribbing (Figure 2 C). If there is no soil contact over the hole, the pressure on the ends of the pad is much greater. The soil could give way or the cribbing could break.
- If you determine that you need five pieces of cribbing to support the load but the foot only touches three of them, the outrigger will sink into the soil. To avoid this problem, lay dunnage the opposite direction on top of the first layer (Figure 2 D). The top layer of dunnage must contact all pieces that are supporting it.

When jacking, put the full weight of the truck on each outrigger, one at a time, and if the pad starts to sink, retract the foot and supply more cribbing. Continue this process until the outrigger appears stable and the pad shows no sign of sinking. Only then are you ready to unfold the boom.

If you are unable to get the outriggers to stabilize, do not unfold the boom. Relocate the pump to a location that will support the weight of the outriggers.

Watch for warnings

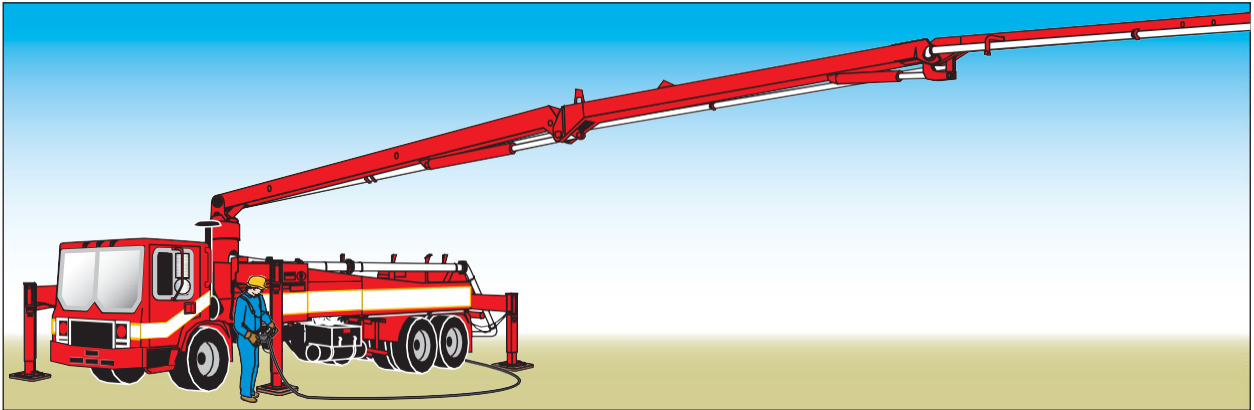


Figure 3

Slowly slew the outrigger around the unit and watch for any outrigger sinking

As you unfold the boom, always test the stability of the unit. Slowly slew the extended boom over each outrigger. If you see that an outrigger is sinking into the soil, immediately slew the boom back to the position it came from, and fold it up. Adjust the amount of dunnage under the cribbing pads until you have enough soil contact to hold the unit without sinking. Repeat the procedure for each outrigger (Figure 3). Stability of the unit must be ensured.

While pumping, continue checking the outriggers throughout the day to be sure they are not sinking.

Other warning signs to watch for during your initial set-up include:

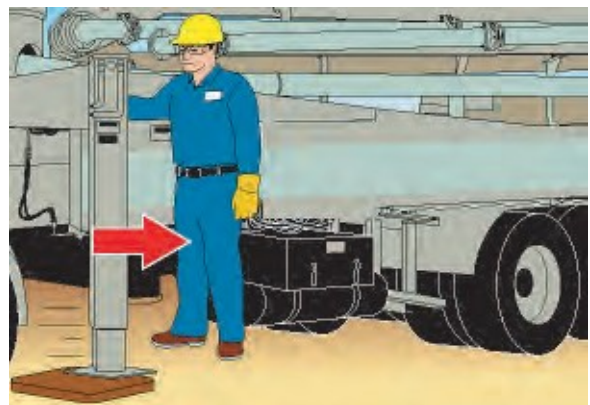
- Very green grass in a circular shape
- Pipes sticking out of the ground
- Signs of excavation
- Sprinkler heads
- Backfilled ditches
- Ditches with water in the bottom

Get as much cribbing as you need

Safety and stability of the pump is everyone's concern. Most people will be happy to provide you with whatever you need - especially if they know their own safety is at stake. Wood dunnage is very common and works well for well compacted, flat soil. If you are on soft soil or near the edge of an excavation, it may be necessary to ask for a large, flat, steel plate to help distribute the weight.

