MOD09 - Bueller

A guide to building this GBC module

Building Guide for module Version 2.6. September, 2024.

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rykfield

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MOD09 - Bueller

Based on 10247 - Creator Ferris Wheel (2015)

Due to the size and nature of this GBC module, I don’t anticipate many people will build it, making it difficult to justify the enormous time required to create step-by-step instructions.

As an alternative, the intent of this document is to guide the reader through the process of building each of the sections of the GBC, based on the model design in the ~7000 part Studio file. If you are unfamiliar with Studio, there are several tutorials available on YouTube to supplement the official documentation.

If you need help, or find a problem, please get in touch.

Change Log: Revisions to the MOD09 - Bueller GBC since the Initial Release of V2.2

Component	Details
Base Structure	2x2 Dark Grey tile underneath Ball Loader changed to 2x2 Dark Grey tile with Single Stud.
	The *Clear Ball Guard - Rear* has been reduced to 1 brick high, removing the 5 brick high clear panels. After the totality of the changes in this updated version of the module, the likelihood of balls falling out the back of the loading area is so low that clear panels were essentially unnecessary any longer.
Ferris Wheel - Complete	Rear ring of Banana Gears duplicated (with guides added to Gear Rack) to correct a torque-related twisting.
Gear Rack	Guides added (aligns inside the duplicated Banana Gears) to hold the Gear Rack in square alignment with the Ferris Wheel. Previously the gear rack was twisted out of alignment.
Gondolas	Slopes on high end of the ball slide replaced with 3L panel, reducing number of ball load failures.
	Light Bulb Cover (white) removed from the end of the ball release arm. No longer required after torque-related twisting correction to the Gear Rack, and removes a possible jam-point due to its tiny amount of clearance from the side of the wheel structure.
Ball Unloading Tower	Top redesigned due to alignment correction of the Ferris Wheel.
Ball Loader	Front step design reduced from 2 studs thick to 1 stud thick, to remove a point of friction from the mechanism.
	Rear step changed slightly to accomodate the Front step change.
	'Spout' changed to reduce ball roll variability.
	Ramp section is now easily removed from the Stepper section, ie, the Loader has been redesigned to be two independant builds. Easy removal of the Ramp section improves access to the Stepper section for maintenance.
Ball Corral	Redesigned to add hinges to rear wall.
Unloading Ramp	Completely redesigned to smaller, independant sub-assemblies, to accomodate two different, interchangeable Return modules.
Ball Diverter	Redesigned to work with either Return module options.
Feeder Ramp Support	**REMOVED**. No longer required.
Feeder Ramp	Redesigned to work with either Feeder module options.
Feeder Module	**GBP WM01 Conveyor**: Modified with front support leg and changed ball guard, to suit new Feeder Ramp.
	Stepper: Jude-suggested alternate Feeder module, for a cleaner look than the Conveyor.
	NOTE: Only one Feeder module is required.
Ball Bridge Return	Redesigned to remove potential jam.
Stand-alone Return Ramp Support	Top altered for easier alignment.

Component	Details
Stand-alone Return Ramp	Redesigned to be easier to align, and changed to Ferris Wheel colour scheme.
Stand-alone Return Module	**GBP WM01**: No changes to the module itself, however the ball guard that sits on top of the return ramp is now considered part of the module, and has been redesigned.
	BW 2018 Ball Pump: Alternate Return module.
	NOTE: Only one Return module is required, and only if running the ferris wheel in Stand-alone mode.

Building For Different Display Modes

As shown on the front cover, MOD09 can be used in a typical GBC loop. Alternatively, for standalone display, additional components can be built to recycle the balls.

In the following pages the typical sequence for building each of the components will be detailed, along with specific important notes. All of the components required for “in-loop” use will be discussed first, followed by the optional components for standalone display.

An effort has been made to title each of the subsequent pages with the name of the *subassembly* in the Studio file.

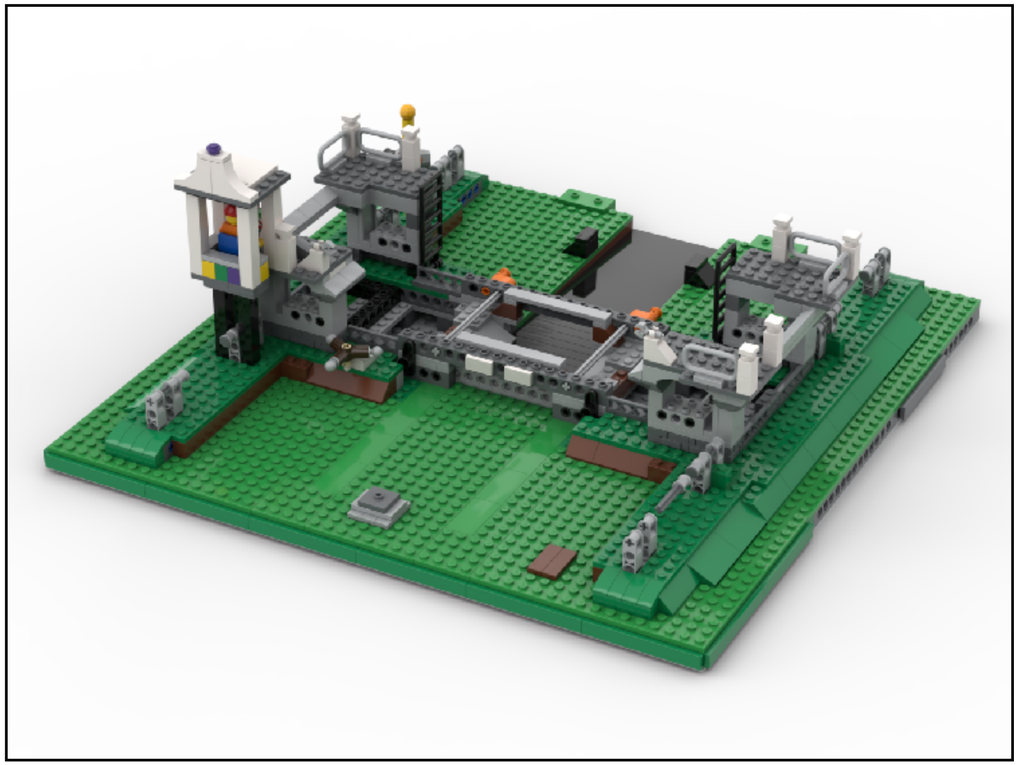
Lets begin…

Base Structure

To add structural integrity and make this large module easier to transport and setup, Parts of this GBC are built upon MILS-style bases. Each of the different components are then *pinned* together to eliminate movement from vibration when the GBC is running.

Decorative tiling is used along the front and sides of the modules, however some additional tiles have been added to make it easier to determine the right spot to connect different components together.

The black ramp guides balls that fail to load to a clean exit from the GBC, to be collected by hand at the rear and added back to the loop.

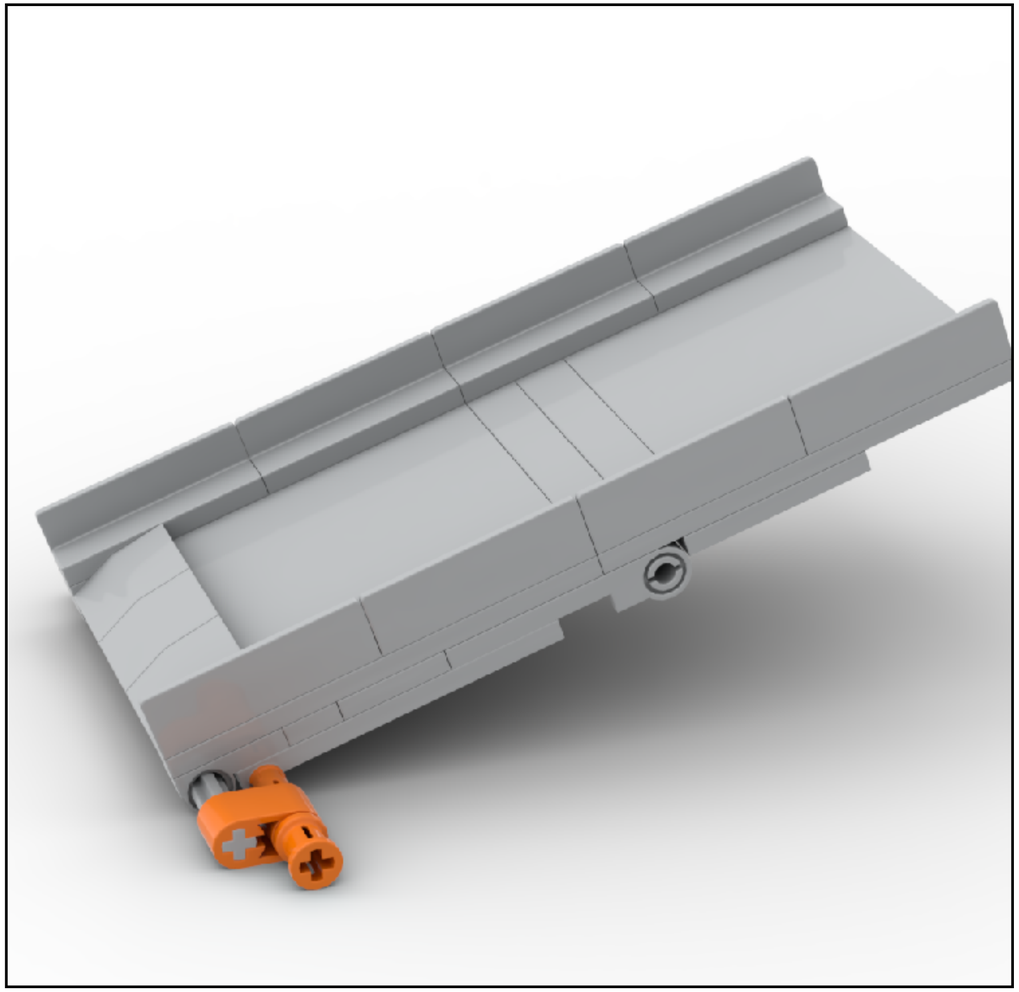


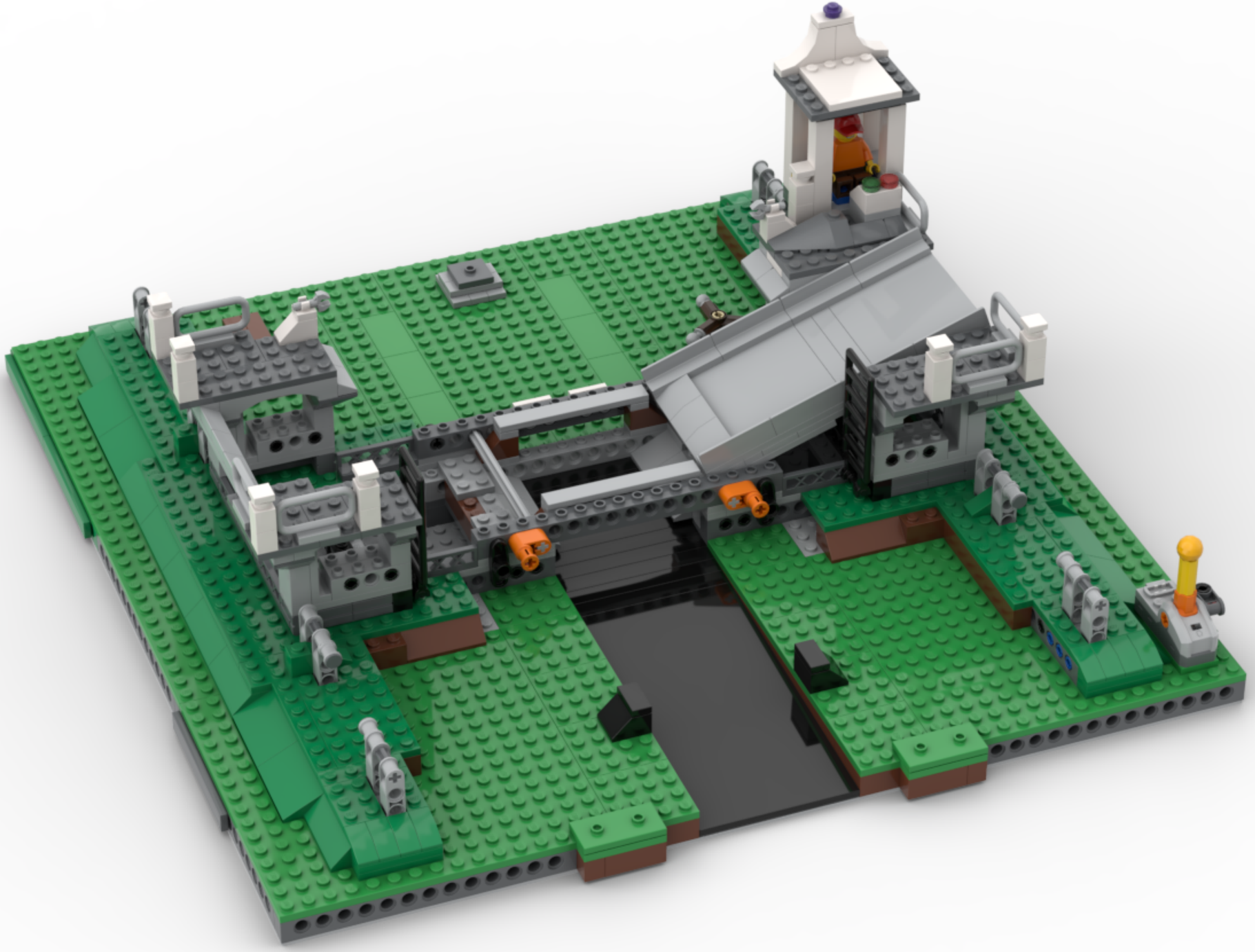
Sloping Platform - Up

The original Ferris Wheel set had grill plates below the Gondolas, which don’t work well with the GBC balls. Tiled platforms have replaced them.

In some circumstances, if a ball fails to load into a Gondola correctly, it can fall in front of the Gondola, and be pushed up this ramp, and placed back into the *Feeder* module.

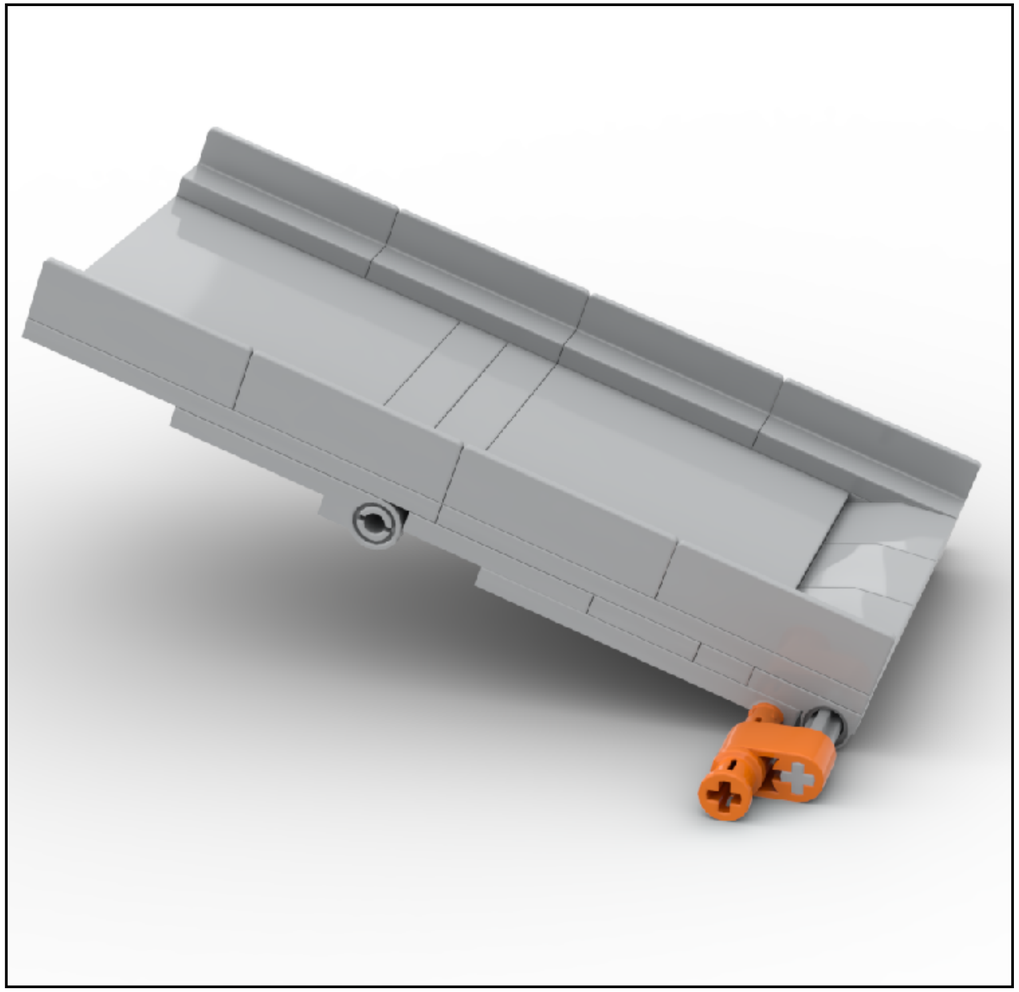
As each section is built, the following page will indicate its placement within the complete GBC.





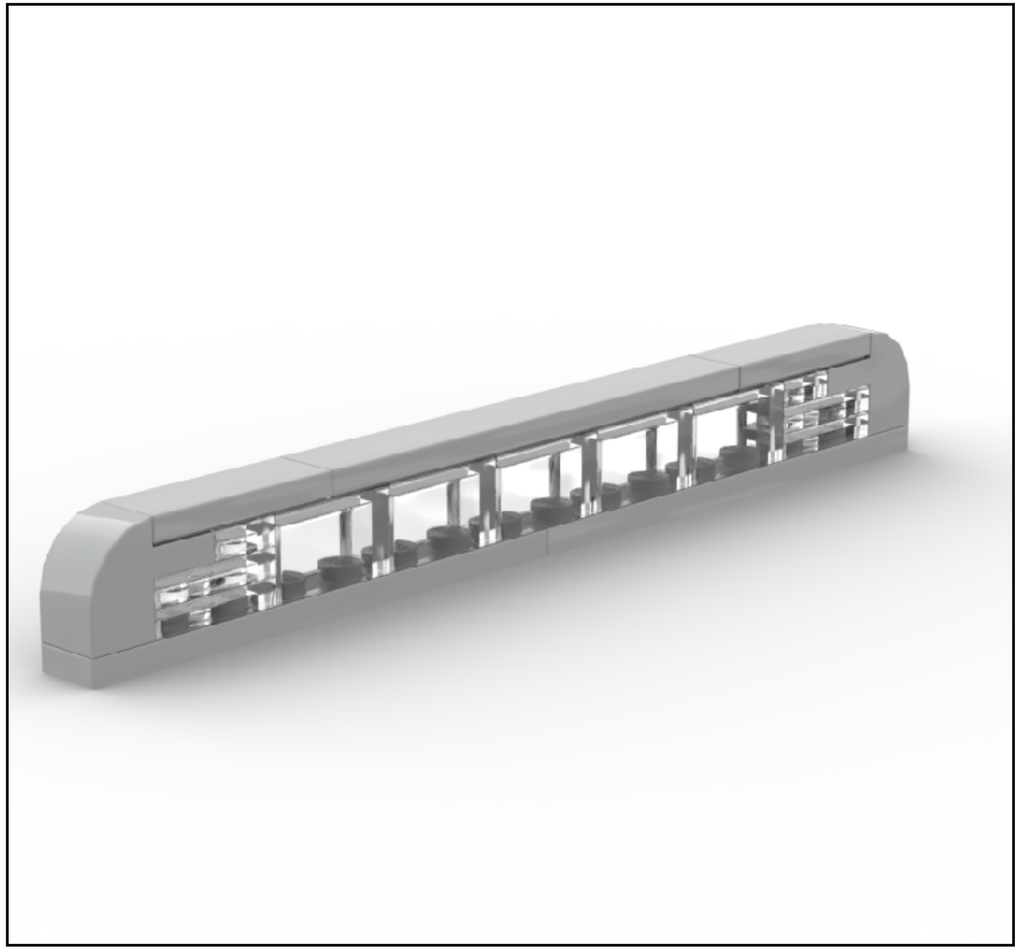
Sloping Platform - Down

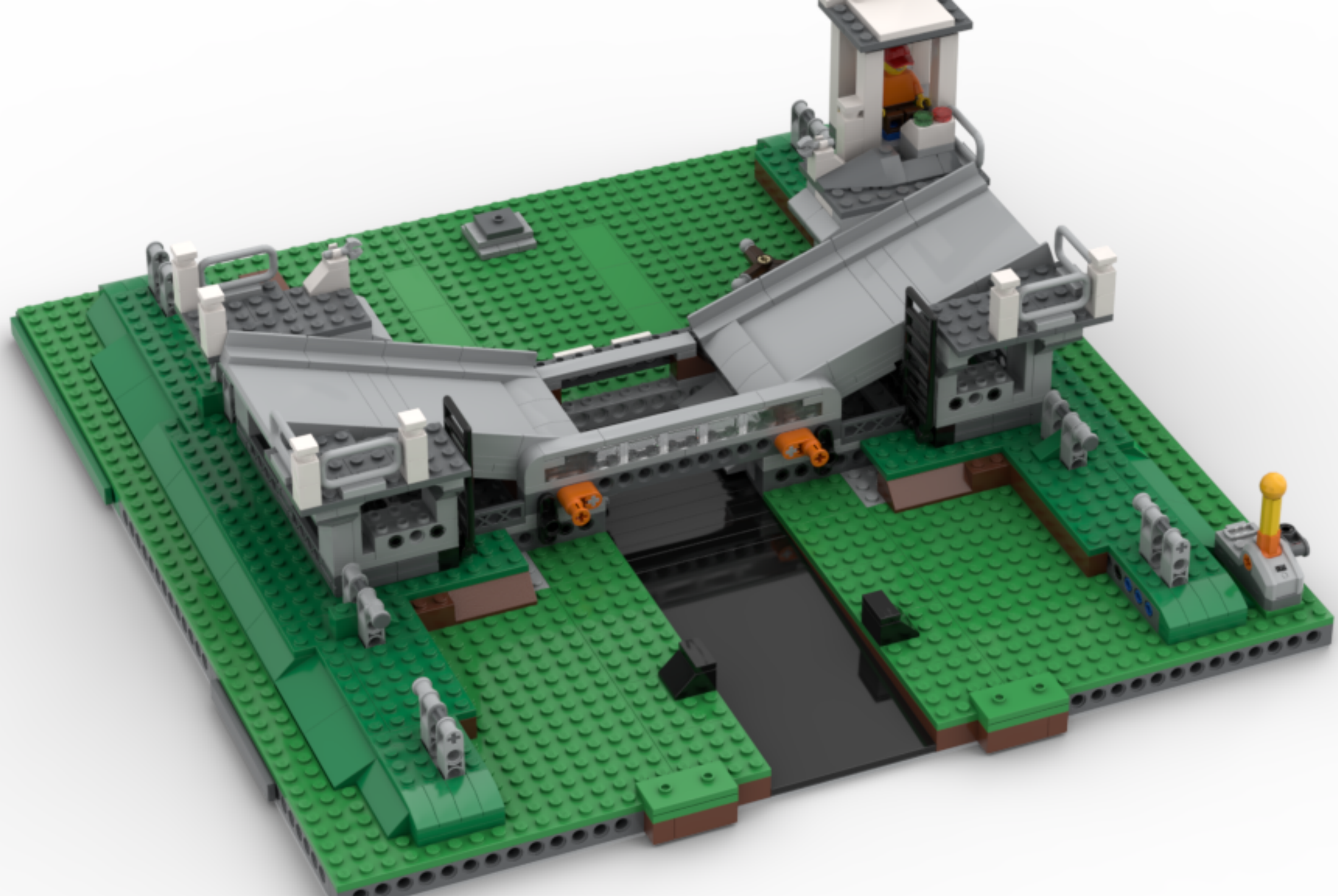
On rare occasions, balls do not unload correctly, and fall onto this platform on the opposite side, which allows the balls to cleanly exit the module via the black ramp shown previously in the *Base Structure*.



