THE COMEBACK ISSUE

ISSUE 7 - Fall 2010

RAILBRICKS™

BRICK RAILROADING MAGAZINE

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BEHIND THE SCENES

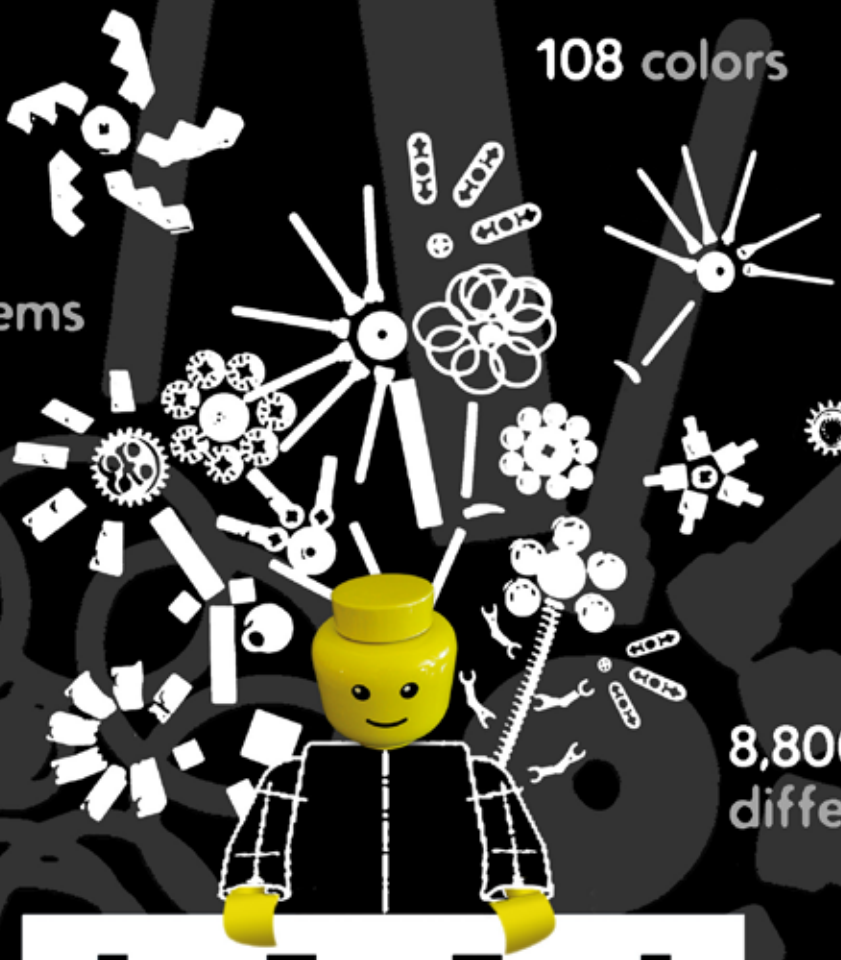
ANTHONY SAVA SHOWS US HOW TO PHOTOGRAPH LEGO TRAINS

WOODEN TRAINS

DIDIER ENJARY DISCOVERS THE ORIGINAL LEGO TRAINS

BUILD

your dreams



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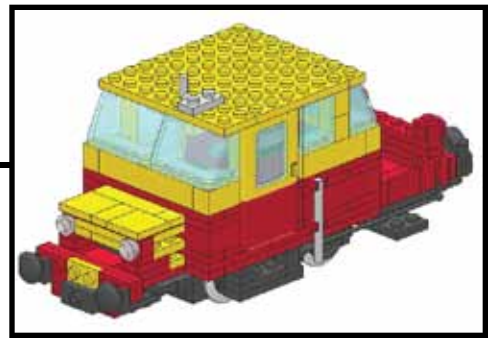
RAILBRICKS ISSUE 7 - Fall 2010

In This Issue



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ALL ABOARD!

Photo By Alfred Speredelozzi

Welcome to the latest issue of RAILBRICKS magazine! It's been a long time coming. In the past year the RAILBRICKS team has done many things, including releasing a calendar and writing many blog posts, but the magazine hasn't had a lot of activity. Thanks to some gentle nudging from one of the RAILBRICKS team members (Thanks Benn!), the magazine came back into focus.

Production of a magazine, especially one written by volunteers, is a time-consuming process. As much as we'd like to spend our time writing, editing, and working on layouts, the reality is that we all have our day to day lives to contend with. Often we find ourselves busy, and the things we love fall by the wayside as we wait for that precious "free time" that we can use for our hobby.

This is exactly the situation that the RAILBRICKS team found itself in. When the team realized that production of the magazine had tapered off, Jeramy Spurgeon, editor of RAILBRICKS said "When things get stale, sometimes it is best to freshen things up." Jeramy suggested a reorganization of the team.

This is how I now find myself in the position as RAILBRICKS current editor. Jeramy's plan worked. With talk of reorganization also came talk of ideas for future projects. Creativity started flowing, and this latest issue of the magazine started coming together.

And so, I am now happy to present you with RAILBRICKS, Issue 7. Enjoy!

-Elroy

Instructions, Challenges, and Tips & Tricks have been categorized into the following levels:

B Beginner

I Intermediate

A Advanced

FROM THE RAILBLOG

Math Can Be Fun!
Written by Anthony Sava | Thursday, 04 February 2010 18:47

After my recent article (*http://www.railbricks.com/railblog-categories/other/159-my-nerd-sense-is-tingling*), I was contacted by a fellow TexLUG member who asked me about the scale I built my trains. He is interested in building a particular model and wanted a starting point, an asked me "do you build your trains 10 feet to 8 studs scale?" After all, I built my two TSRR locomotives at 8 wide scale, and as I said in my article they turned out to be about 10 feet wide. I replied and said no, that was just coincidence.

I scale all of my locomotives based on their driver size, and for my two locomotives I considered a large BBB driver, 4 studs in diameter, equal to a driver somewhere between 55" and 65". But then I got to thinking... just what is that? Well, 60", the average size of a driver I consider to be represented by a large BBB driver, happens to be 5 feet. 5 feet to 4 studs scale... wait a minute... Well what do you know, I really DO model at 10 feet to 8 studs scale.

Math can be fun!

For the curious, 10 feet to 8 studs scale mathematically ends up being 1:48 scale. Then again, my math skills seem to be a little off lately.

Visit the

RAILBRICKS RAILBLOG at

www.railbricks.com

Have an idea for RAILBRICKS? Here are some guidelines for getting your article published in an upcoming issue.

Who may submit an article?

Anyone may submit articles for consideration by the RAILBRICKS staff. Submitted articles are reviewed and, if suitable, used in future issues of RAILBRICKS magazine.

People submitting articles do not need to be professional level writers. RAILBRICKS is a magazine for fans, by fans. We welcome articles from enthusiasts who build, collect, and play with LEGO® trains. When we evaluate articles, we look for quality in the content and the basic writing style. We also evaluate any photos that accompany the submission. Every article to be published is edited by the RAILBRICKS staff to increase readability if needed, and while basic grammar and spelling are expected, perfection is not necessary.

What sort of articles may be submitted?

Any material related to the creation, display, or collecting of LEGO® trains is welcome. This includes articles about prototype trains or railroading locations that may spark inspiration, overviews of models that have been created, or step-by-step instructions for train models. While our focus is LEGO® trains, articles about related items, such as modifying track with non-LEGO® elements, are also welcome. We are also interested in the overall LEGO® train community, so articles about events, people, or clubs are also encouraged.

How long should articles be?

Submissions should be long enough to cover the article's topic, but short enough to hold the attention of the reader. In general articles should be between 750 to 3,000 words in length, and include any photographs or images that will accompany the text. In addition to images, any sort of source material that was used during the writing of the article, such as website URLs or book titles should be included in order to give readers additional resources should they decide to read more about the topic outside of RAILBRICKS.

What if an article is over 3,000 words?

3,000 words is a guideline. If you have an idea for an article that may be over 3,000 words, please send us an outline or summary. We may decide that the idea warrants the extra space, or the article may be a good candidate for being printed in installments across multiple issues.

How should articles be prepared?

Articles should be typed in either a text document or e-mail, and should use proper grammar, punctuation, and spelling. While the RAILBRICKS staff does edit submissions, they need to be in a readable form to begin with. Perfection is not necessary. We don't mind correcting a few spelling mistakes or punctuation errors.

How are articles submitted?

Completed articles may be e-mailed to *submissions@railbricks.com*. The text of the article may either be in the body of the e-mail, or added as a file attachment (MicroSoft Word, OpenOffice Writer, text file, etc). Images to be included with the article should be submitted as separate attachments, and clearly named. We can accept images in JPG, GIF, PNG, or TIFF formats. High resolution images, 300 DPI at least, are preferred as they will reproduce better than lower resolution images.

When will my article be printed?

Accepted articles will be included in future issues of RAILBRICKS. When the article is included depends on a number of factors including the amount of content already available to be printed, themes of specific articles, and article length. In short, there is no way to determine exactly when an article will be included.

Does everything that gets submitted get published?

Unfortunately, no. While we will make an effort to publish what we can, it is not always possible to include everything.

Are authors compensated for their printed articles?

No one is paid for RAILBRICKS, including the editorial and writing staff. RAILBRICKS is an all volunteer project, and as such, authors are not paid for the use of their material. Articles used by RAILBRICKS remain the property of their authors.

Wooden Trains by LEGO

Article and photos by Didier Enjary

Plastic is fantastic. And so are LEGO toys. But the early history of the LEGO company is all about wood.

LEGO wooden Train - 1935

In fact, everything started in 1932 when Ole Kirk Christiansen, owner of a carpentry in Billund, decided to produce wooden toys. The toys sold well and in 1934, the company focused on toys, also gaining its name LEGO. Farm animals such the famous duck were bestsellers but the company also made, among other vehicles, some trains.

There is a poor chance for you to own a LEGO wooden toy. They are at least 50 years old, and the size of production runs was not what they can be nowadays for plastic toys. They are definitively museum pieces. You can see some of them at LEGO Discovery Centers, LEGOWORLD and other temporary exhibitions.

But there is a place one can see a large collection of LEGO wooden toys: the Idé Hus (Idea House) in Billund, Denmark. This museum is not opened to the genral public, but RAILBRICKS has a collection of photographs, some of which we are pleased to share with you today.

There is no motor of course. There is no question here of voltage. The 4.5, 12 and 9 volts train systems would appear only 30 years later. Obviously, no track either.These trains are nothing more than pull-along toys. They deserve the name of trains because they look like prototypical trains - for instance, you can easily recognize the global shape of steam train engines, box and tank cars, or passenger coaches on the pictures here. Also, trains because they are composed of an engine and towed vehicles: tenders, freight or passenger cars. Who says train says coupling device. Here, metal hooks - quite harmful for children, but safety regulations at that time was not that severe - are both of the male and female type. Cars can be reversed and connected in every manner.

If the body of the vehicles is made of wood, it has not been always the same for the train wheels. As you can see beside, this aerodynamic streamlined black engine has wheels made of rubber. The reason behind this move from wood to rubber is maybe to prevent noise of wheels on the floor.

-«I did not know LEGO did trains!»

-«Yes they did, since 1935, and they still do»

About the photos

All the models you can see in this article stand in display cabinets at the Idé Hus LEGO Museum at Billund, Denmark. All photos was taken through wndows which explain some undesired light reflections and slight green-bluish light.

