The Unofficial Free
Brick Built LEGO® Wheels

by Milan Mali
aka Ultimate-Design Bricks



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Please Notice:

The information contained in *The Unofficial Free Brick Built LEGO Wheels* is meant to serve as a collection of time-tested techniques that the author of this eBook have developed from idea of using bricks to made round wheel. The author of this eBook have made all reasonable efforts to provide current and accurate information for the readers of this eBook. The author will not be held liable for any unintentional errors that may be found. The author will not be held responsible to any person or entity in a case of any loss or damage caused directly or indirectly by the information contained in this book.

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Software used for illustrations:
MlCad - Michael Lachmann
LDView - Travis Cobbs

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Author:

Milan Mali --- *Ultimate-Design Bricks*
Website: *www.ultimate-design.org*
YouTube Channel: *https://www.youtube.com/user/TheUltimateDesign*





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IMPORTANT:

- These wheels are good looking and have round shape, bur are not perfect circle! They are made from bricks, the bigger the wheel is, the rounder it will be. There are techniques that will negate this.
- These wheels are designed to mimic both visually and practically real ones, found on real vehicles. However, these are bricks-built, and not made from one piece of ABS, like LEGO wheels, so it may happen that they would not be able to withstand same conditions like LEGO wheels can. Also, under heavier load, some wheels may happen to compress a bit and lose shape if there is no strengthening parts installed But for medium indoor usage, they should be more than enough.
-These wheels require lots of parts. All of these parts are common and cheap, except one part, which is not expensive, but maybe is not available in single store in enough quantity.
-These wheels are not very easy to construct. I have built these wheels more than 70 times, and I could do it with ease, but please, be patient and follow the steps I have provided in the instruction section.
-These wheels, shown in the instructions section, are made in most basic frame-like state. They are completely usable like that, but for full aesthetic and practical pleasure, I suggest you add more parts to them, especially if you want to use them in hard conditions. Then I would make double basic frame and connect two of them together.

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Booklet:
- Total of seven brick built wheels-tires, for which I thought are the most needed for LEGO community, sizing from 75mm to 152mm, each with at least two possible ways of building it, with somewhat different parts.
- Building instructions for all of them.
- Notes, dimensions, part count for each of them.
- Thoughts about customization

Goal of this booklet:
Goal of this booklet is to provide builder with more options for wheel-tire size when building bigger vehicles.
It can also be used for building towers (castle, water), steam rollers, (gas) tanks, and objects that are cylindrical and symmetrical.

My personal goals:
For normal trucks you see every day, which are 2.5m wide, with tires about a meter (42 inches) in diameter, LEGO 24x43 tires are very good match for popular 1:13 scale, both in size, proportions and look (we would all love to have more smooth surface of these tires, though)

But if we want to build something at the same (1:13) scale which has bigger tires, LEGO has given us few choices:
(only non low-profile tires included)

- 24x43 Tire has 82 mm diameter and 24 mm width
- 9398 Tire has 94 mm diameter and 44 mm width
- 8110 Tire has 94 mm diameter and 38 mm width
- 8466 Tire has 104 mm diameter and 60 mm width

While some of these are very good for construction vehicles, builders sometimes finds themselves without exact matching tires, or that tire is shaped like a balloon, while in reality it is more rectangular, or they are too thin or too fat...

This booklet is made to gap those holes, and provide alternatives.

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What makes this wheels different?
Customization- color, width, tire look, surface look!
Using Rubber Connectors as structural parts!

How?
In each wheel, 4x4 round brick is the center and first part used. Then a number of rubber connectors are placed around it, next spokes (made of axles, pins, bushes, connectors, hoses..) are fit into the rubber connectors, then ring of Technic bricks are put onto the spokes, and finally, ring of hinge plates locks it all in a solid wheel.

Why rubber connectors, why not regular ones?
Rubber connectors are flexible, bendable and most importantly *compressible*. I deliberately make a little bit longer spokes than they should be, and just partly insert them into the rubber connectors. When I mount the ring around all that, rubber connectors are compressed a bit (its rubber, its ok) by the spokes.
Their other function: allowing wide number of spokes to be used on limited space - one spoke hold another.

What are benefits of compressing connectors?
They act as a small strong springs inside the wheel, that way the core is sitting tightly in the center and evenly pushing every spoke toward the ring which makes the whole wheel pretty strong.

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Rubber tires for the wheels

Although these wheels may be used as such, without any "tire" on them, on smaller wheels it may be more noticeable that they are made from rectangular bricks-gaps are more visible.

Those gaps can be observed as a off-road pattern, but on smallest wheels they may be too big:



Picture from the smallest, and therefore, wheel with most notable gaps

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Using Rubber connectors (Technic, Axle Connector Double Flexible (Rubber) BL part **45590)** it is possible to greatly reduce these gaps.
You can make your own LEGO tire around each of these wheels, in size you want, width you want, and height you want.
You will also increase the grip extremely, great for crawlers and climbing.
You can make your own width of these connector, and you can make one or more belts stacked one on another and make low profile of high profile tires.



