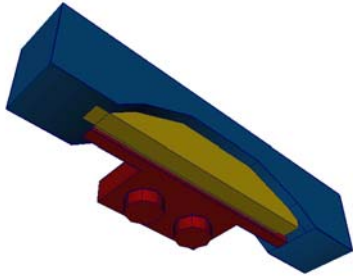




# *Stressing* The Elements

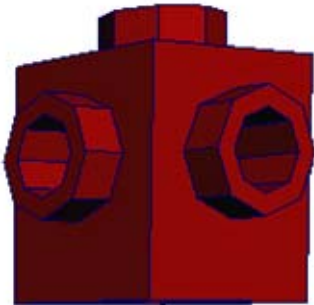


presented by jamie berard



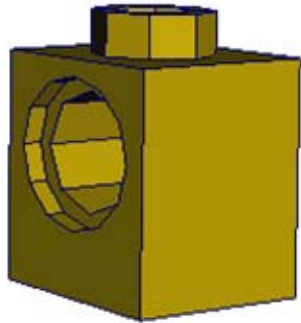
# System and Technic are not 100% compatible

The Center Point for the stud on the side of a System brick is **3.92mm** from the top of the brick



The Center Point for the hole in the side of a classic Technic brick is **3.80mm** from the top of the brick

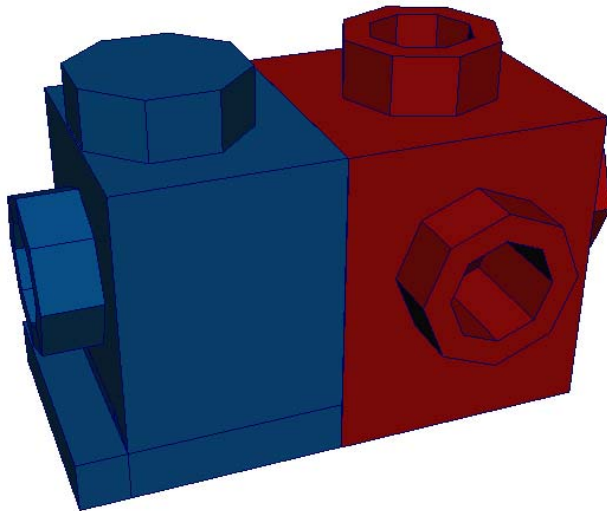
The Center Point was moved up in order to accommodate the additional plastic needed around the Technic hole so that a stud can still fit in the bottom of the brick.



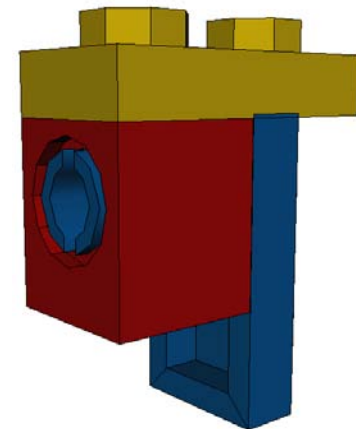
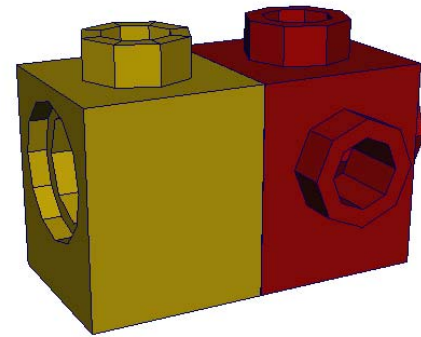


# Examples of Legal vs. Illegal Builds

Legal:



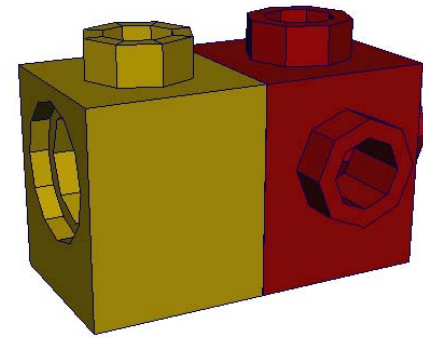
Illegal:





# Examples of Legal vs. Illegal Builds

Legal:



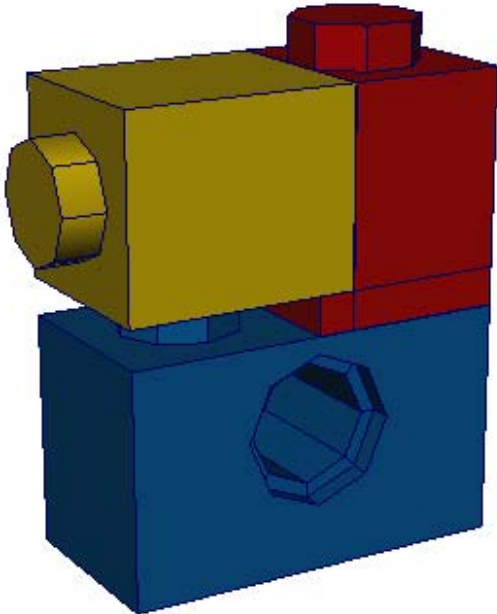
\*Technically legal so long as no additional elements are connected across the top or bottom.

However, this assembly is not recommended.

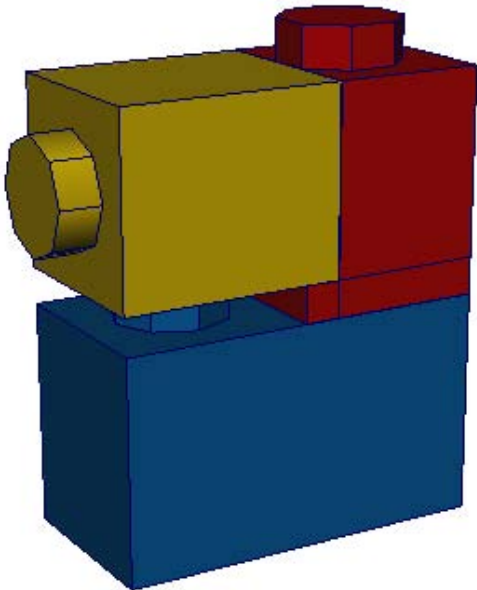


# Examples of Legal vs. Illegal Builds

Legal:



Illegal:

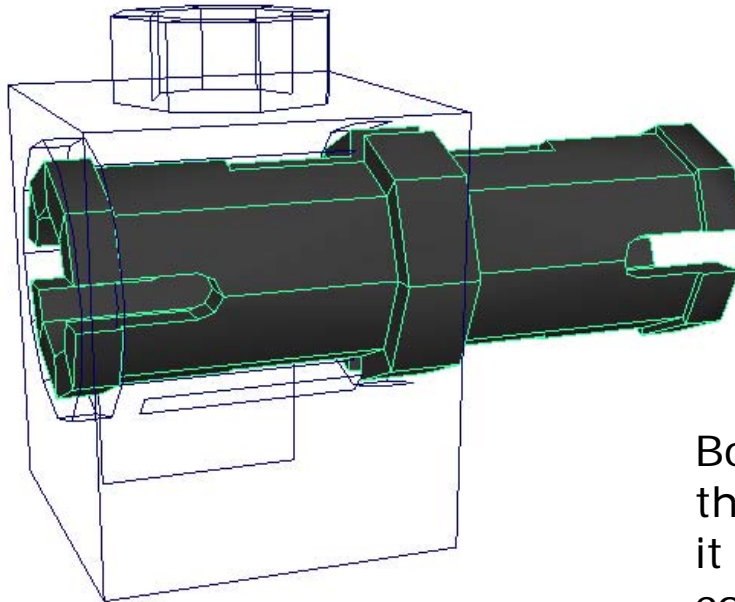


The word *LEGO* molded onto the studs of most System elements increases the height of the stud by **0.14mm**. This extra height causes the stud on the blue brick above to touch the side of the yellow one.

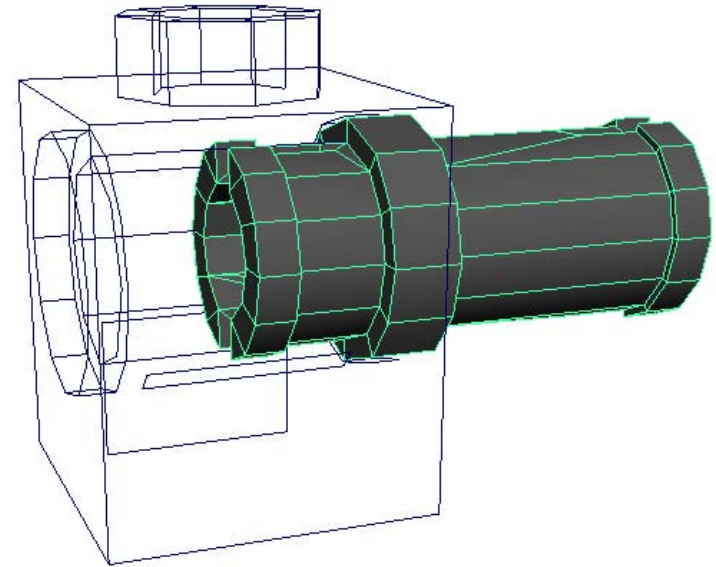


# Examples of Legal vs. Illegal Builds

Legal:



Illegal:

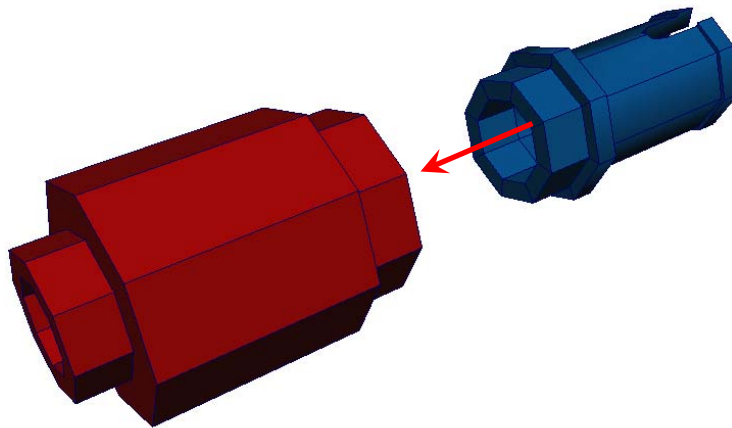


Both ends of a Technic hole are larger than the diameter in the middle. Until it 'snaps' into place, the half-peg is in compression and could be permanently damaged over time. Also, by not being locked into place, the element can easily pop out during play.

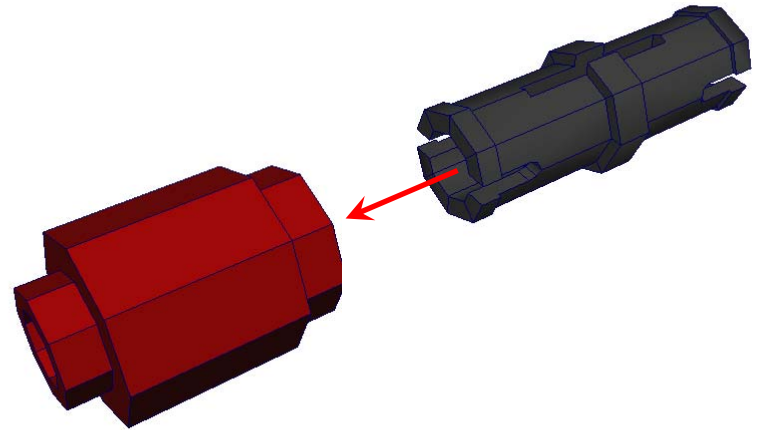


# Examples of Legal vs. Illegal Builds

Legal:



Illegal:

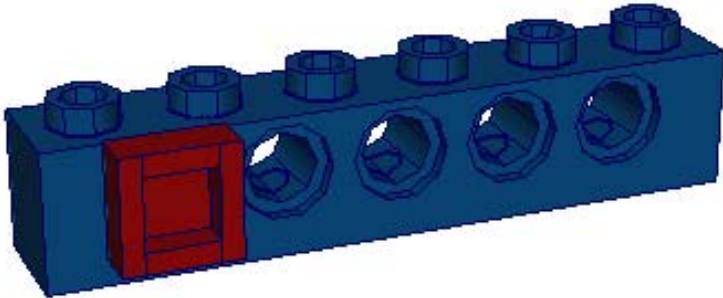


Since the diameter inside the red brick is smaller than that of the Technic pin, the black element will always be in compression. There is no opportunity in this scenario for the pin to be in 'click.'