The wooden toys were painted with three coats of paint and you can recognize throughout these pages the LEGO company main color: red. But the toys were colorful and also wear yellow, green and blue along with black and grey, or more surprisingly orange liveries. (did the yellow paint fall into the red one?) There is an exception: the wheels are not painted. One can imagine that the wheels being in contact with the floor are subject to friction and the paint could have worn off.

Paint is also a way to add details: windows to passenger cars or cabs , thin stripes to underline a shape on locomotives, nuts and bolts on tenders' sides, doors on freight cars, wood pattern and even letterings : LEGO and the DSB name (Danish RailWay Company), brand names such ESSO or GULF.

As you know, nowadays the plastic bricks are not only patterned or decorated, but the LEGO Group also makes a heavy use of stickers. It seems it went the same at the time of LEGO wooden train toys but less intensively, limited to one LEGO logo sticker (two versions). Probably the cost of such an item implied the stickers would fit on a large variety of products.

In 1958, the plastic brick with its interlocking system was born, and the LEGO group started to concentrate on plastic toys. After a fire destroyed a warehouse in 1960, the production of wooden-toys ceased.

Bibliography and further readings

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B

End of Line Buffer

By Elroy Davis

An active buffer that uses the elasticity of a Technic belt to absorb the shock of runaway rolling stock

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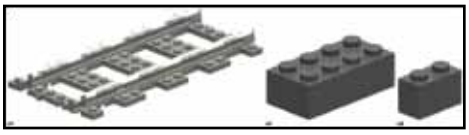

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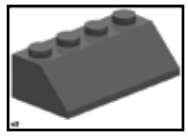

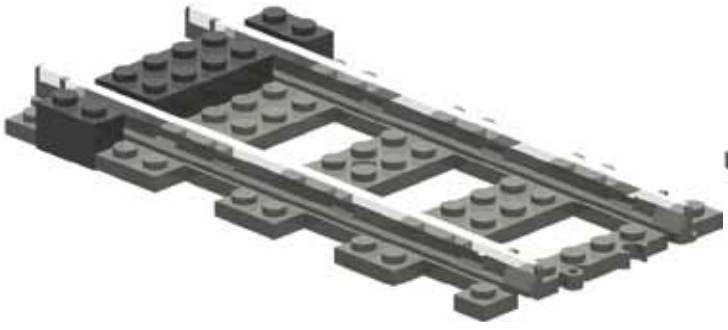

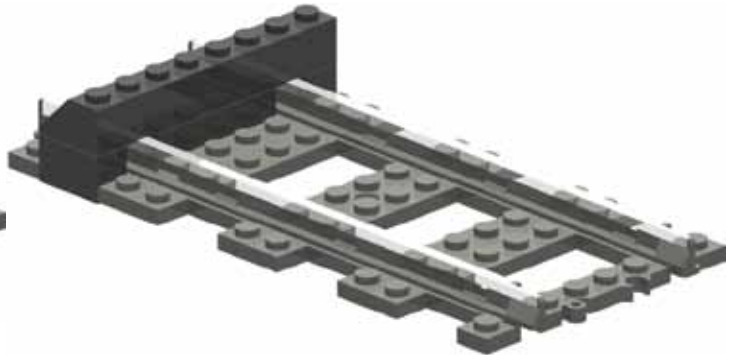

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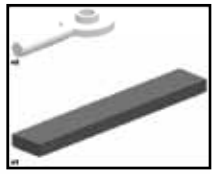

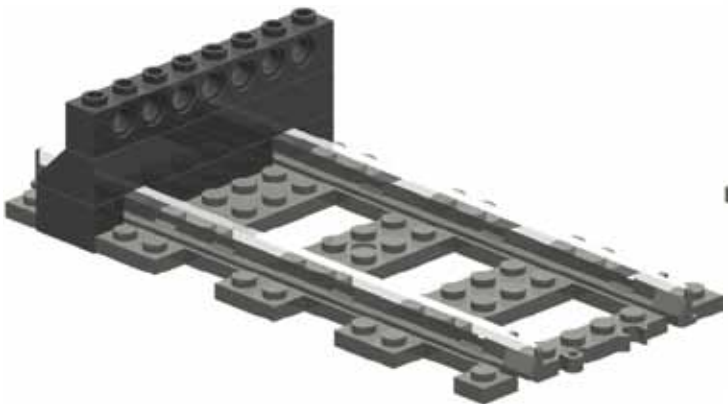

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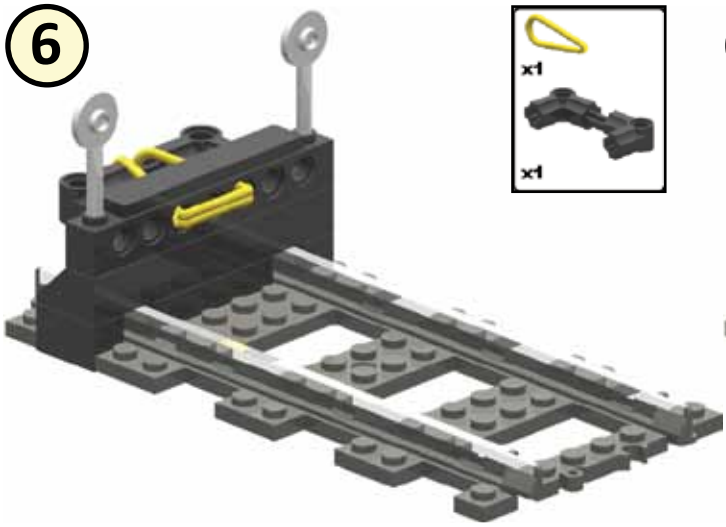

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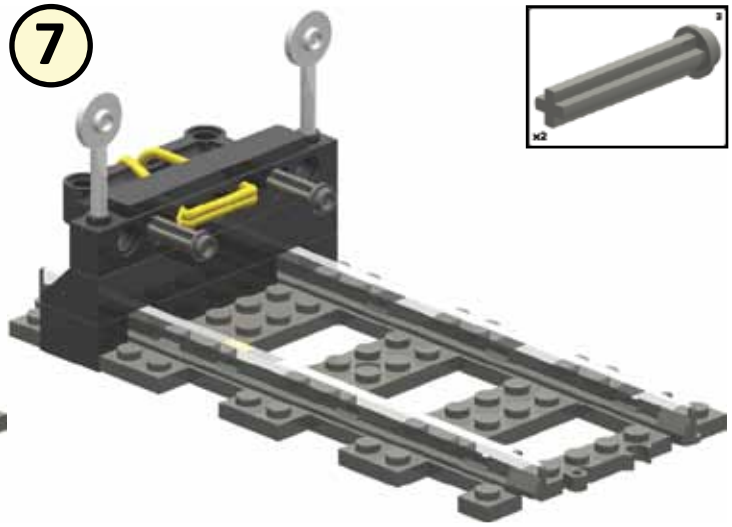

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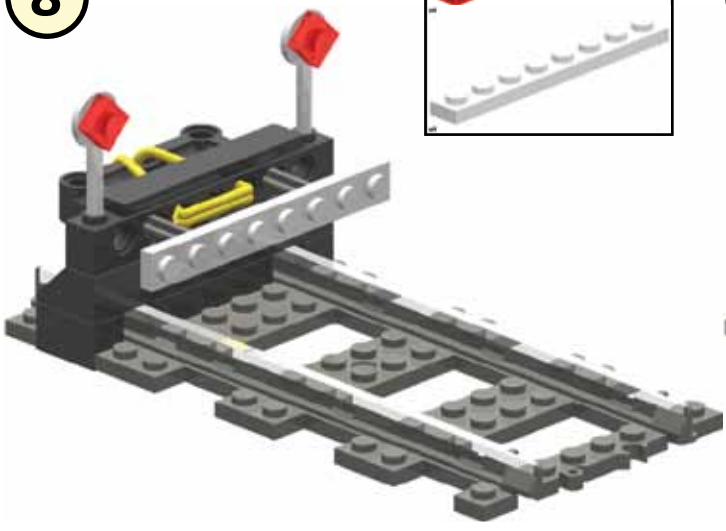

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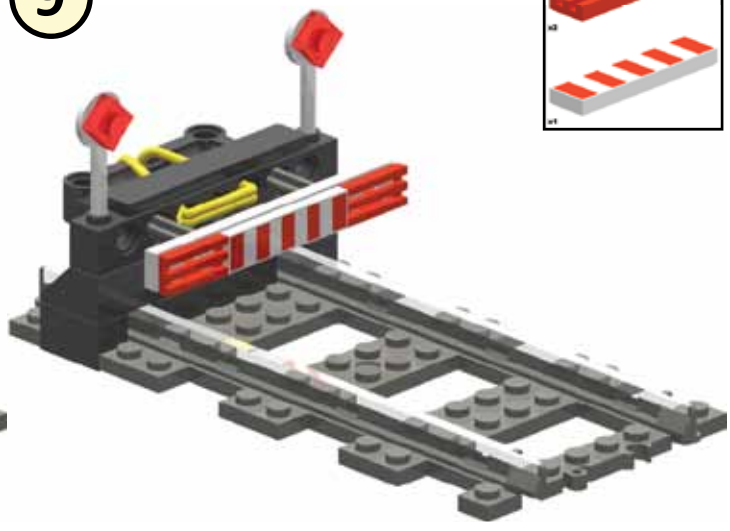
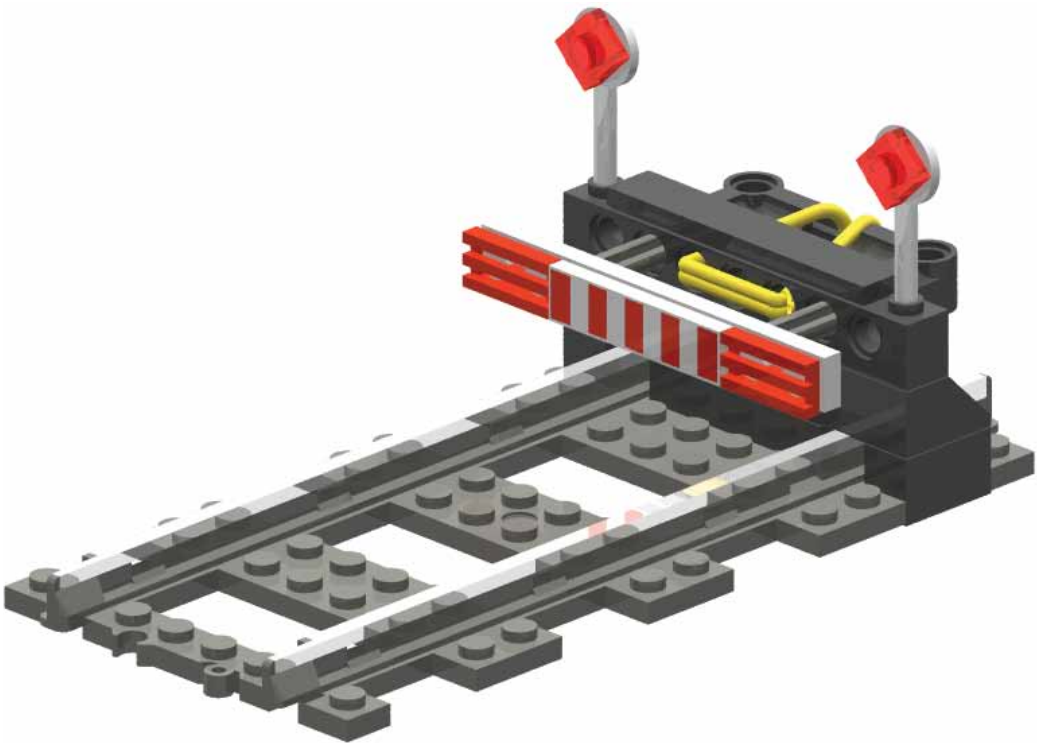




Yeah, we've got issues.

