



PROPER BENCHING & SLOPING TECHNIQUES

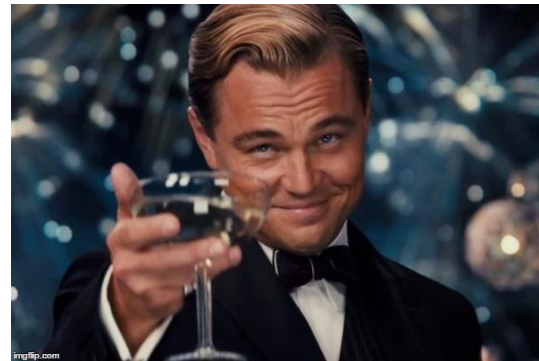
An ARCO SAFE Guide



- THIS IS SOMETHING WE'VE BEEN...

DIGGING...

- INTO, AND THOUGHT A BRIEF SLIDESHOW WAS WORTH SHARING





THE ACTUAL WORDING FROM OSHA

You don't have to read this whole thing

- **1926.652(a)(1)** Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:
 - Excavations are made entirely in stable rock; or
 - Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.
 - Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

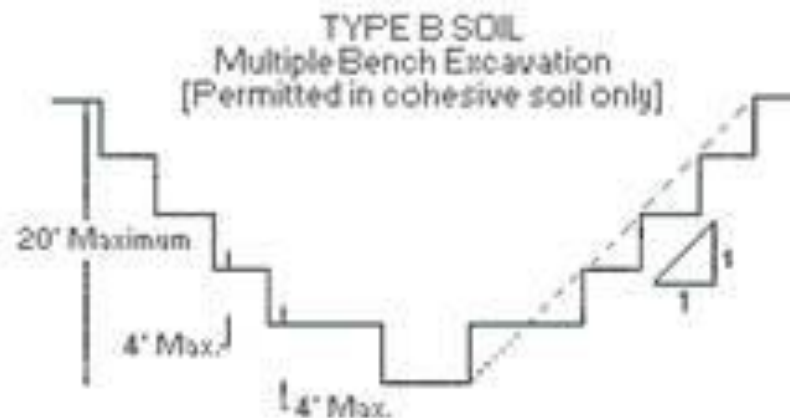


HOW WE'VE ALWAYS INTERPRETED IT

- Excavations 5' or deeper need to be benched/sloped/shored.
- If they're deeper than 20' we need an engineer.



- That is a good interpretation, but... we have to put that interpretation into the correct practice.
- You may have even seen this picture about 4' Max.:





- So you may have always just assumed:
“UP 4 FEET BACK 4 FEET”

I assumed the same thing for a long time...

But let's take a look at how that would work...



FOR OUR EXAMPLE:

- We'll use Type B soil – because it is required to be benched/sloped at 1:1 and that's an easy ratio to work with (and I don't math good).
- We'll assume the deepest possible excavation without needing an engineer – 20'



SOIL TYPES DEFINED

- Type A – cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) or greater.
- Type B – cohesive soils with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf.
- Type C – cohesive soil with an unconfined compressive strength of 0.5 tsf or less.



- Your soils report should tell you what type of soil you have.
- You can also purchase a “Pocket Penetrometer” for about \$50.
 - I ordered some from Certified Material Testing Products www.certifiedmtp.com
 - I believe Grainger carries them as well.
 - Or you could just use the Google.

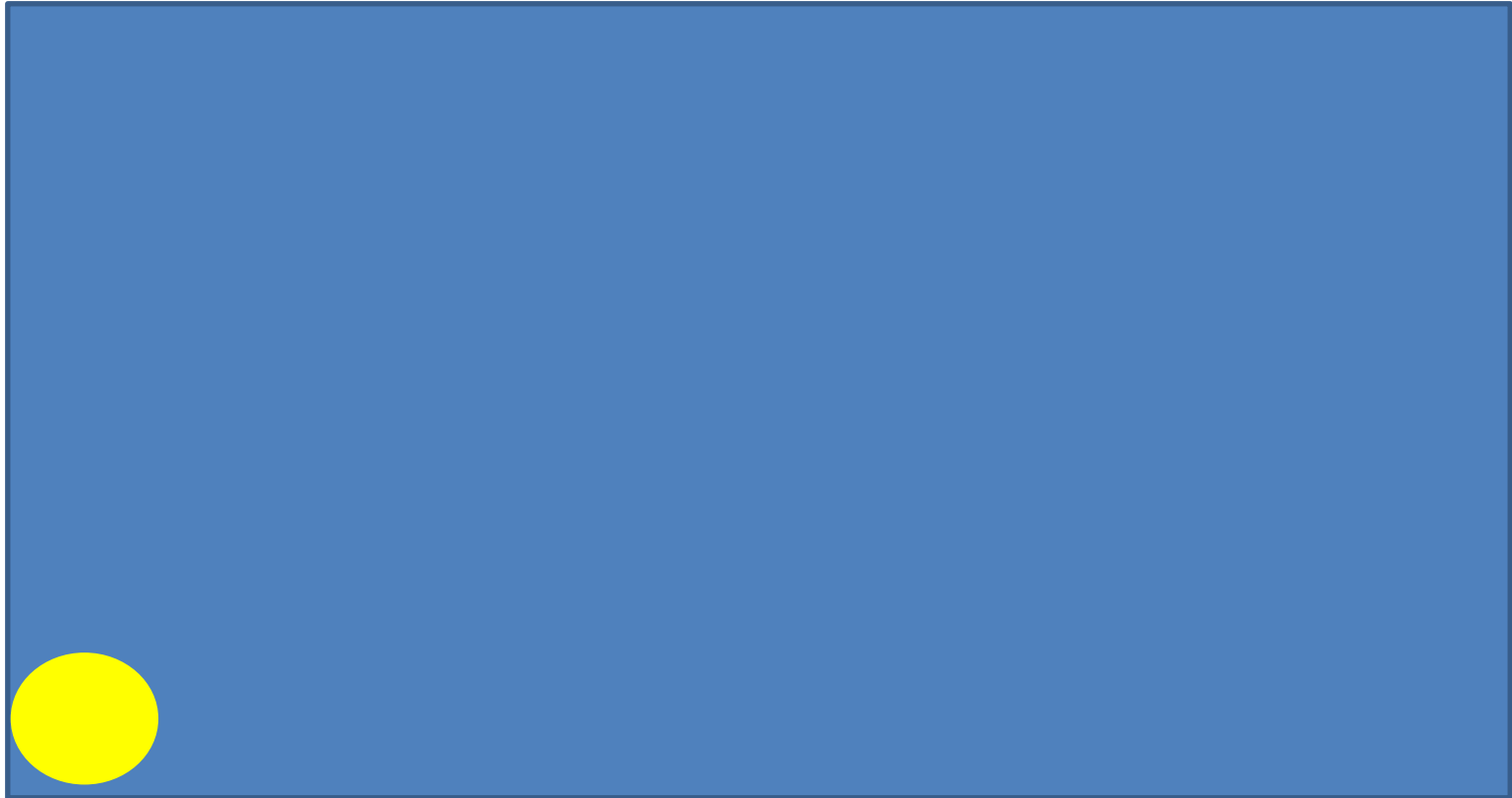


KEEP IN MIND:

- Type A soil can be benched/sloped at $\frac{3}{4}:1$
- Type C soil can only be sloped at $1 \frac{1}{2}:1$
 - Type C soil can NOT be benched.