Picture of the same wheel as above with tire made from rubber connectors

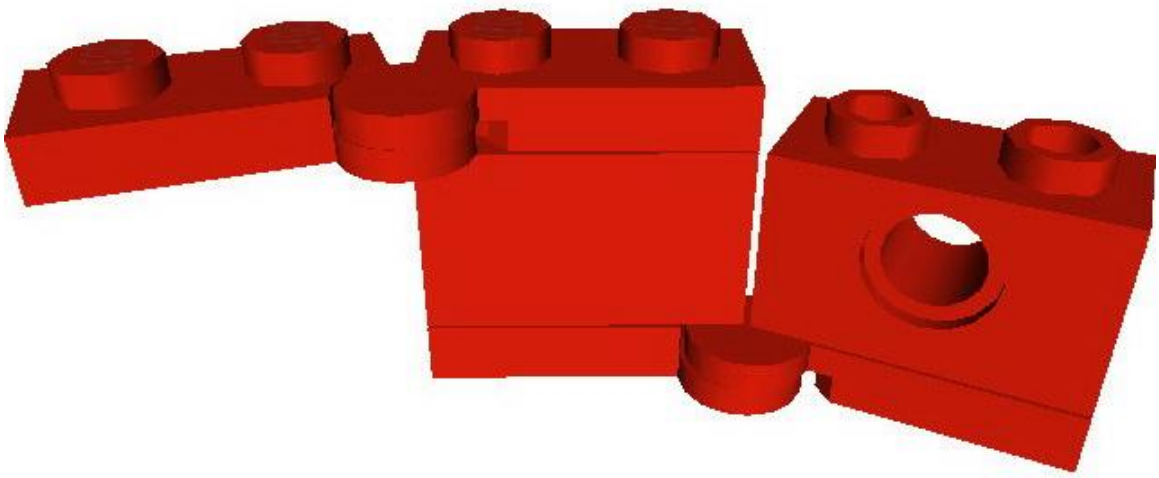
I recommend using these tires on smaller wheels, to improve look and grip. Big wheel look very nice without them.

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Constructing the wheels:

I will present the construction in steps as I am make them while building them.

- Always start with this type of build (depends on the brick type):

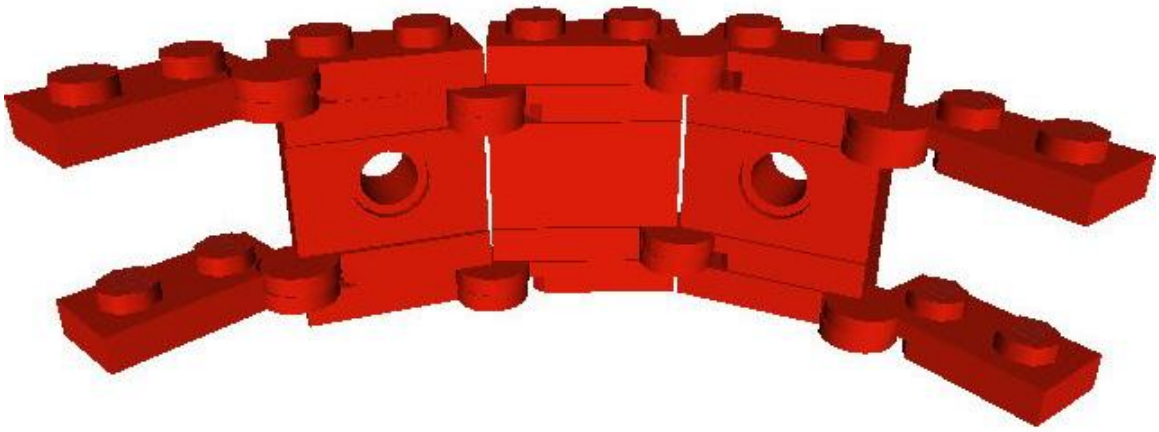


- Examine the picture provided in instruction section for desired wheel, regarding:
    1. type of element used (Brick 1x2, Technic brick with hole 1x2 or Brick modified with Pin)
    2. arrangement of elements used (sometimes the pattern above is used, sometimes there are two Technic bricks used next ot other, sometimes in long chain...)

- Make only one row of hinge-plates under, and one row of hinge-plates above the bricks for now. Do not connect the parts into the closed ring just yet.
- Make spokes as instructed.
- Use 4x4 round brick and start connecting it with spokes, as you connect them to the open "ring" of bricks. This is a tricky part for some wheels, but once you find your own system, it is easy. Sometimes slight pressure (to compress the rubber connectors a bit) is required. I usually place the open ring on the table, standing studs-up, and push in its holes one pair of spokes, while I attach 4x4 round brick onto the spokes with other hand, and start rotating the round bricks and connecting other spokes.