Clear Ball Guard - Rear

This ball guard helps ensure any balls that fail to load properly make their way cleanly out of the module.

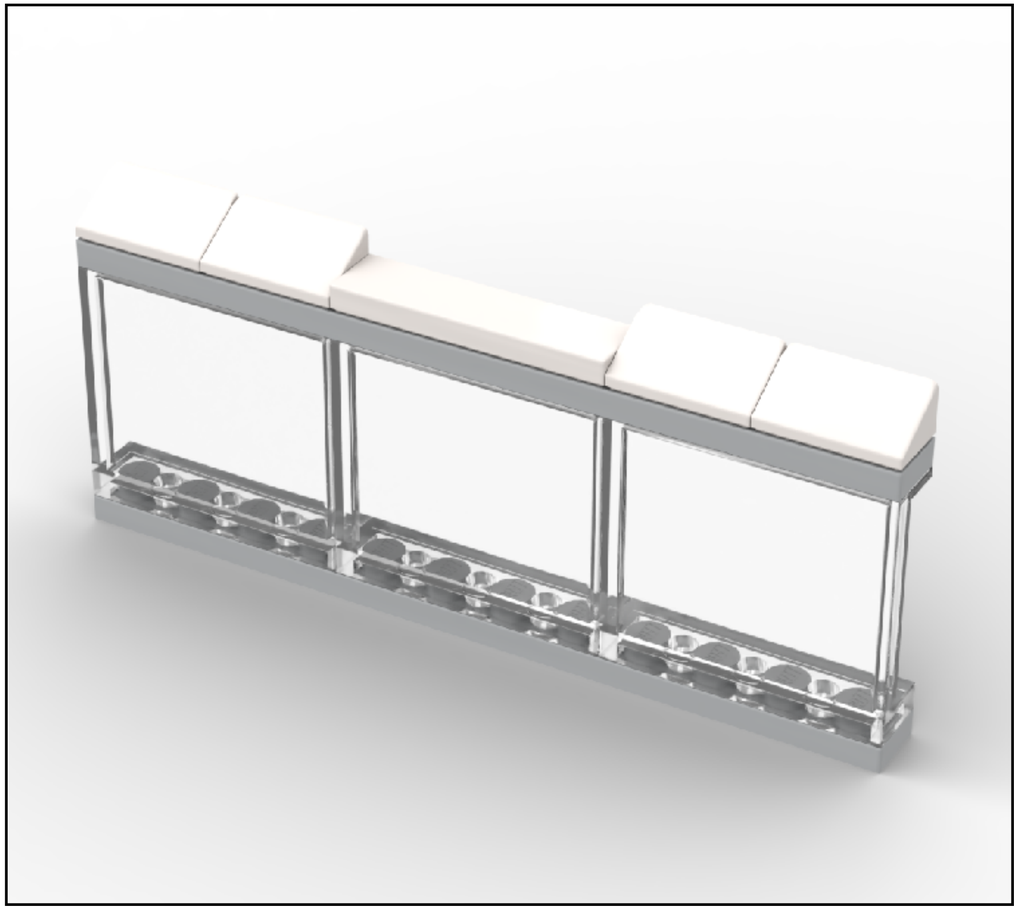




Clear Ball Guard - Front

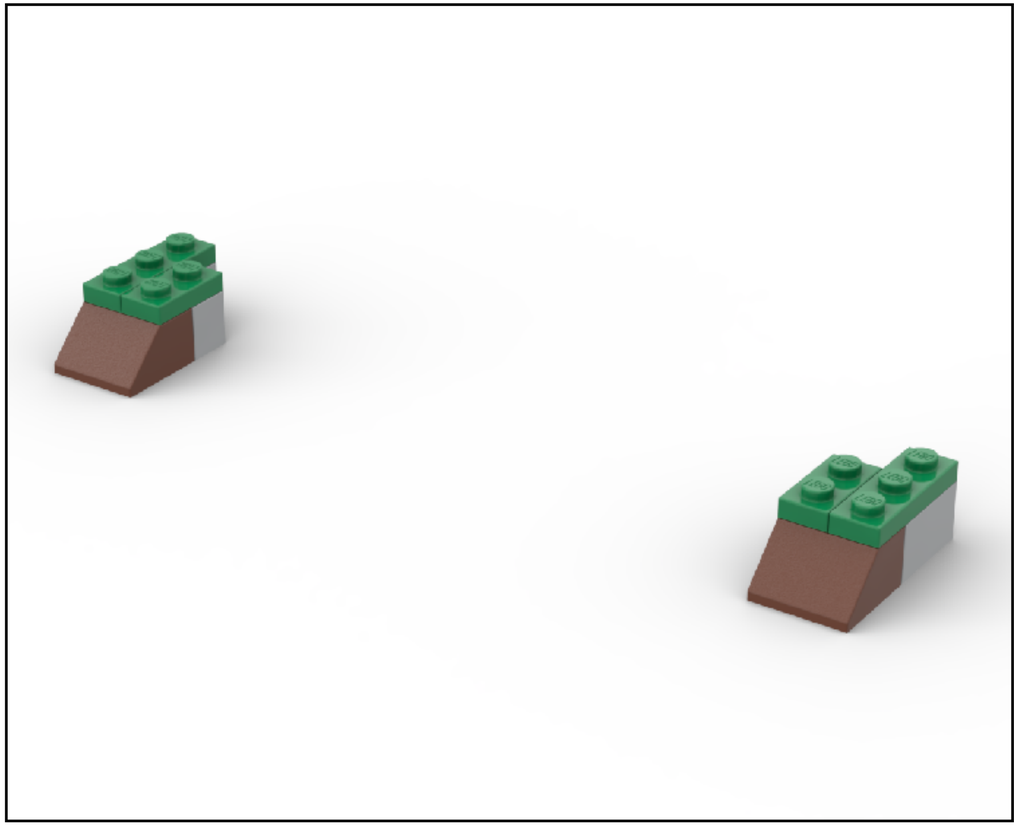
This ball guard is also intended to keep the balls within the sloped path beneath the Ferris Wheel, and in particular to keep the balls from entering the stepper mechanism beneath the *Loader Module.*

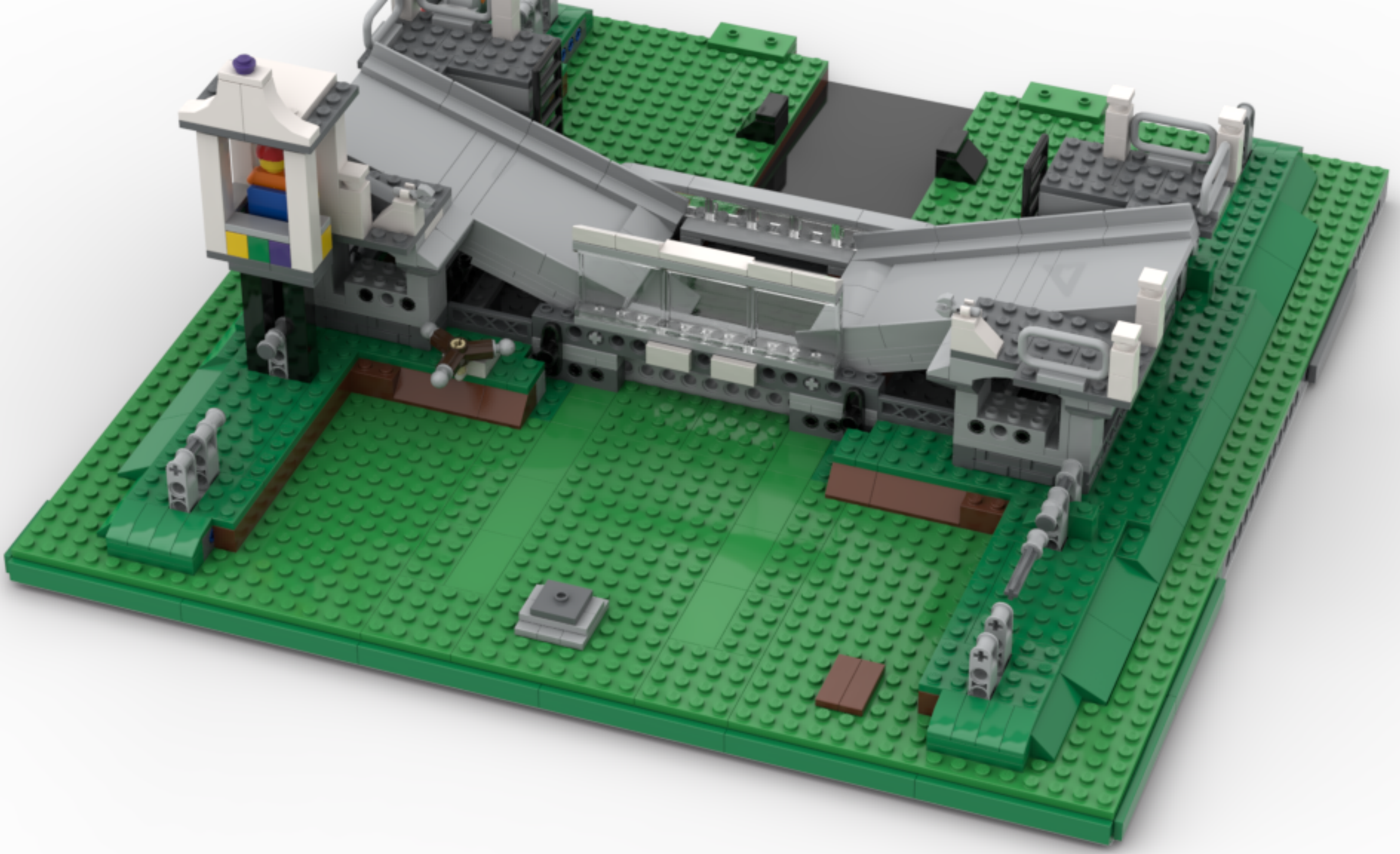
The flat side of the clear panels should face inward, toward the sloping platforms that have just been added.



Grass Slope Plugs

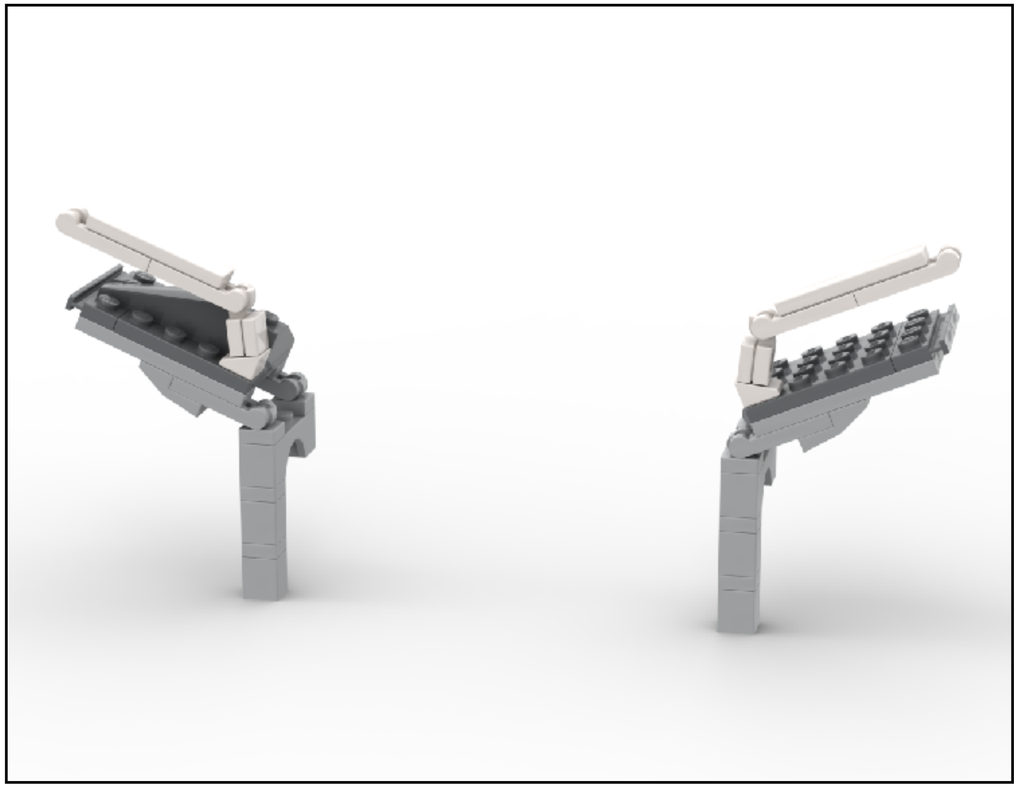
A couple of “plugs” to make the module look a little cleaner.

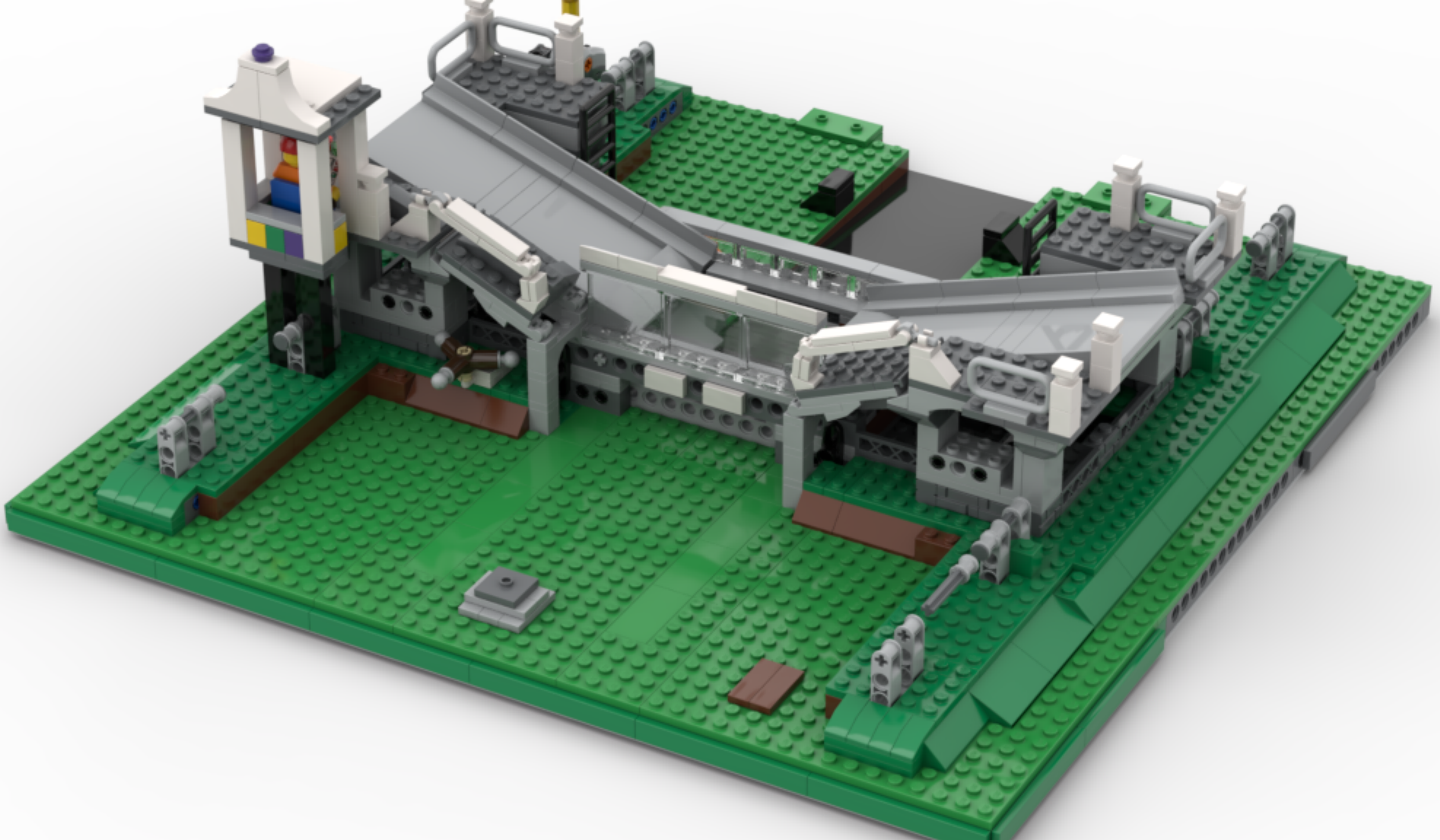




Side Ramp - Left & Right

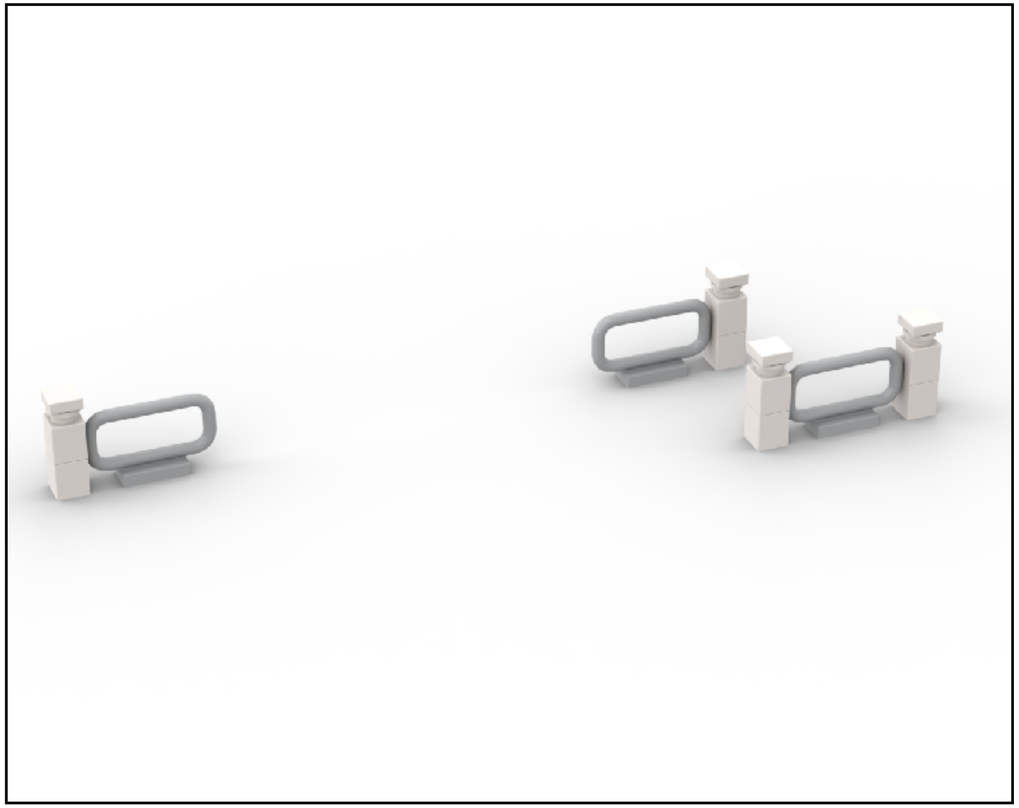
These ramps are decorative (to help retain the original look of the official Ferris Wheel set) as well as functional, in keeping wayward balls within the Ferris Wheel ball path.

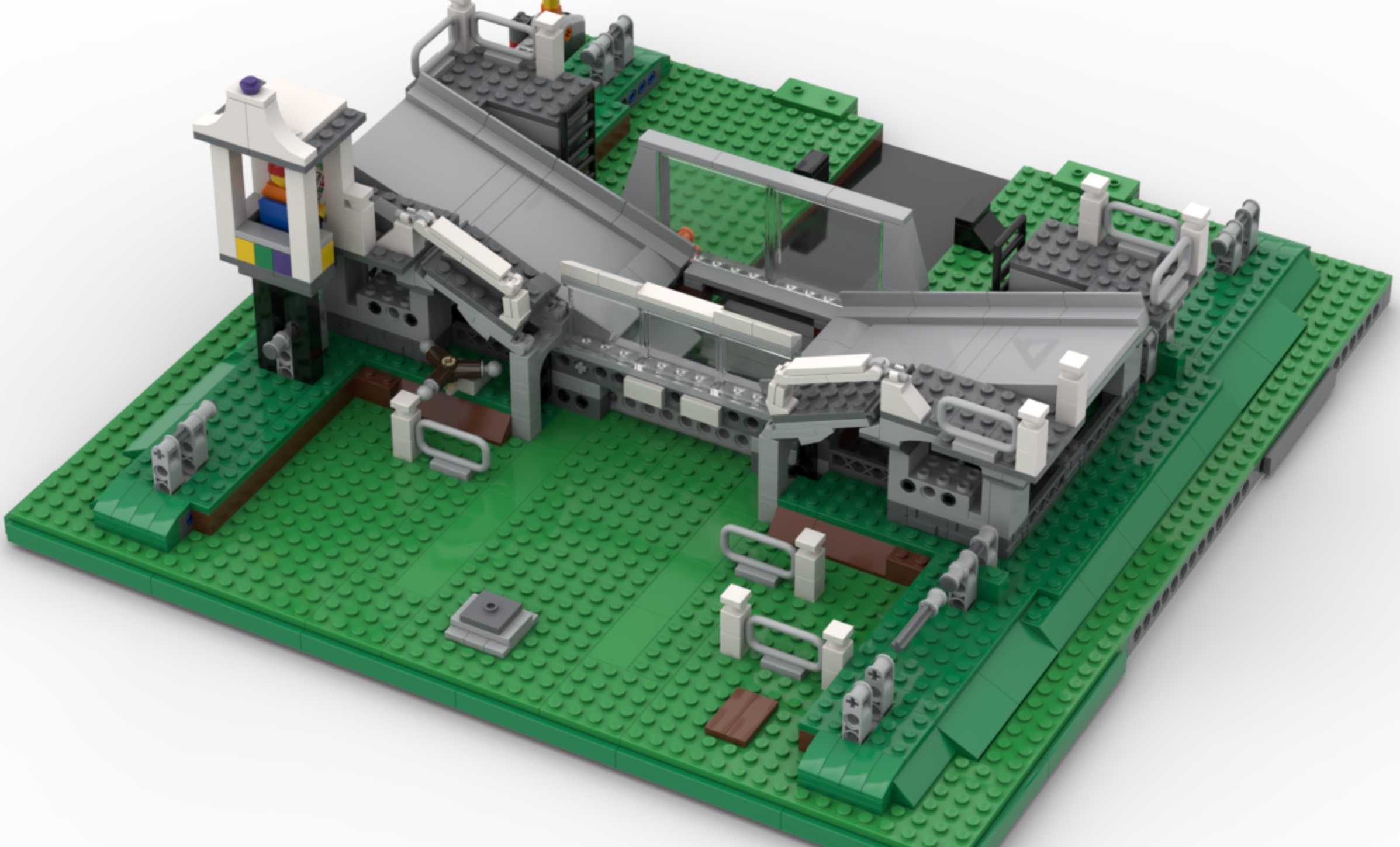




Fences - Front

Decorative elements, to be added now while there is easy access to this area of the build.