Retracting outriggers

An outrigger may suddenly jump when weight is removed, because the center of gravity on the truck has shifted. Never stand behind the outrigger or between it and another fixed object when it is being retracted (Figure 4). Clear the outrigger area of personnel before retracting outriggers.



outrigjump.eps

Figure 4

Don't stand behind the outrigger when it is being retracted



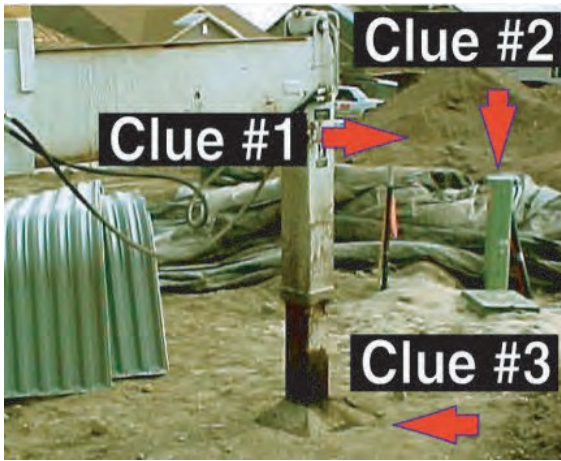
sinking.eps



sinking2.eps

Figure 5

Inadequate cribbing. Is the soil un-compacted or soft?



newbackfill.eps

Figure 6
Warning clues

The pictures in Figure 5 and Figure 6 show examples of signs of trouble when cribbing under an outrigger is inadequate because of soil conditions. Clue #1 in Figure 6 is a fresh pile of dirt, indicating recent excavation. Clue #2 is the utility box which is another sign of recent excavation. Clue #3 is the outrigger (without cribbing) beginning to sink into the soil. When the operator swings the boom over the outrigger, it will begin to sink. When the outrigger begins to

sink, the boom should be brought back to the travel position and adequate cribbing placed under the outrigger.

Figure 7, is an example of an accident with inadequate cribbing that occurred without warning. Virgin ground is capable of withstanding only about 22 PSI of pressure. Because of that low pressure capacity, the load must be spread over a large area.

Had the operator provided a large area of cribbing under the outrigger (like that in Figure 10), this accident could have been avoided.

Figure 7

Punch through accident because of soil conditions



virginground.eps

Do not partially extend outriggers

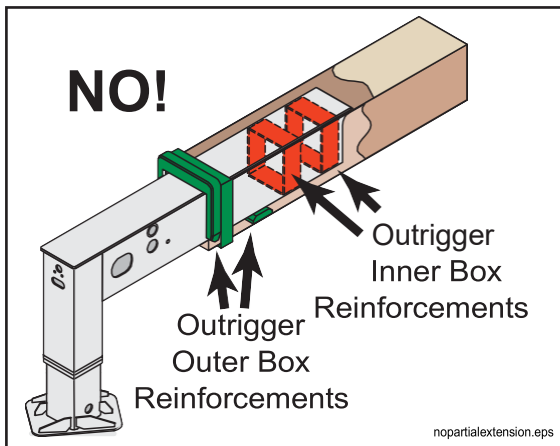


Figure 8
Do not partially extend outriggers

CAUTION

Structural damage to outriggers is possible. Do not jack outriggers unless they are either fully extended or fully retracted.

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Partial extension of telescoping outriggers is not acceptable at any time. Jacking the outriggers while they are in any position other than fully extended or fully retracted could cause structural damage to the outrigger outer box and/or the inner box (Figure 8).