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- Once the spokes are connected, connect the ring to be closed and start adding rest of the hinge plates. There must be two rows of them under the ring and two rows above the ring. Place hinge plates to reinforce each other, like on the picture beneath:



When you put last hinge plate on the place, the wheel is complete and it has its basic strength, which is enough for medium indoor use.

On some occasions, you can use different bricks, depending on what you have more:

- You can use Technic brick with hole, or Technic bricks with axle hole, when building wheels "1, 2, 3"
- You can use either *Brick, Modified 1 x 2 with Pin* ***2458*** **OR** *Technic, Brick 1 x 2 with Hole* ***3700*** **AND** *Technic, Pin with Friction Ridges Lengthwise with Center Slots* ***2780*** when building wheels "4, 5, 6, 7"

For increasing the strength, changing the look, width or colors, please take a look at the modification section.

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1. Wheel "12"



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Notes:

Smallest size in the range. I suggest this one to be used with rubber connectors as tires. Probably the strongest one. Great for large scale supercars.

Data:

Diameter in mm: 75
Diameter in mm with rubber tire: 90
Width min in mm: 24
No of spokes: 12
No of total pieces for most basic version: 79

Comparison with LEGO wheels:

20% smaller than Unimog Tire
28% smaller than Power Puller Tire

Parts:

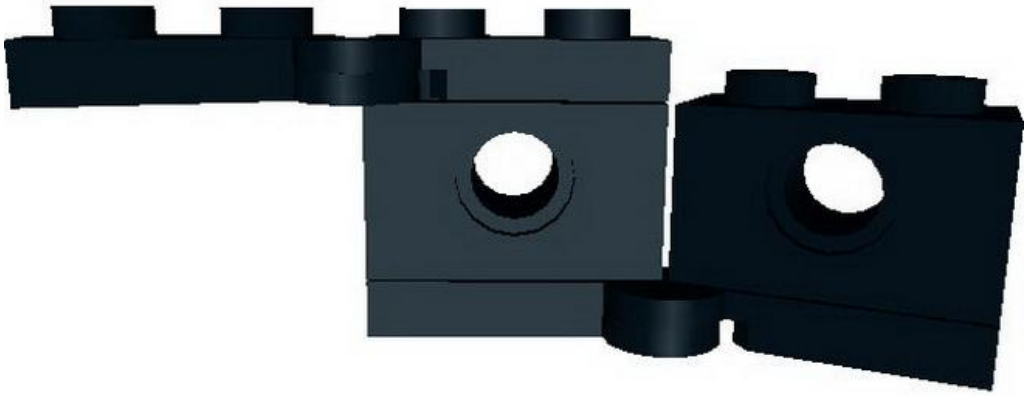
24x Technic Bush 1/2 Toothed Type II **4265b**
8x Technic, Axle 2 Notched **32062**
4x Technic, Axle 3L **4519**
12x Technic, Brick 1 x 2 with Hole **3700** (or axle hole)
6x Technic, Axle Connector Double Flexible (Rubber) **45590**
24x Hinge Plate 1 x 4 Swivel Top **2429c01**
1x Brick, Round 4 x 4 with Holes **6222**

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Construction:

.

First, make a set like this:



Then make six sets of these and connect them, and make spokes like on picture:



Please note that crown half bushes are facing each other and are locked!

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Then make



Note that Technic axle 2L about half way insert into the rubber connector!

Insert spokes into the 4x4 round bricks as on picture and place hinge-plates as you close ring.



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When you connect them, it should look like this:



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Mods examples:

By adding different color onto the rim, you can get nice effects.