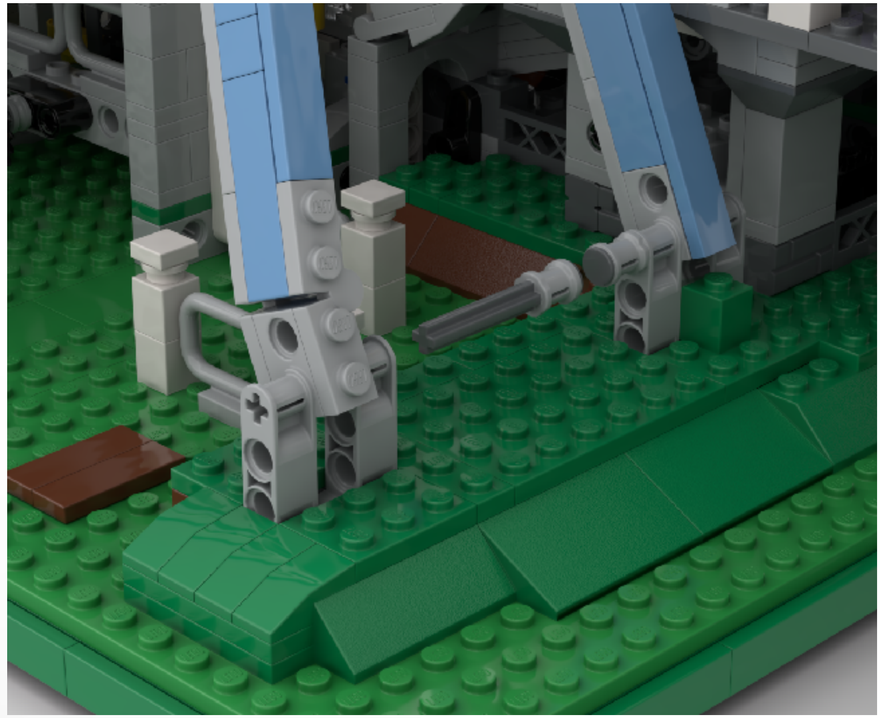
A Frame - Front

These legs will support the front side of the Ferris Wheel. Once built they can be attached directly to the base using the technic axles as shown on the next page.

Note: The rear left leg goes *inside* the control booth.

At this point, Emmett deserves a break for ice cream.

In the original design, only two drive/guide wheels are used, one on the front *A Frame*, and one on the rear. I have changed this to four guide wheels, to improve the overall stability and alignment of the Ferris Wheel for loading balls into the *Gondolas*.



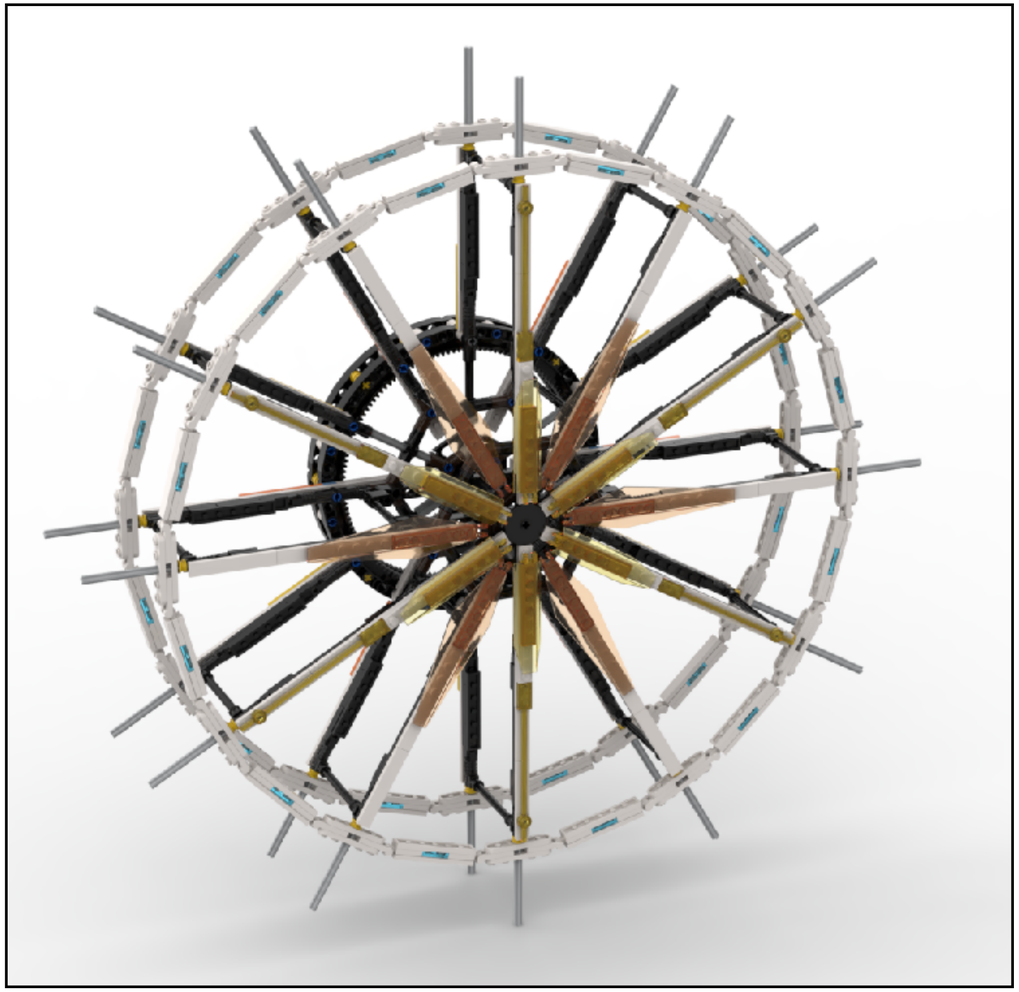
Pull pins and attach legs

Ferris Wheel - Complete

The main wheel is built in two sections, the front wheel, with all of the cross members as well, and the rear wheel, which is modified to include the Technic banana gears, which are used to rotate the wheel.

Once assembled, the wheel can be attached to the front *A Frame*, and should be secure enough to hang there while you build the rear *A Frame.*

However… Two of the rear Banana Gears will need to be temporarily removed to attach the *Gear Rack* and then the *Rear A Frame*. Doing this is fiddly, and easier to do seperately, before attaching to the *Front A Frame.*



GBC

A Frame - Rear and Gear Rack

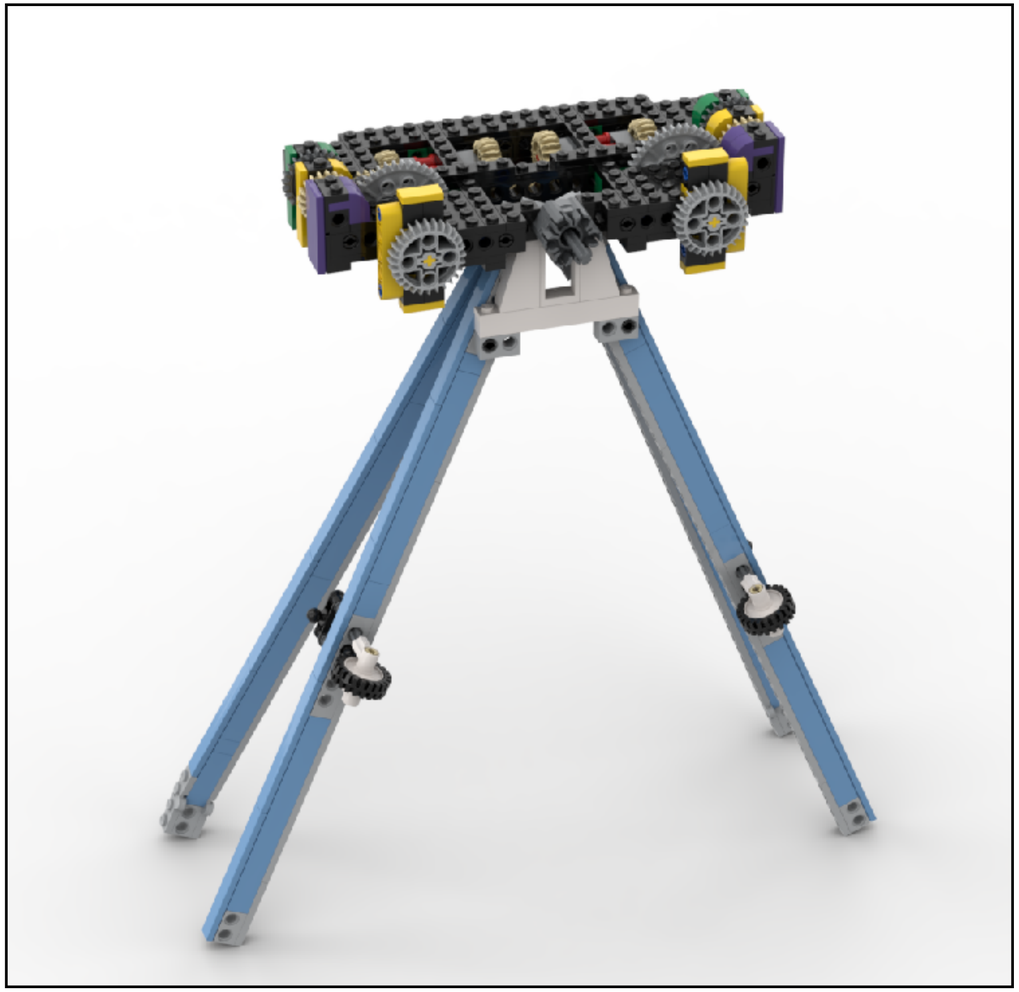
The rear *A Frame* legs are only slightly modified from the original design. The *Gear Rack* will drive the banana gears to rotate the Ferris Wheel.

I found it easier for the *Gear Rack* to be attached to the Ferris Wheel **before** the legs are attached to the *Gear Rack*. To do this, you will need to remove the top and bottom *Banana Gear* from the rear of the Ferris Wheel (see photo next page) as well as the top and bottom 3L yellow axle with half bushes.

With the *Gear Rack* held vertically, insert the central axle into the Ferris Wheel, and then rotate the *Gear Rack* into the horizontal position, so the yellow 5L liftarms slide in between the two rings of banana gears (see next page).

Re-attach the removed *Banana Gears* and yellow axles.

Instructions for attaching the *Gear Rack* to the *A Frame* *are on the following page.*



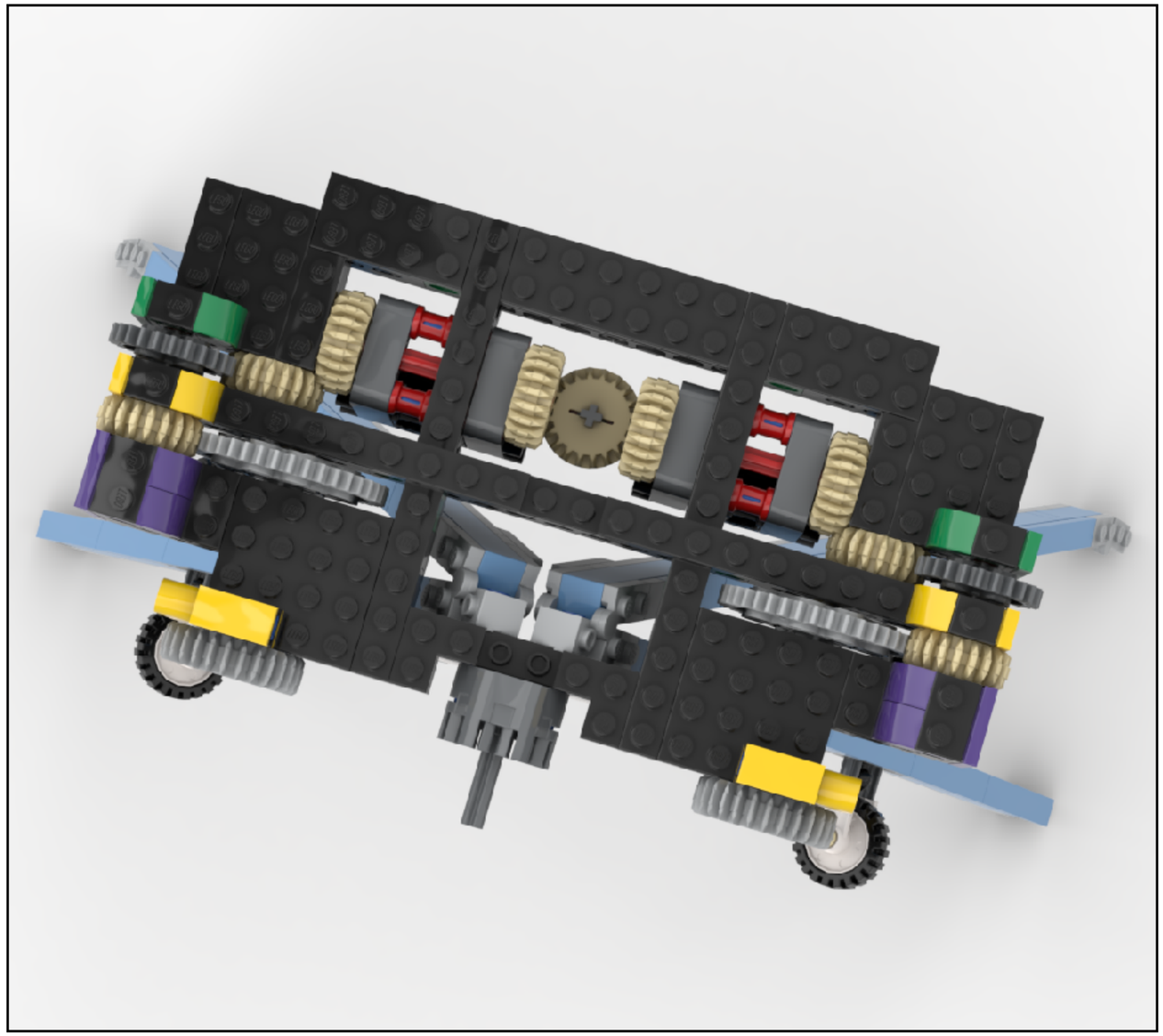
Alignment of Yellow Liftarm (some ring connectors removed for visibility)

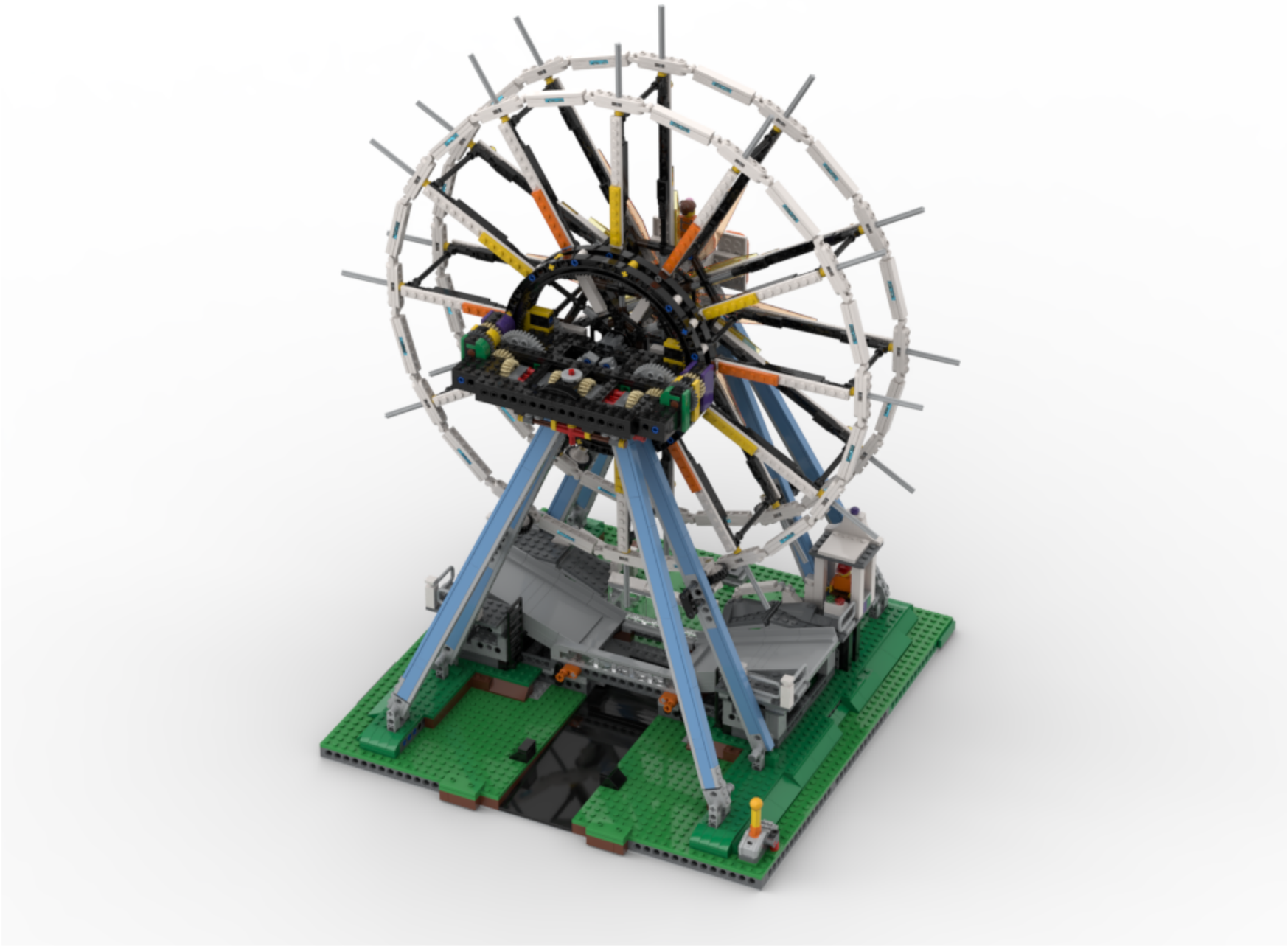
See next page before attaching the rear legs.

This view shows how the *A Frame* is attached inside the *Gear Rack*. There is just enough room in the 3x6 stud rectangle to place the *A Frame* inside it, and then slide it onto the blue technic pins in the *Gear Rack,* while also connecting the black technic pins at the bottom of the white framing to the *A Frame.*

It can be difficult and fiddly, but it does all fit together properly.

Shown here for clarity without the Ferris Wheel & Banana Gears, but this Gear Rack should be attached to the Wheel before these rear legs are installed.





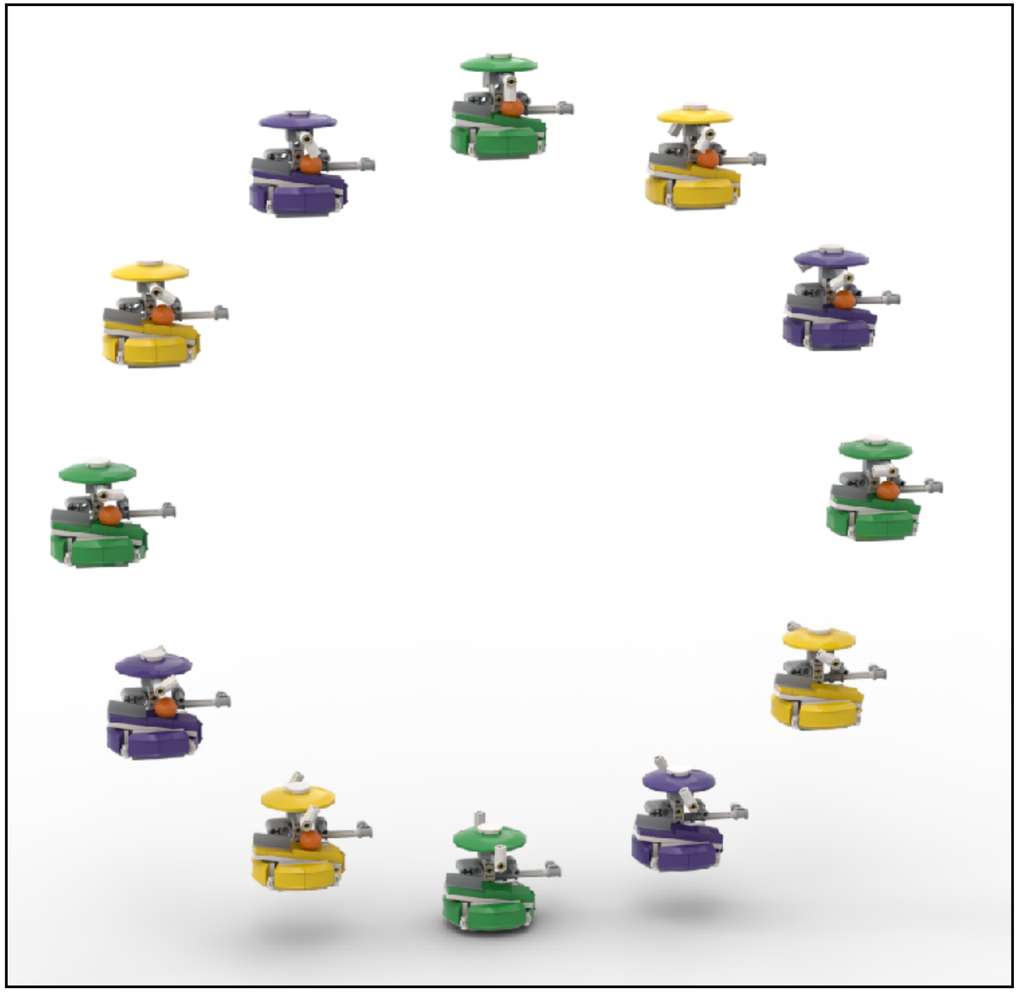
The Ferris Wheel should spin freely by hand.

Gondolas

if you thought building the Ferris Wheel was repetitive, grab a drink or a snack, because its about to get very mind numbing…

12 Gondolas, each identical, in three different colours, arranged as shown.

Note: If you find balls failing to unload from a particular gondola, it usually indicates that the slope the ball is sitting on is not pushed completely down on the low end.