If you want to see what is going on with the LEGO fan community, you'll want to take a look at *BrickJournal*, the magazine for LEGO Enthsiasts! We have articles on all the aspects o fthe LEGO hobby, from building to events to instructions!

Issue 12, due out in mid-October, will have notes on many building standards for those want to build a group project. Also, there's an interview with Gary McIntyre about his design for the LEGO Ambassador Passholder model and a talk with Angus MacLane about his CubeDudes. There's also a look at LEGO history and set design!

BrickJournal will be available at LEGO Brand Retail stores in the US, and can also be ordered at the LEGO website or at www.twomorrows.com!

Missing an Issue?

Back issues of *BrickJournal* can be found at the *BrickJournal* sales site:

http://twomorrows.com/index.php?main_page=index&cPath=78

BrickJournal
people • building • community

FUN WITH RADII

BY STEVE BARILE

It was Saturday, August 15, 2009, when I arrived in Fallback; a suburb of Stuttgart, Germany. Stepping off the ICE from Frankfurt I was received by a dear friend and ready to have a relaxing weekend full of German beer and LEGO®! The next morning, after a long breakfast on the veranda bathed in sun, we broke out the LEGO® track and started implementing Holger's vision. It was to create a circle of track that encircled his apartment; from the living room, out on to the balcony, back into the bedroom, through the hallway, and finally back into the living room. The goal was to use the technique that Holger developed where straight track segments where connected with a one rail ½ stud disjoint; thus causing a very large radius curve while maintaining electrical continuity (see article *Smooth Curves Without Cutting Corners* in RailBricks issue #1). It was a blast building the ramps and bridges to span the thresholds of the outside doorways (see picture). As we built I could see the enthusiasm that Holger had envisioning his ICE going full speed around his apartment on the graceful

curve of LEGO® track. And so it was… when we closed the loop and fired up the first train we chased it around the mainline like little kids! I recall that at one point Holger was bee-lining toward the door. I asked where he was going, his reply, "To get more trains from storage!"

After a few beers and listening to Lyle Mays on vinyl and watching all manner of trains zoom around the apartment (see picture), we started exploring by powering small loops of 9v track with Power Functions receivers to create remote control 9v loops. We played with several permutations of powering the track with 9v controllers and then Power Functions. Running 9v trains and battery motor trains on the same track etc… I would strongly recommend this exercise to all train-head AFOLs, it is the only way to really understand and experience the options that combining the three systems provides.

Then it occurred to us to apply Holger's technique to curve track segments to achieve a slightly larger radius by separating the inner rail with ½ stud gaps. It took 10 segments of curve track to achieve a ½ circle at about a 40" (~1m) diameter. This gentler curve is awesome for longer train cars and it worked like a champ. There was very little shudder of the train as it traversed the gaps. Then we tried separating the outer rail with ½ stud gaps causing (perhaps less useful) a tighter radius. It took 7 segments of curve track to achieve a ½ circle at about a 25" (~63cm) diameter (see all four radii in picture).

As new ideas may seem foreign at first, this is a must do! At least try it at home or as a club activity during a meeting; it will make everyone go WOW! Holger's technique applied to curve track is a VERY useful tool for track design and increases the overall visual aesthetic of your layout by relaxing the tight look of curves.

Thanks Sina for the free time to remodel your apartment!

Photo By Eric Kingsley

WHAT TO DO AFTER THAT STARTER SET?

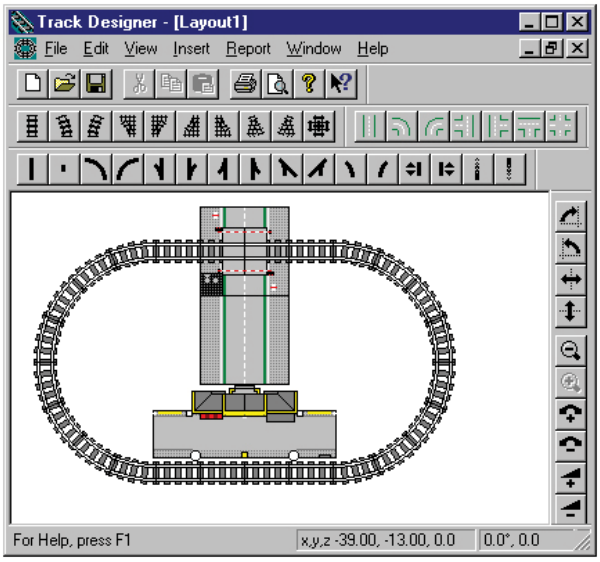
B

7 Tips for the New Train Builder: By John Robertson (aka TheBrickster)

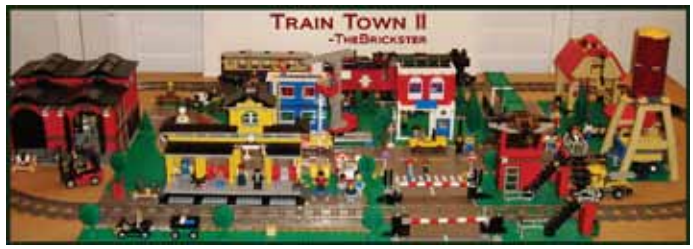
So you've finally decided to break-down and purchase a LEGO® Train. Now you own a shiny new Cargo Train Deluxe, or perhaps a Passenger Train, or even the beautiful dark green Emerald Night. You may have even found a nice 9V set at a reasonable price. You've got an oval of track, even a few switch tracks, but the fun has come to a crashing stop. You're bored and not sure what to do next to excite your LEGO® Train hobby. With 9V sets no longer available, at least without a hefty eBay® price, your layout loop is just about to be replaced with adventures of Indiana Jones(TM), that Hoth scene you always wanted to build, or perhaps the expansion of your modular city, but without train track to get in its way. Don't fret. It's time to reinvigorate that interest in trains that initially made you go out and buy one.

Here's a few fresh ideas to build upon:

1. **Expand your layout**. You can either expand your train table or find a large room with a flat surface and start buying more track. A set of 8 straight track and 8 curves currently sells for $15.99 (USD) on LEGO®'s Shop at Home (LSAH) web site. Pressed for cash? Consider ordering one or more packs each month as you build your collection. Within just a few months, you will have a nice supply of track for creating numerous layouts until you find one you like. For some added excitement, pick up a few sets of Switching Rails at a price of $15.99 (USD). Have you run out of ideas for different layouts? There's a track designer program offered through the North Georgia LEGO® Train Club's Train Depot that provides a great utility for creating digitally designed layouts. Pictures of track plans can also be found on Train Depot's Plans for Track Layouts page. As your track expands, so will your desire to add trains and buildings to your layout.



2. **Build a town or city around your layout**. What good is a train without a town? Set up those road plates under the track and start building a town around that track. You might consider adding some track-side structures like a large train engine shed that your train can pass through, a station, or even a switching tower. LEGO® SAH offers 7997 Train Station as a nice addition. Adding track-side buildings really add a lot of detail to your train layout and create focal points. While tunnels, bridges, and elevated track are certainly wonderful creations, they may not be a great idea for beginners, but you can certainly try and improve your building skills with these more advanced track-side creations. When it comes to adding a new town around the track, you might consider trying a common theme (i.e. farm and country, a port/harbor, modular City, or even a classic town). A common theme helps add realism to your layout.



3. **Become active within the LEGO® Train Community**. There's some great on-line sites where train fans can discuss a multitude of fun and exciting train topics. Train Tech, a new train forum on Eurobricks provides an excellent place for train fans to share their creations/MOCs, read train set reviews, discuss various technical topics, and share their interest with others with a passion for LEGO® trains. There are also a number of LEGO® Train Clubs across the country, especially in the United States. You might try to "google" LEGO® Train Club and the name of your city, or find a list of LEGO® Train Clubs nearest you. LEGO® Train Clubs sponsor displays in local malls and conventions building elaborate layouts. You may even learn some tips and tricks from these "master builders".

4. **Launch a "Classic Train Restoration Project"**. Visit Brickset, Lugnet, or Peeron, and begin looking at the wonderful LEGO® Trains from the past. Classic 12V and 9V trains are truly spectacular, with instructions scans available through Peeron. You will most certainly find a train that sparks your fancy, and may want to try building it within your piece collection. While you may not always have the pieces you need, substituting parts and changing colors is always possible, and only limited by your own imagination. Once you create one LEGO® set-inspired creation, you will find yourself interested in building more. Train sets with lots of parts, like 10183 Hobby Train, and others that have numerous base plates, wheels, and buffers really help provide the needed train parts.

5. **Begin collecting old sets**. Many LEGO® Train sets are still available through ebay® and Bricklink. While some sets do come at a very expensive price, you may find a non "Mint-In-Sealed-Box" (MISB) set at a reasonable price or within your budget. Pieces and parts are also available to build your own. Bricklink has a very nice feature that allows members to create a "Wish List". One can add sets to their Wish List and be sent an E-mail reminder when the set becomes available. Receiving an old set in the mail is a great feeling and that set may soon become a favorite within your train collection.

6. **Create a train display**. If you are limited for space and want to change your train table, try creating a dedicated space for displaying your train. Book shelves work well for adding track, trains, and buildings, but you might also try wall shelves for a vertical display. Keep in mind that shelves do not need to be very wide, with length being more important. You'd be surprised at how quickly one can fill a shelf with their favorite train and rolling stock. Eurobricks' members discuss different train display methods in Train Tech topic, "Train Storage & Display". You might also consider new and innovative ideas to display your train, and share them with the LEGO® Train community.

7. **Build your own train**. Nothing is more enjoyable than to create a custom train to your liking. Using parts from your train set combined with other non-train sets, one can create all kinds of interesting trains. Don't let yourself be limited to cargo and passenger trains either. One can use parts from new Castle sets to create a narrow gauge Dwarf mining train, an Indiana Jones(TM) Adventure train, or even a Power Miners lime-green tunnel digger. Combining themes provides the opportunity to create very unusual and creative train designs unique to your vision. If you are a traditionalist; however, you might gain inspiration from looking at images of real-life trains and try building them with LEGO®. As mentioned in Idea # 4 above, in looking for sets that provide good train pieces, consider older sets that have a few cars with train base plates, wheels, and buffers; all very important pieces in creating a custom train. Hobby Train 10183 is an excellent set that contains numerous train pieces, and will also offer a lot of inspiration for designing your own creation. Brickshelf, MOC Pages, Flickr, and Majhost.com are excellent web sites where LEGO® builders share their creations. You can use train pictures as inspiration or even apply certain building techniques to your own creations.

LEGO® Trains is a fantastic theme among the LEGO® Group's numerous products. Trains have held the "test of time" by being available throughout LEGO®'s history from push trains after the company's inception to the new Power Functions system available in 2009. Whether you are a fan of 4.5V, 12V, 9V, Remote Control, or Power Functions, LEGO® Trains will always be a special theme that offers builders moving bricks. There's no limit to what you can build with a little creativity and determination. So, now that you have that starter set, consider any of the ideas mentioned here to expand your interest in LEGO® Trains. Imagination has no boundaries!