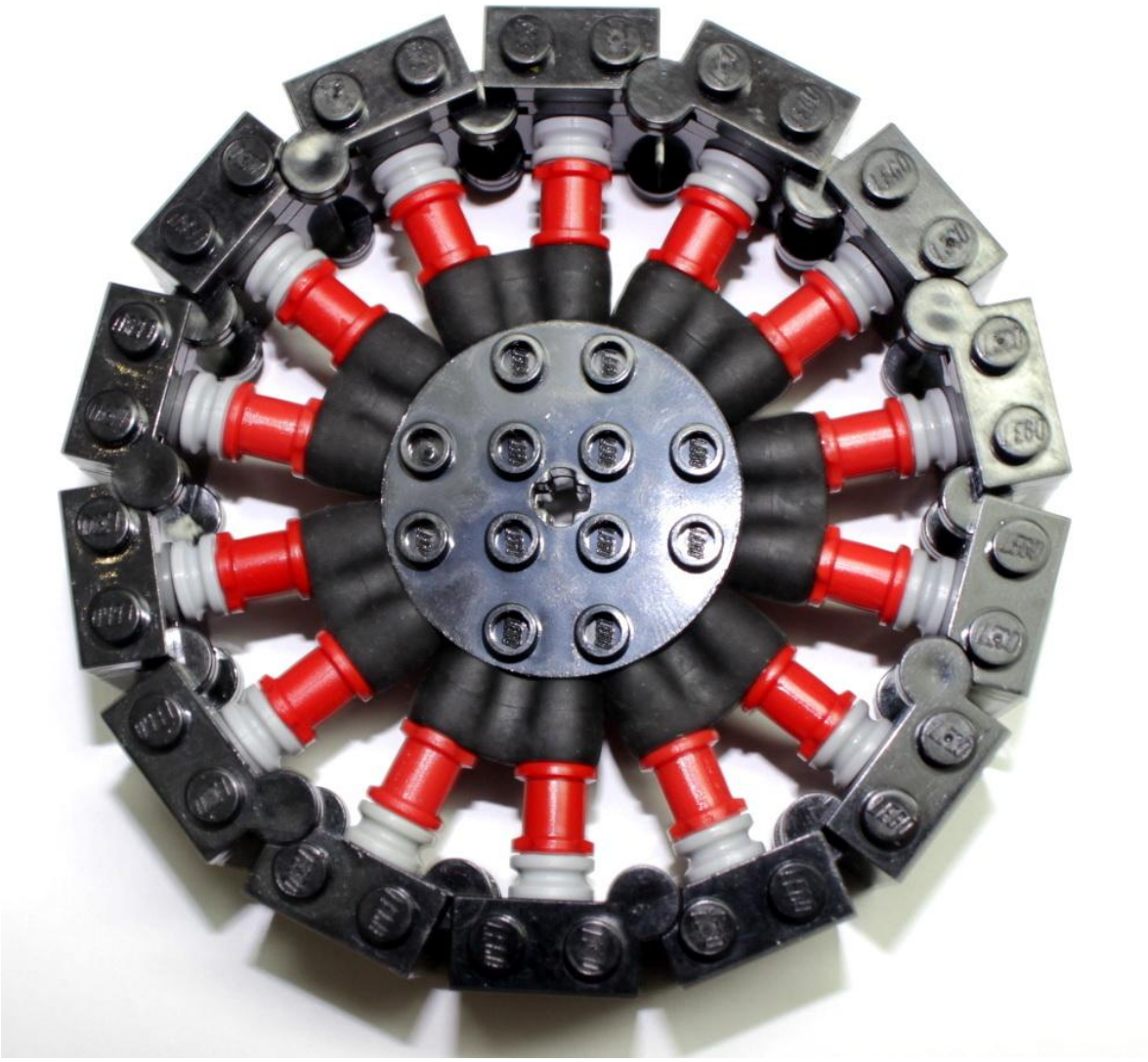
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Comparison- big Unimog wheel (94mm) and my "12" Wheel (90mm):
(width of my wheel is easily changeable)



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2. Wheel "14"



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Notes:

Similar size to Unimog tire. Nice looking due to clear symmetrical shape.
Good for cars in scale 1:10 or constructions equipment in scale 1:13.

Data:

Diameter in mm: 86
Diameter in mm with rubber tire: 100
Width min in mm: 24
No of spokes: 14
No of total pieces for most basic version: 92

Comparison with LEGO wheels:

8% smaller than Unimog Tire
18% smaller than Power Puller Tire

Parts:

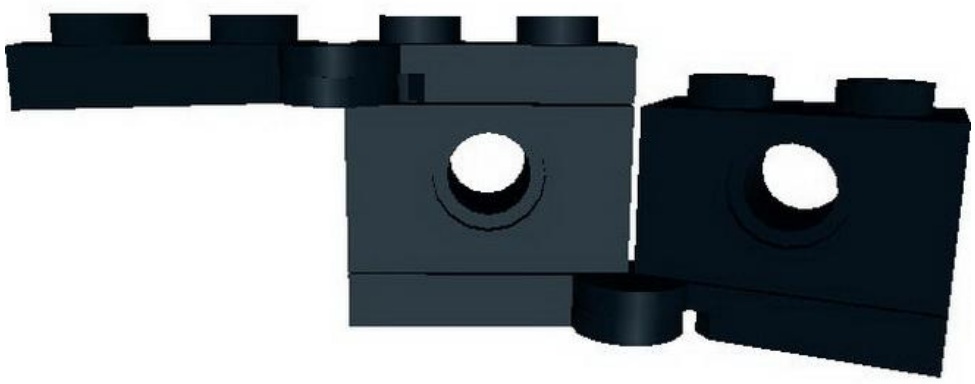
14x Techinc Bush **3713**
14x Technic Bush 1/2 Smooth **4265c**
12x Technic, Axle 3L **4519**
2x Technic, Axle 4L **305**
14x Technic, Brick 1 x 2 with Hole **3700** (or axle hole)
7x Technic, Axle Connector Double Flexible (Rubber) **45590**
28x Hinge Plate 1 x 4 Swivel Top **2429c01**
1x Brick, Round 4 x 4 with Holes **6222**