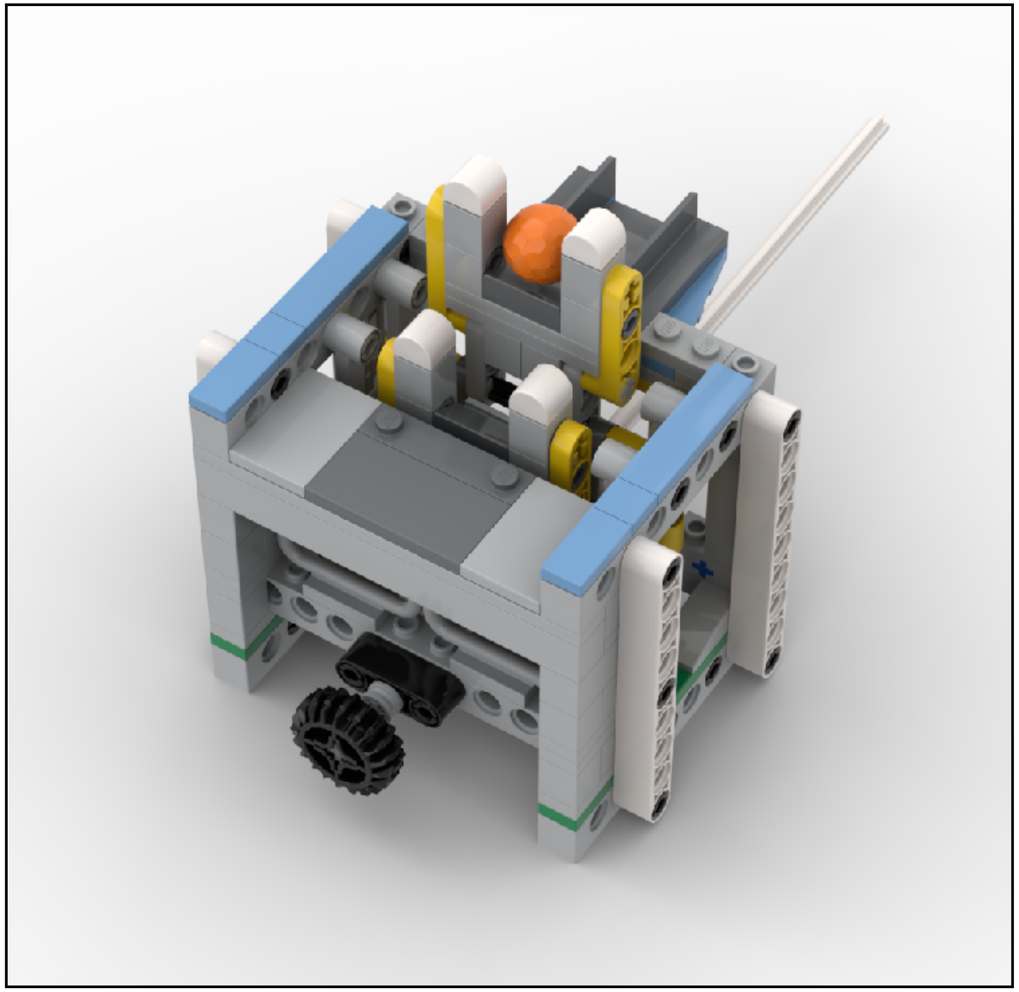


GBC

Ball Loader

This basic Akiyuki-style step loader is driven by the long white axle that travels directly under the *Gondolas* and connects to the *Timing Assembly and Support Frame* (yet to be built) at the rear of the GBC.

Once built, refer to the next page, and then slide it into place, until the blue Technic pins click into the *Base Structure*.



The white tiles are to help guide the axle into the correct hole. They are not required for any other purpose.

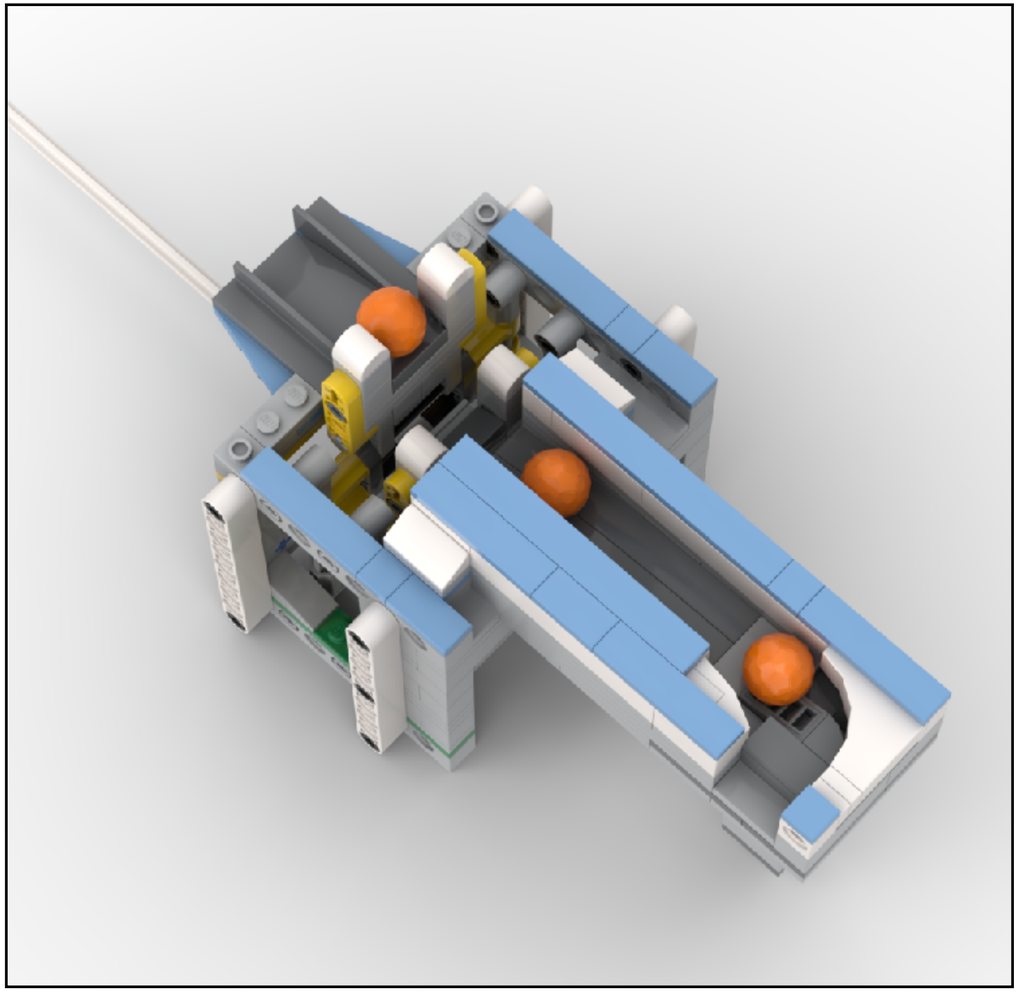
The black gear underneath the *Ball Loader* will rotate the stepper mechanism. Use this to rotate the long axle so it can slide into the *Timing Assembly* (not yet built) without being forced.

When either the *Ball Loader* or *Timing Assembly* have been removed and need to be reconnected, rotating this long axle with the gear for proper alignment will prevent this axle from being forced back into the stepper mechanism, resulting in a jam in the stepper.

Loader Ramp

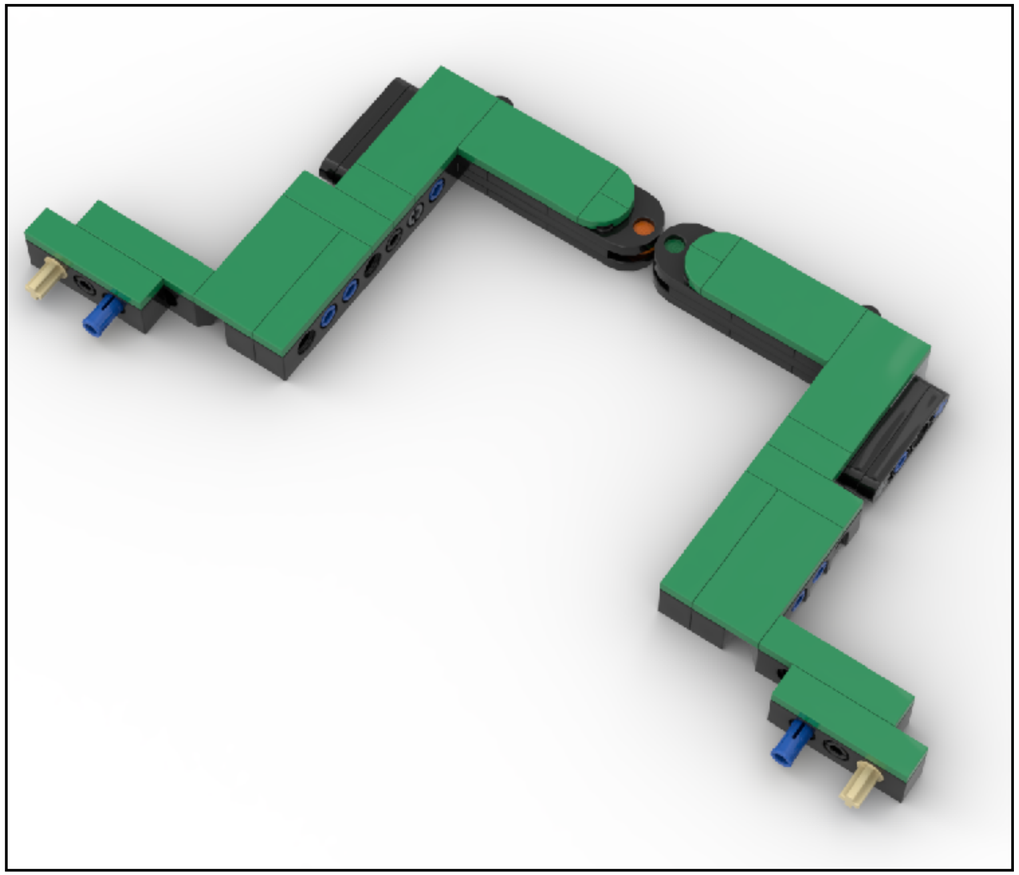
The ramp that feeds balls into the loader is secured in place by a few studs, but easily removable for access to the *Ball Loader*.

If it becomes necessary to bypass this entire module at an event, removing this *Loader Ramp* will make space for the *Stand-alone Return Ramp* to be used at the front of the module as a temporary bypass.



Ball Corral

Most of the balls that don’t load into the *Gondolas* correctly will drop out between the *Sloping Platforms*, roll down the black ramp and come to rest in the *Ball Corral, where* they can be collected, and placed back into the *Feeder Module*.



Main Drive Shaft

Principally an effort to reduce twisting of what would have otherwise been a long axle from the *Power Delivery Assembly* driving the Ferris Wheel, this drive shaft is more rigid.

The black 3L pins with Stop Bush at the bottom can be pulled up, to disconnect the two bottom gears. If you leave the bottom-most gear on top of the *Power Delivery Assembly* (not yet built) you can easily remove and re-attach the *Power Delivery Assembly* if required.

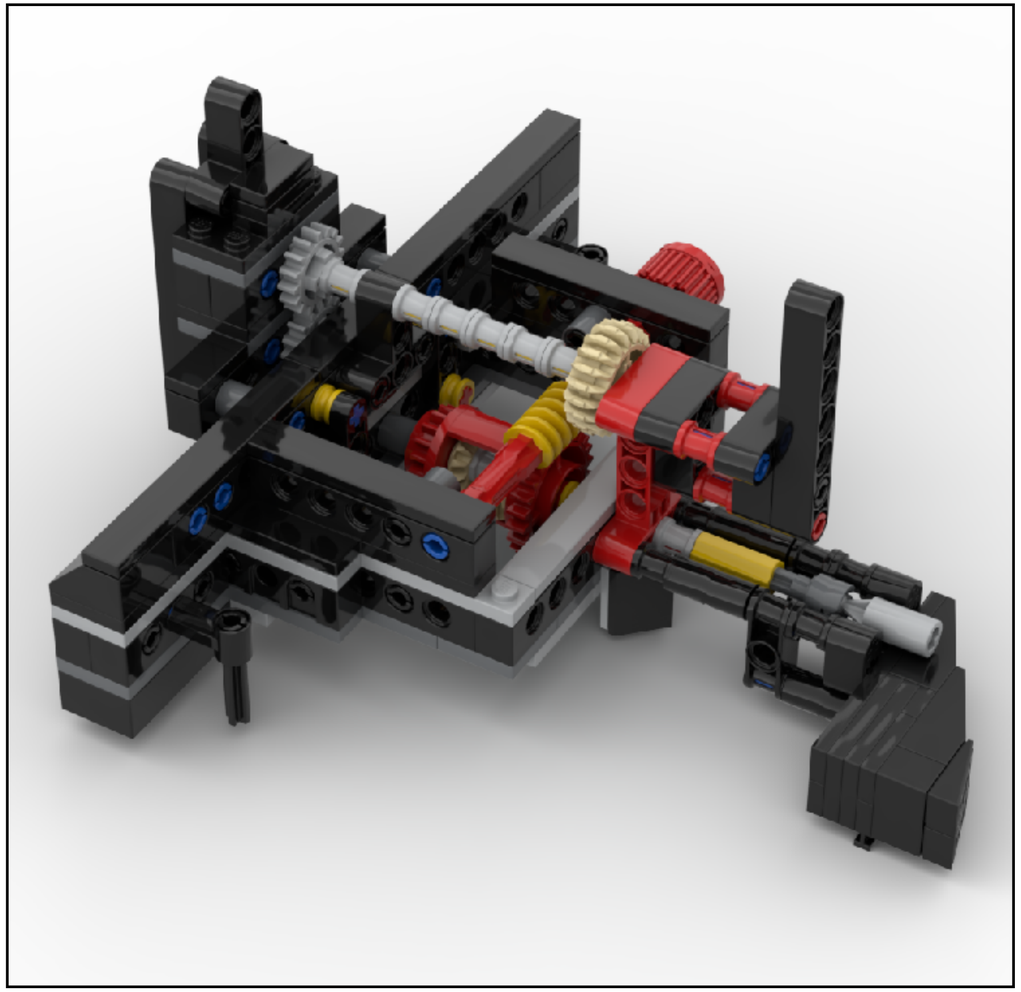
Timing Assembly and Support Frame

The black slopes at the front are used to guide balls away from the differential and down to the *Ball Corral*.

The red knob is used to make small adjustments to the position of the differential, which alters the timing between the *Ball Loader Steps* and the *Gondolas*. Use this to “dial in” the correct timing to load the balls reliably.

This structure also bears the weight of the *Power Delivery Assembly*.

After building, set aside. It will be attached to the *PDA* (see next page) before adding it to the rest of the build.



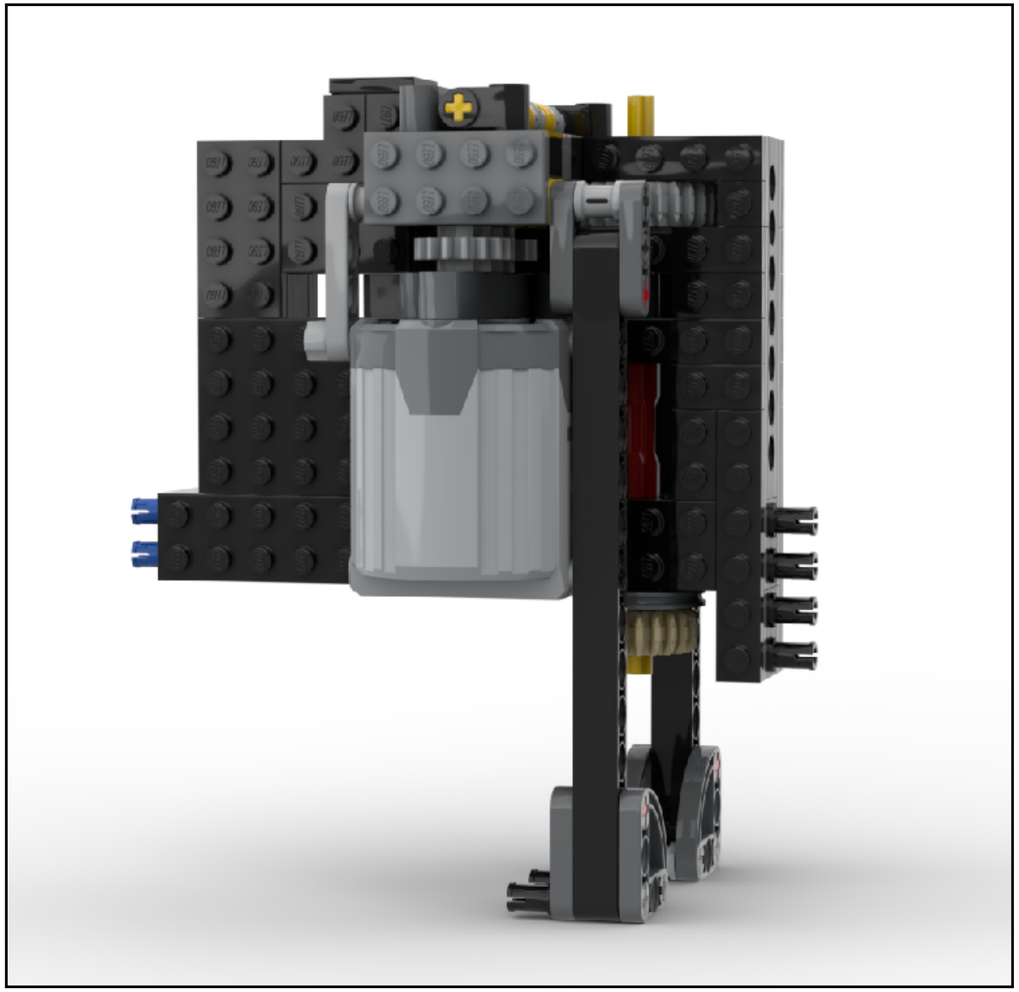
Power Delivery Assembly

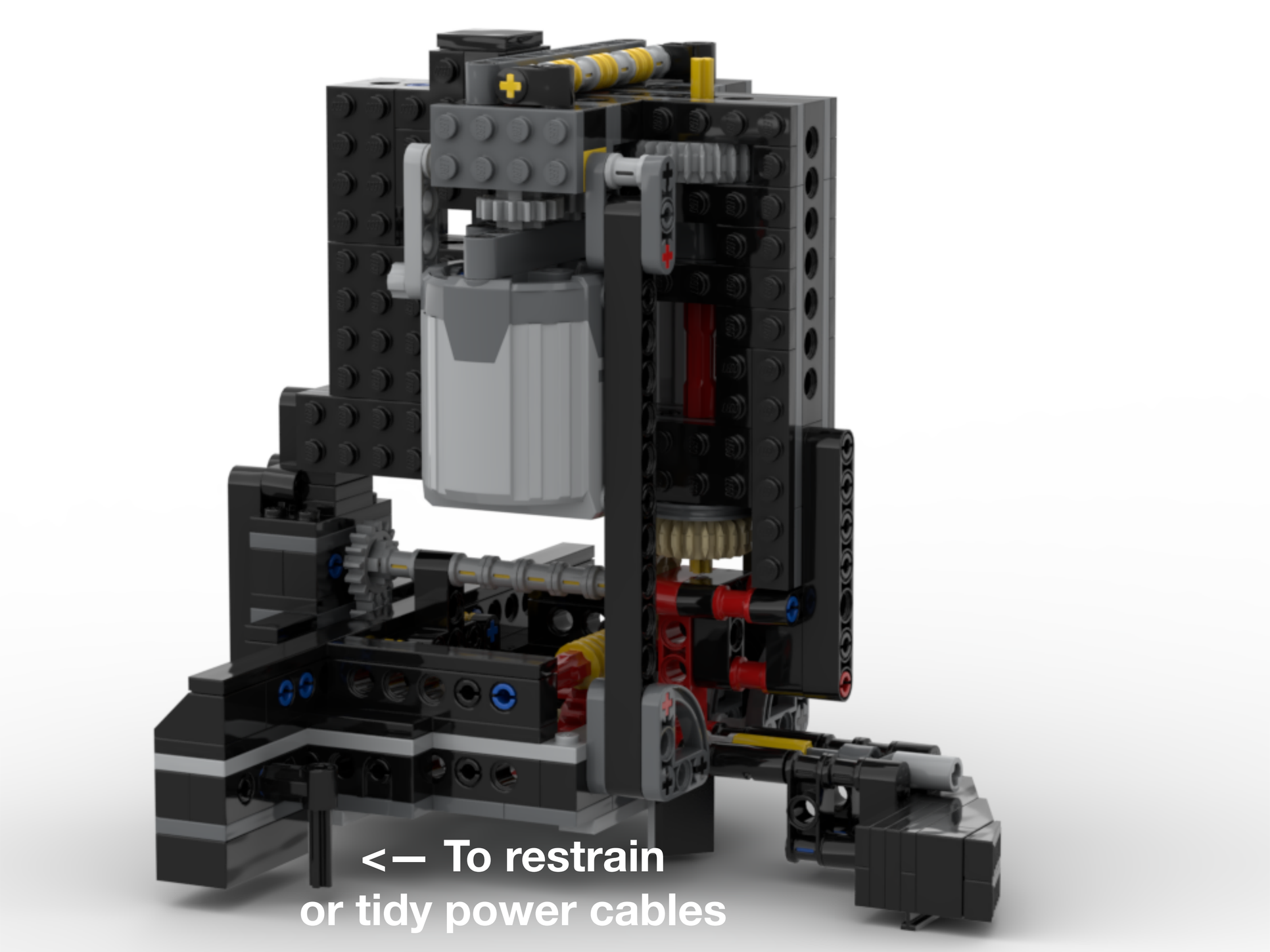
This gearbox converts the output of the two XL motors - at full speed on a *Lego Train Controller* - to 60rpm along the vertical axle, which is then transferred to the *Ball Loader* via the *Timing Assembly* below it without additional gearing for a 1 ball per second loading speed.

60rpm is also delivered to the *Gear Rack* above which is then re-geared to rotate the Ferris Wheel 5rpm, with 12 gondolas, for 60 balls per minute.

Attach the *PDA* to the *Timing Assembly,* build and attach the two *Motor Support Struts,* and then add them as one assembly to the rest of the build.

Note: This module seems to run fine on only one motor, but i'm concerned about over-burdening a single expensive motor for long durations (all day at a show). It is fine to just remove a motor. No other changes required. I prefer to reduce the burden on a single motor and share the load.