To visit the sites mentioned in this article, go online:
LEGO® Shop at Home - http://http://shop.lego.com/Default.aspx
North Georgia LEGO® Train Club (NGLTC) Train Depot - http://www.ngltc.org/train_depot/td.htm
North Georgia LEGO® Train Club (NGLTC) Track Plans - http://www.ngltc.org/train_depot/plans.htm
Eurobricks Train Tech - http://www.eurobricks.com/forum/index.php?showforum=122
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Benn Coifman's

Reverse A Engineering Challenge 7

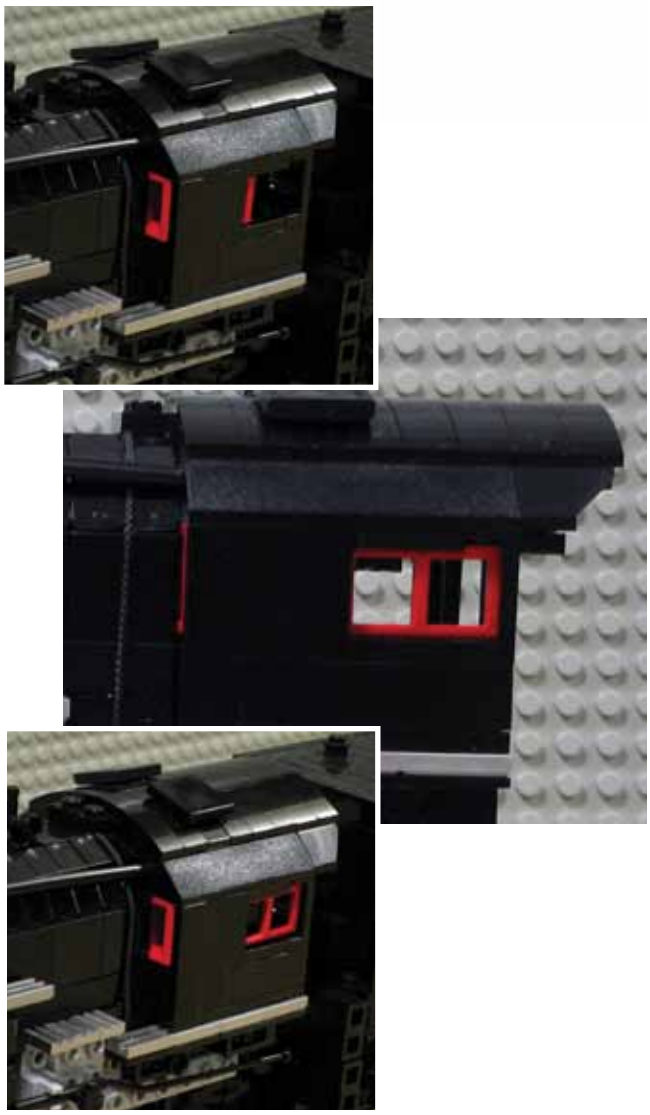
This column seeks to challenge readers to look around at other builders' work and tease out how they achieved a specific effect, an important skill as you wander off the instruction sheet and into your own creations. After the Emerald Night came out I decided to build my own Pacific. My chosen subject was the Southern Pacific Railroad, 4-6-2 'Pacific' type steam locomotive. Several of these locomotives survived into commuter service and were preserved at the twilight of steam in the U.S. Two were operational in the past decade (2467 and 2472) and a third is under restoration (2479). I had planned to use the banded drivers from the Emerald Night and finally power a steam engine via the drive wheels. But then I saw Cale Leiphart's PF Y at Brickworld 2009 and now I had better propulsion to pursue. Moving the motors to the tender gave me room to play in the cab. The front windows are borrowed directly from Gerrit, but the side windows are my own working. Look closely, they open and close.

Your challenge is to reproduce the opening windows within the confines of an 8 wide cab that is only 6 studs long. The primary challenge is the windows, but in the event of a tie, a submission that also includes the roof vent hatches will receive preference.

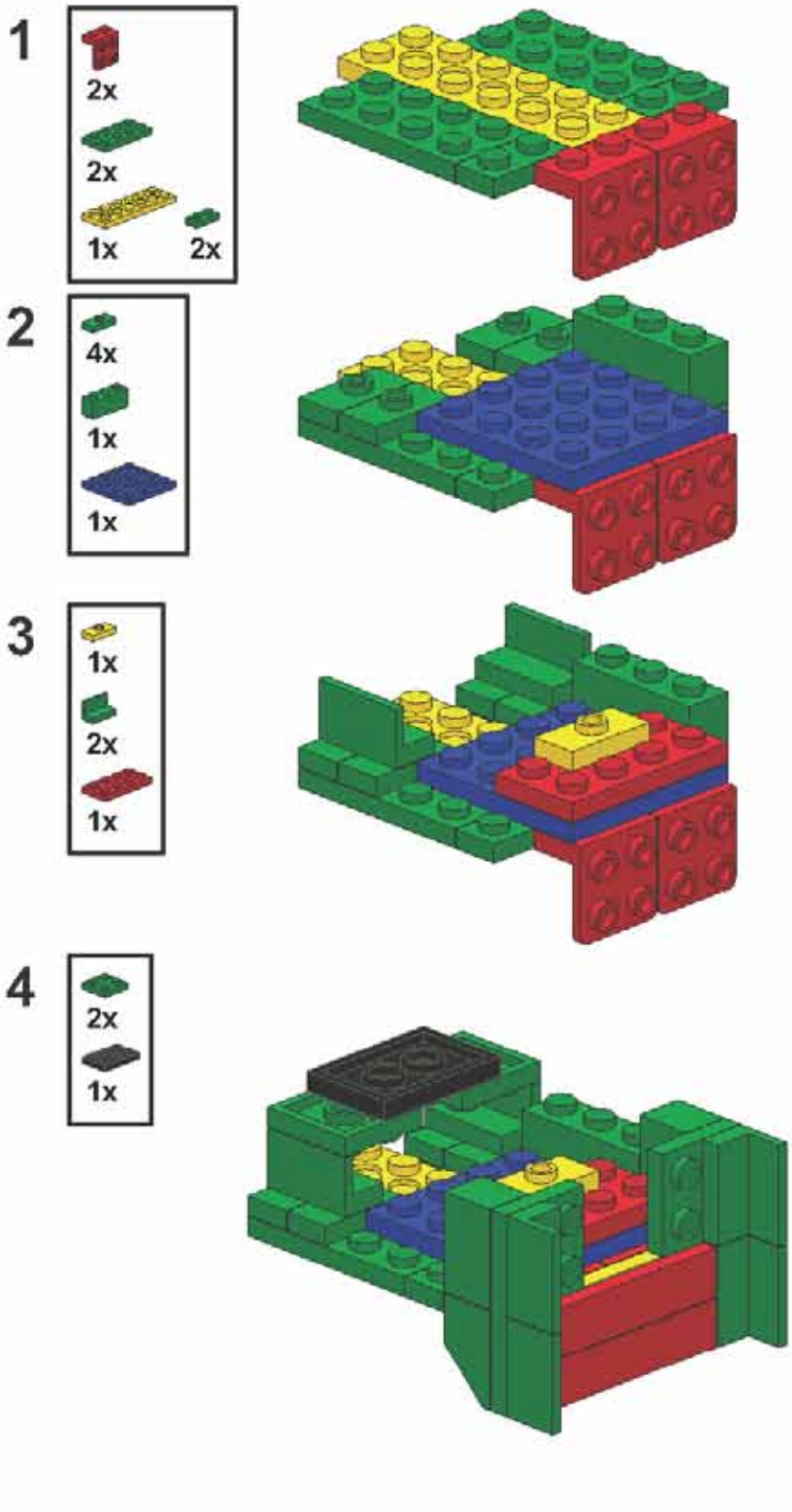
Submit your solution to challenge@RAILBRICKS.com with the title "SEVENTH REVERSE ENGINEERING CHALLENGE" in either ldraw format or provide sufficient digital photos on how to construct the feature. Judging will begin on November 15, 2010, and will continue until we are ready to release the next issue. But be sure to get your submission in by opening date for full consideration. If you build a physical model, you can use more common colors. Be sure to include your name and contact information.

The editorial staff will select the best design from all of the buildable submissions that achieve this effect and winner will receive a "RAILBRICKS Challenge" engraved brick. If one of our readers is able to solve this challenge we will publish the solution in the next issue. Otherwise, in the event that none of the entries are able reproduce the feature by the deadline, this challenge will remain open until someone is able to solve it.

All submissions become the property of RAILBRICKS and by submitting an entry you will allow us to print your submission in whole or in part.



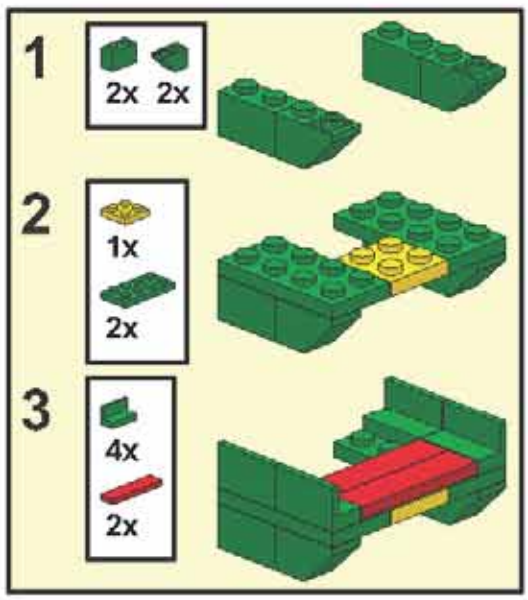
If you have ideas or suggestions for future challenges, contact us at submissions@RAILBRICKS.com.