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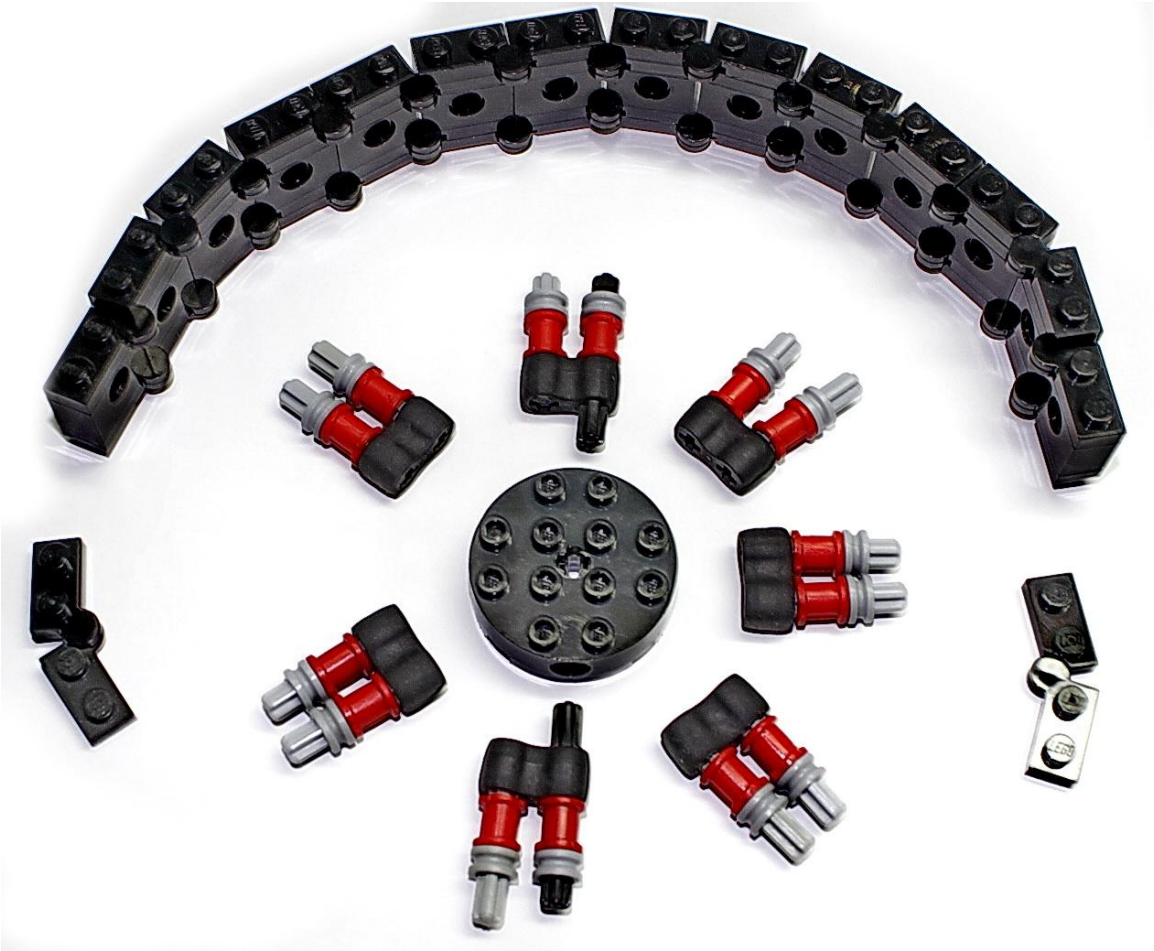
Construction:

.

First, make a set like this:



Then make seven sets of these and connect them, and make spokes like on picture:



Please note that gray 3L axles are insert jus about halfway through the rubber connectors!

Connect the ring to closed state, and add hinge-plates above and under the ring.

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Mods examples:

By adding different color onto the rim, you can get nice effects.
Remember that this is very basic modding.





Comparison between Unimog wheel and my "14" Wheel.

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3. Wheel "16"



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Notes:

Similar size to Unimog tire. Nice looking due to clear symmetrical shape.
Uses lots of half-bush Crown pieces. Good for cars in scale 1:10 or or constructions equipment in scale 1:13.