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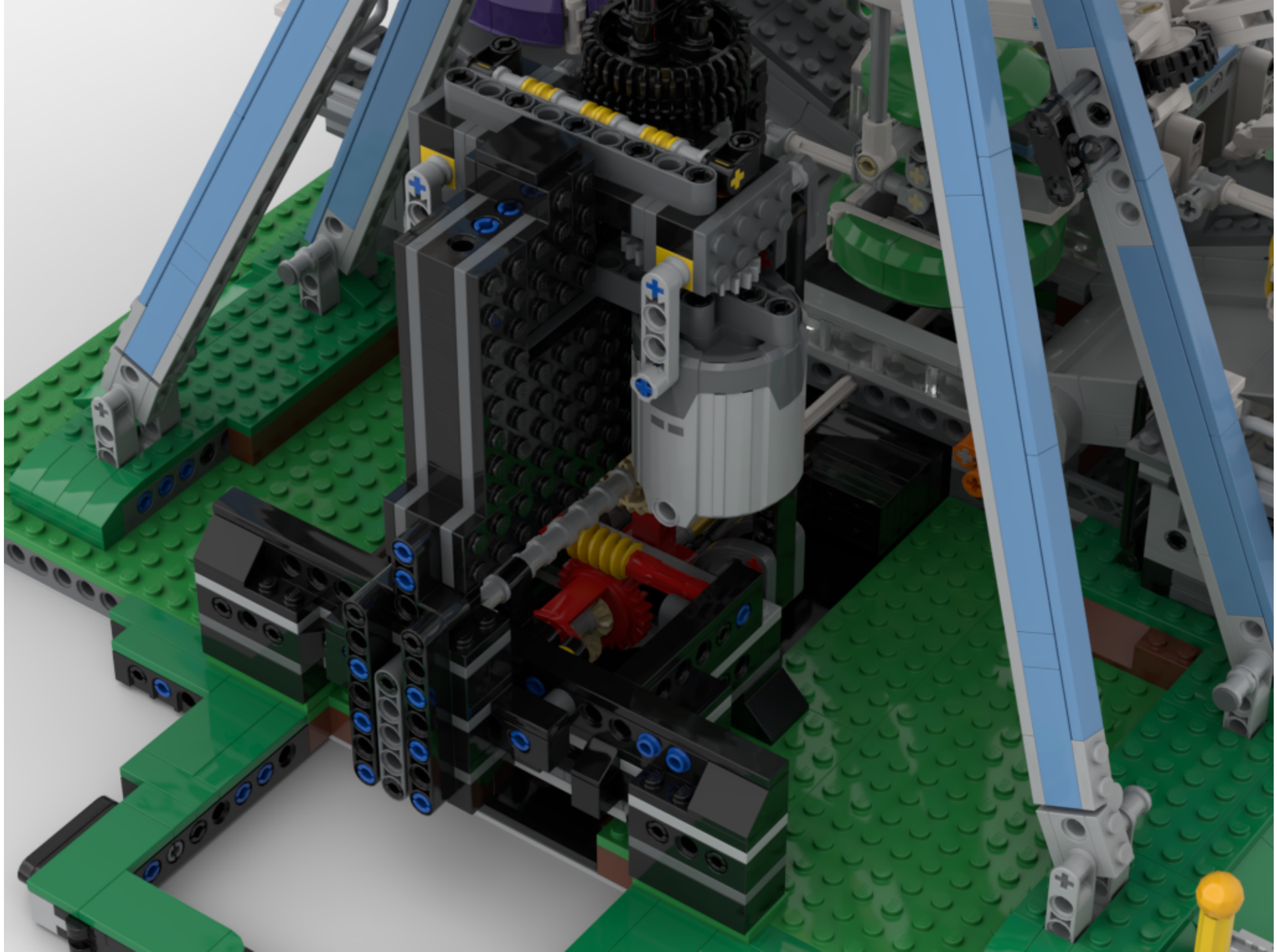
or tidy power cables



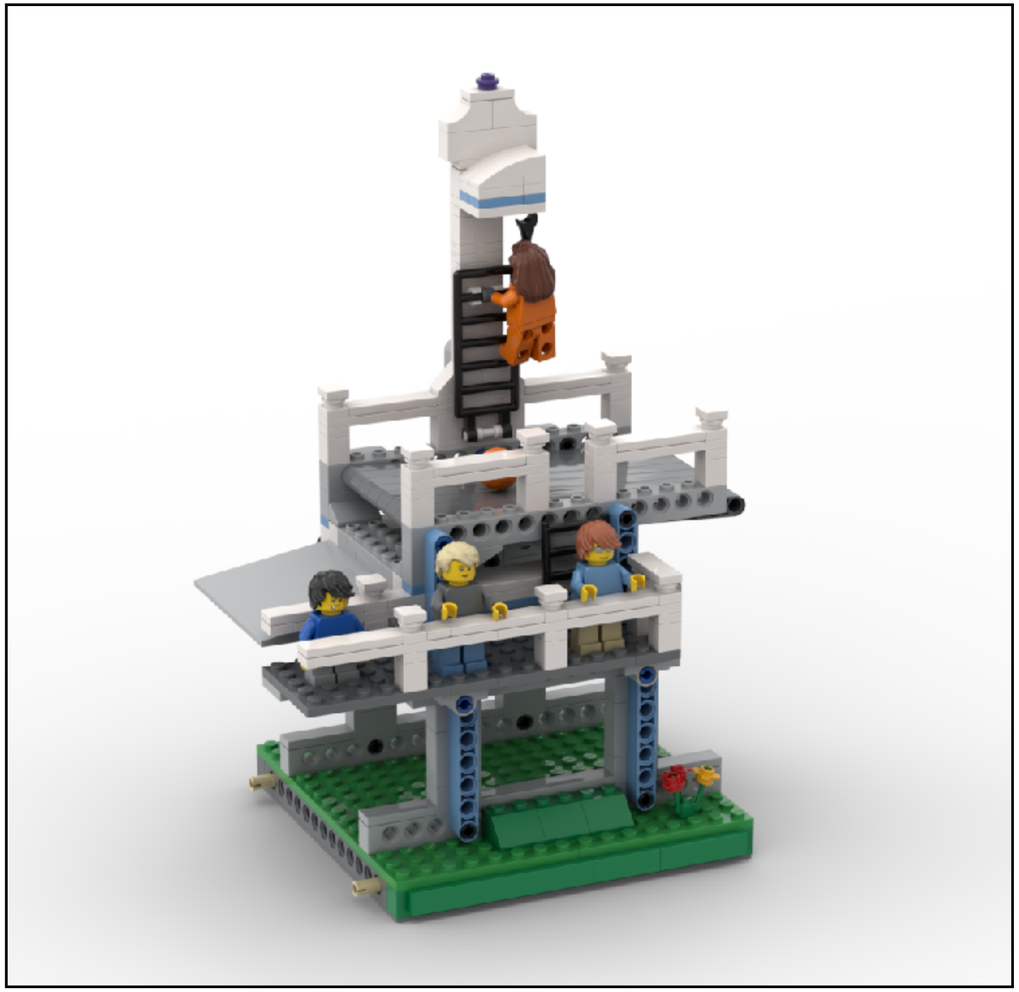
Unloading Ramp

The extra sections of this GBC are built upon seperate base plates that do exist, however neither their cost or availability has been a consideration during design.

Cutting baseplates to custom sizes with a *Box Cutter* is relatively easy (using a 16L brick as a guiding edge) and that is my preference when I built this GBC.

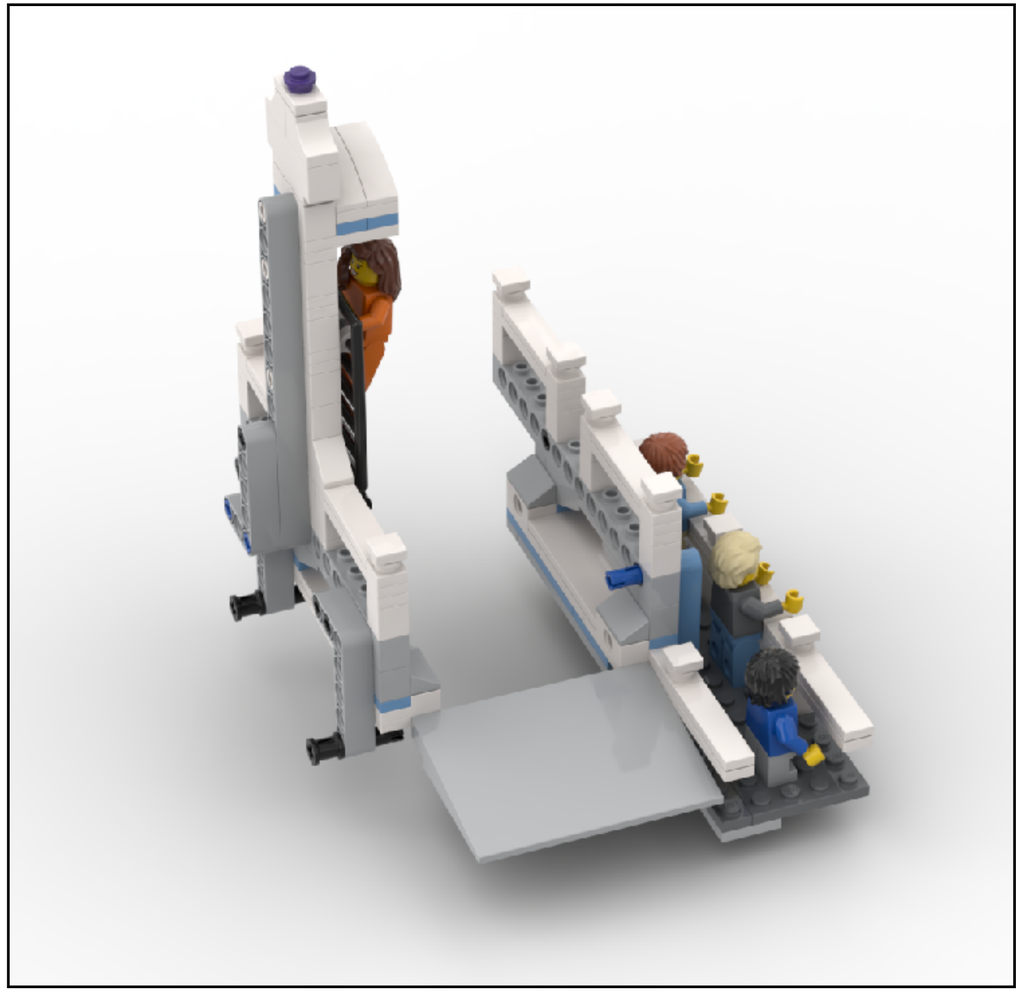
Minifigures used in Studio are an approximation of the figures that came with the original 10247 Ferris Wheel set.

This *Unloading Ramp* is built from several sub-components that together unload the ball from the *Gondolas* and deliver it to the next module.



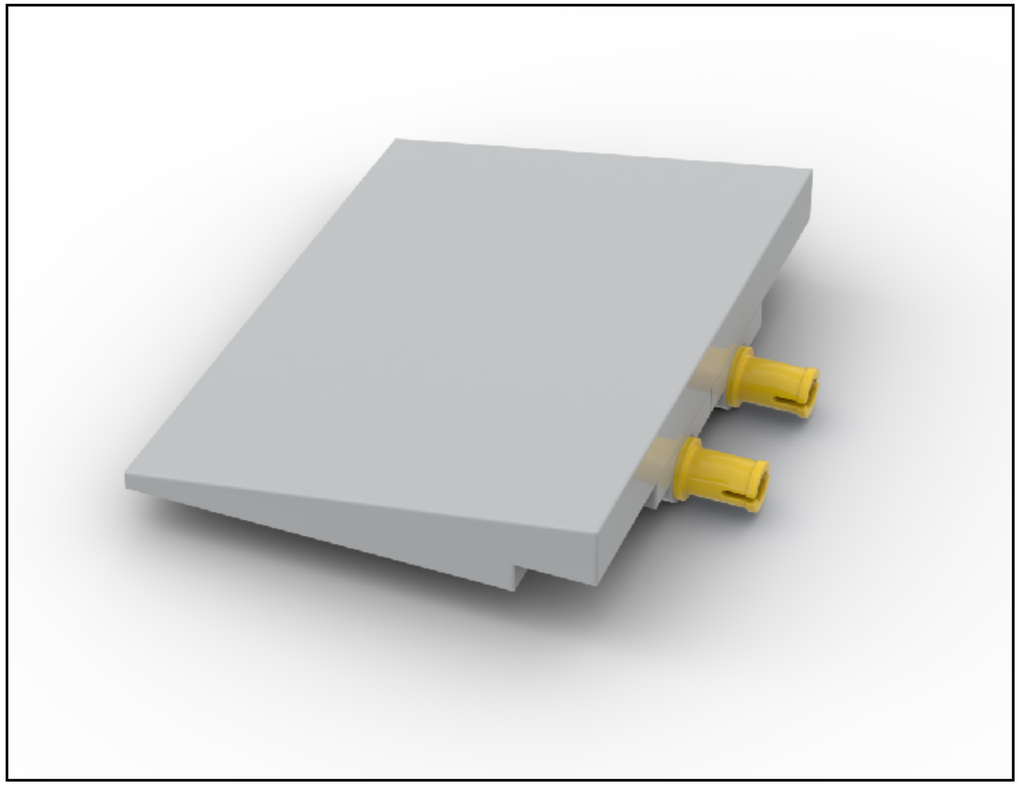
Unloading Ramp - Components

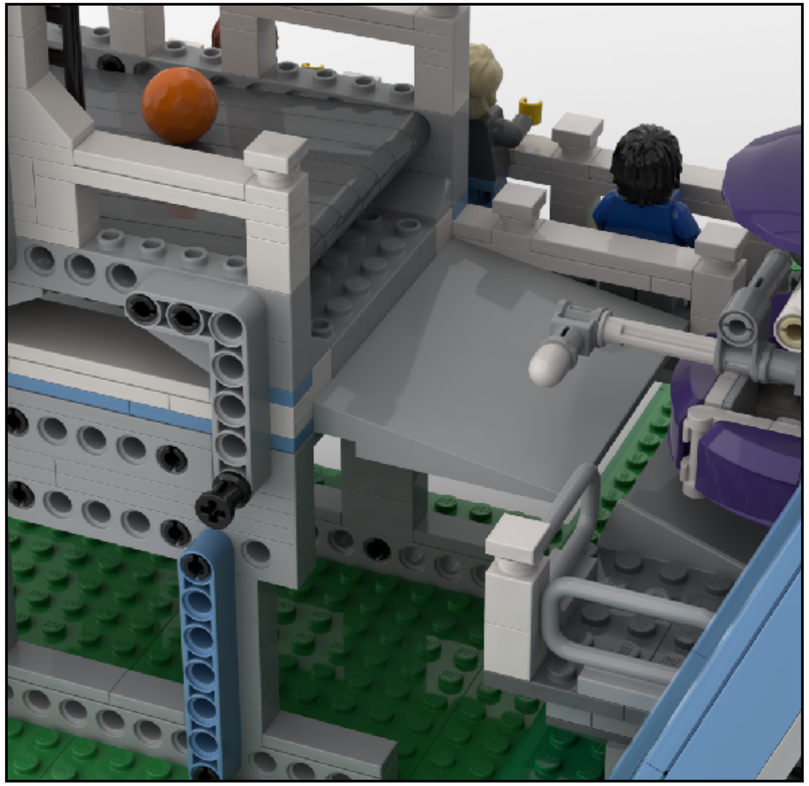
The *Unloading Ramp* is built in smaller sections so that the three shown - *Unloading Tower, Front Decoration and Ball Diverter* - can be removed from the *Unloading Ramp Base* and attached to the *Stand-alone Return Module - BW 2018 Ball Pump*, if required.



Ball Diverter

This small ramp is designed to attach to either the *Unloading Ramp Base*, or the *Stand-alone Return Module - BW 2018 Ball Pump*. Occasionally balls unload in an unexpected manner. This *Diverter* helps prevent balls from dropping underneath other sections of the module, so they don't need to be removed manually.





GBC

Decorations for Base Structure

This is the appropriate time to add the decorations from the original 10247 Lego Ferris Wheel set if you have them, or your own to suit.

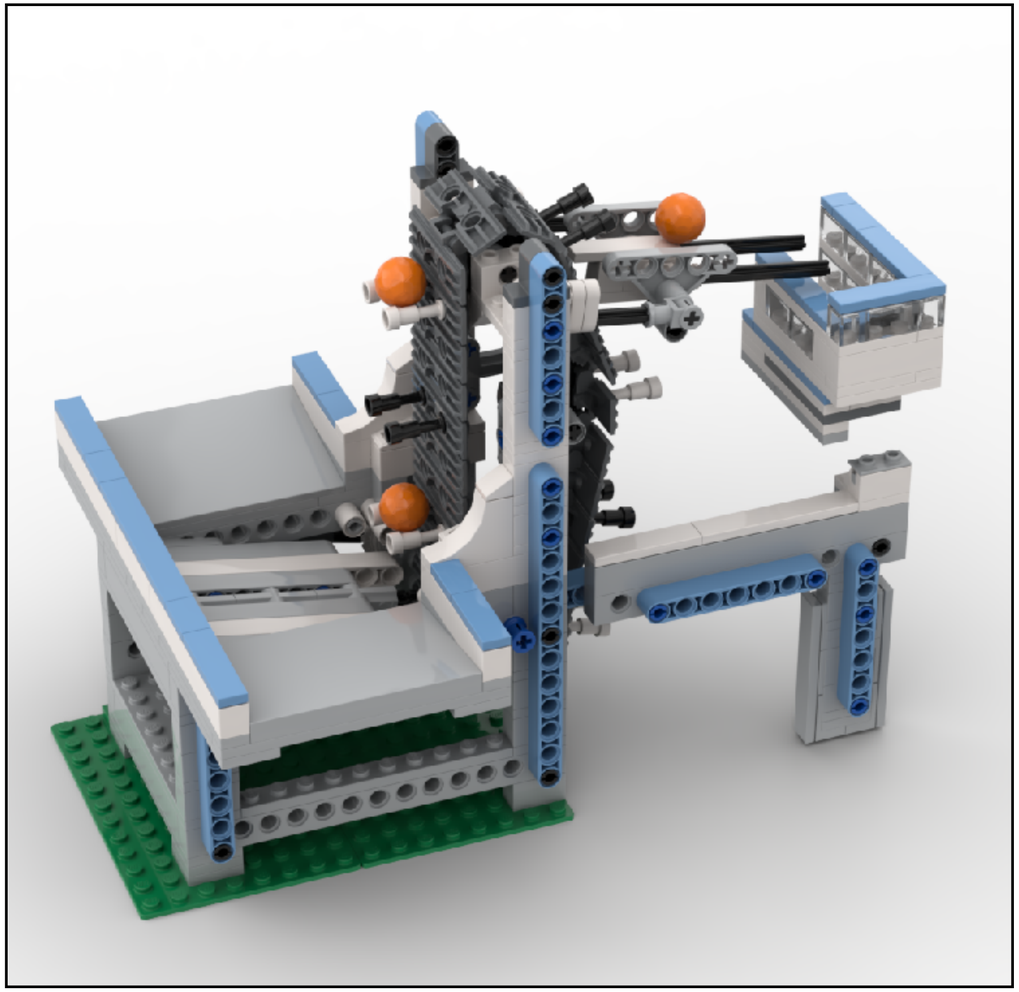
Following this we are going to add a ramp which restrict access to this area of the build, so its easiest to add the decorations now.

Feeder Module - GBP WM01 (Modified)

Matt Norman's Great Ball Pit Workshop Module 01 is a reliable, versatile design that I have modified to suit the Ferris Wheel.

The slope on the left side (viewed from rear) allows for balls which have failed to load into *Gondolas* properly, an opportunity to be pushed up the Ferris Wheel ramp by the *Gondola*, and routed back to this *Feeder Module*.

The clutch reduces the chaos if a ball jams during unloading at the top, and the extra sprocket wheel helps tension the tread correctly for this modified version of the module.

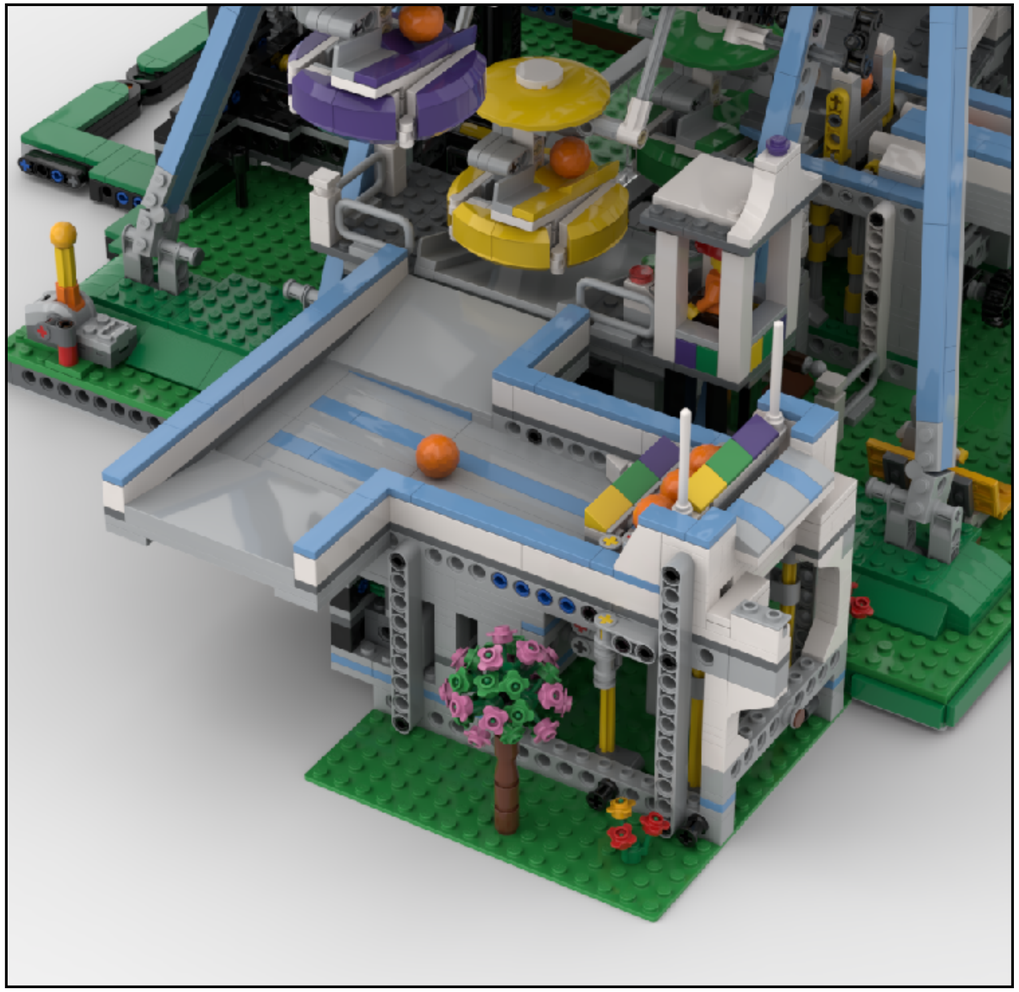


Feeder Module - Stepper

A different *Feeder Module* was suggested by *Jude* for a cleaner looking design.

This friction-less stepper sends three balls at a time to the *Loader*.