HERE'S OUR BIG CHUNK OF EARTH AND WHERE WE WANT TO GET TO...





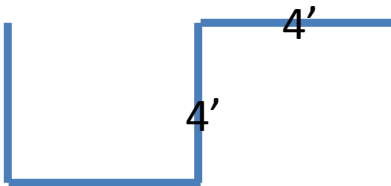
Here's the start of our excavation...

- Because of the size of our slides we'll only be demonstrating on one side of the excavation (assume the same is happening on both sides).



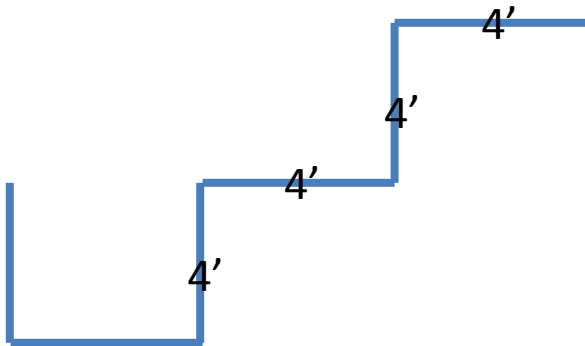


- UP 4' OUT 4'



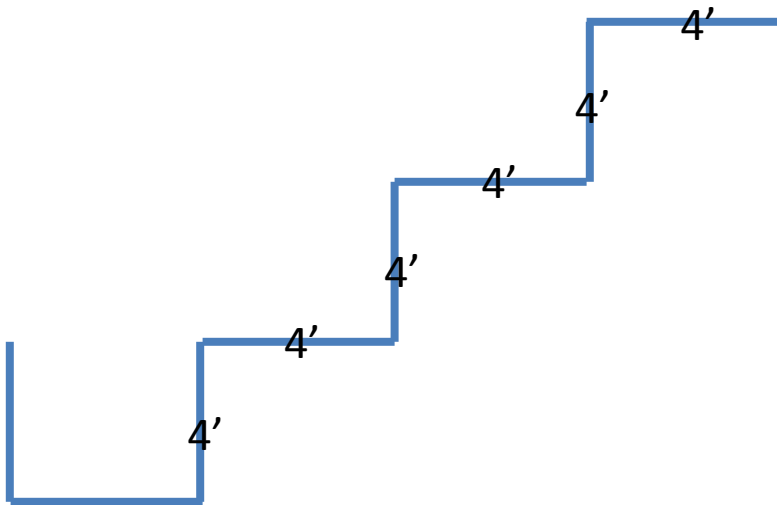


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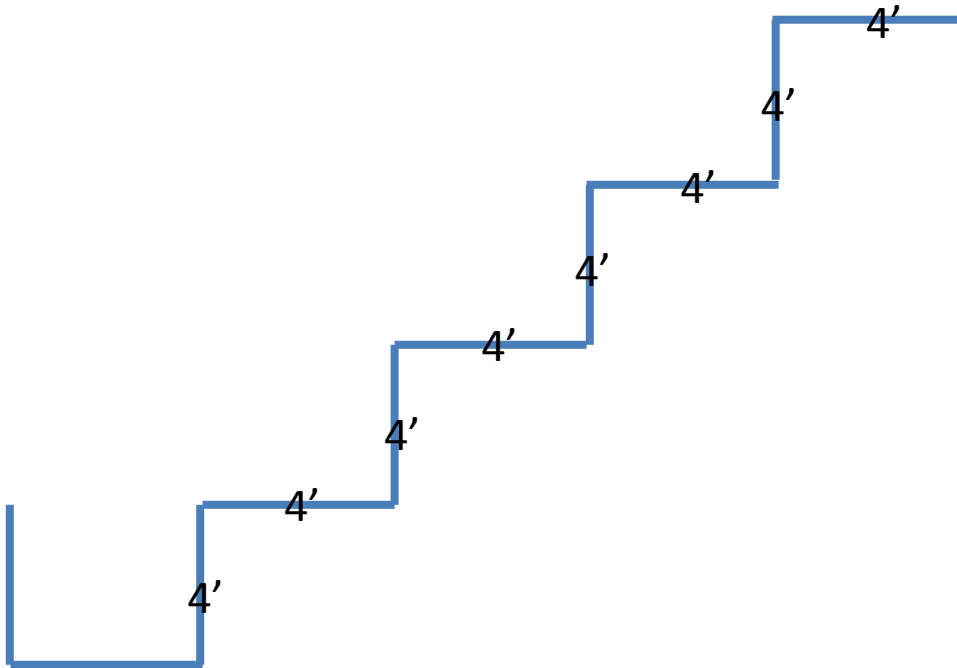


- UP 4' OUT 4'