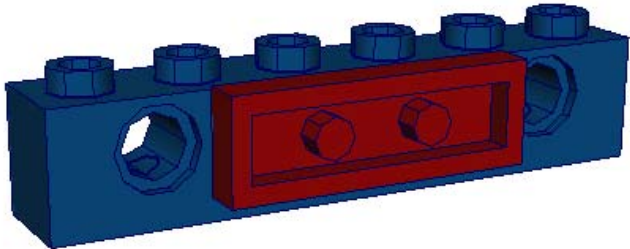
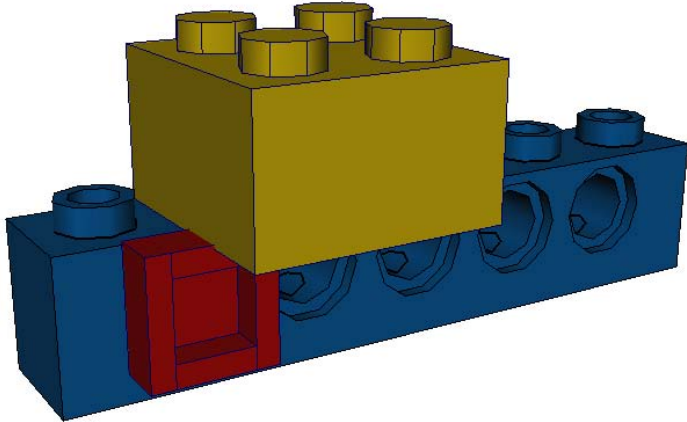


# Examples of Legal vs. Illegal Builds

Legal:



Illegal:



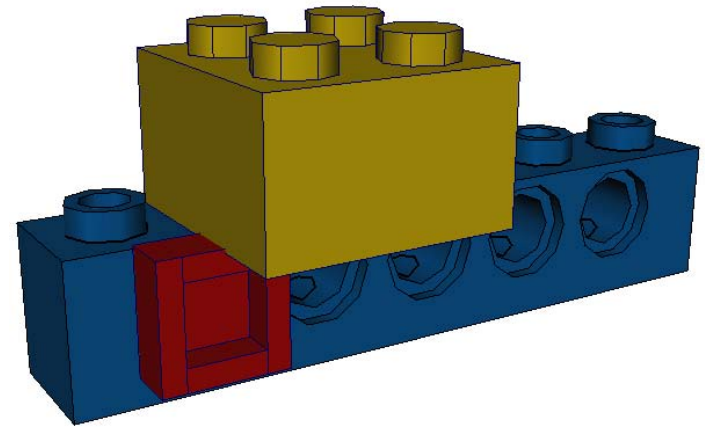




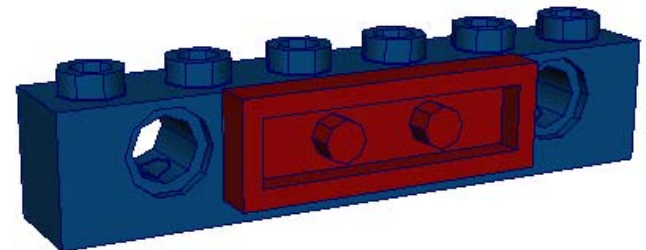
# Examples of Legal vs. Illegal Builds

## Illegal:

When you place an element into a Technic hole, the side of that element will be taller than the attached Technic brick. Because of this, the yellow brick is hitting the red plate.



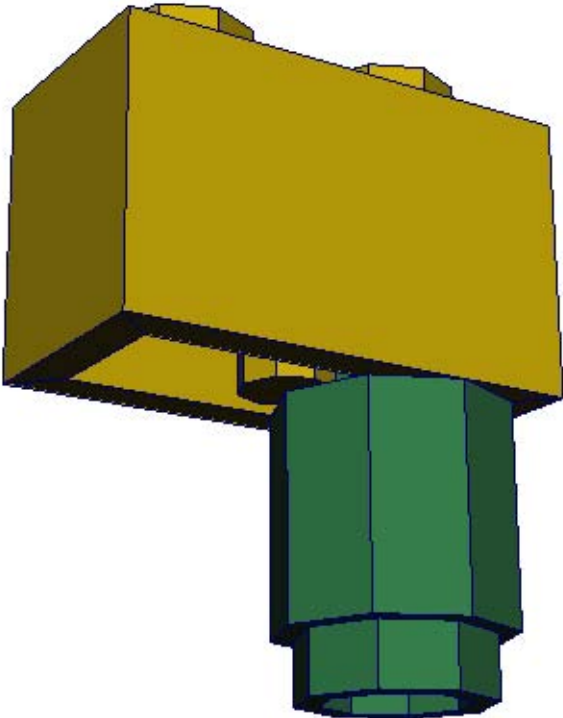
Technic holes are slightly smaller than those of System. You can connect a single stud into a single Technic hole and a child can still take them apart. Any more than that and the resistance becomes too great and there is the potential for elements (and children) being stressed.



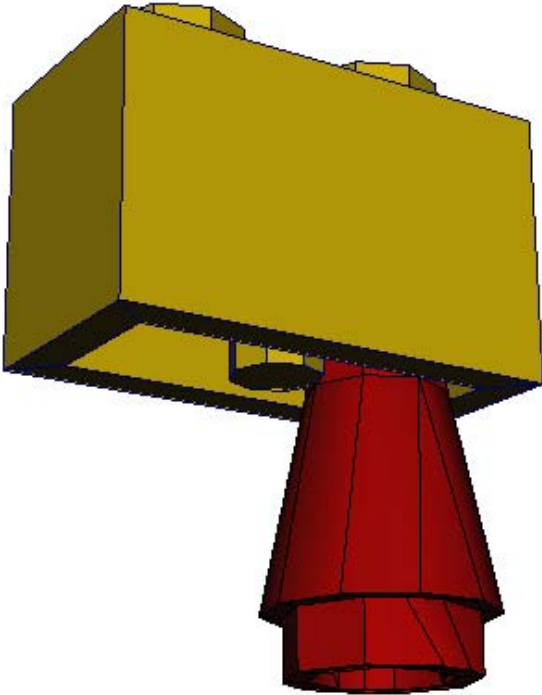


# Examples of Legal vs. Illegal Builds

Legal:



Illegal:

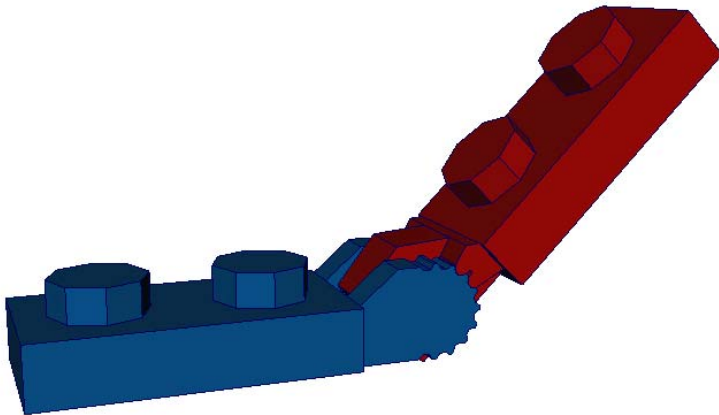


Because there is no stop at the top of the cone, the red element could be pushed in too far. This will stress the pin and inner walls of the yellow brick

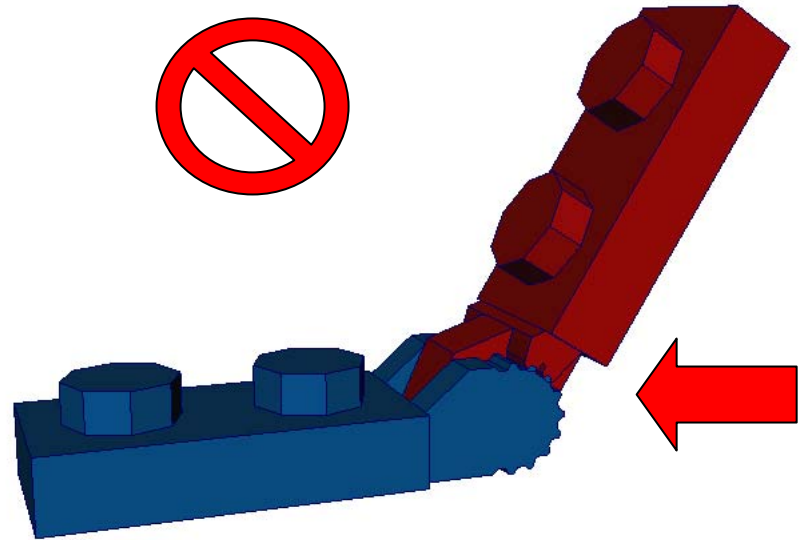


# Examples of Legal vs. Illegal Builds

Legal:



Illegal:



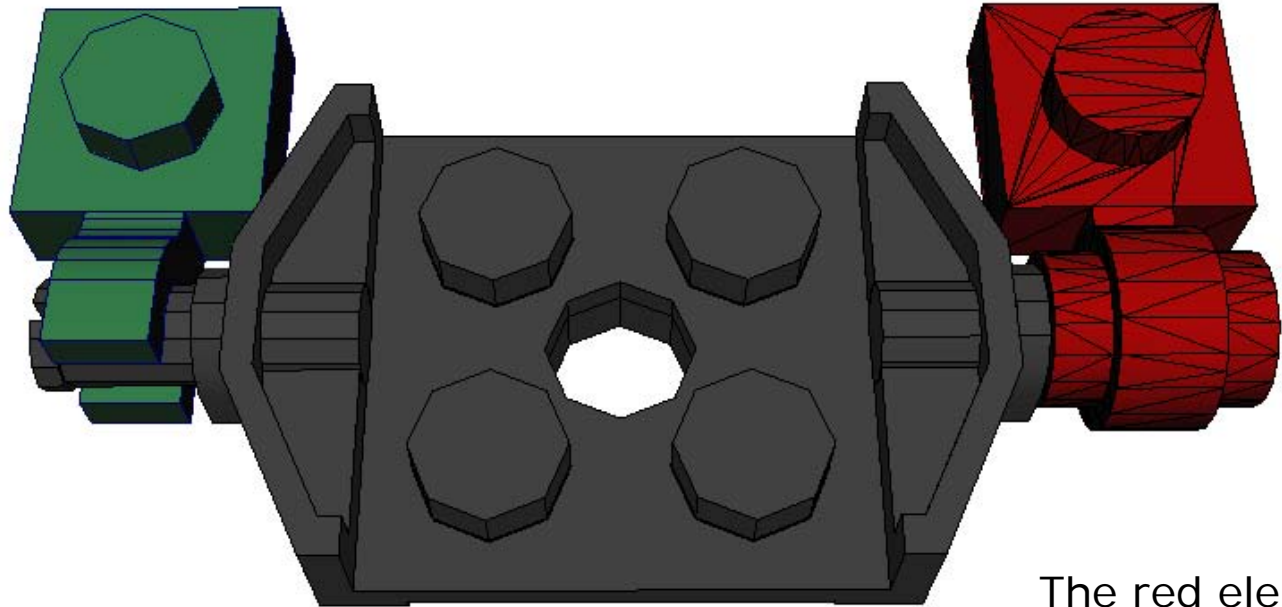
Click hinges must be in 'click.' Approved angles are in multiples of 22.5 degrees. Some LEGO projects require an engineer to determine whether an angle is legal.