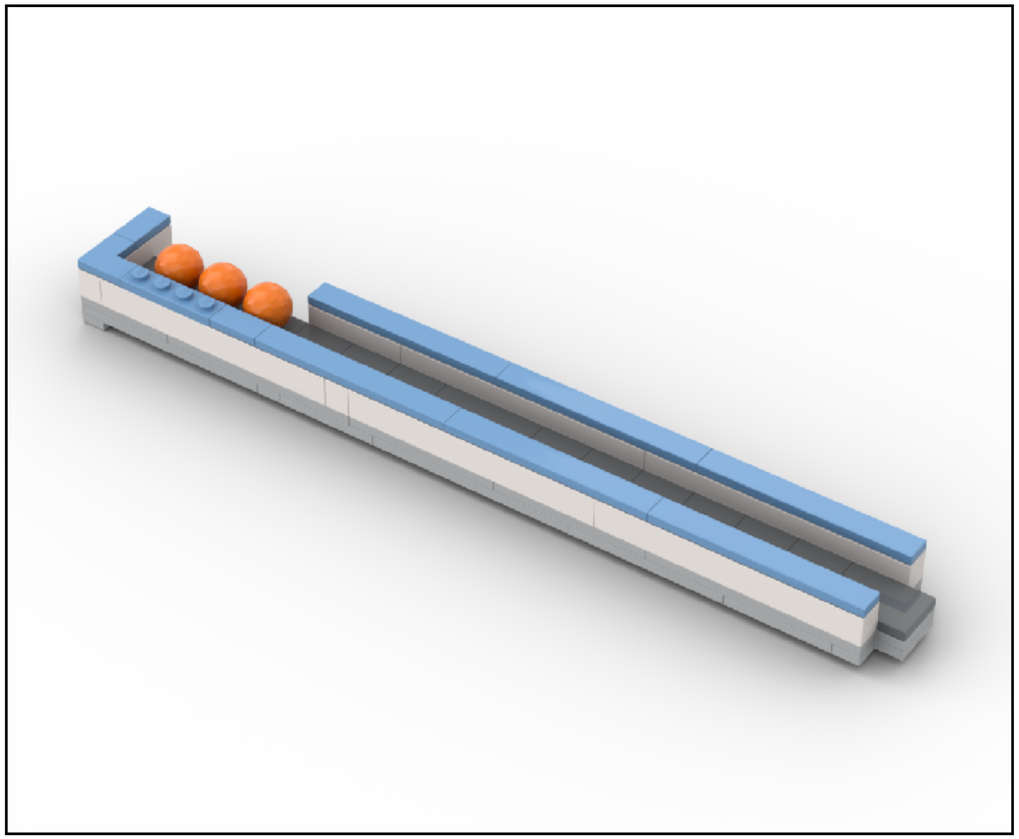
The geometry of this module is consistent with the other feeder module (WM01). They are interchangeable.

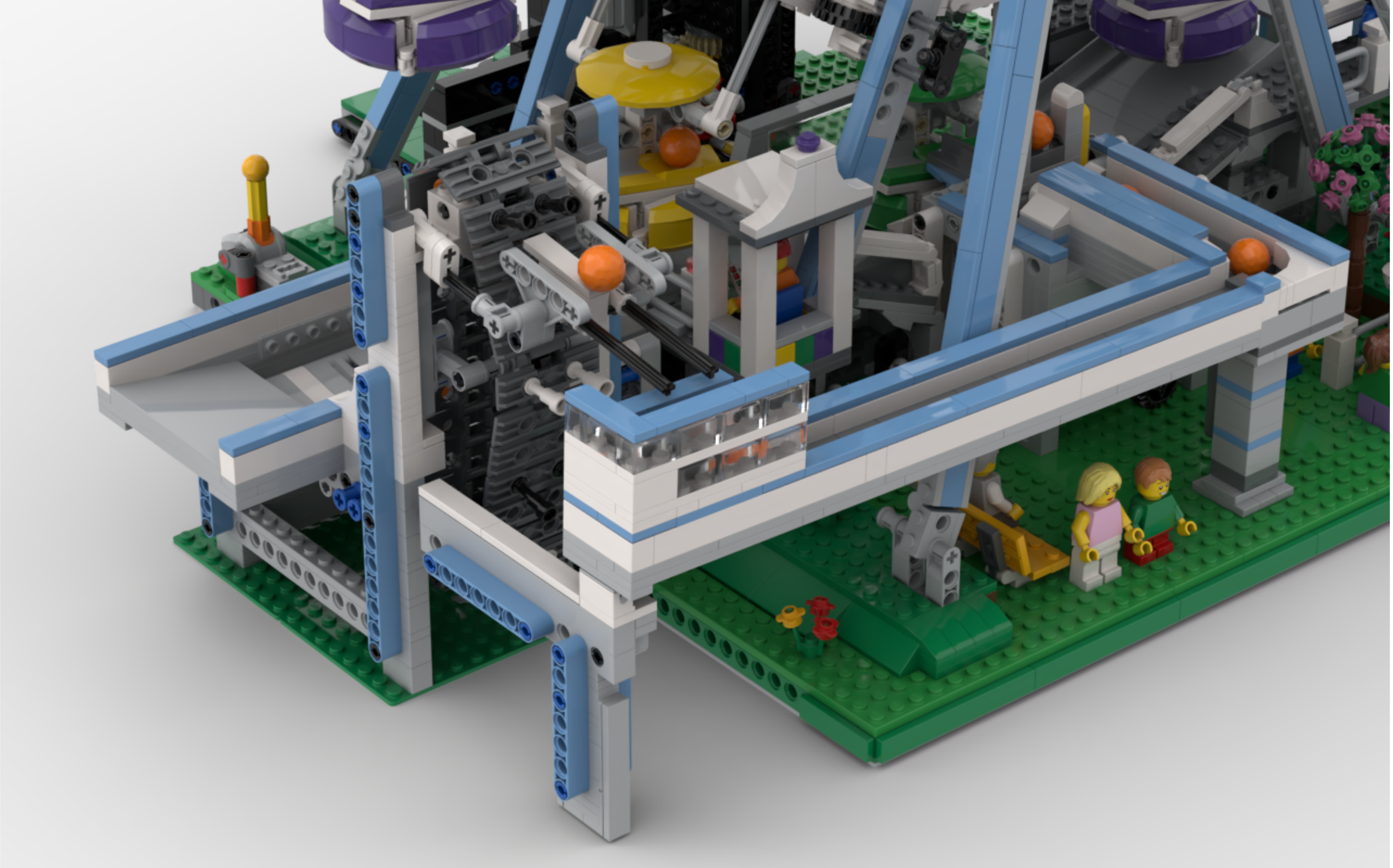


Feeder Ramp

This ramp transfers the balls from the *Feeder Module* to the *Ball Loader*.

It is designed to be used with either of the *Feeder Modules* shown in the previous pages, and is attached by connecting to the 2x1 hinge brick at the front of each *Feeder Module*.





FINISHED! If you don't intend to build the extra components to run the Ferris Wheel as a standalone display, there's nothing more to build, but take a look at the photos near the end of this document for suggestions on routing the *Power Functions* cables, and to see how I transport the entire module.

If you haven't already done so, you'll need to tune the timing of the *Ball Loader* to synchronise it with the *Gondolas* as they pass the loading ramp.

Rotating the *red knob* on the side of the *Timing Assembly* will load the balls earlier or later (depending on which way you turn it), in small increments. It may take a little while to find the "sweet spot".

Note: The following page shows how you can setup a bypass if the Ferris Wheel isn't working.

Following that, the subsequent pages detail the *Standalone* version of this GBC.

Failure Mode - Bypass

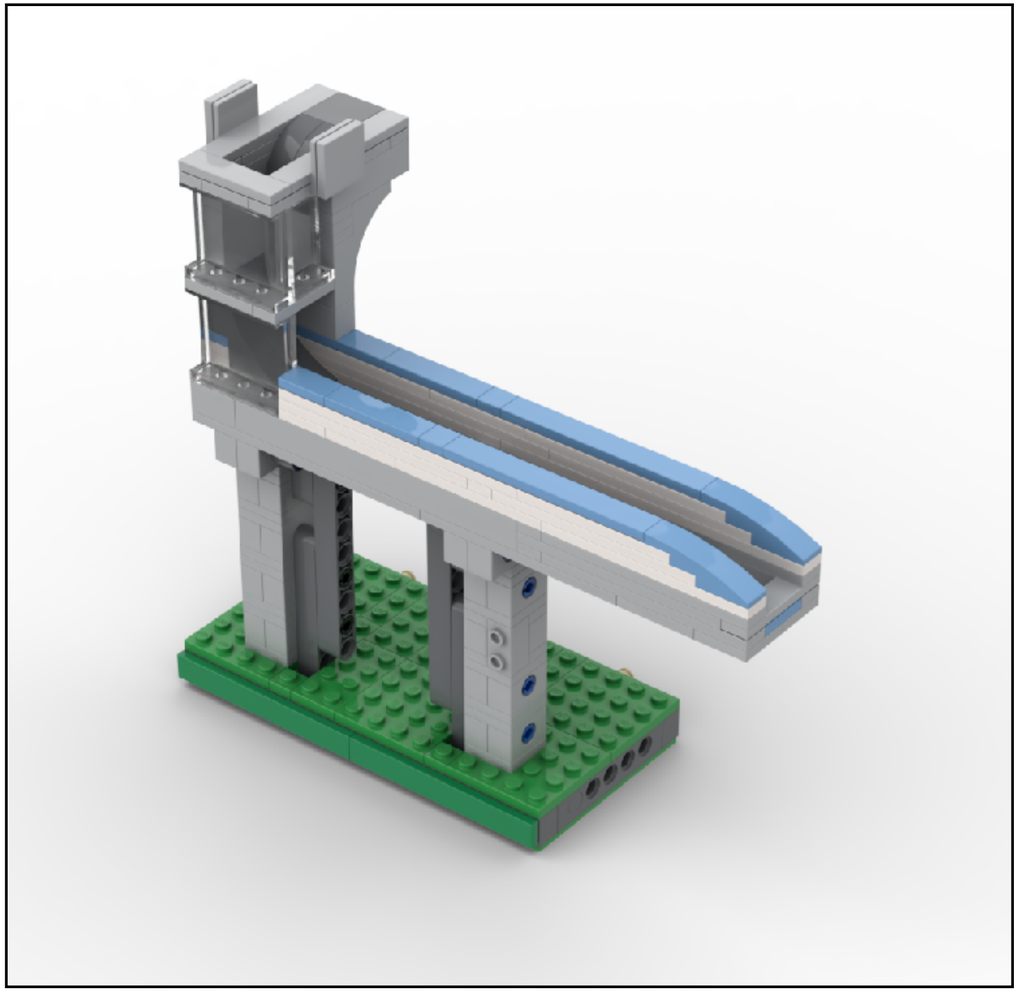
If the *Ferris Wheel* is unable to operate, the *Stand-alone Return Ramp (with the ball shield from the Return Conveyor module)* can be used with the *GBP WM01 Feeder Module* to bypass the *Ferris Wheel.* The *Stepper Feeder Module* (or any other module can be used to receive the balls from the bypass ramp.

Ball Return Bridge

This small bridge completes the “loop” for the returning balls, depositing them back into the *Feeder Module*.

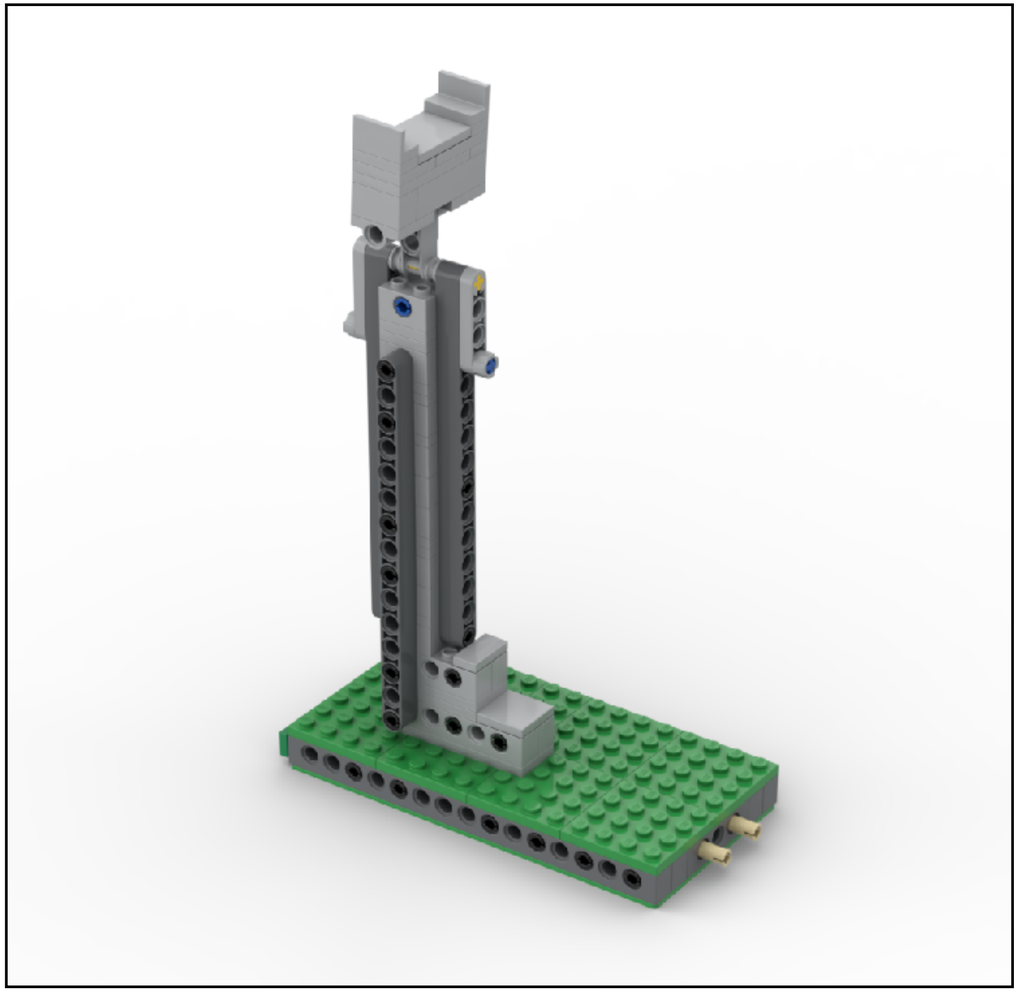
The technic lift arms may be excessive, but I prefer the different parts of a module to be sturdy, so they travel better.

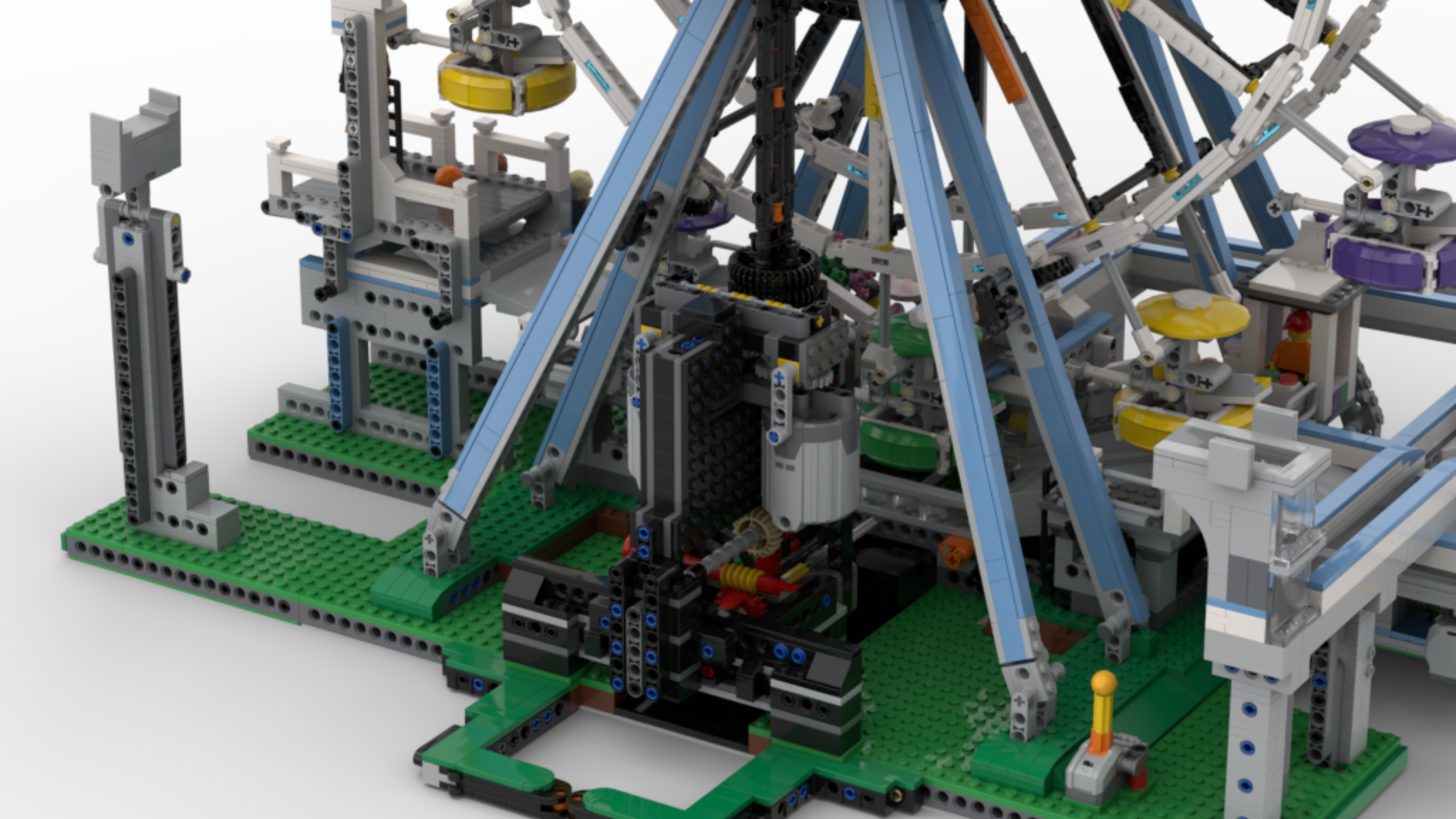
The two studs on the side of the front support column can be used for attaching PF extension cable connectors, for tidy cable arrangement.



Stand-alone Return Ramp Support

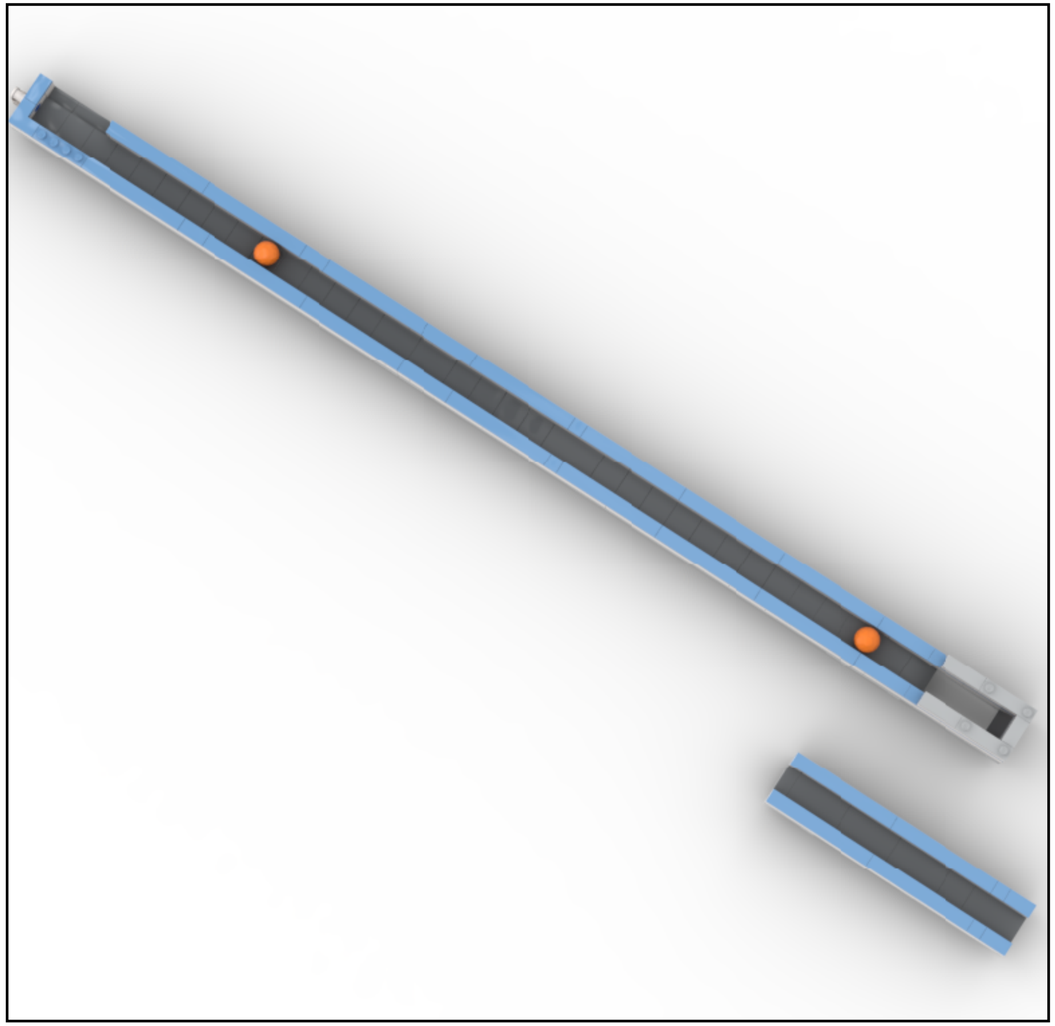
This support column holds the return ramp in the correct position for use with either *Return Module.*

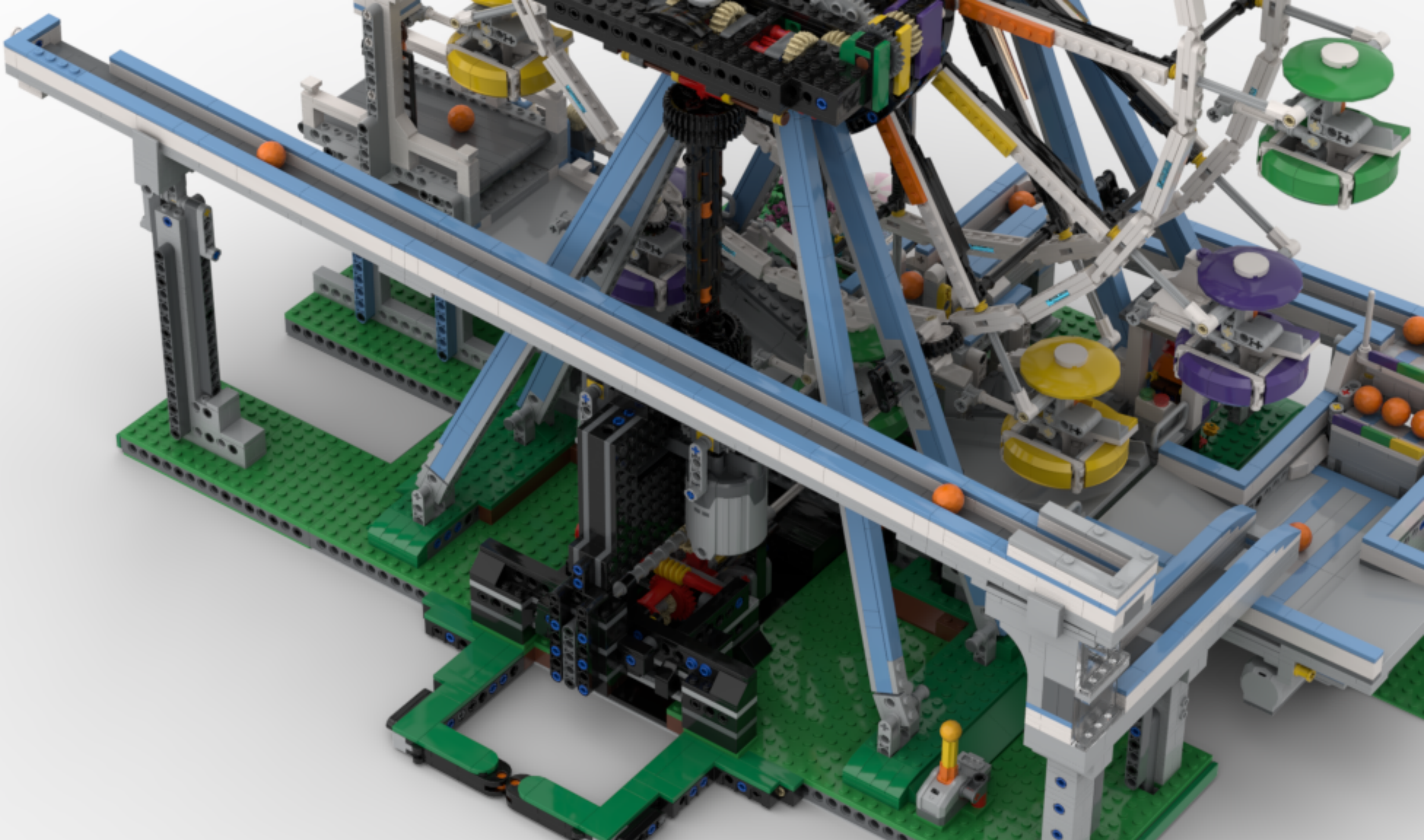




Stand-alone Return Ramp

Balls unloaded from the *Return Module* are delivered back to the *Ball Return Bridge* via this ramp. Note the Bump on the top of the *Power Delivery Assembly*. This return ramp should sit directly on that bump for extra support. The lower end can be disconnected, and swapped for the alternate shown here, for use in the previously mentioned *Failure Mode - Bypass*.