The three illustrations shown in Figure 9 explain the situation with the outrigger in all positions.

Remember that the boom must *never* be extended over a retracted outrigger.

Figure 9
Partial extension can cause damage to the outrigger

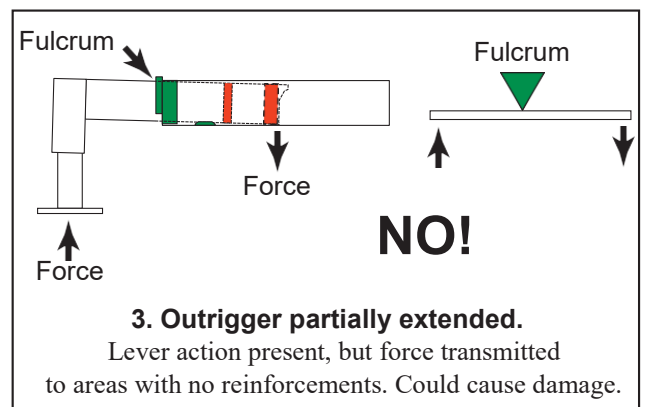
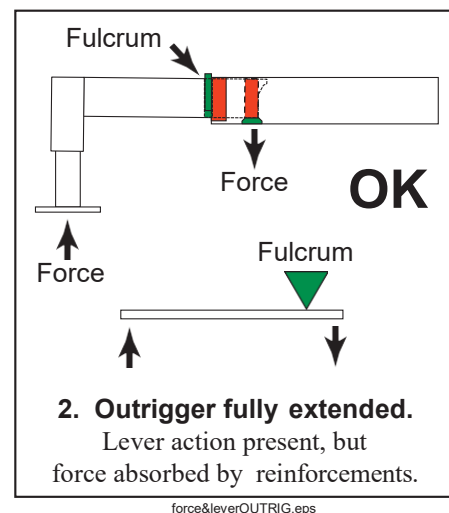
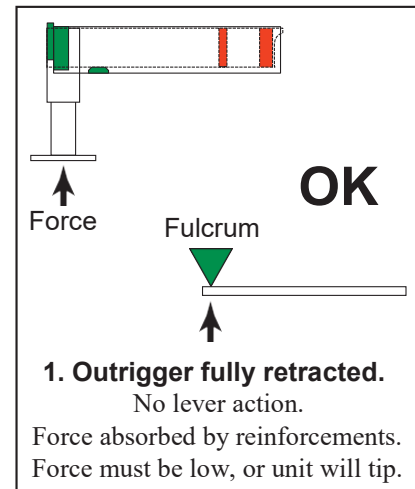


Figure 10
 Outrigger load spread properly to avoid the possibility of accidental punch-through



Figure 10 shows an effective way to spread the load of the outrigger foot and bring the pressure imposed on the ground to a minimum.

4' x 8' sheet of steel = 4608 square inches
Outrigger force = 32,600

$$32,600 \div 4608 = 7.07 \text{ PSI}$$

Excavations and cliffs

If set-up will be done near an excavation, the one-to-one rule must be applied (Figure 11). The outrigger force emits pressure as a 45° cone below the surface, so it is very important to be aware of washouts at the base of an embankment as shown by the “X” in Figure 12. Engineered support walls can be treated differently than excavations, and the operator may follow the advice of the contractor or engineer on the job if he believes the advice to be sound.

NOTE!

Measurement for the one-to-one rule shall be made from the edge of the outrigger pad nearest the excavation, and the distance from the edge should be increased if soil conditions appear unstable, if the jobsite authorities indicate the soil conditions are unstable, or if the manufacturer's recommendation is more restrictive.