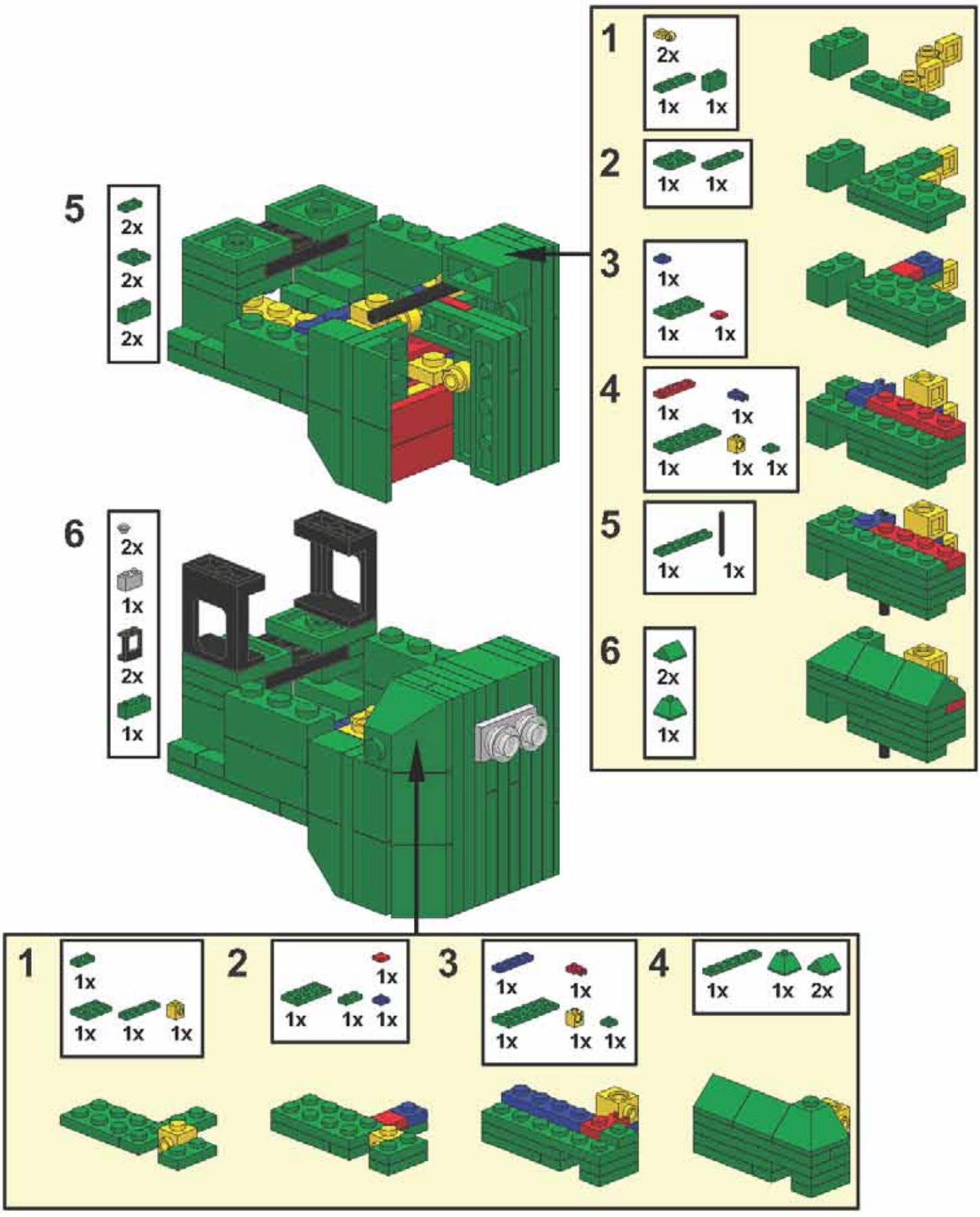


REC6

-Reveal-

Congratulations to Randall Feldhusen of West Sand Lake, New York for submitting the winning enry for Reverse Engineering Challenge 6.

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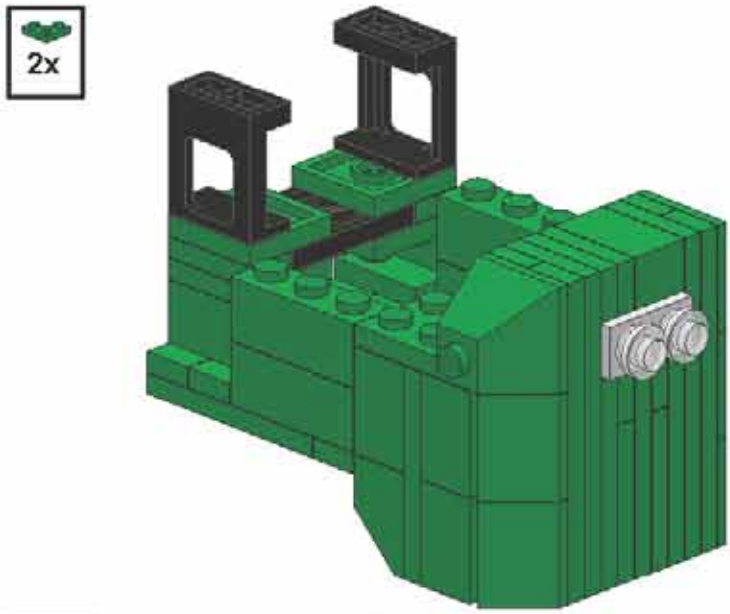

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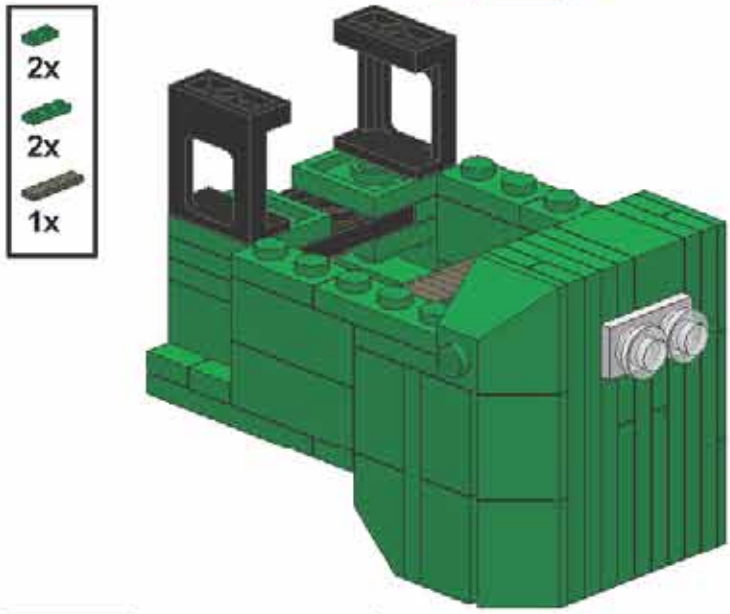

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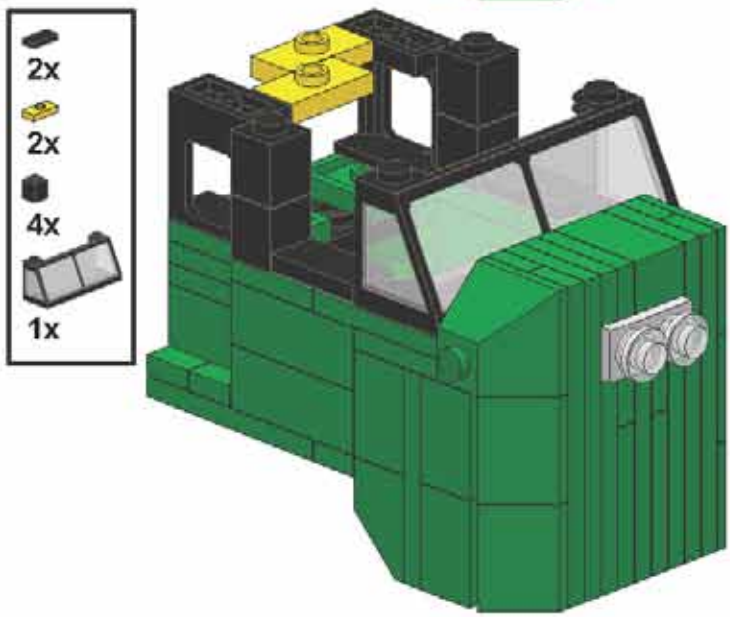

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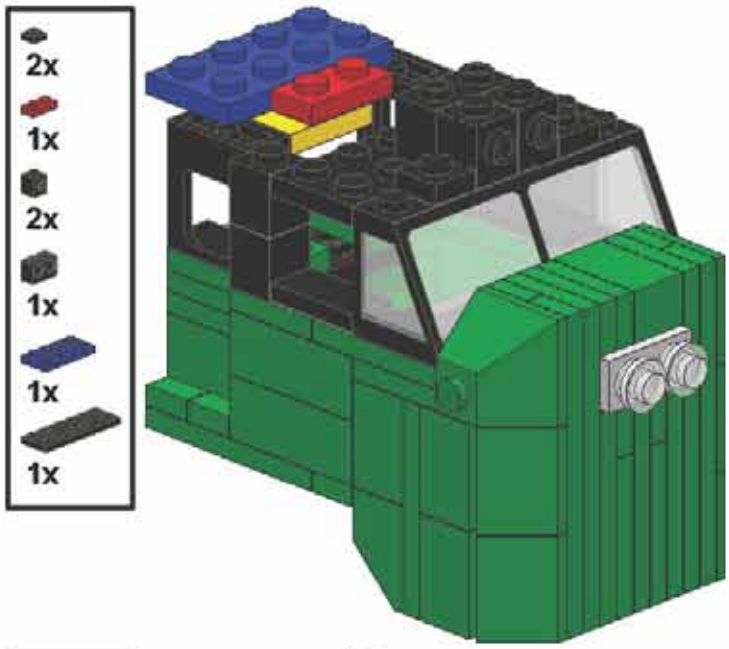

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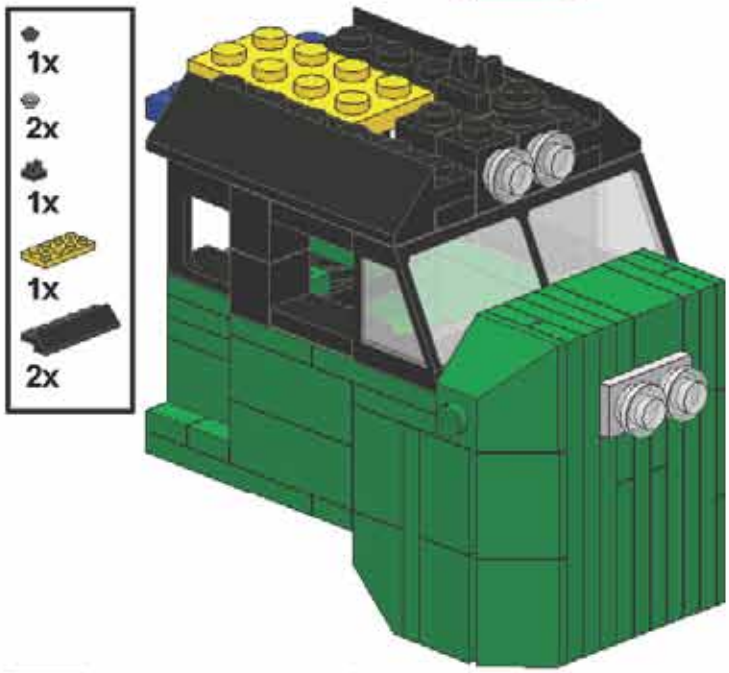

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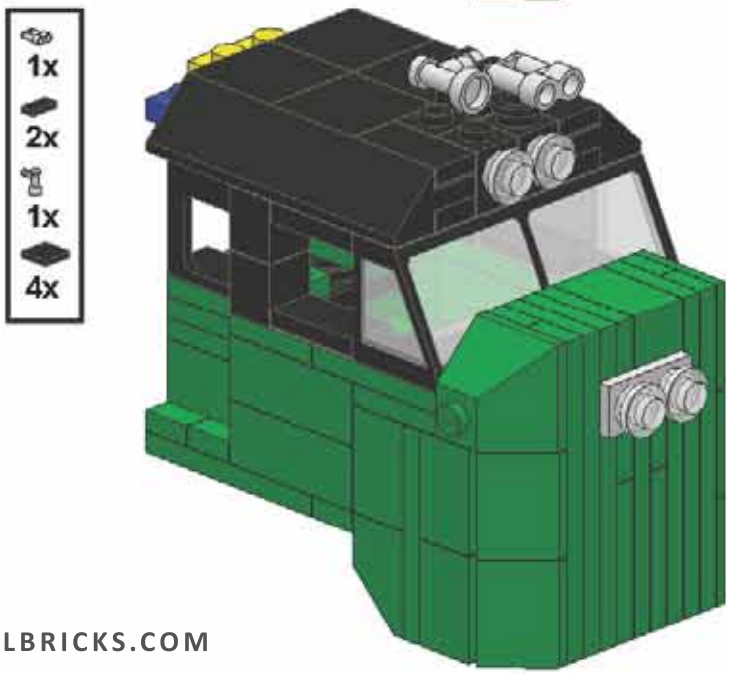


Billund's Miniland Trains

The average LEGO train fans are familiar with the 6-stud wide train models from the LEGO company. But the company also exhibits much larger train models in the Miniland at LEGOLAND parks. However, these models are far less well known as not everyone can easily visit one of the four parks. That is why RAILBRICKS has decided to present some of these LEGO train models from Billund's Miniland.