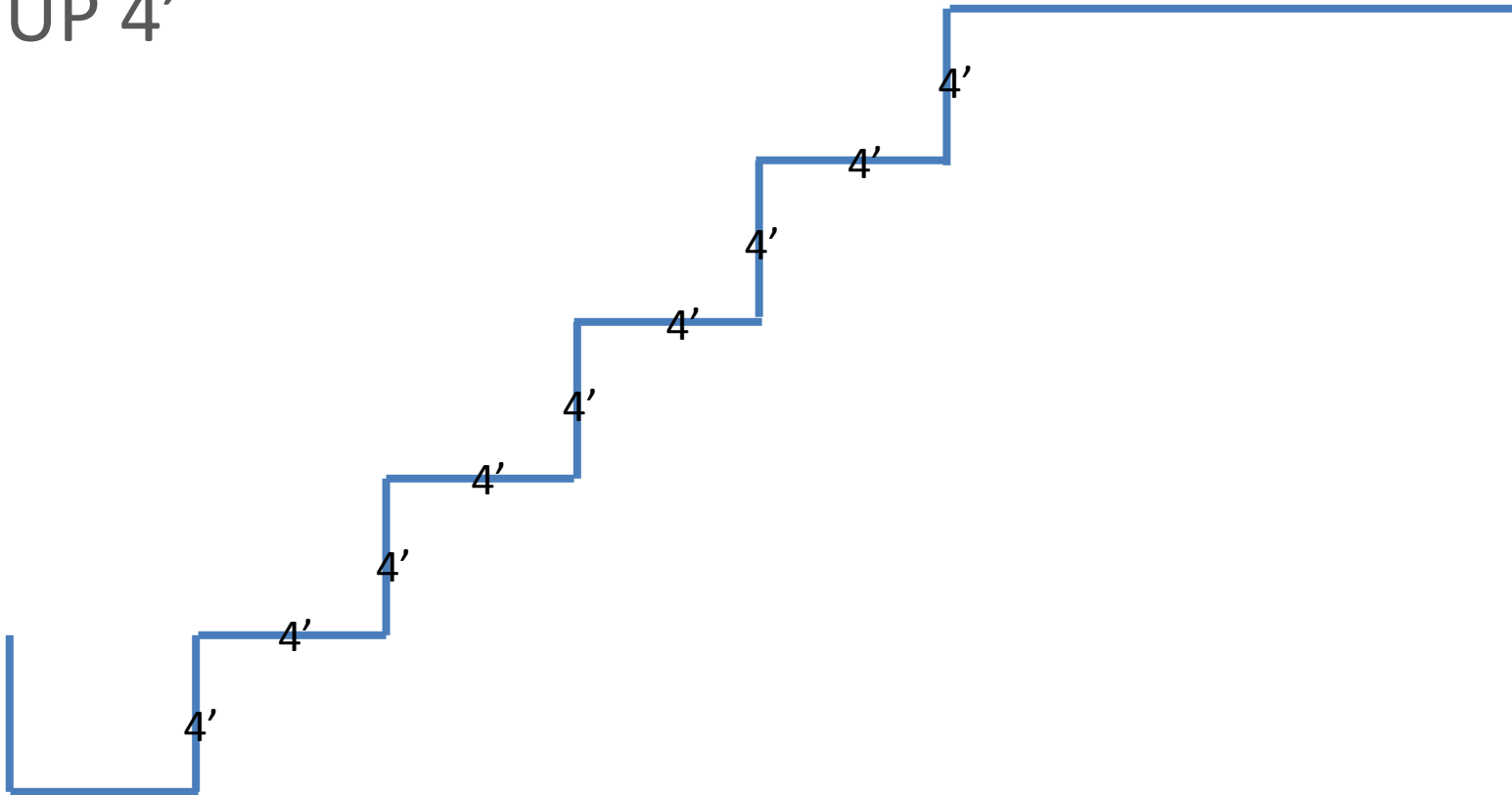


- UP 4' OUT 4'





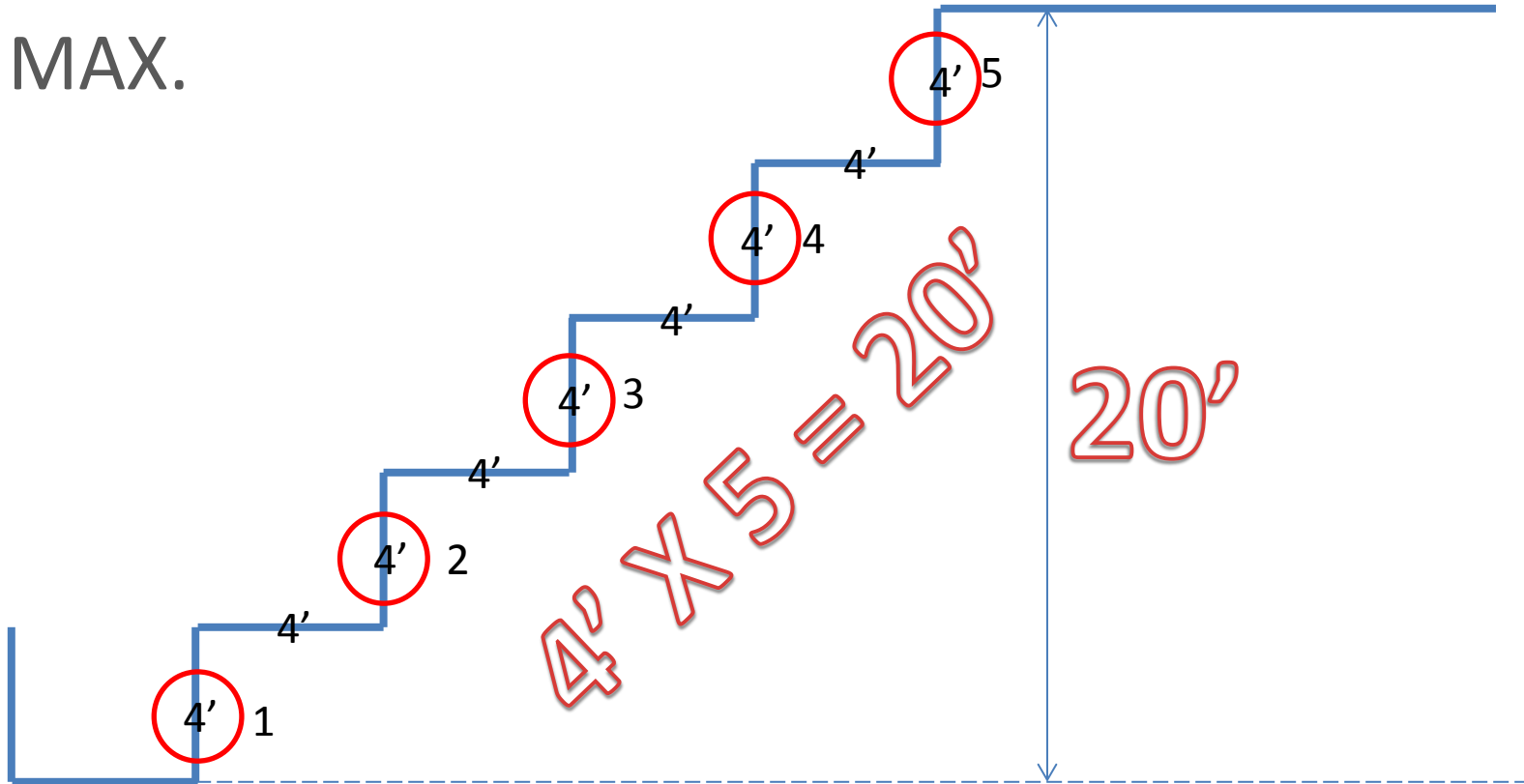
- UP 4'