Data:

Diameter in mm: 96
Diameter in mm with rubber tire: 110
Width min in mm: 24
No of spokes: 8
No of total pieces for most basic version: 106

Comparison with LEGO wheels:

2% larger than Unimog Tire
9% smaller than Power Puller Tire

Parts:

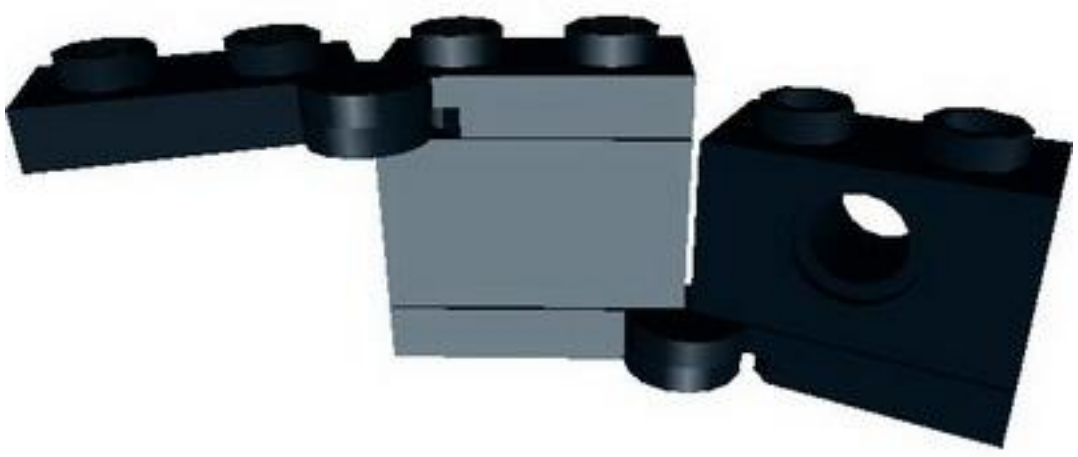
32x	Technic Bush 1/2 Toothed Type II **4265b**
8x	Technic Bush 1/2 Smooth **4265c**
4x	Technic, Axle 4L **305**
5x	Technic, Axle 5L **32073**
8x	Technic, Brick 1 x 2 with Hole **3700** (or axle hole)
8x	Technic, Axle Connector Double Flexible (Rubber) **45590**
8x	Brick 1x2 **3004**
32x	Hinge Plate 1 x 4 Swivel Top **2429c01**
1x	Brick, Round 4 x 4 with Holes **6222**

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Construction:

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First, make a set like this:



Then, build 8 sets and connect them.
Then: make spokes. Try to build them as close to to the picture:
Note that all half-bushes (crown type) are facing each other!

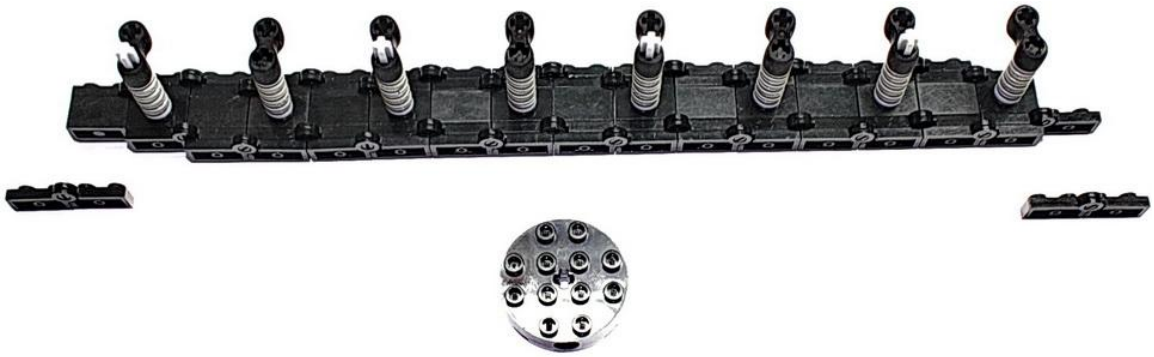


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Now insert the spokes into the open ring like on the picture:



Next add 8 rubber connectors on top of the spokes (you can rotate them later)
Prepare the 4x4 round bricks and rest of the hinge-plates.



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Connect the ring and place hinges above and beneath.



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Mods examples:

By adding different color onto the rim, you can get nice effects.
Remember that this is very basic modding.





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Comparison- big Unimog wheel (94mm) and my "16" Wheel (110mm):
(width of my wheel is easily changeable)



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4. Wheel "18"



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Notes:

Great for wheels for tractors, Nice looking due to clear symmetrical shape.

