

Beams are smaller and lighter than bricks, but they are also more elastic. Long beams are therefore more likely to bend or even buckle under a load than long bricks, making it more difficult to create large, rigid studless structures and requiring more complex connections using smaller pieces. Another difficulty comes when you want to create a perpendicular connection between beams without putting one beam on top of the other. It's possible to do so only with a right-angle connector or with a T-shaped studless frame (see Figure 3-55). These frames are quite popular and can also be used as a means of reinforcing joints.

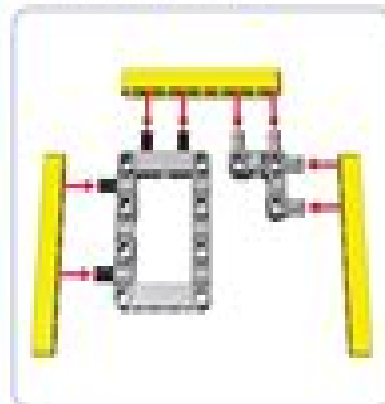


Figure 3-54: Two right-angle joints show you a ready-made right connection between perpendicular beams in the same hole.

The presence of both pin and axle holes means that studless pieces and connections can also be connected with axles to create bigger, sturdier structures. These sorts of connections require advance planning because of the complexities of the studless technique (see Figure 3-55). When making a structural with connections, you should have a good idea of the size of your structure and those which pin holes can be used for pins and which have to be reserved for axles. All of these considerations make it more challenging to build with studless pieces. There is even a popular saying that being so over-engineering playing them. The builder tends to plan a couple of weeks ahead.



Figure 3-55: Studless pieces connect the pieces. They also tend to be used as a joint when you have such a flat surface and other soft pins, as shown in this study connection used to create the structure right, with carefully used pins both used to shape and use.

Learning to build primarily with studless pieces allows you to build stronger, sturdier, and more compact structures. Being studless MOCs are usually more functional, sturdier, and lighter than studful ones. They can give your model a fairly elegant or 'technical' appearance, though. To avoid this and to create a good-looking studless model like the Ford GT (see Figure 3-56), you can add panels and flexible axles, or you can combine a studless interior structure with a studful body, an idea fully explored later in this chapter.

### studless advantages

In general, the advantages of studful connections are that they

- are easy to combine in any direction, allowing for three-dimensional building
- are easy to combine with most standard Technic pieces, such as motors and actuators
- have more pin holes, making compact construction elements possible
- rarely need extra reinforcement (if using right connections)
- are sturdier and lighter than studful pieces



Figure 3-56: The Ford GT model had a completely studless body. It combined beams, panels, and flexible axles to recreate the flowing lines of the original car. Studless pieces can create shapes that are impossible to make with bricks, at the cost of extra connections in the case, panels represented the shape of the hood in a way not possible with studful pieces, but they were gone between them.

### studless disadvantages

In general, the disadvantages of studful connections are that they

- are less rigid: the largest studless structures have to be complexly reinforced to maintain rigidity
- are harder to combine with non-Technic pieces
- require at least two pins to create a rigid connection; extra pieces with complex shapes are often needed for rigidity
- don't always look as good as bricks

## combining the styles

Combining the two styles in a clever way can be a key to creating a great-looking, highly functional MOC.

With vehicle models, the chassis and the body are often independent, and we can take advantage of that independence. For example, adding a studless body to a studful chassis results in a very sturdy but light model, and it's a popular combination when building in large scale, where weight is a serious concern. Adding a studful body to a studless chassis, on the other hand, results in compact, good-looking models with many functions.

# The Unofficial Lego Technic Builders Guide

**Allan Bedford**



## **The Unofficial Lego Technic Builders Guide:**

The Unofficial LEGO Technic Builder's Guide, 2nd Edition Pawel Sariel Kmiec, 2016-10-01 This thoroughly updated second edition of the best selling Unofficial LEGO Technic Builder's Guide is filled with tips for building strong yet elegant machines and mechanisms with the LEGO Technic system World renowned builder Pawe Sariel Kmiec covers the foundations of LEGO Technic building from the concepts that underlie simple machines like gears and linkages to advanced mechanics like differentials and steering systems This edition adds 13 new building instructions and 4 completely new chapters on wheels the RC system planetary gearing and 3D printing You ll get a hands on introduction to fundamental mechanical concepts like torque friction and traction as well as basic engineering principles like weight distribution efficiency and power transmission all with the help of Technic pieces You ll even learn how Sariel builds his amazing tanks trucks and cars to scale Learn how to Build sturdy connections that can withstand serious stress Re create specialized LEGO pieces like casings and u joints and build custom complex Schmidt and Oldham couplings Create your own differentials suspensions transmissions and steering systems Pick the right motor for the job and transform it to suit your needs Combine studfull and studless building styles for a stunning look Build remote controlled vehicles lighting systems motorized compressors and pneumatic engines This beautifully illustrated full color book will inspire you with ideas for building amazing machines like tanks with suspended treads supercars cranes bulldozers and much more What better way to learn engineering principles than to experience them hands on with LEGO Technic New in this edition 13 new building instructions 13 updated chapters and 4 brand new chapters

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