# Examples of Legal vs. Illegal Builds

Legal:

Illegal:

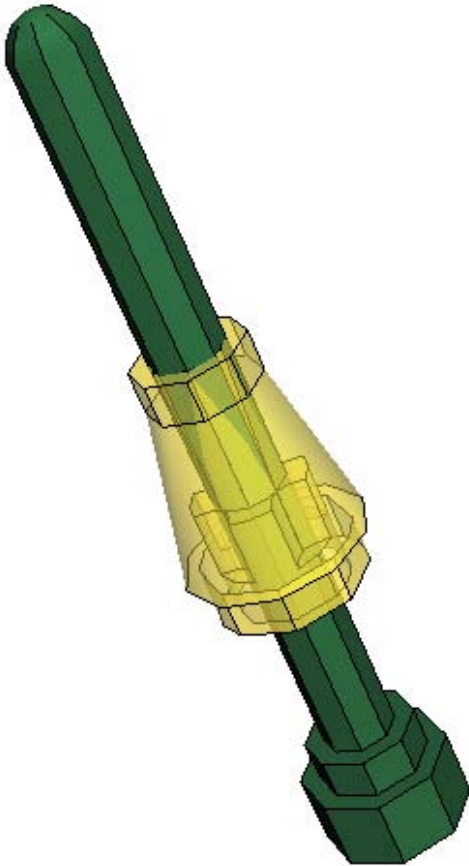


The red element is forcing the black element into compression.

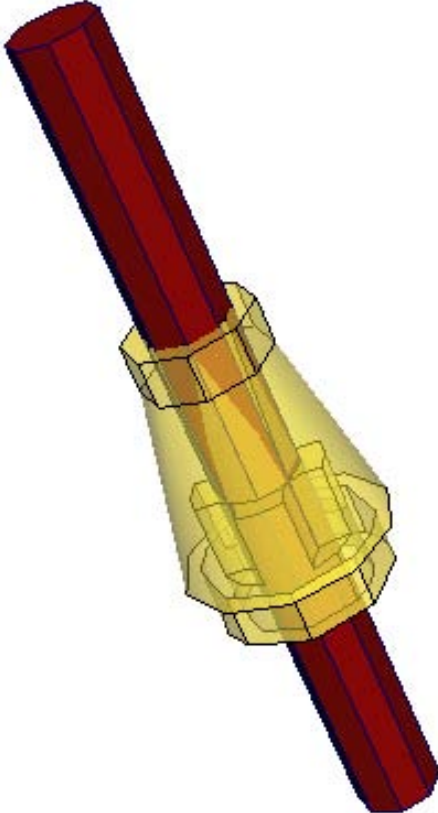


# Examples of Legal vs. Illegal Builds

Legal:



Illegal:



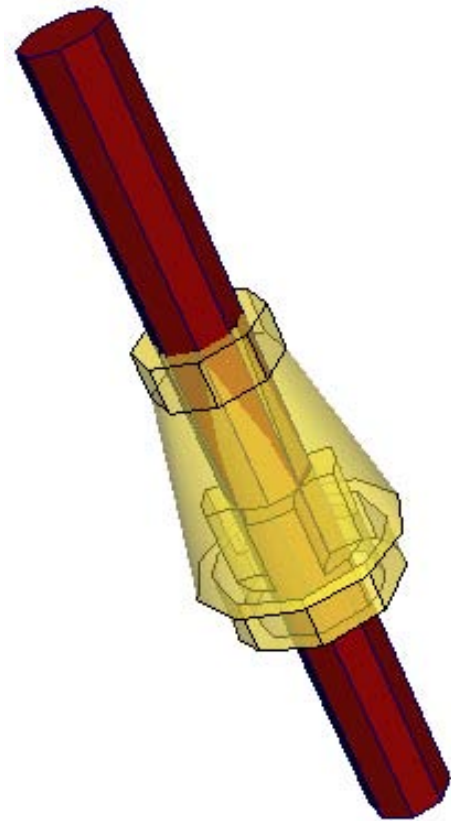


# Examples of Legal vs. Illegal Builds

## Illegal:

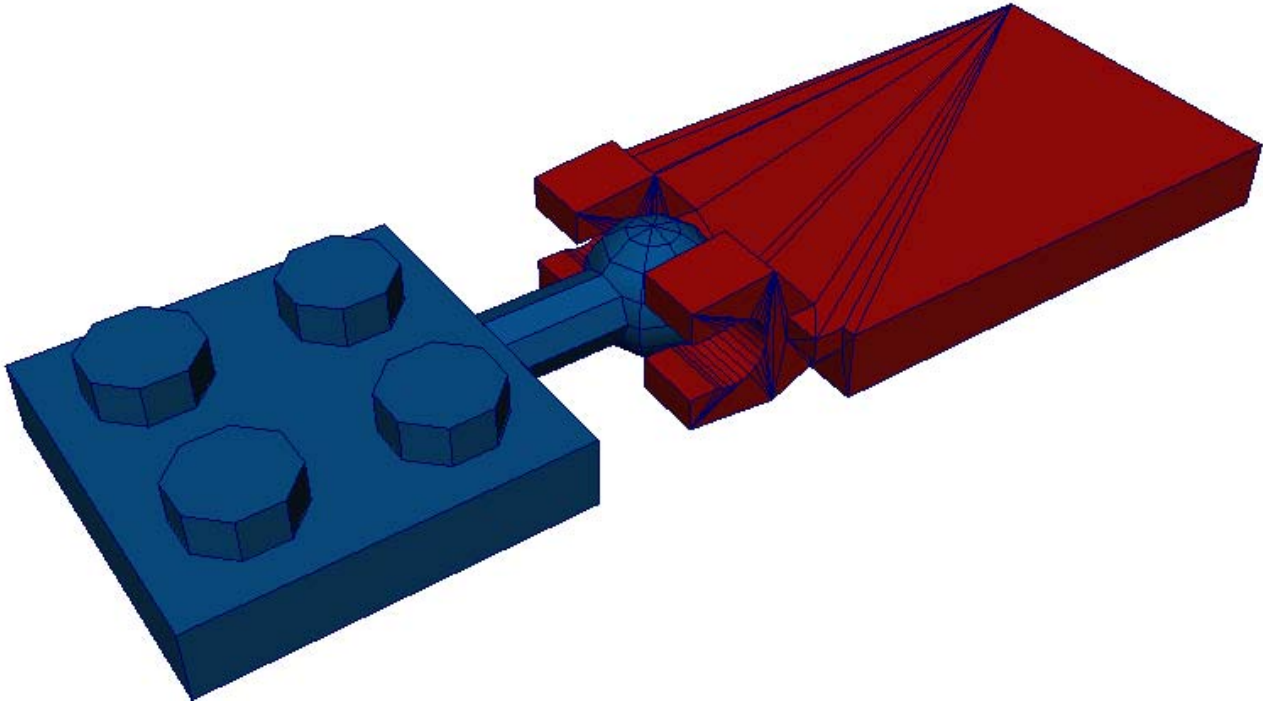
Both of these elements are made of a plastic called polycarbonate. PC reacts with PC to cause a great amount of friction. This is ok for stud on stud connections, but when sliding one PC element over another, there is little hope of a child pulling them apart.