Data:

Diameter in mm: 107
Diameter in mm with rubber tire: 121
Width min in mm: 24
No of spokes: 12
No of total pieces for most basic version: 109

Comparison with LEGO wheels:

14% larger than Unimog Tire
2% larger than Power Puller Tire

Parts:

12x	Technic, Pin Connector Round (Pin Joiner Round) **75535**
24x	Technic Bush 1/2 Toothed Type II **4265b**
2x	Technic, Axle 4L **305**
10x	Technic, Axle 2 Notched **32062**
6x	Technic, Axle Connector Double Flexible (Rubber) **45590**
36x	Hinge Plate 1 x 4 Swivel Top **2429c01**
6x	Brick 1x2 **3004**
12x	Brick, Modified 1 x 2 with Pin **2458**
1x	Brick, Round 4 x 4 with Holes **6222**

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Construction:

.

First, make a first set like this:



Then make this pattern, and build the spokes;

Please note that Technic axle 2L about half way insert into the rubber connector, and that crown half bushes are facing each other and are locked!



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Connect the construction into one piece by adding another layer of hinge-plates above and under the ring to lock the wheel:



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Mods example:

Last wheel that can use 2x3 wedge plate. Next one must use 2x4 wedges.



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5. Wheel "20"



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Notes:

Great size for wheels for mobile cranes (cca 150cm diameter) in 1:13 scale.

Data:

Diameter in mm: 117
Diameter in mm with rubber tire: 131
Width min in mm: 24
No of spokes: 10 or 12
No of total pieces for most basic version: 106

Comparison with LEGO wheels:

24% larger than Unimog Tire
11% larger than Power Puller Tire

Parts:

10x	Technic, Pin Connector Round (Pin Joiner Round) **75535**
10x	Technic Bush 1/2 Smooth **4265c**
10x	Techinc Bush **3713**
5x	Technic, Axle Connector Double Flexible (Rubber) **45590**
8x	Technic, Axle 3L **4519**
2x	Technic, Axle 4L **305**
40x	Hinge Plate 1 x 4 Swivel Top **2429c01**
10x	Brick 1x2 **3004**
10x	Brick, Modified 1 x 2 with Pin **2458**
1x	Brick, Round 4 x 4 with Holes **6222**

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Construction:

This wheel is one of the easiest to assemble.
First, make a first set like this:



Now, follow the picture beneath and build this pattern of bricks and Technic bricks.
Prepare the 4x4 round brick, and make the spokes.
Please note that gray 3L axles in spokes needs to be just about half way insert to the rubber connector!
Insert spokes into the open ring and into the 4x4 round brick



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Make the ring complete:



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Mods example:

These are my second favorites wheel, only because are perfect match for 1:13 scale mobile cranes. Also, this wheel has additional strength when modded like on the picture. Namely, those wedges are touching each other and provide additional support to the wheel!
I use basic width of 24mm and just add 20 wedge plates, 8x8 DBG dish and some hub details.
I was very excited to find that dimensions are very fitting to hte model of the crane I was building!



Picture of modded wheel, but with a little bit of width added.

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6. Wheel "22"



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Notes:

Wheel which is good for largest 1:13 scale wheels (Backhoes, big Tractors)
For max strength, only for this one, I recommend building two of them and joining them together to act as one, but rotating one of them 90 degrees.
One of the nicest one when modded!

Data:

Diameter in mm: 126
Diameter in mm with rubber tire: 142
Width min in mm: 24
No of spokes: 14
No of total pieces for most basic version: 117

Comparison with LEGO wheels:

34% larger than Unimog Tire
20% larger than Power Puller Tire

Parts:

"V1"

28x Technic, Pin Connector Round (Pin Joiner Round) **75535**
6x Technic, Axle Connector Double Flexible (Rubber) **45590**
2x Techinc Bush **3713**
2x Technic, Axle 5L **32073**
12x Technic, Axle 4L **305**
44x Hinge Plate 1 x 4 Swivel Top **2429c01**
8x Brick 1x2 **3004**
1x Brick, Round 4 x 4 with Holes **6222**
14x Brick, Modified 1 x 2 with Pin **2458**

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Construction:

Start with this:



Then make this open ring using the picture, and make spokes like this:



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Then insert the spokes into the holes like in the picture:



Next, start closing the ring and insert axles into the 4x4 round bricks:



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Make the ring complete, and preferably, make the whole setup (wheel) twice, and join them together, but rotate one to each other 90 degrees.