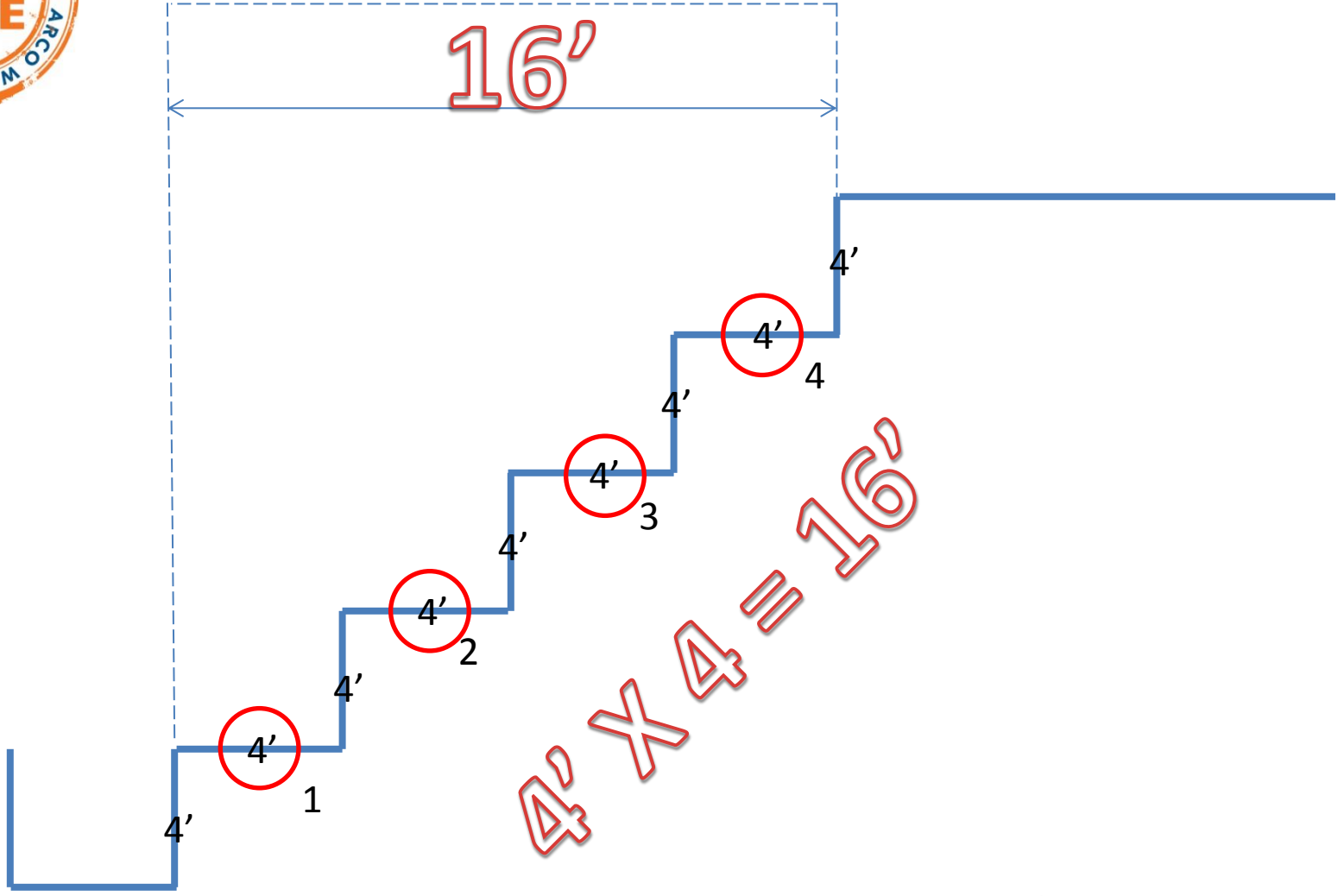
THAT'S IT!

- WE'RE AT OUR 20' MAX.





- NOW LET'S GO LOOK AT OUR HORIZONTAL

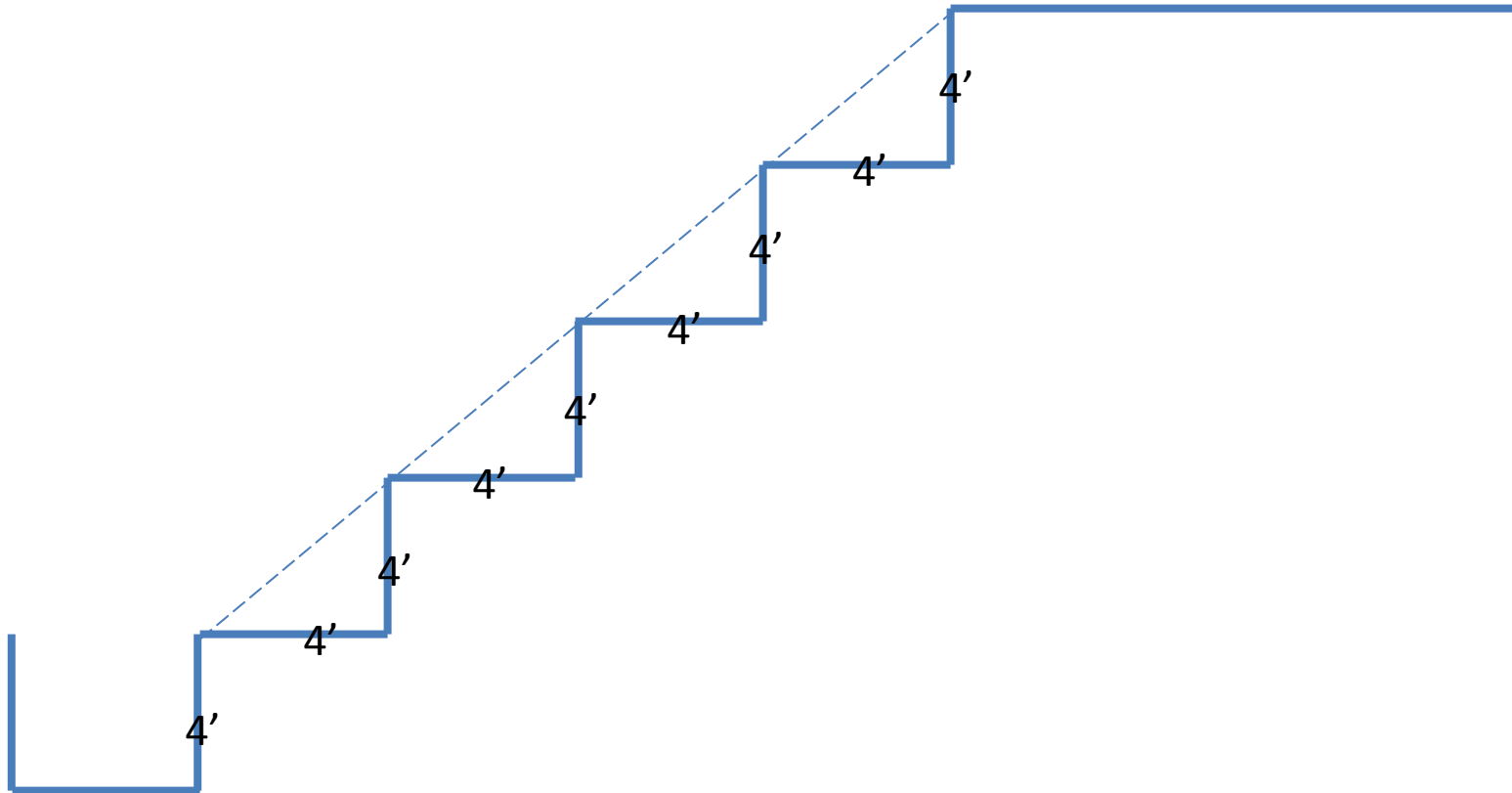




- LIKE I SAID BEFORE, I DON'T MATH GOOD, BUT I'M PRETTY SURE 16 DOES NOT EQUAL 20.
- BUT WE WENT UP 4' OUT 4'! THAT'S 1:1!
- YOU HAVE TO START THE HORIZONTAL MEASUREMENT AT THE BOTTOM OF THE TRENCH AS WELL.