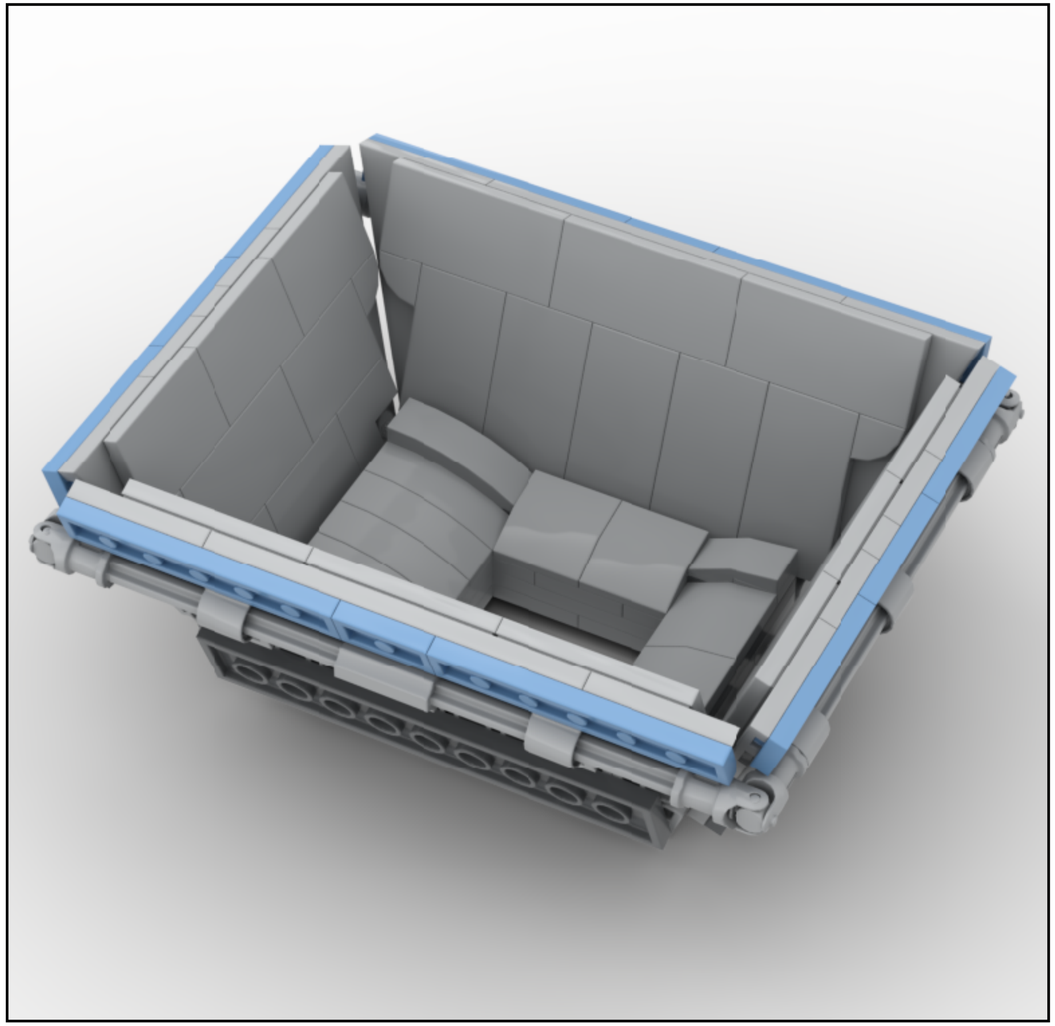


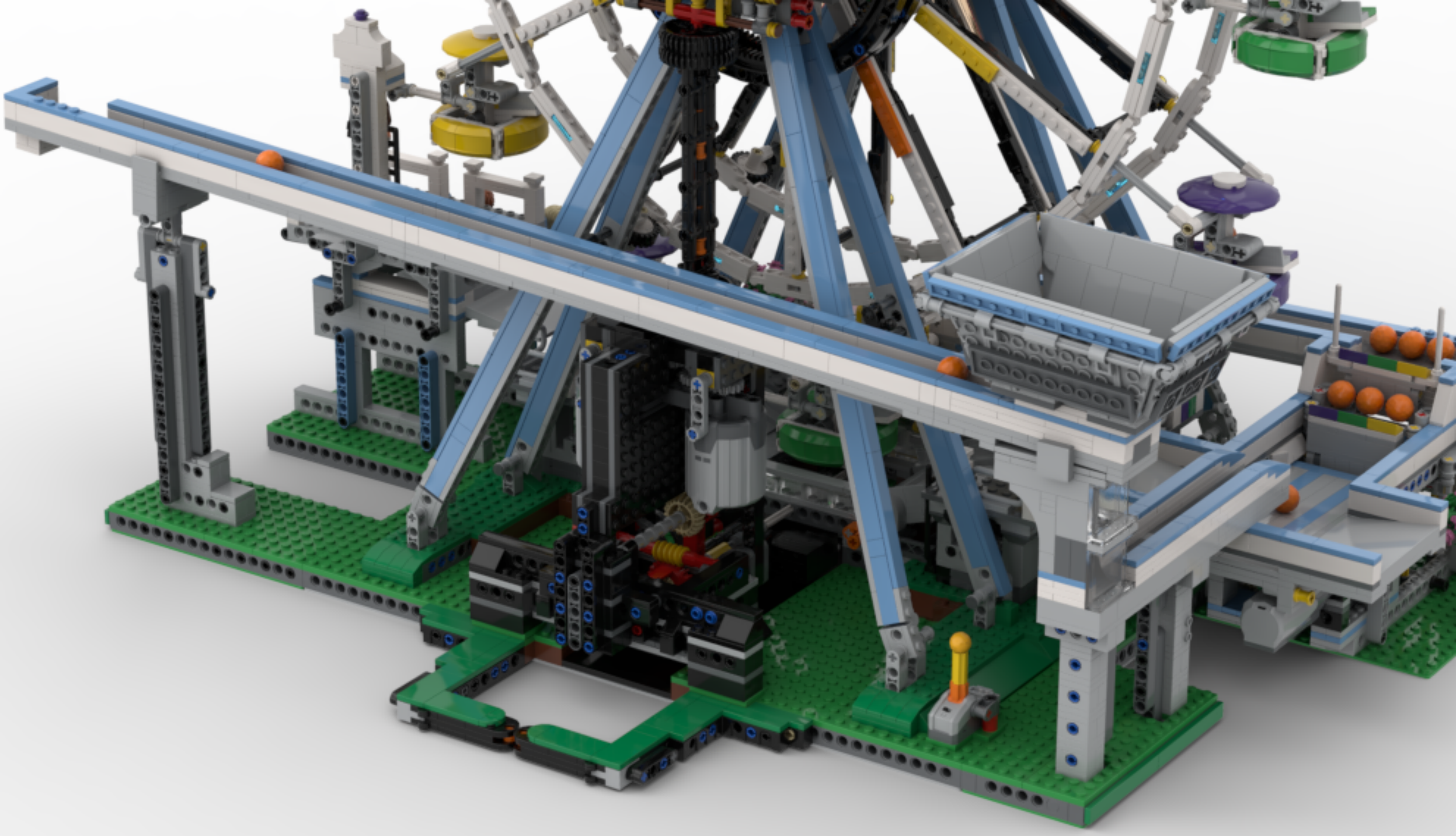


Dump Bucket

This entirely optional *Dump Bucket* is somewhere to drop the wayward balls collected while tending to modules at a show.

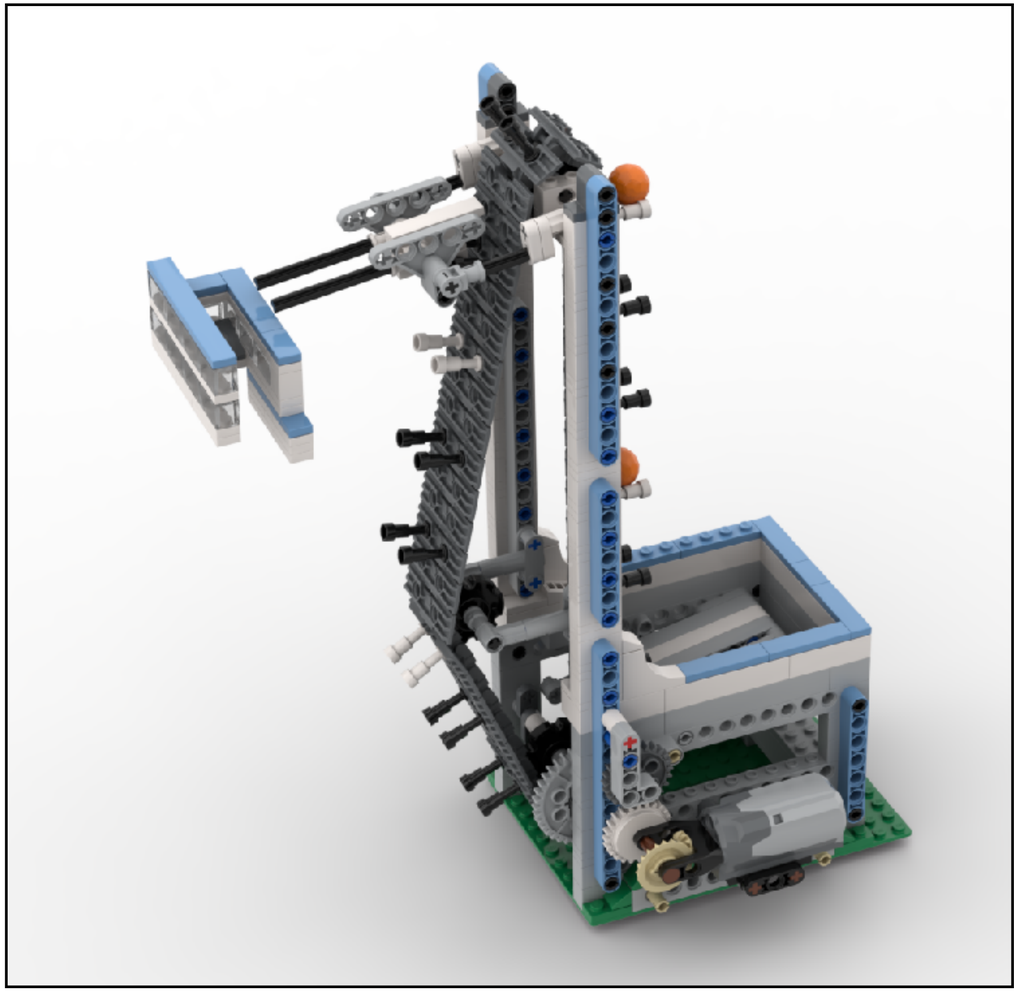
The bucket can sit on top of the Return Ramp (Stand-alone), or the Return Bridge (at a show).





Stand-alone Return Module - GBP WM01 (Modified)

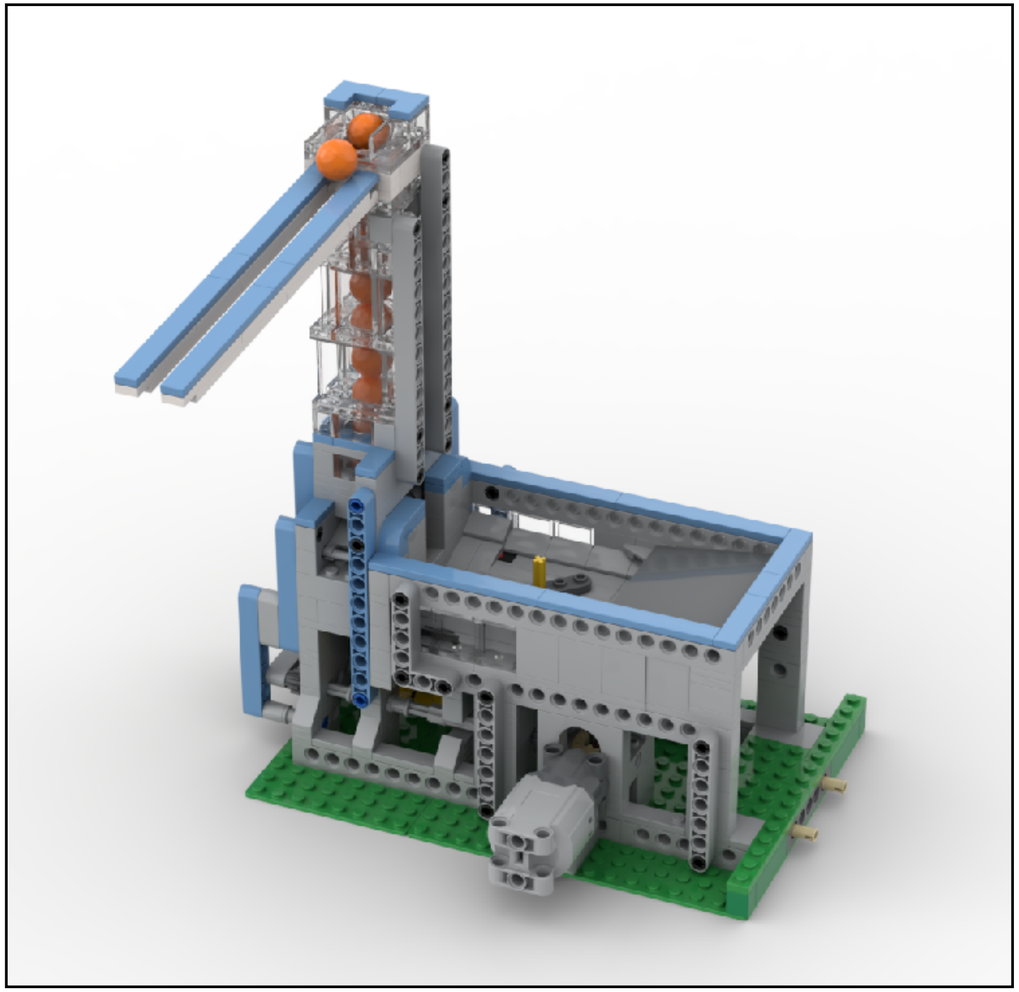
Another Matt Norman conveyor, modified to suit the Ferris Wheel is the last component to build, completing the stand-alone GBC. It is essentially the same as the *Feeder Module* already built, with an extended “neck”. The number of treads required might be off by one or two. (doing treads accurately in *Studio* is overly time-consuming)

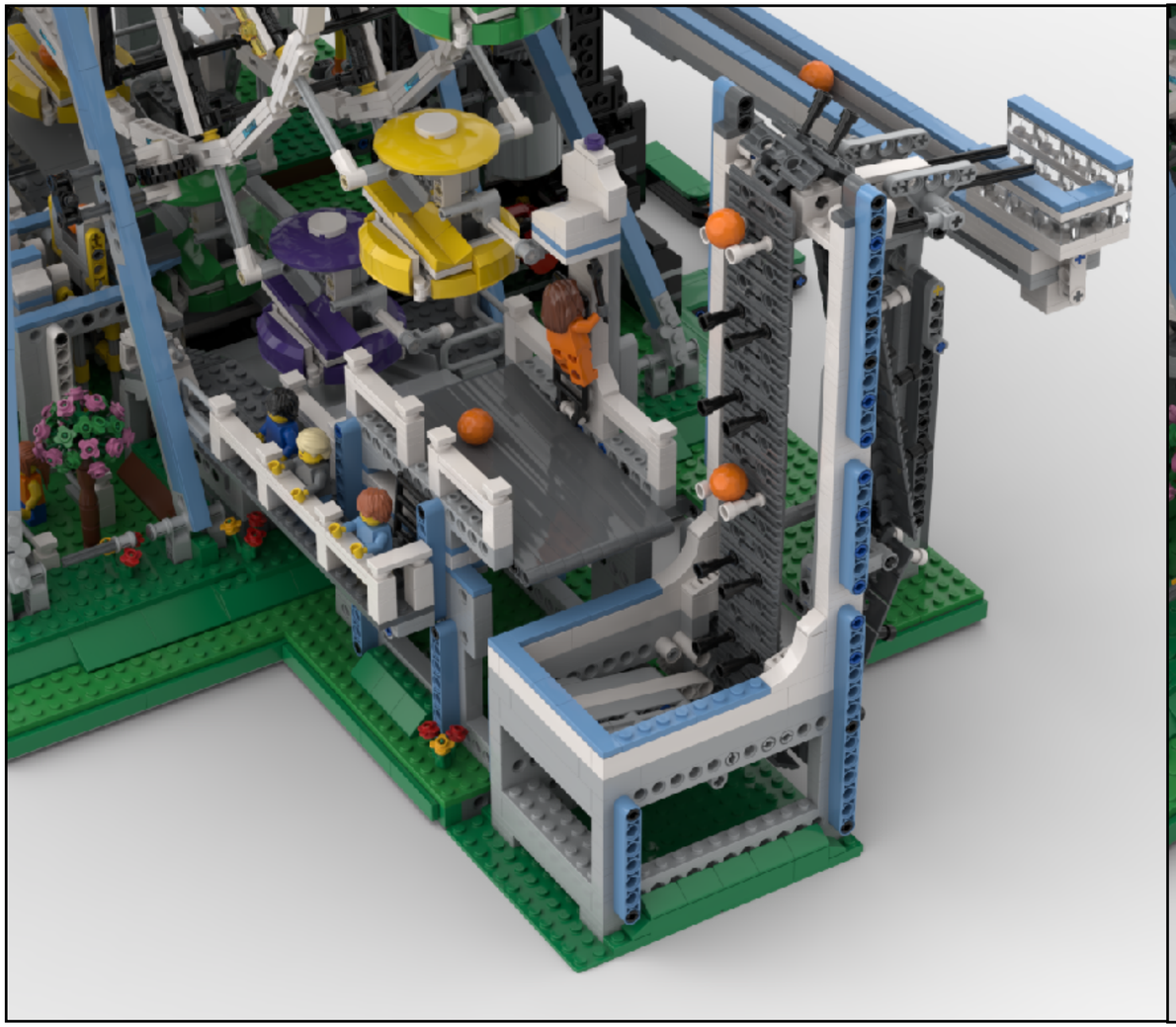


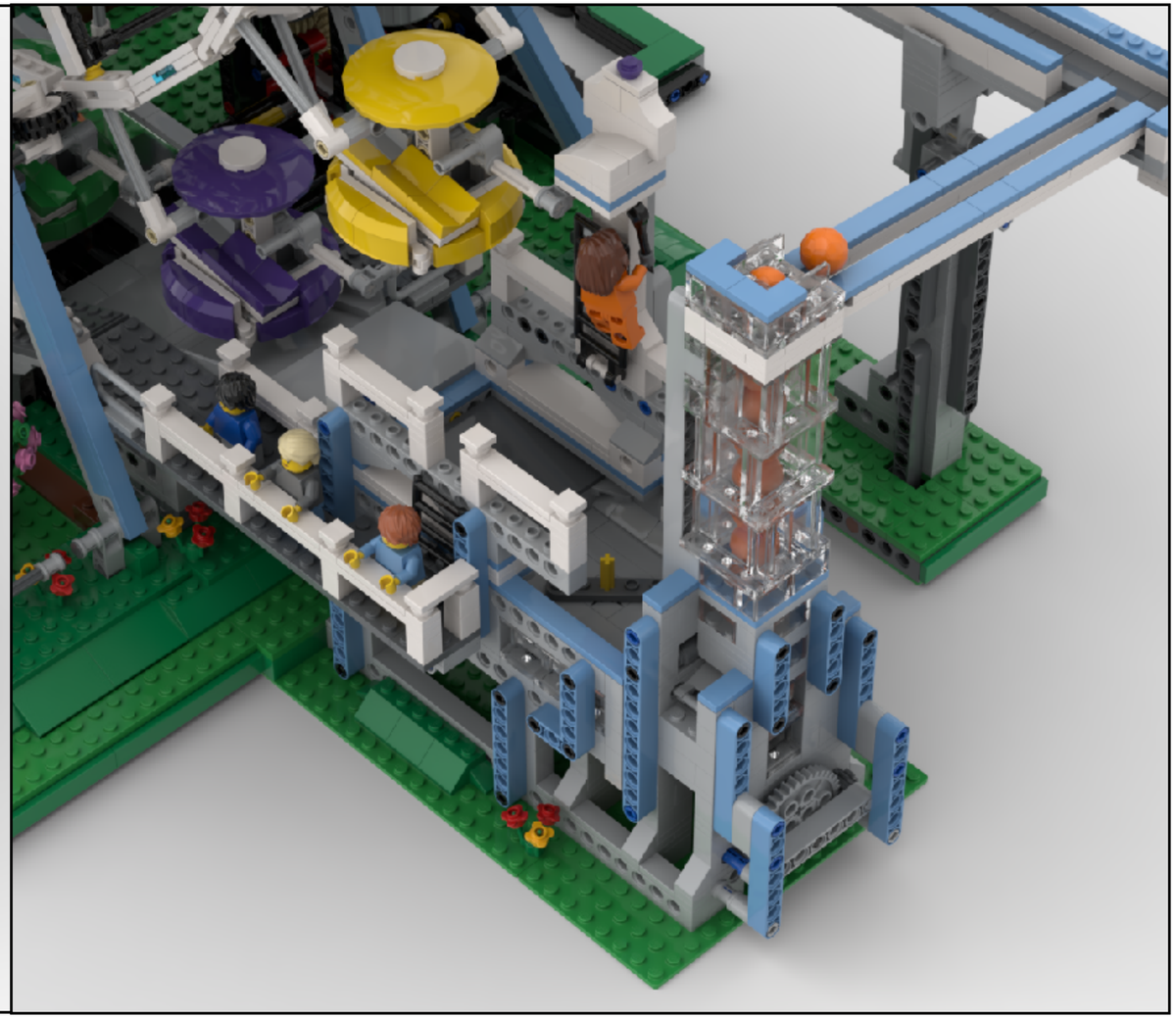
Stand-alone Return Module - BW 2018 Ball Pump (Modified)

This *Return* module is a modified version of Brian Alano's BrickWorld 2018 Ball Pump.