Figure 11
 One-to-one rule

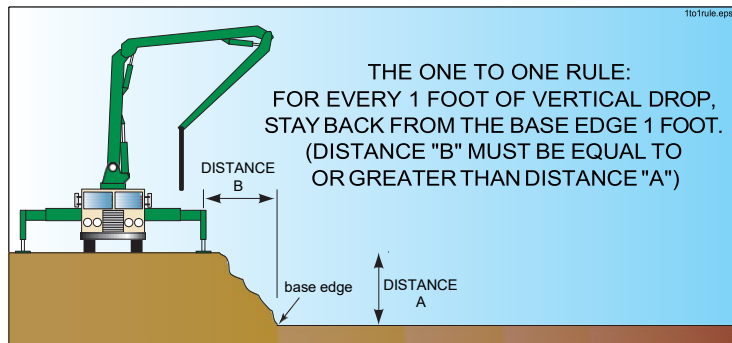
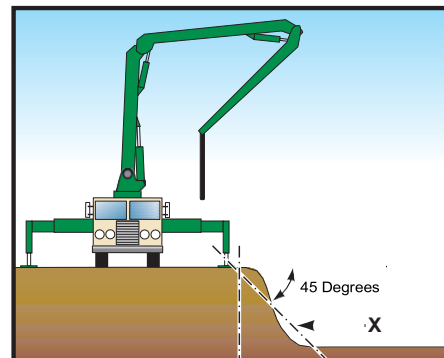


Figure 12
 Watch for this
 (Soil washed out at the “X”)



Hidden voids are hidden hazards

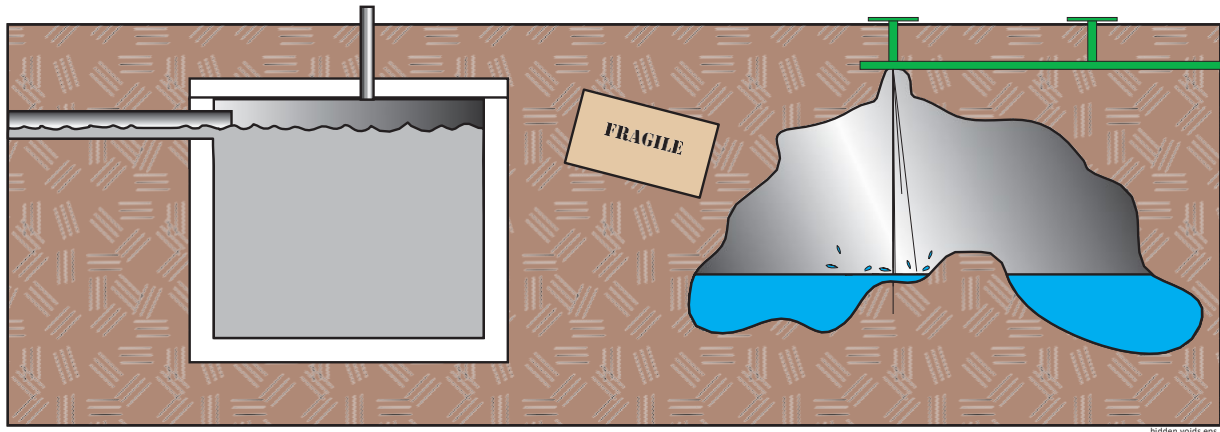


Figure 13
Examples of underground hazards

Unless an operator has x-ray vision, there is no way he can tell if he is setting up over a hidden void (Figure 13). Some voids, like septic systems, may have a pipe protruding from the ground. Sprinkler heads would give some indication that there might be buried hazards. But some voids, like a buried box, leave no clues for even the safest-minded operator. His only chance is spreading the load.

Figure 14 shows an example of a punch-through that occurred without warning because of an underground void. The pour had progressed for some time with no warning of the outrigger sinking when it suddenly punched through and brought the boom crashing down.



Figure 14
Hidden voids cause accidents

Inadequate cribbing

The formula for determining the load imposed on the soil is to divide the total outrigger force (pounds) by area of soil contact (square inches).