The Miniland is divided into subsections, each one presenting a typical spot (Space Kennedy Center, Billund's Airport), country landscape (Japan, The Netherlands) or Tourist spot (Rhine Valley, Hollywood Boulevard). In this second and last part, we are going to discover the largest trains layouts presenting danish and german rolling stock.

Article and photos by Didier Enjary

Angels Flight, funicular railway in the Bunker Hill district of Downtown Los Angeles, California.

Lilleby

Lilleby (little town) is a fictional but typical danish village of the early years of the twentieth century - the blue car has a "1903" mark.

You can see from the taller than usual characters that it is part of the very first Miniland models at Billund's park.

Lilleby layout feature two trains : a passenger and a freight train. Both of them are 4-car trains powered by a 0-6-0 steam engine.

Vrads Station
& VETERANBANEN

Vrads station is part of the Vrads-Bryrup line. It is a 5 kilometers long preserved section of the former line between Horsens and Silkeborg. First operated in 1899, it was known as the most scenic railway in Denmark.

Locomotives were originally steam-powered. Nowadays, as exhibited in the park, you can still see a working steam engine on the line along with a diesel train.

The steam engine model, parked on a sidetrack, emits some steam (sprayed water) while the diesel train goes over the line.

Esbjerg Station

Esbjerg is not only a city but also a harbour on the western coast of Denmark (Jutland peninsula) and the terminus of trains from Copenhagen.

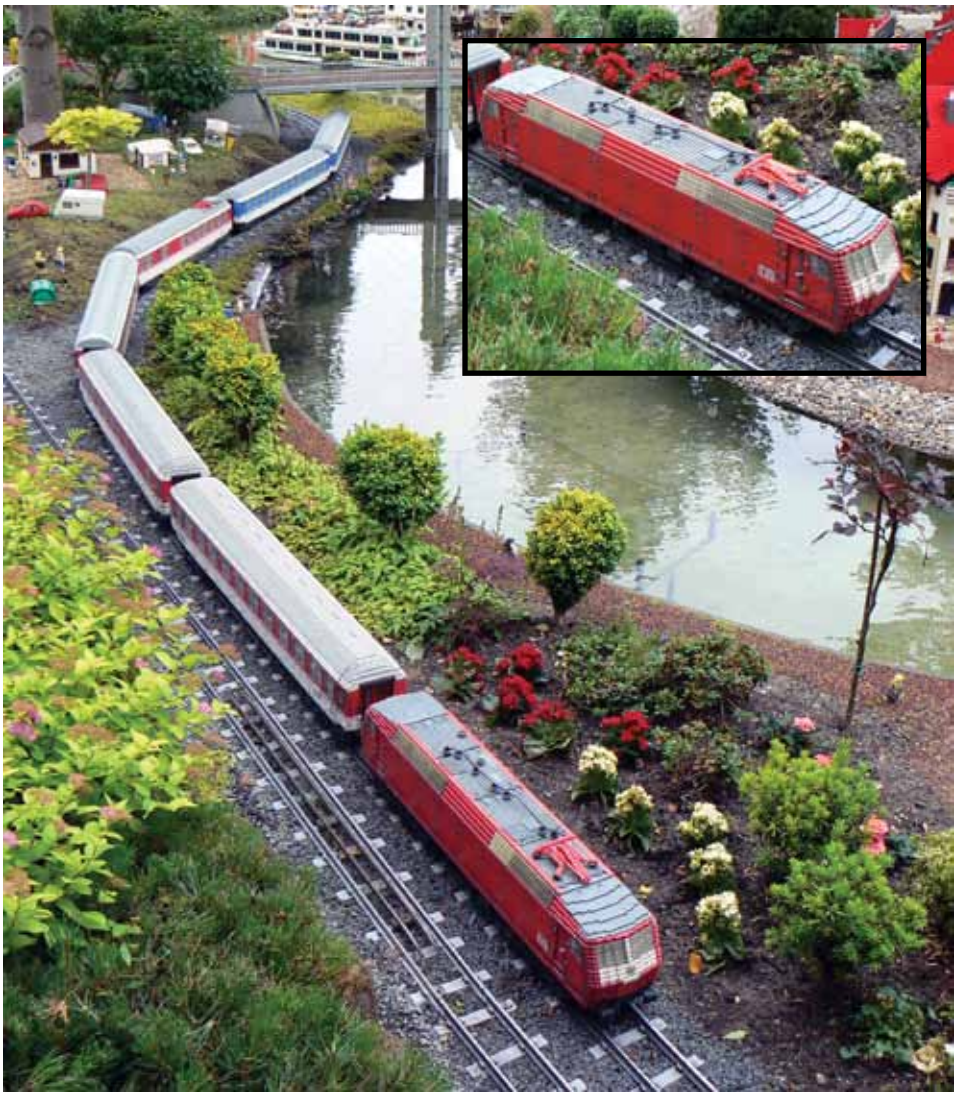
The line is deserved by white and red IC3 (InterCity) diesel multiple-unit passenger train.

On the picture, you can see in the background the water tower of the city.

This simple station - a unique railway platform - features an old class, probably of the second generation from 1967, of S-tog (suburban rail network of Copenhagen). However, Sydmolen is not a station part of the S-train network but a touristic place dedicated to fishing and windsurfing.

Sydmolen

Germany



Germany has a large place at the Miniland of Billund. Let us discover some of the most noticeable trains that one can watch on the Miniland tracks.

The DB (Deutsch Bahn) Class 120 is a class of electric locomotives operated by DB Fernverkehr (the company that operates long distance passenger trains in Germany), first delivered in 1979, originally aimed at pulling passenger trains as well as freight trains.

You can see the LEGO model at the front of a 6-car passenger train, in the Rhine valley. Probably the longest train in the Miniland world at Billund.

Two electric locomotives of the Class **E50** are presented at the front of a freight train in green and blue/beige color scheme.

The train consist is five different goods wagons: covered van or open wagon, refrigerated or with sliding sides. All of them pretty recognizable to European visitors.

The DB Class **614**, a diesel multiple unit, featured in the park comprise two driving units and a center car in the ozeanblau-beige livery (ocean blue and beige). The Class 614 is an evolution of the Class 624 and 634.

This is the end of this two-parts article on Billund Miniland trains. You have seen how much the designers at the Billund park take care at designing detailed and realistic models from real prototypes.

The article covers about fifteen train sets but that is just a sample of what a railroad modeler can spot on site. Just for the pleasure of the eye and for your curiosity, you can see here more rolling stocks seen at Billund : historical, shunter or maintenance of way.

And Billund is not the only LEGOLAND park. Windsor, Guenzburg and Carlsbad parks also feature train layouts. Yes, LEGO does trains!

Emerald Night Improvements

By Ludo Soete

The Emerald Night is one of the most unexpected trains among the whole train line.

Who had ever thought that there would be a steam locomotive with real LEGO® driver wheels? With the Emerald Night a dream came true. Being a participant of the LEGO® Power Functions Train Development team in the workshop held in November 2007 (see also *Brick Journal Issue 6, Volume 2*), I'm a proud owner of three copies of this train, but I've built only one.

The first appearance of my Emerald to the public was at an exhibition on Easter weekend 2009. The train was set on the track and started, first with the remote receiver and IR transmitter. After a while, tired from constantly running after the train to keep up the communication between the receiver and controller, I decide to connect the battery box from the Monster Dino set (4958) straight to the PF XL motor. Starting with fresh loaded Mi-MH batteries, the train drove almost 50 minutes with two 52-stud long passenger cars before the first problem occurred. One of the tan gears had moved, and lost grip with the adjacent gear. This was a real disappointment for me. The Emerald wasn't able to run reliably on the track.

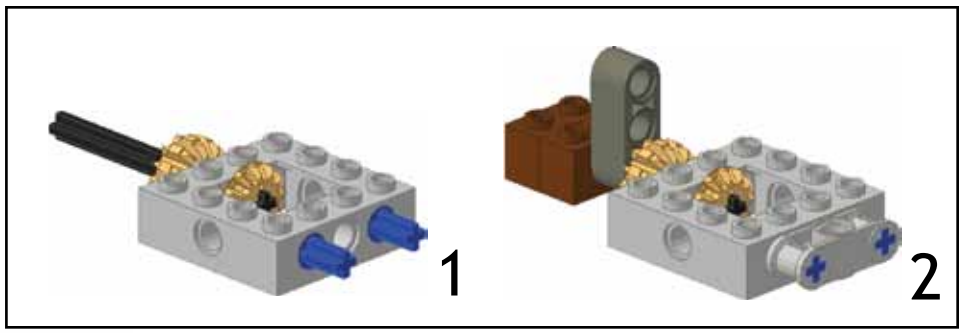
When browsing around on different newsgroups, it seems to be that I'm not the only one with this problem. So I would like to solve the problem with a minimum of extra pieces, and if possible make it not noticeable from the outside, keeping to the official model as much as possible.

Facing the First Problem

When examining the problem, I was convinced that the problem lay in the movement of the 5.5 axle with stop (32209.dat). Because of the 'heavy' load from the 2 passenger cars, the axle moved into the recess of the second 1x2 brown Technic brick, causing the tan gear to lose grip on the axle. I noticed also that the Emerald Night wasn't running smooth, but shuddering, and had large problems driving backwards. This problem was caused by another issue I'll discuss later on (See: Facing the Second Problem). I tried to solve this problem and found a solution, perhaps not the best one, but a working one

The stop collar fits into the recess of the 1x2 brown Technic brick.