The pumping mechanics of this reservoir are unchanged from the original design, with structural and aesthetic changes to suit its use with the *Ferris Wheel.*







Power Functions Cable Routing

Either in a loop, or stand-alone, I run all sections of this module on a single train controller, or (custom AC hard-wired) battery pack, as detailed below, and shown on photos on the following pages.

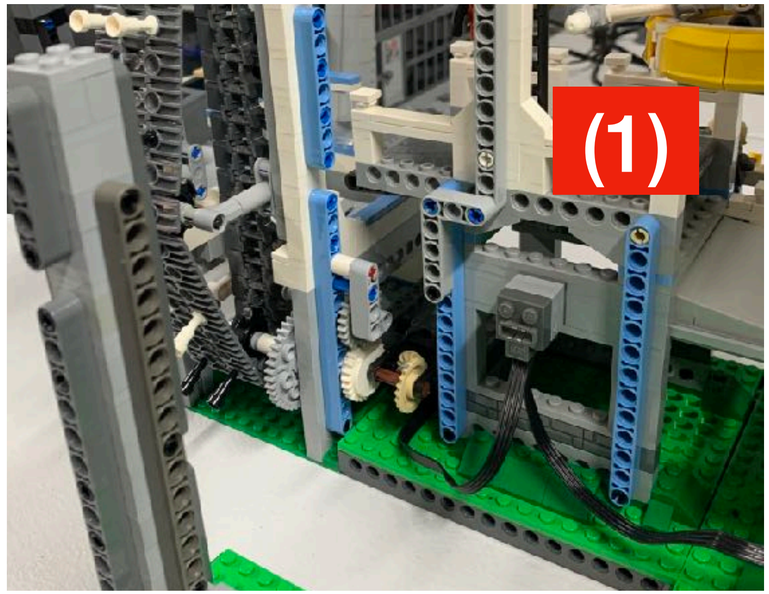
The *Stand-alone Return Module* is connected to a long *PF Extension cable* (1), which goes around behind the *Power Delivery Assembly* (2) and is connected to the motors (3) and a short *PF Extension cable* (4).

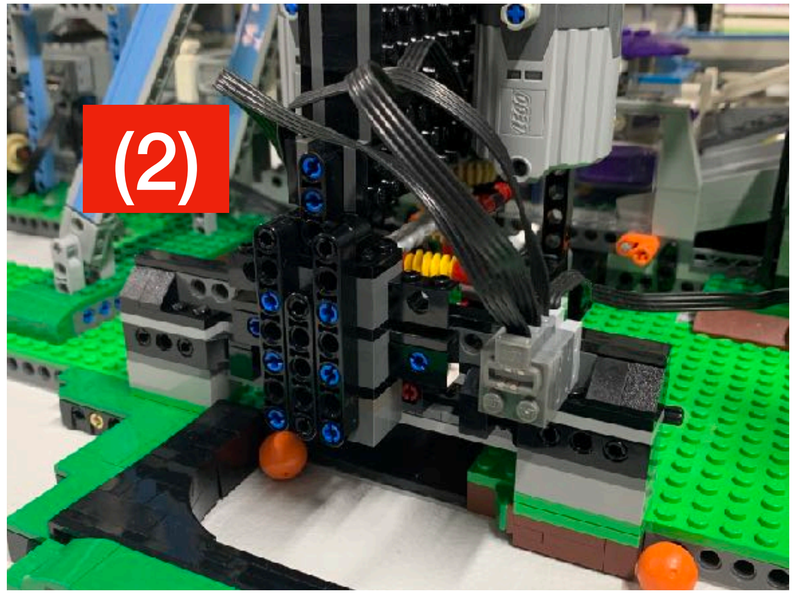
The motor from the *Feeder Module,* along with the short *PF Extension cable,* are connected onto the switch (5) which provides a single point to turn the entire module on and off, and prevents the module from running backward.

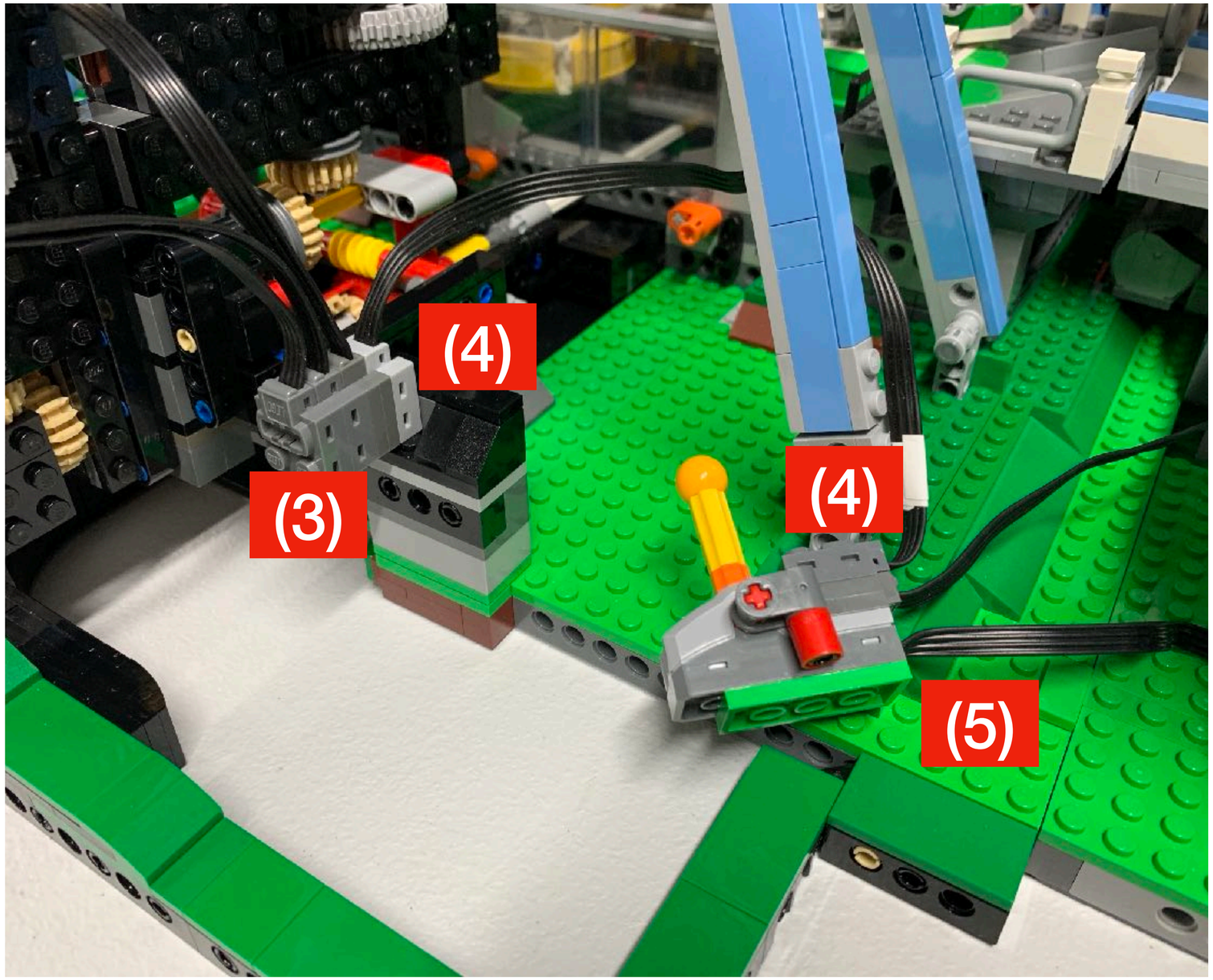
The switch's power cable is then either connected directly to a battery box, or is mounted underneath the *Ball Return Bridge* (6) for further connection via *PF Extension cable* to a train controller.

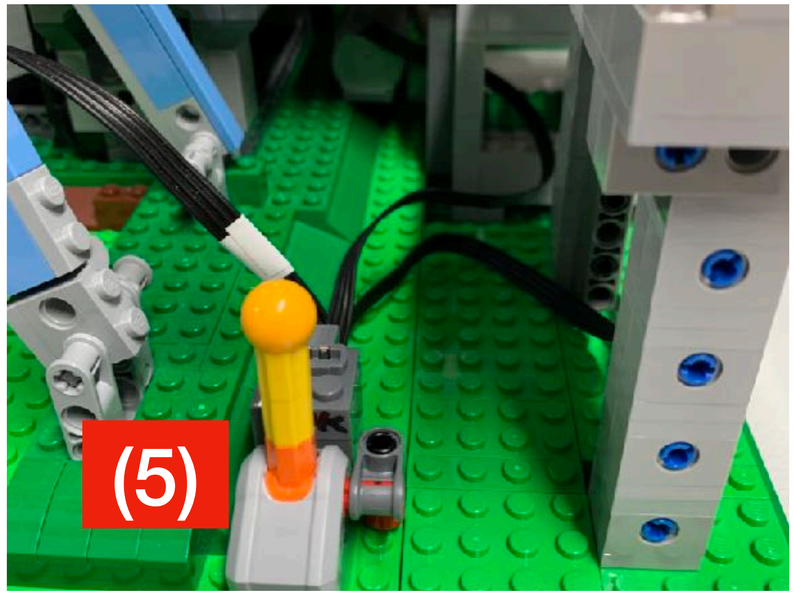
The following photos are from an earlier version of this module. Cable connection points remain more-or-less the same.

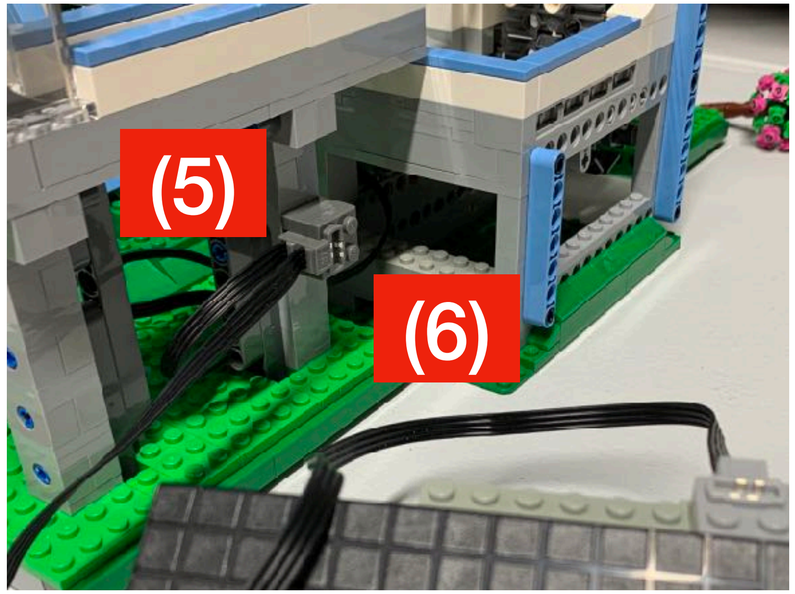
(1)
(2)


(1)


(2)


(4)
(3)
(4)
(5)

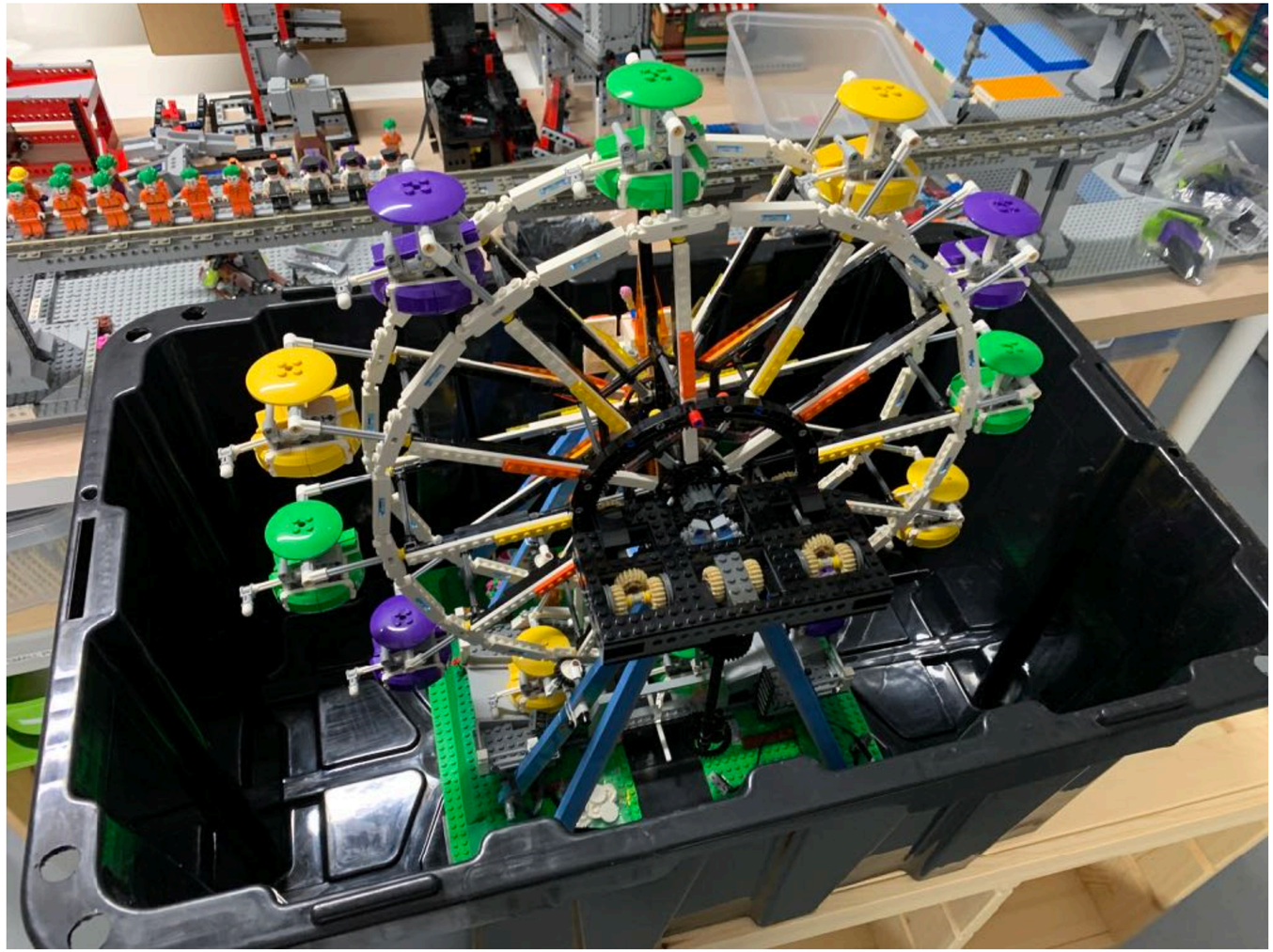

(5)


(5)
(6)

Module Transport

Co-incidentally, I found that two of the standard crates I use to transport GBC modules - when tied together - were the perfect size to transport all of the components together. Disassembly and packing takes about five minutes. Shown here are the details of the specific crate I use. Visible are the four raised plastic lumps that align into slots in the lid of the container. Using a dremel I removed these lumps on *one* of the containers, and cut slots that matched the lid. When the containers are placed together, they lock into each other.

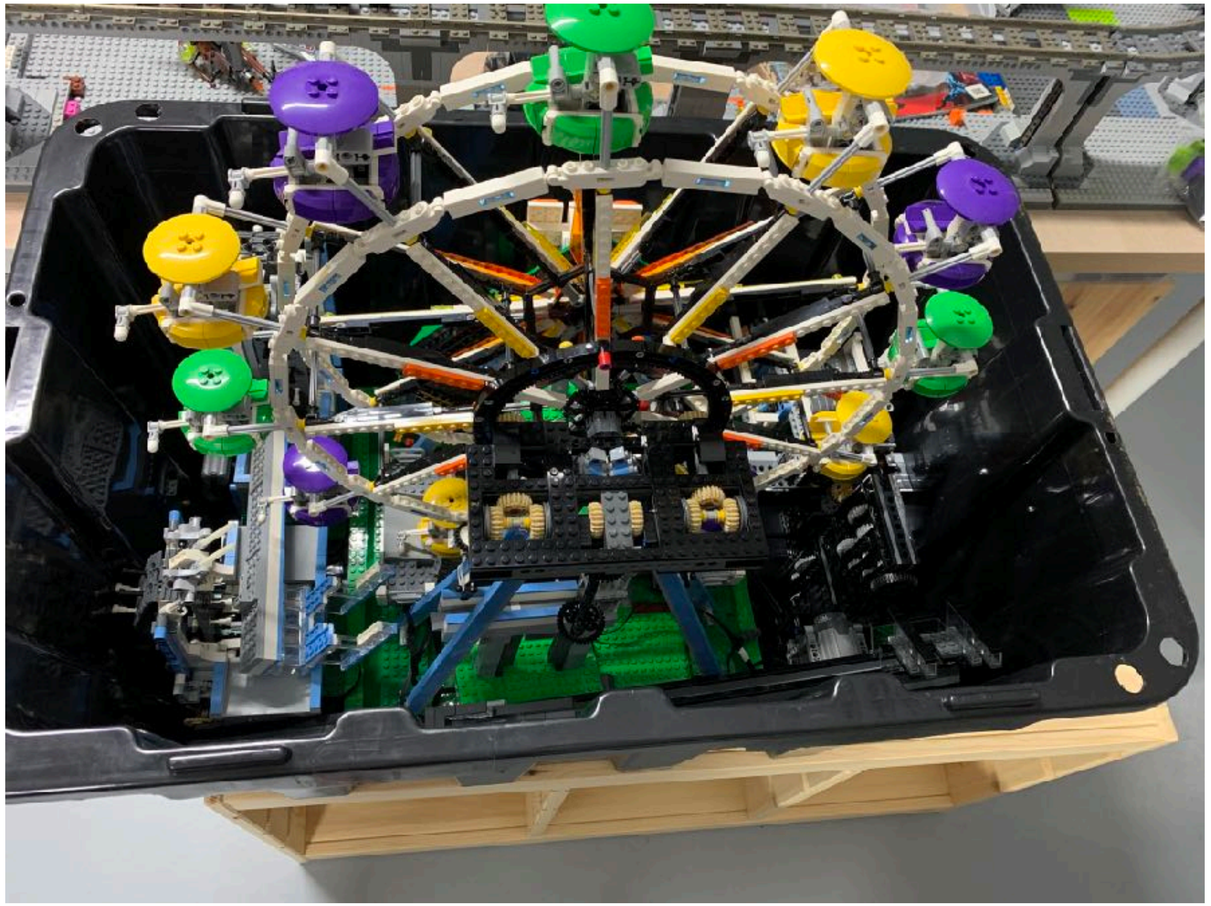
On each corner of both crates I have drilled two holes that align across both crates. Velcro straps through these holes are used to hold the top and bottom crates together during transport.

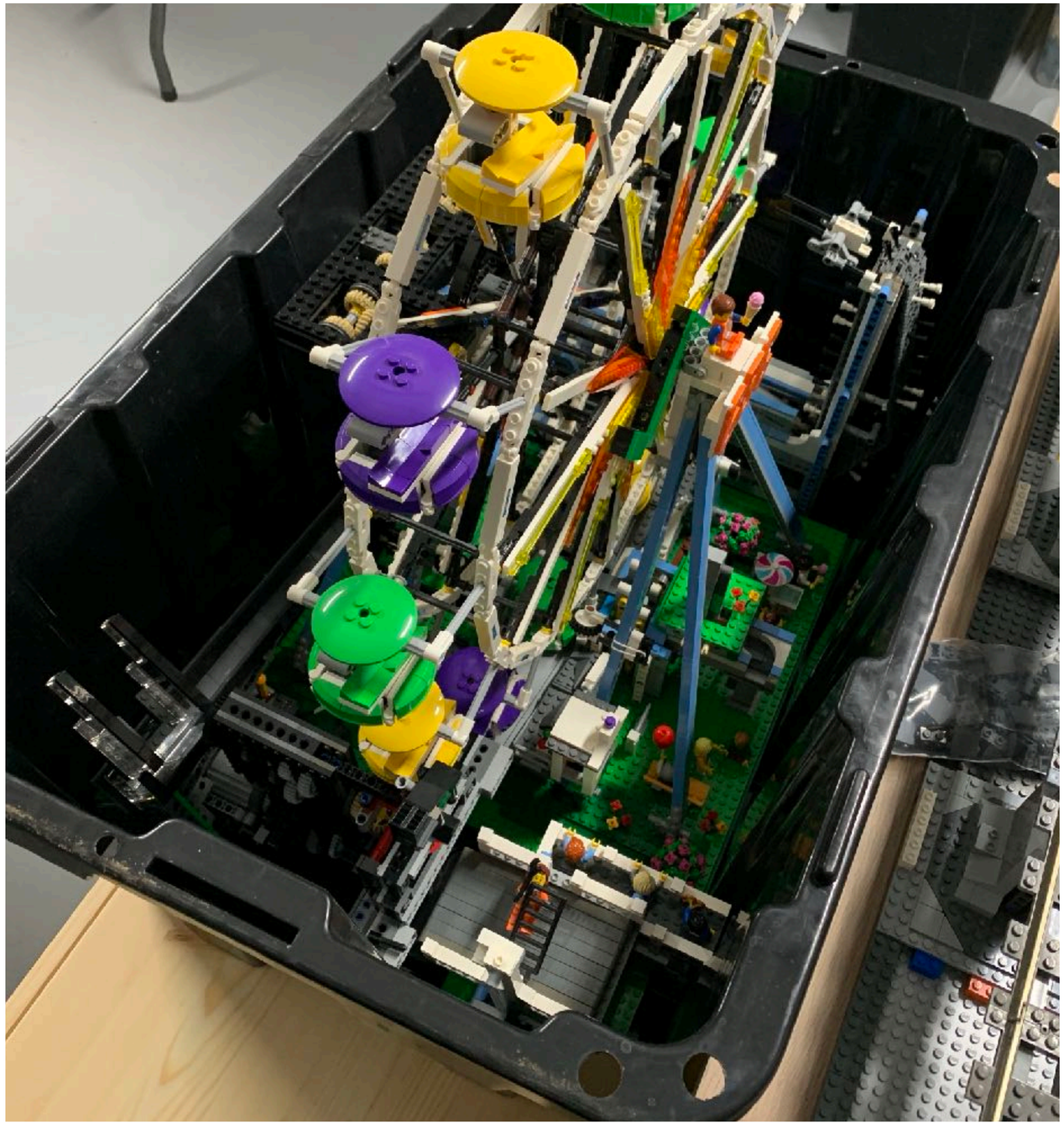


The main baseplate and Ferris Wheel structure are placed into the centre of the crate first.

All remaining components fit neatly around the main structure.

Photos are from an earlier version of this module.





Both crates are stacked together. Stickers (from Amazon) hopefully help keep the GBC right-way-up. Velcro cable ties secure the two crates together and are quick and easy to attach and remove.

GBC