Soil pressure = total outrigger force ÷ area of soil contact

The following chart shows a few of the different soil types and their approximate load-bearing capacities:

Soil Type and Approx. Load-bearing Capacity

Virgin ground.....	14 PSI
Asphalt.....	29 PSI
Compressed, crushed stone.....	36 PSI
Clay/silt soil, firm.....	43 PSI
Mixed granular soil.....	51 PSI
Firm, compacted gravel.....	58 PSI
Brittle, weathered rock.....	145 PSI

Misjudging the soil

Operators rarely have access to the compaction data of a jobsite, and will generally have to make judgment calls. Because of this, they should make the cribbing base as large as is practical.

An example:

The decal on a pump outrigger shows a maximum force of 32,600 pounds (Figure 15). The soil is firm, compacted gravel, which has an approximate

load bearing capacity of 58 PSI. If an outrigger was placed on the manufacturer's supplied cribbing pad, which has 576 square inches of surface, it could technically support the unit.

$$32,600 \div 576 = 56.59 \text{ PSI}$$

It is easy to misjudge the soil material or compaction, and the information is often not available. The best case scenario would be to spread out the load considerably more than the 576 square inches by placing a larger base under the supplied pad. For example, ten 36" long 4x4's (1260 square inches) or a 4 foot x 8 foot (4608 square inches) sheet of strong material (like steel) would lower the outrigger pressure dramatically, reducing the chance of an outrigger sinking or dropping.

Operators are not expected to make calculations such the one shown above while on a jobsite. This information is given only to show that the ground has many different load bearing capacities, and boom trucks all impose a different force on the soil. The bottom line is this, the greater the force imposed on the soil, the larger the dunnage area must be.

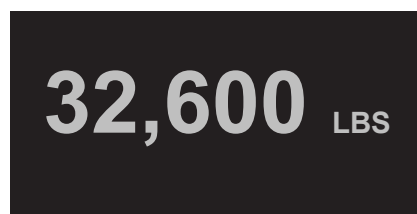


Figure 15
Pump outrigger decal example

Summary

Prevention

Tip-over accidents can be avoided if people take precautions when the unit is set up. Both operators and contractors must be aware of the potential danger that exists when a large boom is unfolded and extended over outriggers. If the contractor remembers to offer additional cribbing and if the operator remembers to ask for it when it isn't offered, the problem can be minimized even before the boom is extended.

Cribbing: more or less?

- More is better
- The stronger the material the better
- Pay close attention to the type of soil where you're setting up the unit.

Training

Every person in the chain of a pumping job has a responsibility to help protect the hose person and other nearby personnel. Education is the key, followed closely by diligent watchfulness and personal protective equipment. Educational materials are available from the ACPA, and everyone involved in the concrete pumping process should be trained, including:

- Job superintendents
- Labor foremen
- Laborers
- Pump operators

Responsibilities

Contractors

- One of the things a contractor can do to help is to order the right size boom:
 - If the boom is too small, for example, he may have to set up too close to an excavation to reach the pour.
 - If the boom is too large, it will require much more cribbing than a smaller unit.

- Have a place prepared for the pump before it arrives on the job.
- Inform the operator of backfilled areas, soft or muddy areas, or underground obstructions.
- Have cribbing nearby the set-up area prior to the pump's arrival (including steel sheets if the soil is known to be bad).
- Monitor the set-up. Don't let the operator cut corners or take chances.

Dispatcher

The dispatcher can help by communicating with the contractor when he calls to order the pump, and:

- Send the size pump that is needed, if available.
- If availability causes you to send a unit that is too big or too small, warn of possible complications.
- Ask about soil conditions or underground obstructions.

Operator

The operator is ultimately in charge and must make good decisions regarding set-up including:

- Use as much cribbing as practical; too much is better than too little.
- Watch for all warning signs prior to set-up.
- Watch for sinking outriggers while unfolding the boom, and continue to recheck them throughout the day.
- Keep people out from under the boom whenever practical.

This document is intended to supplement, but not supersede the manufacturer's applicable instructions.

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Edited by the ACPA.

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