Most transparent elements are made of PC. PC is also used on other parts where ABS is not strong enough.

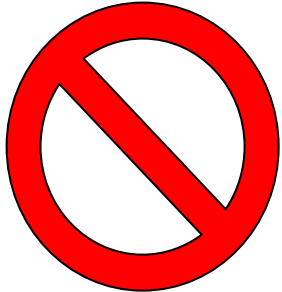




# Possibly Legal...But Not Recommended

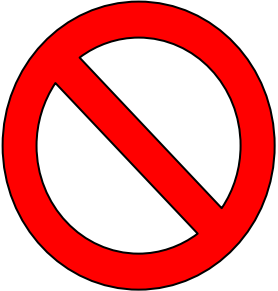
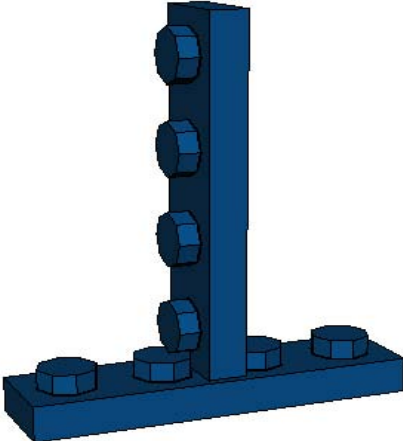
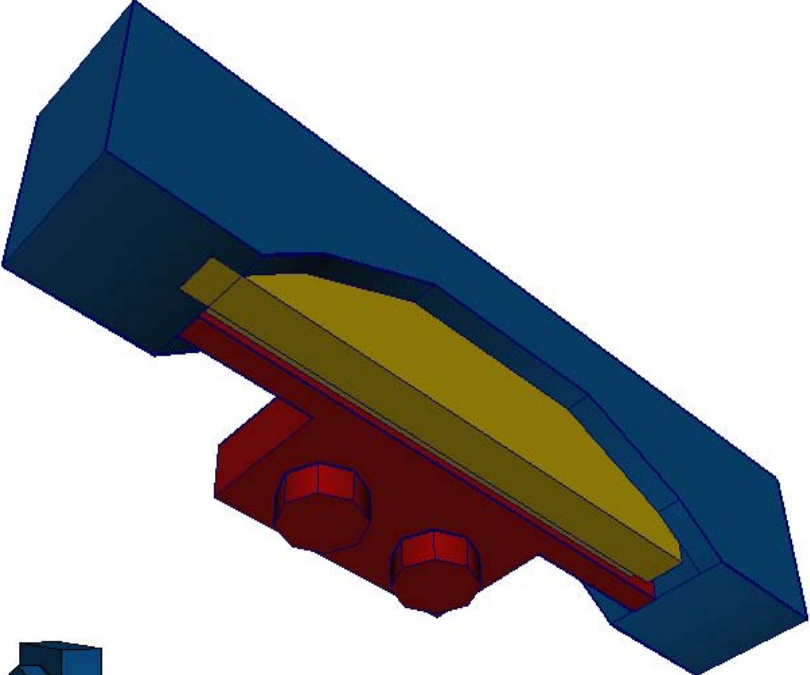
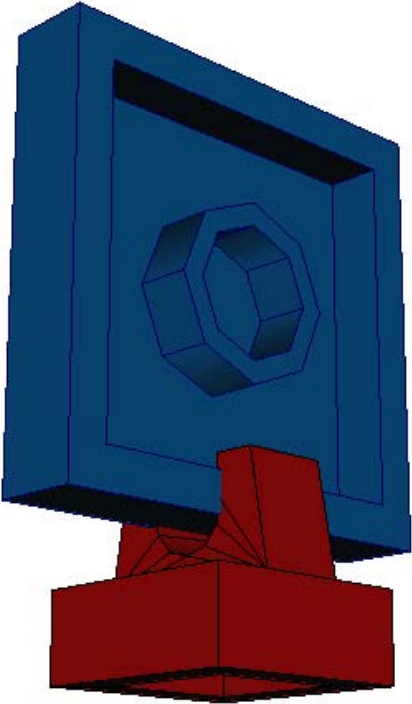


Not recommended because the two plates will not be at the same height. This causes the assembly to be 'out of system.' Also, there are other elements in the assortment that can accomplish this legally.





# Definitely Illegal!

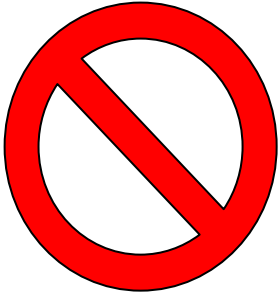
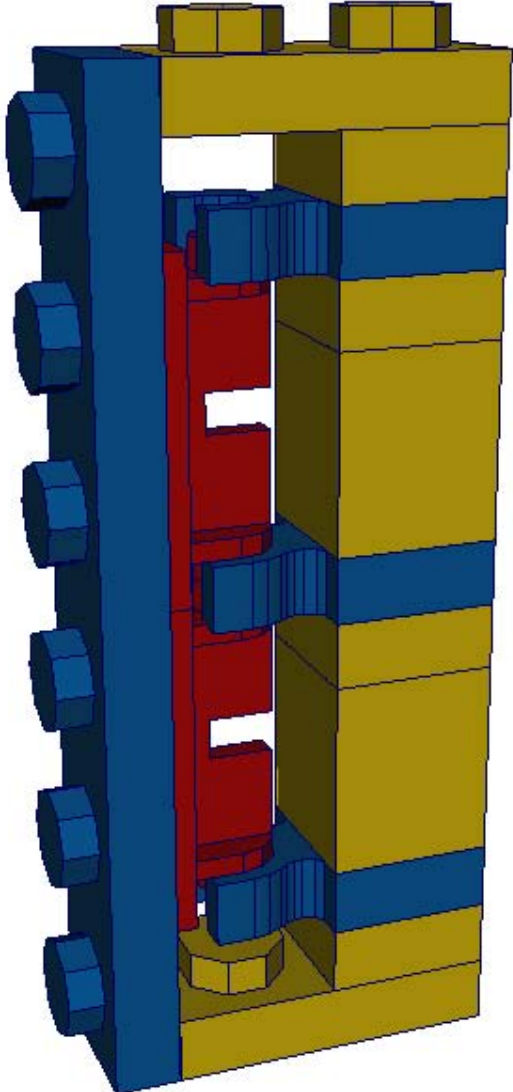


All are illegal because the receiving brick has smaller dimensions than the one being connected to it.