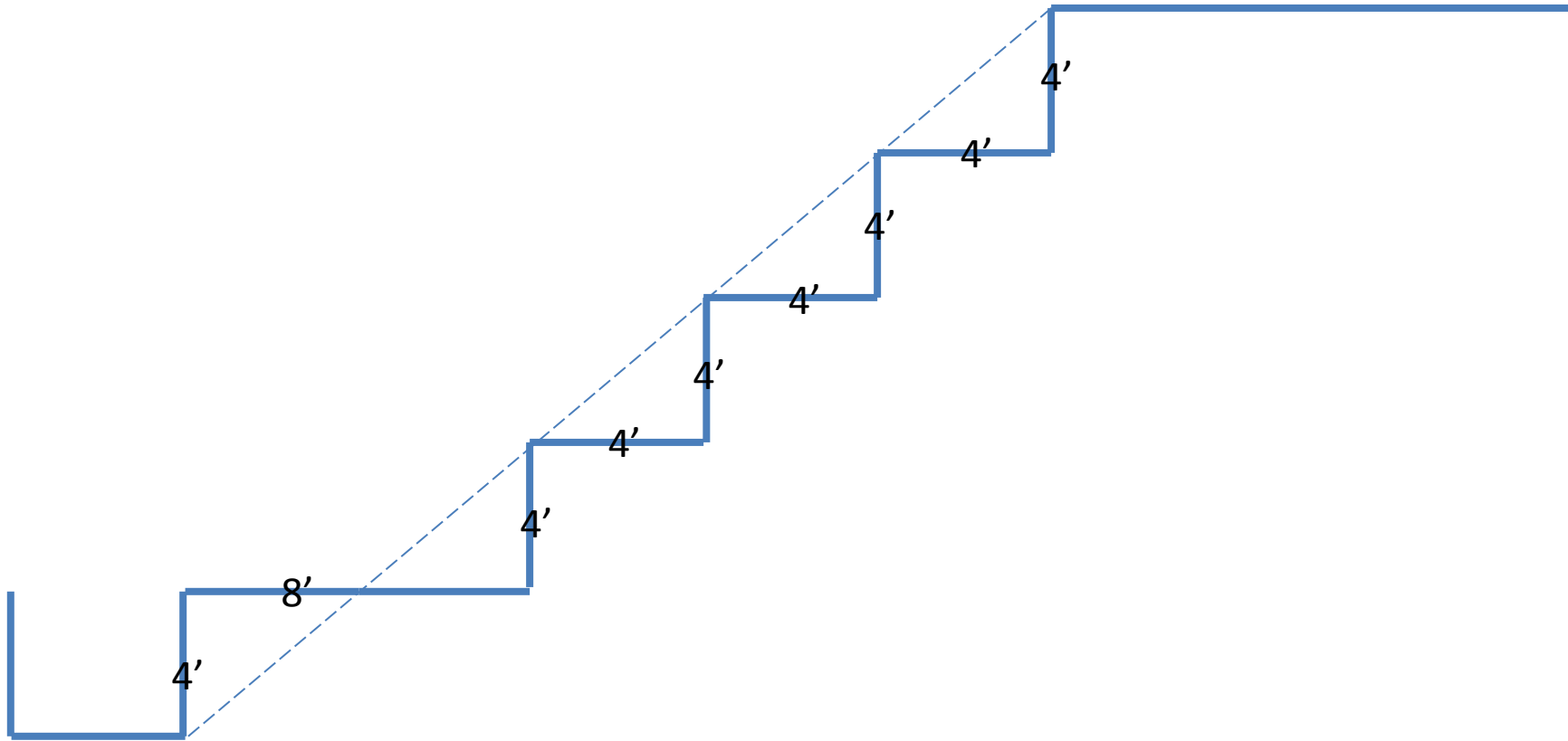


SO INSTEAD OF THIS





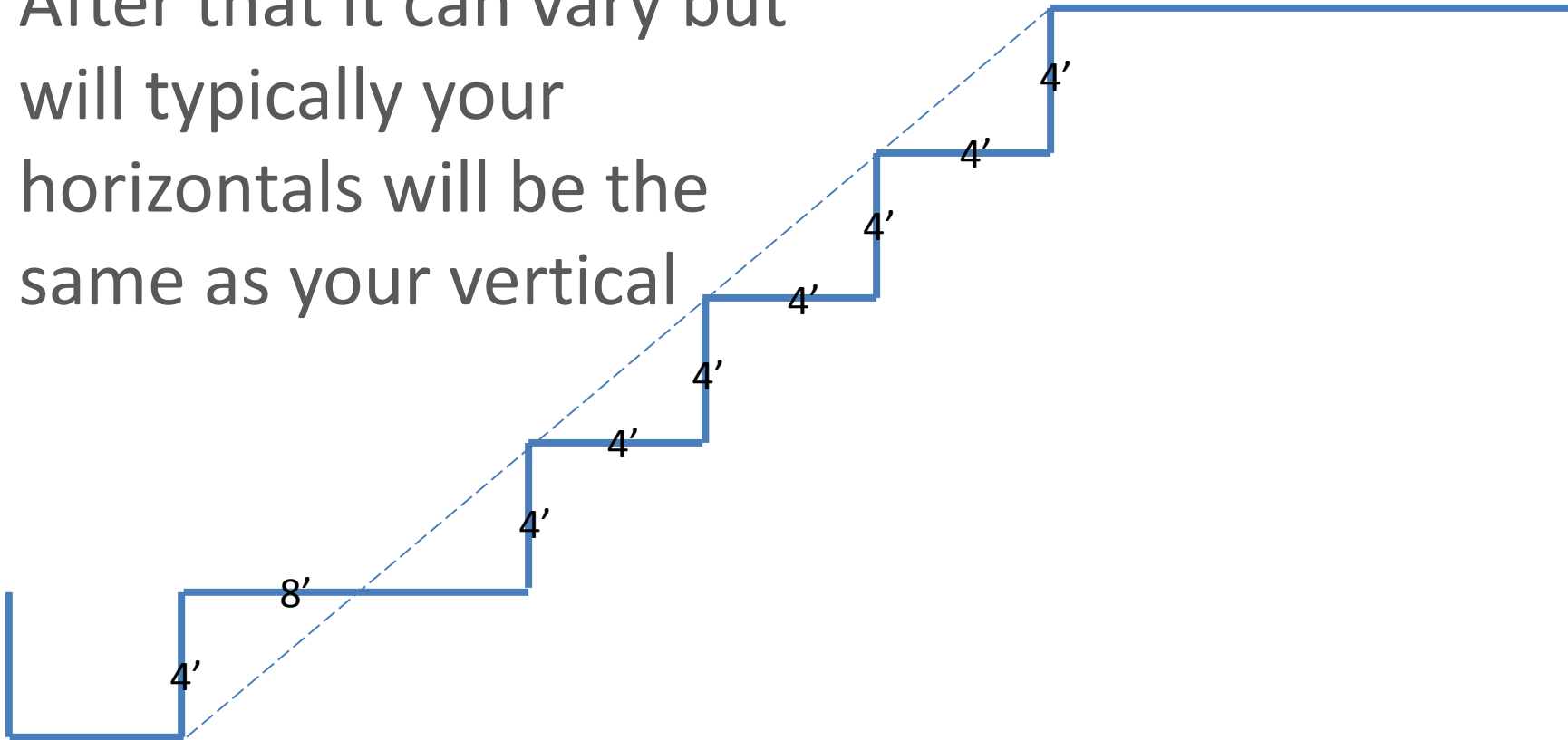
YOU END UP WITH SOMETHING LIKE THIS...