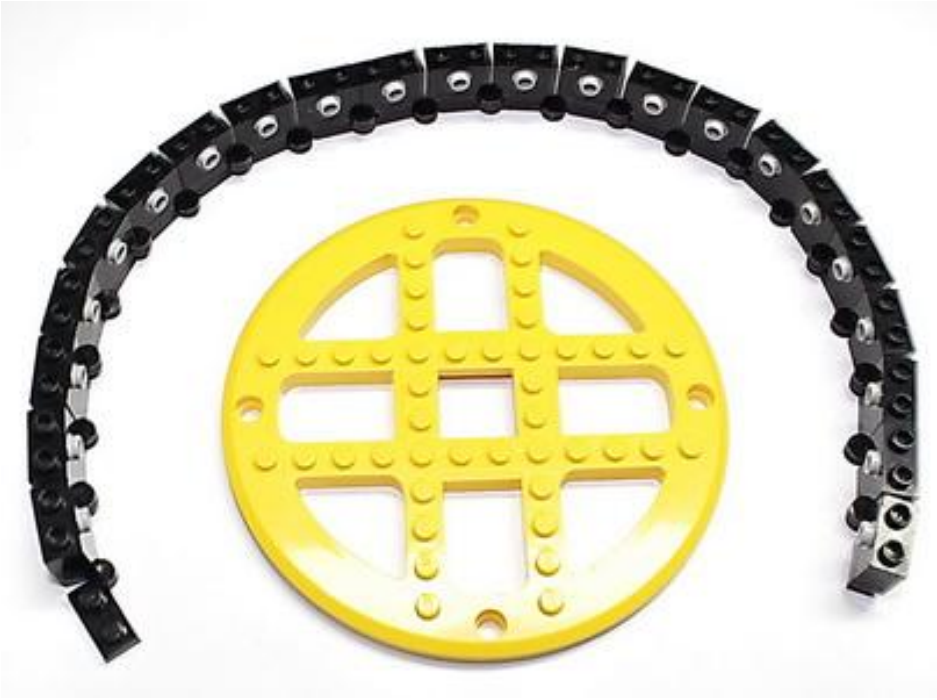
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"V2"

22x Technic, Brick 1 x 2 with Hole **3700**
22x Technic, Pin 1/2 **4274**
44x Hinge Plate 1 x 4 Swivel Top **2429c01**
4x Plate 2x4 **3020**
1x Fabuland Plate, Round 13 2/3 Stud Diameter - (Ferris Wheel Side, Merry-Go-Round Type 2 Base) **4750**
X HERE YOU NEED TO CHOOSE HOW THIS WHEEL WILL LOOK AND ADD THE PARTS YOU WANT!

Construction:

Make a 22 Technic bricks open ring, connect them worth one row of hinge-plates above and under, and insert half-pin in each of the bricks.



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Now connect the ring and make 2 sets of 2x4 plates, like on the picture:



Connect two sets of plates to the ring and to the yellow wheel:



Now you need to choose how you will complete the wheel.
Most important is that 2x4 plates get reinforce above them. I would suggest that you place one layer of 1x2 plates around the ring, to level the surface to match the 2x4 plates. Then, you can add more layers of bricks, or more plates. Important thing is that you finish the building with two rows of interlocked hinge plates at the top and bottom!

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Mods:

This wheel is my personal favorite for modding, because I am using this wheel as the perfect match for the MOC of vehicle -construction equipment- which in reality has really massive, fat tires.



Great feature of this modded tire is that , like on real machine, it has very deep center hole from outside, where white "wheel" is placed. Also, it is very strong and it has double support inside, both at back and front.

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7. Wheel "24"



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Notes:

The biggest wheel in this booklet.
Ideal for large scale bicycles, motorcycles, Big-Foots, gas-tanks, too big even for tractor and backhoes in 1:13.
Due to large circumference, the shape is good and round-like, and looks good without rubber tire.

Data:

Diameter in mm: 138
Diameter in mm with rubber tire: 152
Width min in mm: 24
No of spokes: 12
No of total pieces for most basic version: 139

Comparison with LEGO wheels:

46% larger than Unimog Tire
31% larger than Power Puller Tire

Parts:

8x Technic, Axle 4 **305**
4x Technic, Axle 5.5 with Stop **32209**
24x Technic Bush 1/2 Toothed Type II **4265b**
6x Technic, Axle Connector Double Flexible (Rubber) **45590**
24x Technic, Pin Connector Round (Pin Joiner Round) **75535**
48x Hinge Plate 1 x 4 Swivel Top **2429c01**
1x Brick, Round 4 x 4 with Holes **6222**
12x Brick 1x2 **3004**
12x Brick, Modified 1 x 2 with Pin **2458**

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Construction:

As usual, start with building this:



Then connect 24 of them:



Prepare the spokes (note the half-bushes are facing each other and are locked together):



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And complete the circle by attaching spokes into the center and locking the first row of hinge-plates. It will be wobbly a bit at this moment.



Finally, add one row of hinge-plates on the top, and one row at the bottom, and the wheel is locked.



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Size comparison with Unimog tire (94mm):



Mods:

This wheel has the greatest options for mods due to its size. Example:



This is the mod where 2x4 wedge plates are added, 10x10 round dish, as well as one layer of rubber connectors.
To further improve look, wedge plates could be added at the back, too. As well as putting few more rows of 1x2 bricks around the wheel to make it more fat.

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