# A Massive Migraine for Design Lab!!





# Other Considerations...

Heat Test

Different Plastics = Different Rules

Can it be built and played with by a 7 year old?

Can one brick replace the need for 5?

- Reduces Complexity
- Adds Strength and Stability
- Reduces Tolerance Accumulation

Technic Half-Beams and System Plates are not friends

Support Everything!



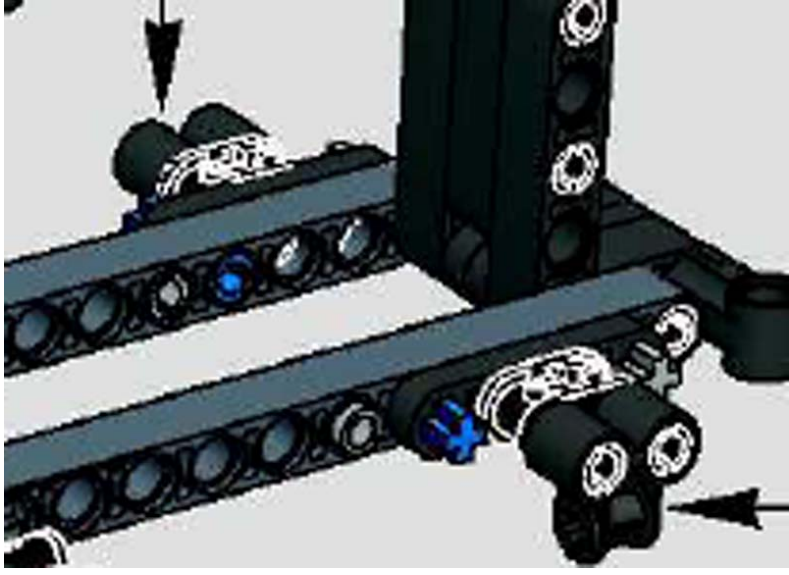
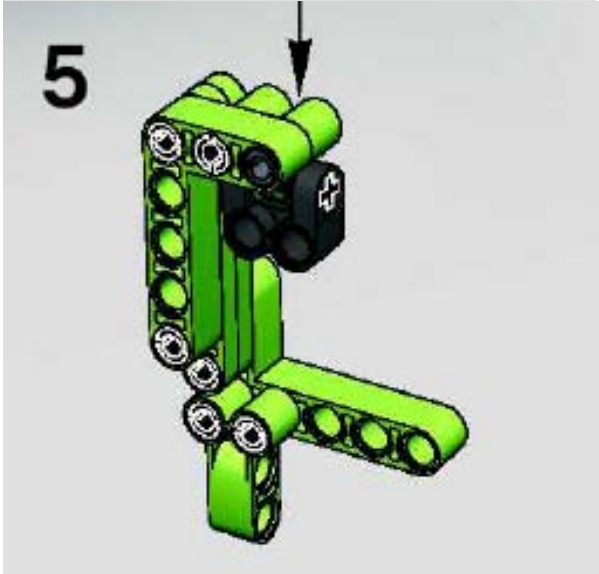
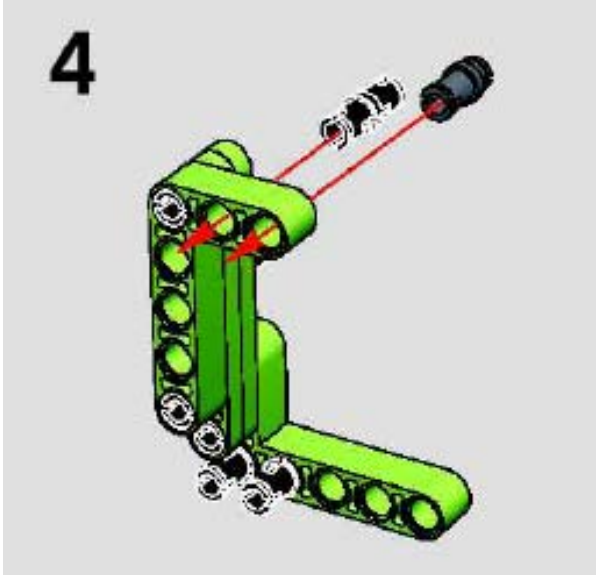
# Legal back then...Illegal now



Gray 'cannons' are attached by 1x2 plates wedged between two studs.



# Illegal builds that made it to market...



**Technic pegs are not in "click"**

This not only stresses the element, but also weakens the build resulting in potential failure during play