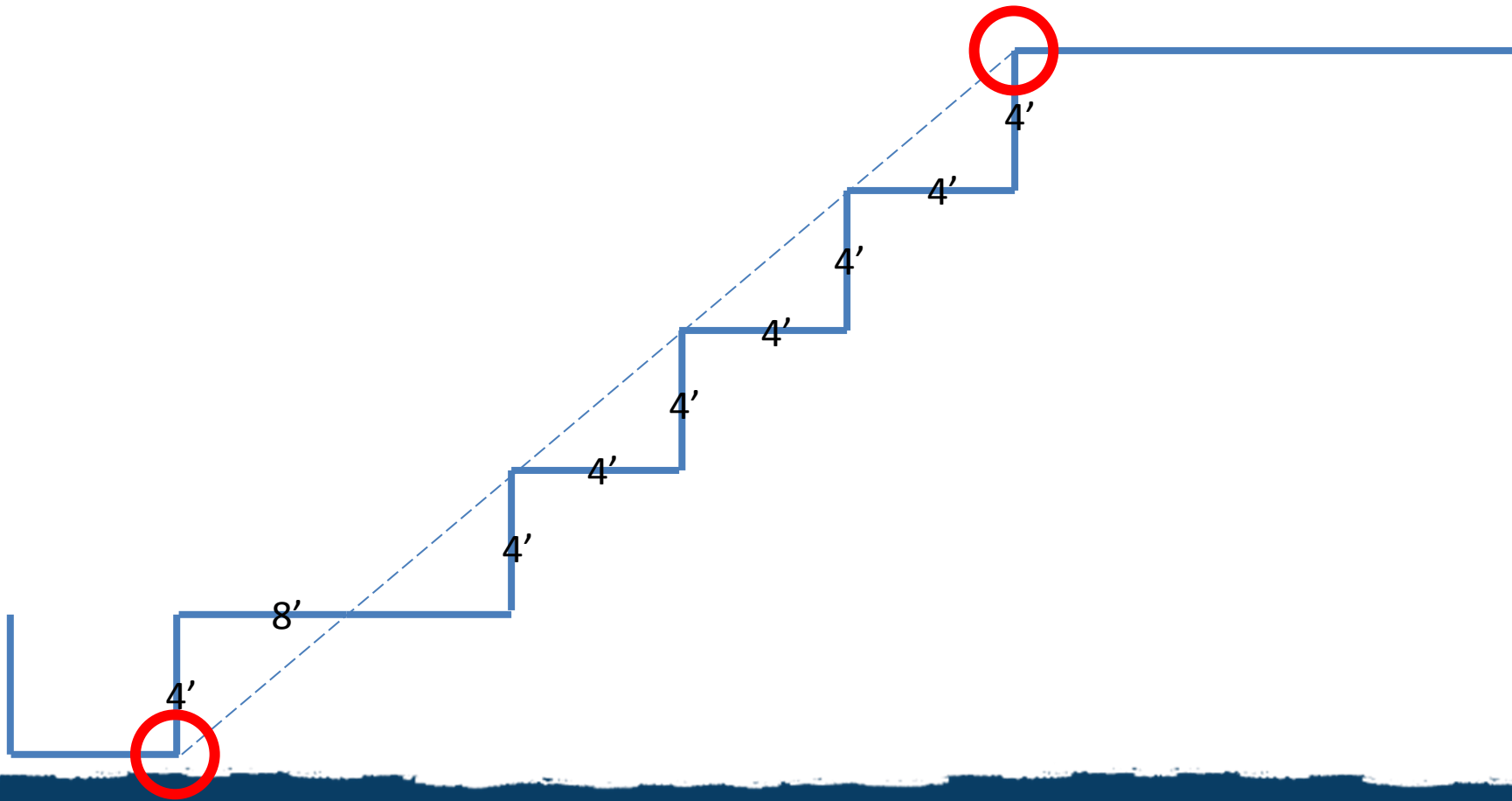
YOUR 1ST HORIZONTAL WILL ALWAYS BE DOUBLE YOUR FIRST VERTICAL

- After that it can vary but will typically your horizontals will be the same as your vertical





THESE ARE YOUR MAGIC CORNERS

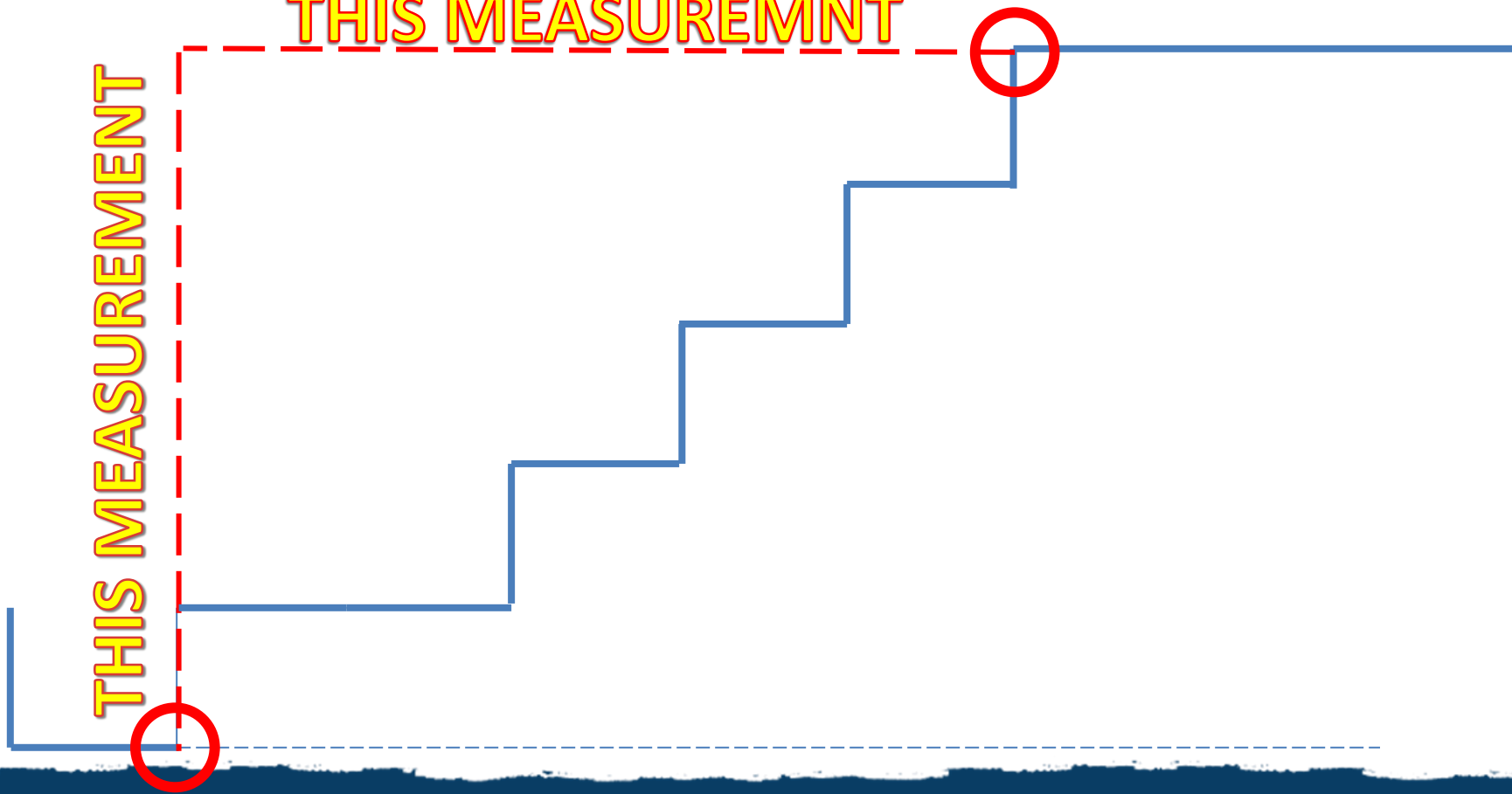




MEASURING FROM YOUR MAGIC CORNERS...