Because the 5.5 axle could move backwards into the recess of the second brown Technic brick, I was convinced that this needed to be replaced by another axle, longer, and held on both sides, one side on the driving rear wheel axle, the other side by a brick. The best fit was using an axle 6 studs long.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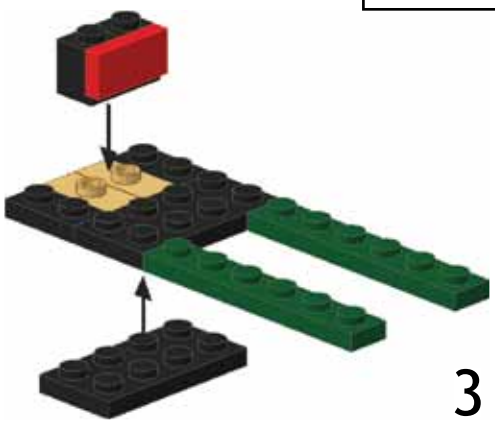
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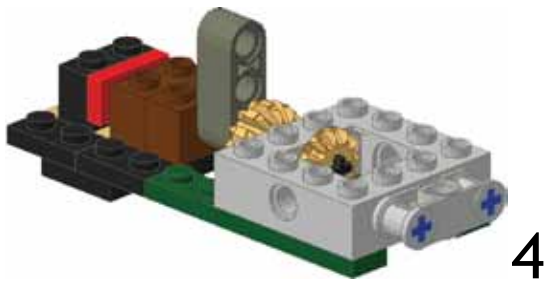
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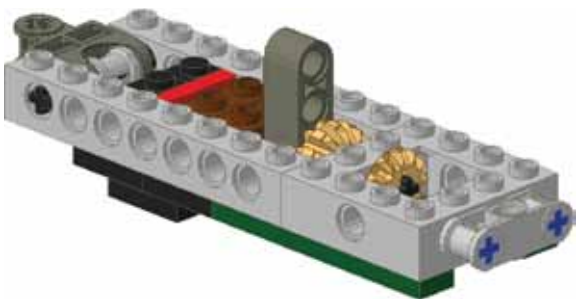
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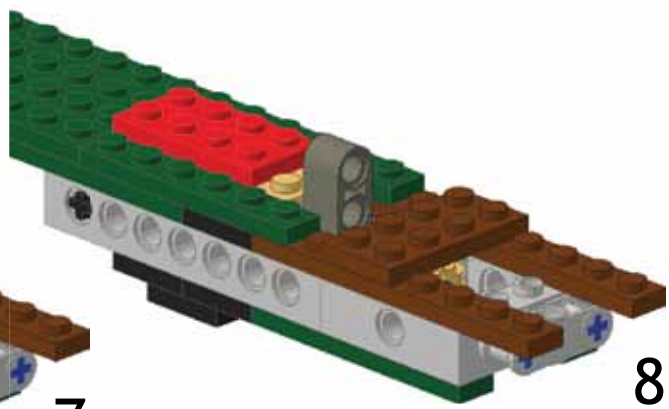
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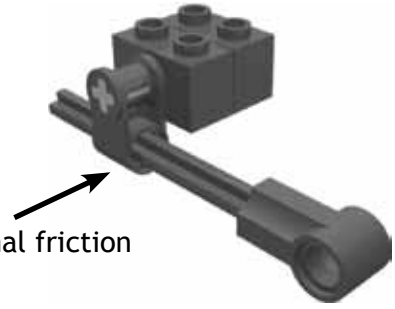
After this modification, the axle couldn't move anymore, and this problem was solved.

I placed the train back on the track with its two passenger cars and ran again. This went pretty well, and after a low battery – 55 minutes later, I immediately changed batteries and started the train right away, but then came problem 2! The PF XL motor heated up and the train slowed down. That's abnormal for as heavy-duty a motor as the PF XL motor, pulling only its tender and the two passenger cars.

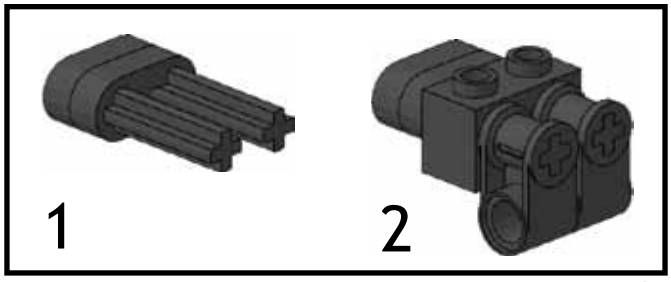
Facing the Second Problem

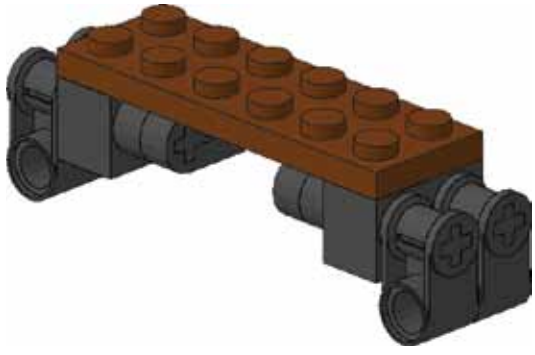
As mentioned above, we still noticed the shuddering driving of the train. My oldest son, Matthias – age 15 - joined me and examined the behavior of the train. After a few minutes, he thought he found the problem, and discussed it with me. The problem he discovered is that the driving rods (pistons) weren't always moving horizontally, but at certain moments angled up or down, causing an abnormal friction in the Technic 'Perpendicular Axle joiner'. This explains the shuddering behavior of the train. This problem is also mentioned in the *RailBricks issue #6* – page 19.



Abnormal friction

The solution is to double the sliding holes for the piston to prevent the abnormal friction, thus making the cylinder 2 studs long. This can be done as follows:





Because of the covering of the cylinder by a bracket and the labeled 2x2 tile, the modification is almost not noticeable, and it works great!

After those modifications, we started the train again to see how the modifications worked out.

With fully loaded batteries (1800 mAH – Ni-MH), the train drove more than 3 hours before recharging the batteries! This means that the problems facing the Emerald Night had been resolved. We did 6 different runs, and the batteries needed to be recharged after more than 3 hours. It sounded like music in my ears to see the large improvement in time before a recharge was needed.

Run	Driving time	Modification	Remark
1	00:57:00	After modification 1	Shaking
2	00:22:00	After modification 1	Shaking, Motor heat up
3	02:30:00	After modification 2	Stopped for shopping!
4	03:32:00	After modification 2	
5	03:19:00	After modification 2	
6	03:08:00	After modification 2	
7	03:09:00	After modification 2	
8	03:36:00	After modification 2	4 x 52-stud long passenger cars – 2300 mAH Ni-MH batteries

After both modification tests, Matthias rebuilt the train as in the original state, but kept modification 2. Started the train again, it drove until the batteries where empty without any problem – still pulling those two 52-stud long passenger cars. I was wondering if the first modification was done for nothing, because the train kept on running. But almost 2 hours after the battery change, the problem occurred again! The tan gear came lose. Implementing modification 1 again, we started the train and it kept on running, now with four 52-stud long passenger cars without a problem, and this for more than 3hours and 30 minutes – see the table above!

Facing the Third Problem

In *RailBricks #6*, there is mention of a problem with the trucks - a lack of enough vertical movement. The implementation of vertical movement for the front truck is built into the first modification.

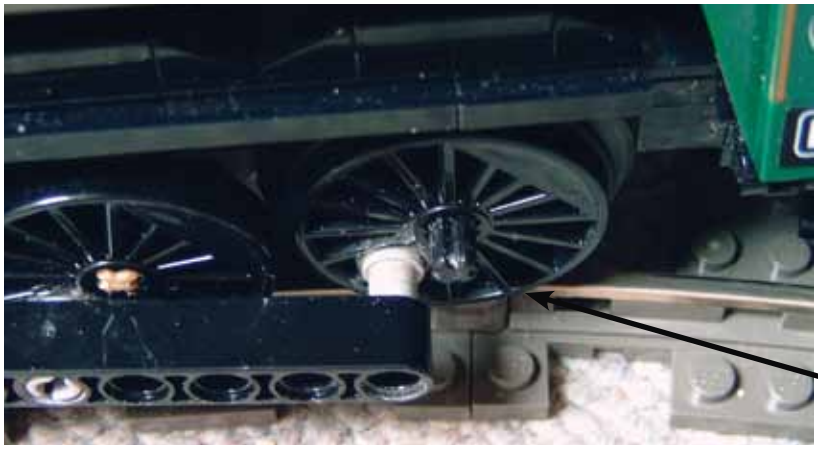
The change to be made to obtain vertical movement for the rear truck is very easy. Replace the gray Technic pin with a Technic Axle pin (3749.dat), and rotate the Technic Axle Joiner Perpendicular with 2 holes (42003.dat) by 180°.

The train drove now more than 20 hours, but another problem was rising up!

The Rise and Fall of Problem Four

The driving axle from the rear driving wheels tends to move towards the inner trackside.

The major problem I have now is that the driver gets stuck against the Technic axle after running for 6 – 10 minutes! See picture.



Moving axle, causing the rod to move outwards, and get stuck after a few minutes!

The problem here is the lack of enough mechanical clutch between the axle and the axle hole in the train wheel. Due to a too large tolerance on both parts, the train wheel slide very easy over the axle. If both parts are on there smallest dimension, the tolerance is at its maximum. This is a big difference with the BBB wheels, where those need a whole lot more force to put the wheel on the axle.

To prevent this problem, there are a few options possible.

1) Glue the wheels on the axle – Worst solution.

2) Place a small piece of paper over the axle hole, and press the axle in the hole. The paper will be pressed between the axle and wheel hole, filling the tolerance between both pieces. – Better solution than option 1, added mechanical stress on the wheel hole.

3) Tape a small piece of cello tape over the axle hole, and press the axle in the hole. The cello tape will be pressed between the axle and wheel hole, filling the tolerance between both pieces. – Perhaps the best solution, cello tape is thinner than paper – less mechanical stress on the axle hole in the wheel than option 2.

After all those modifications, the train drives perfect – and that's what it's all about, isn't it?

Last remarks:

1) Running uphill with an inclination of one plate / track piece works – with two 52-stud long passenger cars. An inclination of 2 plates / track piece isn't possible. The driving wheels float over the track and lose grip.

2) Be sure to have enough cable length between the locomotive and the tender. Better a bit too long then a bit short. This can be the reason of derailing at points.

3) Derailing over points is still possible.

Good Luck,
Ludo Soete – Ambassador cycle 7
www.belug.be

Just Like Clockwork-

Running steam and PF on 9V track

By Benn Coifman

Ever since I started building Lego steam locomotives I have periodically tripped over the unseen gremlins and had my locomotive derail for no good reason. I have recently stared one of the gremlins in the eyes and now that I've seen it, the solution is obvious and hopefully it will dispel some of your own problems.

While testing one of my newest steam engines I found it kept derailing on the curves for no apparent reason. After much head scratching, I realized that the 9V track has a flaw in its design. Consider the schematic of a 9V rail joint in Figure 1. At the joint the rails bulge outward as a result of the metal contacts. The bulge is ever so small, but if you run your finger along the rail, you will feel a small bump, as shown in the figure. This bump is no problem for the normal train wheels and motors, but can be a big headache for steam locomotives if a flange catches the leading edge of the bulge on the right hand rail. The trailing edge of the bulge on the left hand rail is generally not a problem.

The good news is that you can usually work around the problems, as discussed below. The even better news is that the RC track (i.e., the newer, non-metalized, all plastic track) does not appear to have the bulge problem, at least not in the few segments that I have gotten my hands on.