# The model that forever changed LEGO...





# The model that forever changed LEGO...



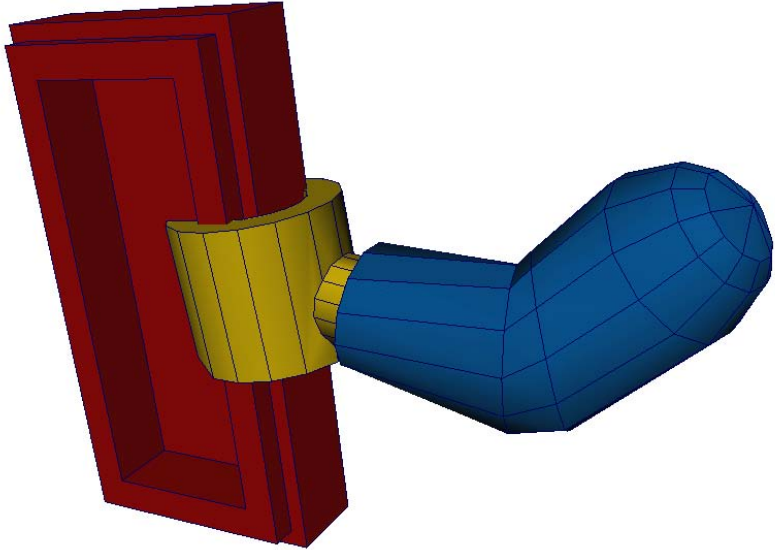
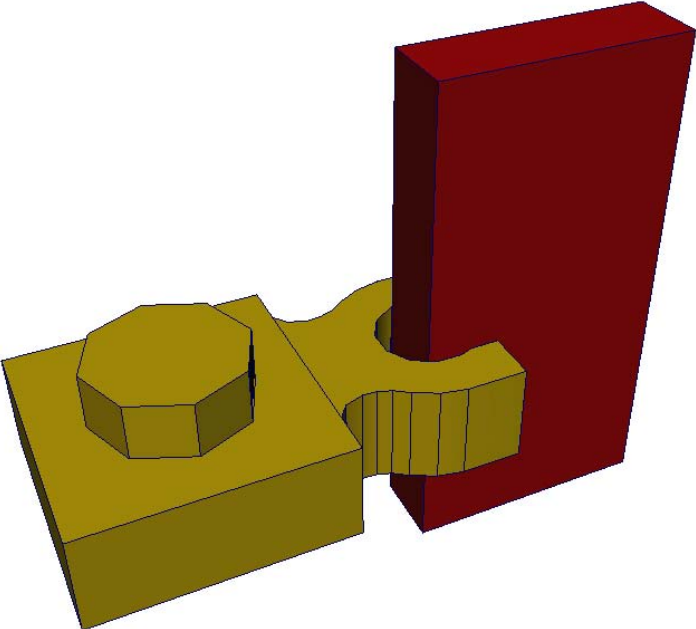
This model was released as a promotional set for the opening of Legoland Germany. It is supposed to be an Audi TT. In addition to its unorthodox and difficult build, it forces elements into unnatural connections causing them to be permanently damaged. It was packaged with only a single picture and no building instructions.

As a direct result of this set, all models now produced by the LEGO Group must go through the Design Department. This ensures that nothing gets released without first being approved by a Model Committee. Sometimes lasting up to 2 or 3 days, this review allows representatives from building instructions, senior designers, engineers and the designer sit down together and build the model. The goal is to maintain an 'only the best is good enough' approach to our design process. A final heat test then highlights further weaknesses that must be changed before the set can be launched out onto the market.



# Examples of Legal Builds

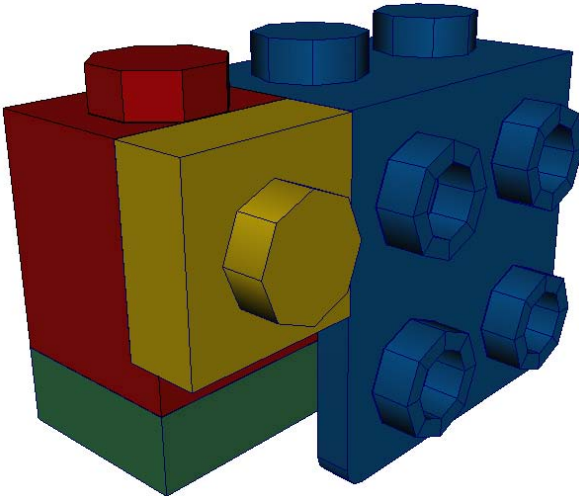
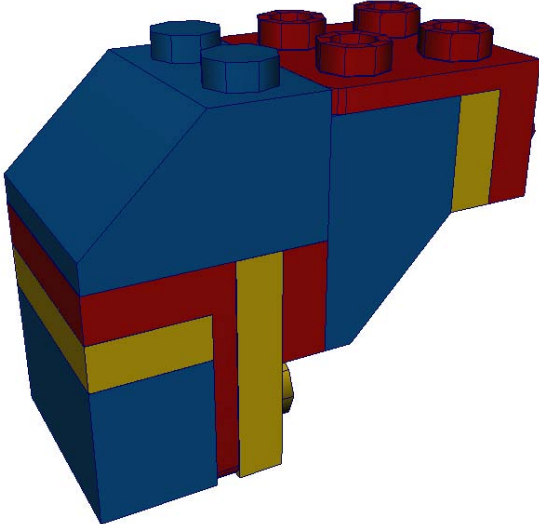
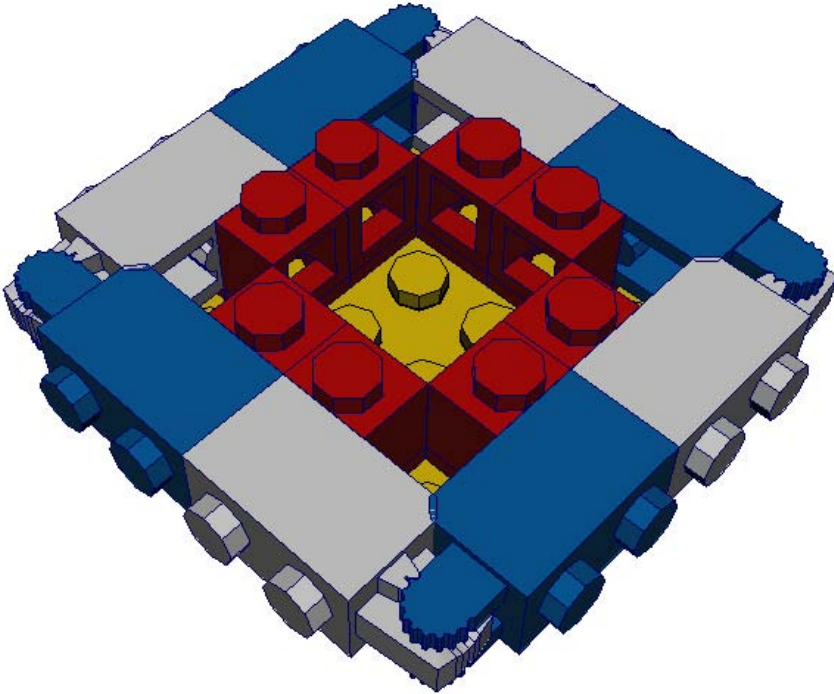
Legal:





# Unusual, But Legal Builds

Legal:







Thank You  
&  
Play Well!