SHOULD ALWAYS MATCH

THIS MEASUREMENT

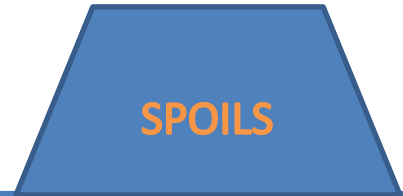




DON'T FORGET

SPOILS HAVE TO BE A MINIMUM OF 2 FEET FROM THE TOP EDGE OF THE EXCAVATION, REGARDLESS OF THE TYPE OF SOIL OR THE METHOD OF PROTECTION

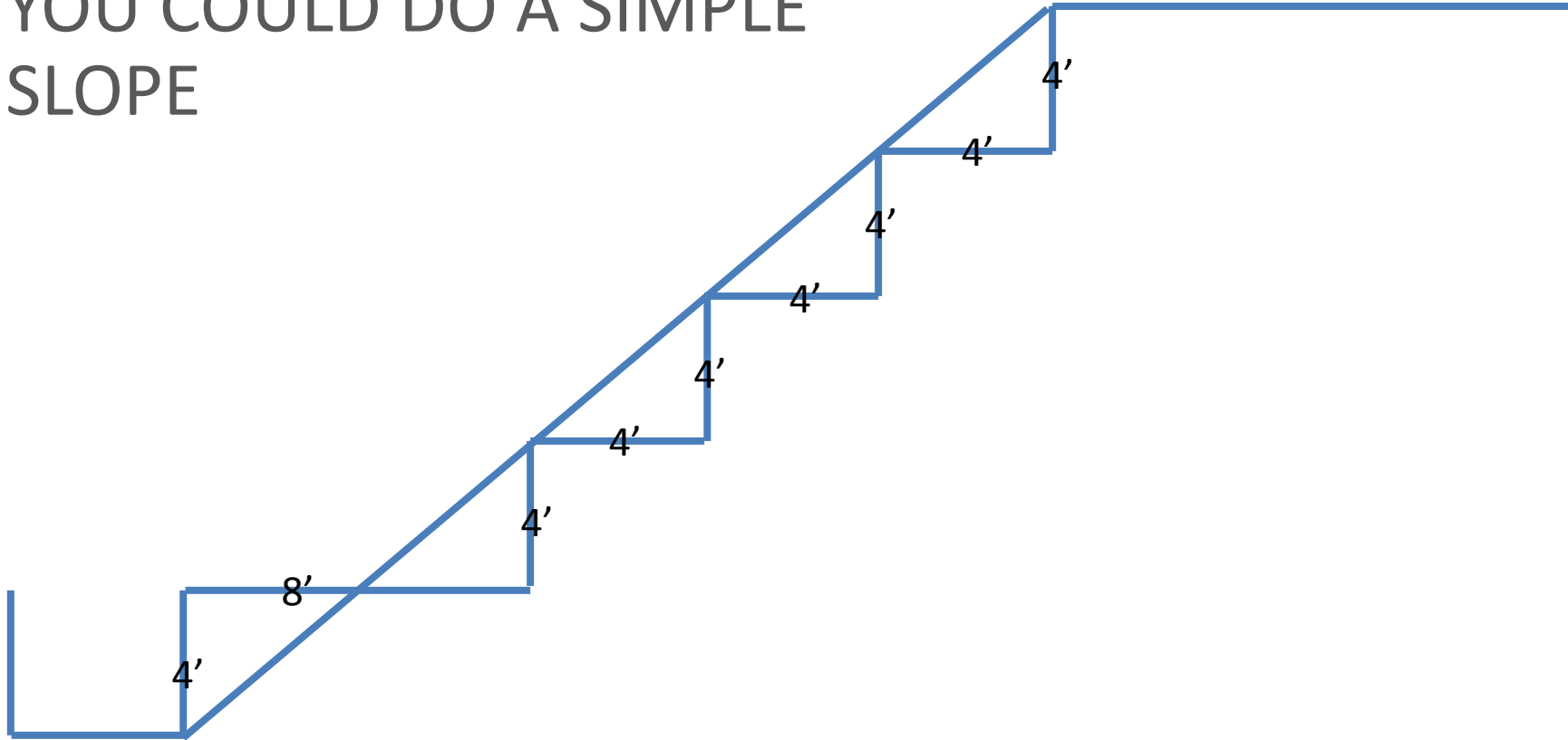
2'





