

CSG Subtract:

Taming the Beast

It is a well-known fact that CSG Subtract can cause errors galore in your map.

Some mappers tend to shy away from CSG because of this fact.

I am sure you have all seen this in your map as a result of bad CSG:

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That's right: the dreaded infinite brush!

The purpose of this mini-tut is to show how to properly use CSG Subtract in a completely error-free environment. Say goodbye to those infinite brushes!

Hopefully, after reading this, you might have more understanding and less fear of the CSG Beast.

I am sure some are wondering, "What is CSG?"

CSG means **Computed Solid Geometry**.

The best definition for CSG Subtract comes right out of the Q3 Radiant Manual:

The CSG function ***"calculates the removing of sections from that geometry and breaking solid brushes (not curve patches) into smaller pieces."***

So, by creating a wall brush in which you wish to place an opening, you are using another brush to subtract a geometric **solid** shape from another **solid** shape.

Before anything else, let me state the most important rule when using CSG Subtract:

ALWAYS use **"ctrl + g"** to snap both the brush to be subtracted, and the subtracting brush to the grid **BEFORE** subtracting.

This is especially important after rotating a brush(es).

After a rotation, they are almost never on the grid, (see *image below*)

resulting in the possibility of subtracted faces less than 1 grid thick, non-rendered faces, and, of course, infinite brushes.

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If you have a brush that you cannot snap to the grid due to a complicated shape that will become misaligned during a snap, then don't CSG it. If you do, you do so at your own risk.

With that said, a good habit to get into is saving your map before you subtract. This guarantees that if something should go wrong during the subtract, you can easily revert back to the map just before the erroneous subtraction.

There are two acceptable alignments for the CSG function:

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In the previous image, you see two CSG setups.

The first (on the left in 2D, right in 3D) is a CSG brush the exact width of the wall that is being subtracted from.

The second (right in 2D, left in 3D) passes completely through the wall.

For non-rotated brushes, the first method is fine, and will ensure that no other brush but the

intended brush is subtracted.

For rotated brushes, the second method is a must to be sure that no infinite brushes or brushes that are too small are created.

These next images look OK, right?

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NO PICTURE AVAILABLE

After all, the z-fighting is obvious between the two brushes, so therefore they have to be on the same plane, right?

WRONG!

Let's take a closer look:

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Notice that the brushes are not aligned along the same gridlines?

The inner brush, when used to subtract, can, and most likely will, cause serious errors.

Never CSG in this situation.

Always extend the subtracting brush **through** the brush to be subtracted when brushes are rotated.

CSG can also cause problems when used with terrain in your map.

The most likely occurrence is that Radiant will have an "unrecoverable error and have to close."

Have no fear! There is a simple reason for this, as well as a simple solution.

When subtracting with terrain similar to this:

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where the brushes are in contact with the terrain, Radiant will crash.

But suppose your brush is not touching the terrain.

That should be OK, right? Like this:

NO PICTURE AVAILABLE

WRONG! This too can cause Radiant to crash.

Even though the brush is not directly contacting the terrain? Yep, even then. Here's the reason:

Although the brush is not in direct contact with the visible terrain, the brush intersects the **volume** of the terrain patch (*note that the brush is within the bounding box of the terrain*). Since, by definition, CSG can only be used with solid brushes, and not curves (LOD, along with patch meshes and primitives, is considered a curve), this will cause a crash.

The program assumes that the LOD volume should be subtracted, cannot complete the operation, and crashes.

For sanity's sake, when subtracting with terrain in your map, set your grid to 512:

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Go into one of your 2D side views, and lower it

so that your terrain's highest vertex is below your lowest brush.
(I use 512 because it is the easiest way to replace the terrain in the exact same spot from which you moved it.)

It should now look like this:

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Note that no terrain vertex is higher than any brush side.
This GUARANTEES that Radiant will not crash during CSG if you have terrain in your map.

Let's sum it all up.
Follow these simple steps, and your CSG Beast is tamed:

- 1) **ALWAYS** snap to grid before subtracting.
- 2) **ALWAYS** be sure your subtracting brush is exactly as wide as, or wider than your brush to be subtracted (when no rotation is involved.)
- 3) **ALWAYS** be sure your subtracting brush is completely extended through your brush to be subtracted when dealing with rotated brushes.
- 4) **ALWAYS** be sure that your highest terrain vertex is below your lowest brush face.
- 5) **NEVER** CSG a brush not snapped to the grid.
- 6) **ALWAYS** save before subtracting.

Put that Beast to bed!