The purpose of this tutorial is make a foundation for hard dynamic simulations. Hard Dynamics is a way to run simulations of objects in scene that would otherwise be very challenging to keyframe. Some examples are objects that blow up, bounce, break, etc.

This tutorial is going to show how a car running into a brick wall. The main focus of the tutorial is how the bricks break and fly apart from the wall and then land on the ground.

In terms of its objects, the scene itself is relatively simple. There are three objects, the car, the ground, and the brick wall as seen in Figure - 1.

Figure - 1

The first major set up work you have to do is make the brick wall. Since it is going to be broken apart, create the brick wall out of an array of boxes that are close together. From there, cut up the wall a few times so that the bricks will not break apart in uniform. The wireframe of the brick wall can be seen in Figure - 2.

Figure - 2
The next step is setting all of the object properties of the objects in our scene to respond to one another. This is done by selecting the Dynamics tab from the Object Properties window. Since this particular object is the ground, we will add the Dynamic “FX Collision” as seen in Figure - 3. This does not need to be a Hard FX since the ground will not be breaking apart but simply having objects fall and bounce on to it.

Figure - 3
Next we will change the object properties of the car. Since the car will also not be breaking apart we will simply add the FX Collision and change some of its properties as indicated in Figure - 4.
Now for the brick wall. For this step make sure you set its Dynamic to “HardFX”. As seen in Figure - 5 below, it’s important to modify the basic settings of the HardFX. Changing the “Piece Mode” makes sure the object’s individual polygons do not break apart. From here change the “Gravity” setting to -9.0 so that our brick wall behaves as it would in the real world.

Below in Figure - 6 is the settings I used for the Collision tab. The most important changes I made here is to make sure the simulation starts by the collision so the bricks don’t start falling before the car reaches them. Another important setting here is to make sure the Self Interaction and Interaction are set to box since “box” most likely approximates the shape of the individual bricks and we want them to react to each other as well.
Here (Figure - 7) is the graph editor for the motion of the car. It is simply moving straight along the z-axis into and through the brick wall.

![Figure - 7]

Once this is set, it is time to go back to the object properties of the brick wall as indicated in Figure - 5 and hit the "calculate" button. This takes a min or two for the computer to calculate and you actually see the simulation take place from your desired camera angle as seen from frame 27 in Figure - 8 below.

![Figure - 8]
Once the simulation is carried out its time to render. Add a little motion blur and the final render can look fairly realistic. Still frames from the render can be seen in **Figure - 9**. In conclusion, there are many settings in hard dynamics to achieve a variety of results. The best way I have found what works is to simply jump in and start changing the settings until you get a desired result. Good Luck!