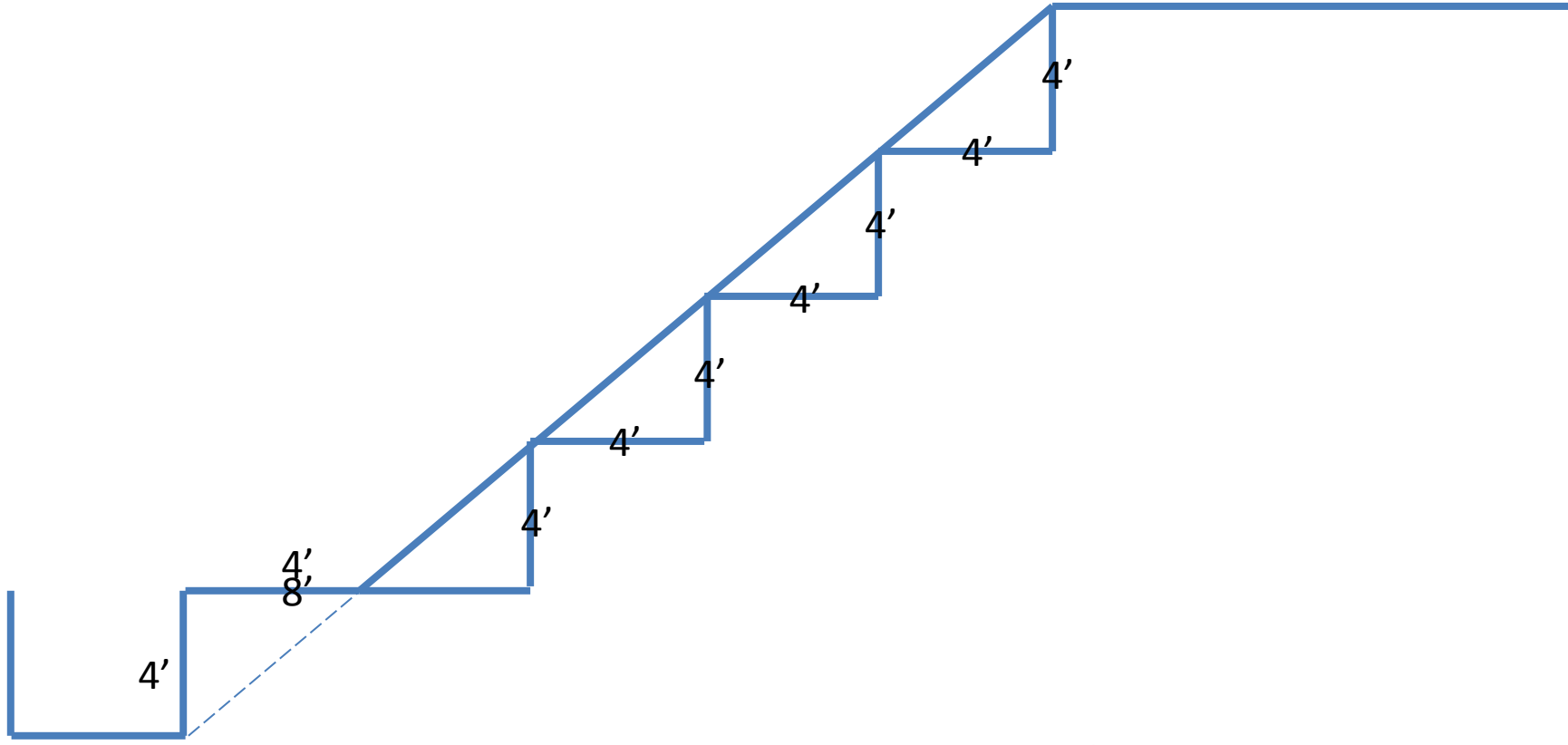
THERE ARE OTHER OPTIONS

- YOU COULD DO A SIMPLE SLOPE





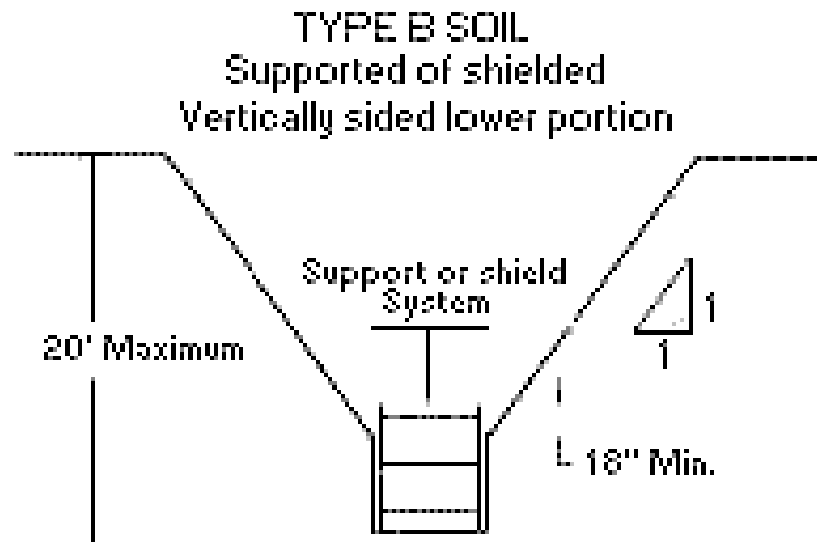
YOU COULD DO A SINGLE BENCH





YOU COULD INSTALL A TRENCH BOX OR SHORING SYSTEM

- REMEMBER: The top of the trench box must extend 18" above the bottom of your slope.





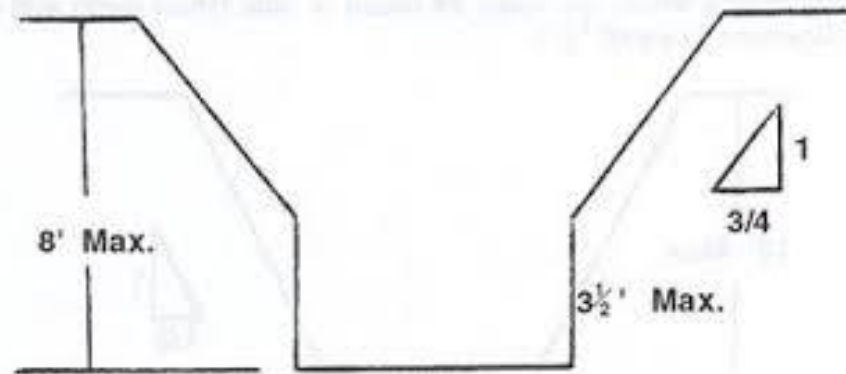
A COUPLE OF EXCEPTIONS THAT WILL MAKE THIS MUCH EASIER!

- THESE APPLY TO TYPE A SOIL ONLY!
- We will most likely encounter these situations at our dock walls when excavating footings.



IF YOUR EXCAVATION IS 8' DEEP OR LESS (IN TYPE A SOIL)

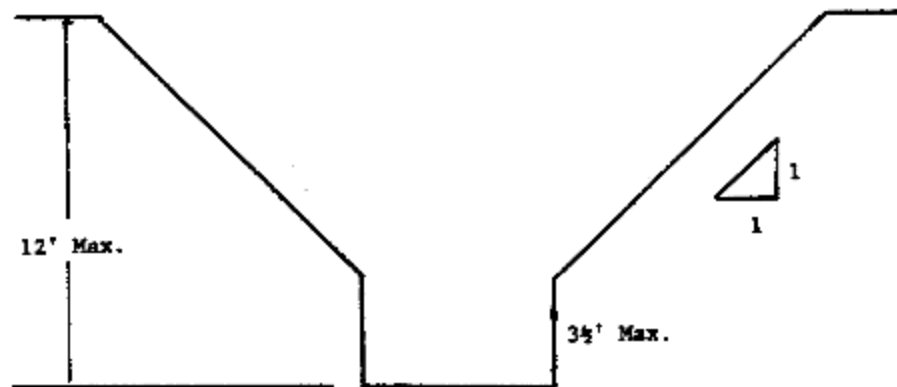
- You may start with a maximum 3 ½' vertical cut.
- Then begin sloping at ¾:1 at the top of the vertical cut.





IF YOUR EXCAVATION IS 12' DEEP OR LESS (IN TYPE A SOIL)

- You may start with a maximum 3 ½' vertical cut.
- Then begin sloping at 1:1 at the top of the vertical cut.





- WE UNDERSTAND THIS IS NOT HOW YOU'VE DONE IT IN THE PAST.
- WE ALSO UNDERSTAND THAT THIS REQUIRES A SUBSTANTIAL AMOUNT OF EXTRA DIGGING/SPOILS/WORK/ETC.
- WE ALSO UNDERSTAND YOUR SUBCONTRACTORS WILL DISPUTE THIS.



- WE HOPE YOU UNDERSTAND THIS REQUIREMENT IS CLEARLY SHOWN IN OSHA 1926 SUBPART P APPENDIX B FIGURE B-1 ON PAGE 388 OF YOUR OSHA MANUAL OR AVAILABLE ONLINE RIGHT HERE:

[OSHA 1926SUBPART P APPENDIX B](#)



- THIS WAS NOT DESIGNED TO BE A COMPREHENSIVE REVIEW OF PROPER EXCAVATION METHODS/TECHNIQUES, RATHER PROVIDE AN INTRODUCTION TO A COMMONLY OVERLOOKED OSHA REQUIREMENT.



IF YOU HAVE ANY QUESTIONS OR CONCERNS
PLEASE CONTACT ARCO SAFE.