Returning to the 9V track, consider Figure 2, most large Lego steam locomotives will have a blind driver between two flanged drivers, as shown. This wheelbase is about twice as long as a normal Lego train truck and 50% longer than the 9V motor. The outside wheel flanges are pushed against the outside rail on curves. If the locomotive is running counter clockwise (to the left in this figure), the long wheelbase ensures that the leading outside flange will catch the leading edge of the bulge at every rail joint (top left). The combination is an opportunity for the wheel to climb and derail the locomotive. Oh the headaches I have had over this problem. Now turn the locomotive around and run clockwise (i.e., to the right in this figure). Now the outside flange takes the bulge from the trailing edge and has nothing to climb (top right). The inside flange encounters the leading edge of the bulge at the joint, but by the geometry of the curve it is far enough away from the rail that generally it should not be able to climb the rail. It's like clockwork, if your steam locomotive likes to climb the rail on 9V track,

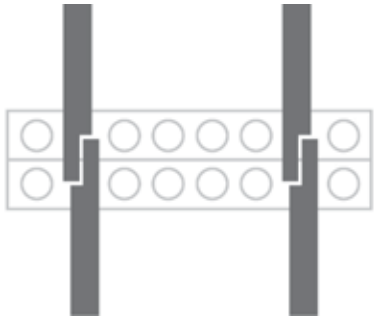


Figure 1

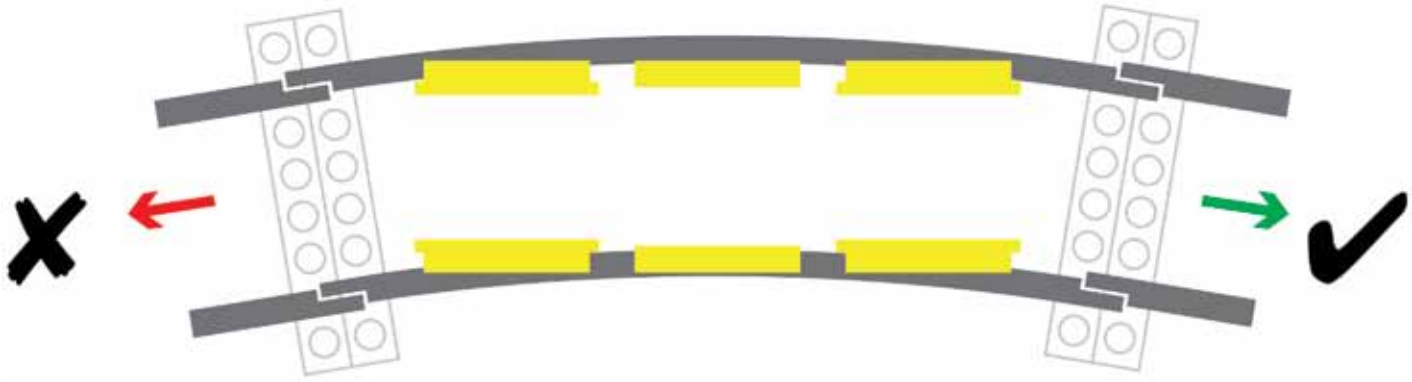


Figure 2

you just have to remember to go clockwise around the loop and you should see improved performance and earn an A+ in staying on the rails.

More recently, industrious AFOL's have sought ways of powering trucks via XL or M PF motors built in the carbody (e.g., inside a tender). The center axle holds the truck on the frame and simultaneously delivers power to the wheels via a series of gears in the truck (See *Embracing The New PF System For Trains* in RAILBRICKS #6). Typically the motor is mounted to the carbody frame. If there is a second truck under the frame, the motor will torque the powered truck in the direction of the motor rotation. Through the choice of gearing at the design stage, one can choose which motor direction will propel the locomotive forward. Figure 3 shows one such truck. If the truck moves towards the top of the figure as the motor spins clockwise, it will torque the truck to the right, as shown with the red box on the right of the figure. The flanges will be pressed against the leading edge of the bulge at every 9V rail joint, thereby having an opportunity to climb and derail. The problem will be more pronounced when the track curves to the left because the angle of attack will be larger. Exploiting the torque of the motor rotation can actually provide active protection against this problem. If you rebuild your truck so that it moves towards the top of the figure as the motor spins counter clockwise, it will torque the wheels away from the leading edge of the bulge, as shown with the green box on the left. The right leading wheel will be pulled away from leading edge of the bulge at every joint, and the left leading wheel will be pressed against the trailing edge of the bulge, but again, there is nothing to climb on the left and the train should stay on the rails. The one down side is that if build the locomotive with counter clockwise motor torque to go forward, whenever you reverse you will have clockwise torque and will be at greater risk of derailment.

The conventional train motors available from Lego (9V, RC and now the PF train motor) do not suffer from this problem because the motor is housed in the truck, so there is nothing for it to torque against. A few recent AFOL truck designs also use this idea, affixing the motor directly to the truck.

In summary, 9V track has a minor flaw that appears to have been fixed in the RC track. If you are running a steam locomotive with a large wheelbase on 9V track, you will likely have smoother running if you go clockwise around your layout. On the other hand, if you are using an XL or M PF motor built into the body of your locomotive to power your trucks on 9V track then you want to make sure that you gear your trucks so that a counterclockwise motor rotation will propel the truck forward.

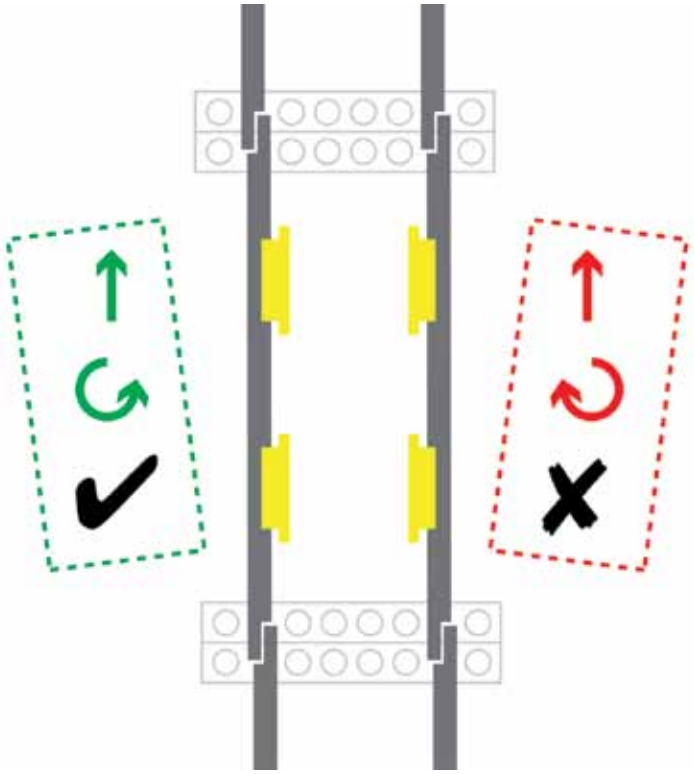


Figure 3

Brickworld's Train Roundtable

By Jordan Schwarz

For an hour each year, the Trains Roundtable at Brickworld provides an opportunity for fans of LEGO trains to congregate, convene, and discuss the latest from the world of trains with other fans and experts from across the community. Presented are some highlights from this year's roundtable discussion, in case you missed it.

Jeramy Spurgeon and Dave Sterling led the discussion. With the recent release of the latest battery-powered LEGO City train sets, early conversation focused on these new sets and the performance of the new train motors. The new sets feature an updated motor unit compatible with other Power Functions components. Testing has shown the efficiency of this motor to be much better than its RC predecessor, rivaling that of the 9V motor. Those attending the Roundtable were excited to hear that the performance of this motor with six AAA batteries exceeds that of the former motor with the 6-AA battery box. Fans also got to take a look at some of the new and unusual elements included in the latest train sets such as yellow bogie plates and 2x2 jumper plates.

The discussion transitioned to the potential for future train offerings and train-related LEGO Exclusives. Significantly, this year's roundtable was attended by Tormod Askildsen, head of the LEGO Community, Education, and Development (CED) Team, who was able to provide some insight into future directions. Fans asked about whether there would be additional cars for the Emerald Night or future train-themed LEGO Exclusives, although Askildsen was not able to comment on these specifics. In the Roundtable and at forums elsewhere at Brickworld, fans expressed considerable interest in bringing back service packs. However, Askildsen commented that the online Pick-a-Brick system is largely intended to replace service packs, which were phased out due to inherent challenges associated with maintaining inventories of many small, very specialized items.

Askildsen also provided the Trains community with an overview of a new fan collaboration effort known as Cuusoo (pronounced "KOO-so"). A pilot project between the CED team and Japanese LEGO fans, Cuusoo is an online forum where fans can post their ideas for new elements and sets. Visitors to the website, www.cuusoo.com, vote on each suggestion, and those ideas that reach the 1000-vote threshold make it on to the LEGO Group for further consideration and possible eventual realization as products.

According to Askildsen, the LEGO Group is flooded by suggestions from fans for new products, and these ideas are often simply thrown away. Cuusoo will transform this aspect of community involvement, providing a way for fans to contribute in a meaningful way to product development – and in a way that does not overwhelm LEGO with product suggestions. What could this mean for the future of trains? Potentially, the Trains community could develop concepts for new train sets and specialized elements using a web-based interface like Cuusoo.

BRICKWORLD 2010 ROUNDTABLE PARTICIPANTS. FROM LEFT TO RIGHT, BACK ROW: LARRY PIENIAZEK, MARK PETERSON, NATE BRILL, BENN COIFMAN, KURT BATY, CALE LEIPHART, JOE ELLENBECKER, JORDAN SCHWARZ. FRONT ROW: SCOTT WARDLAW, PAUL FOSTER, BRIAN WILLIAMS, JERAMY SPURGEON, JASON STEINHURST.

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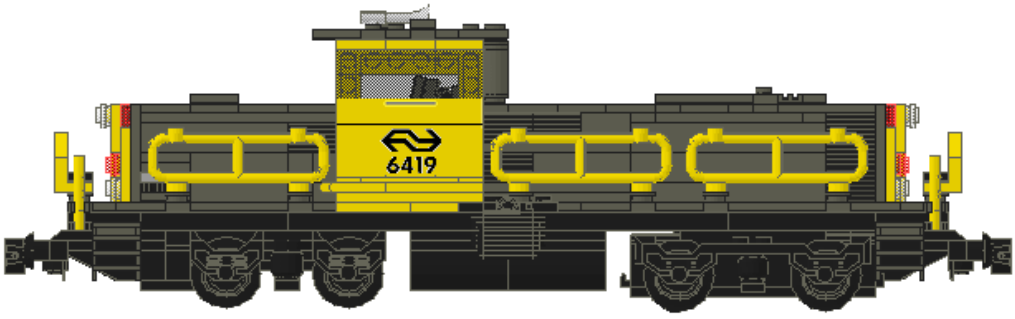

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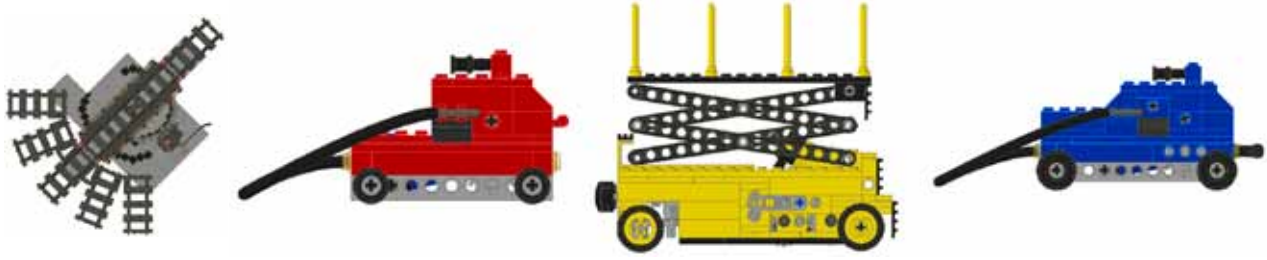

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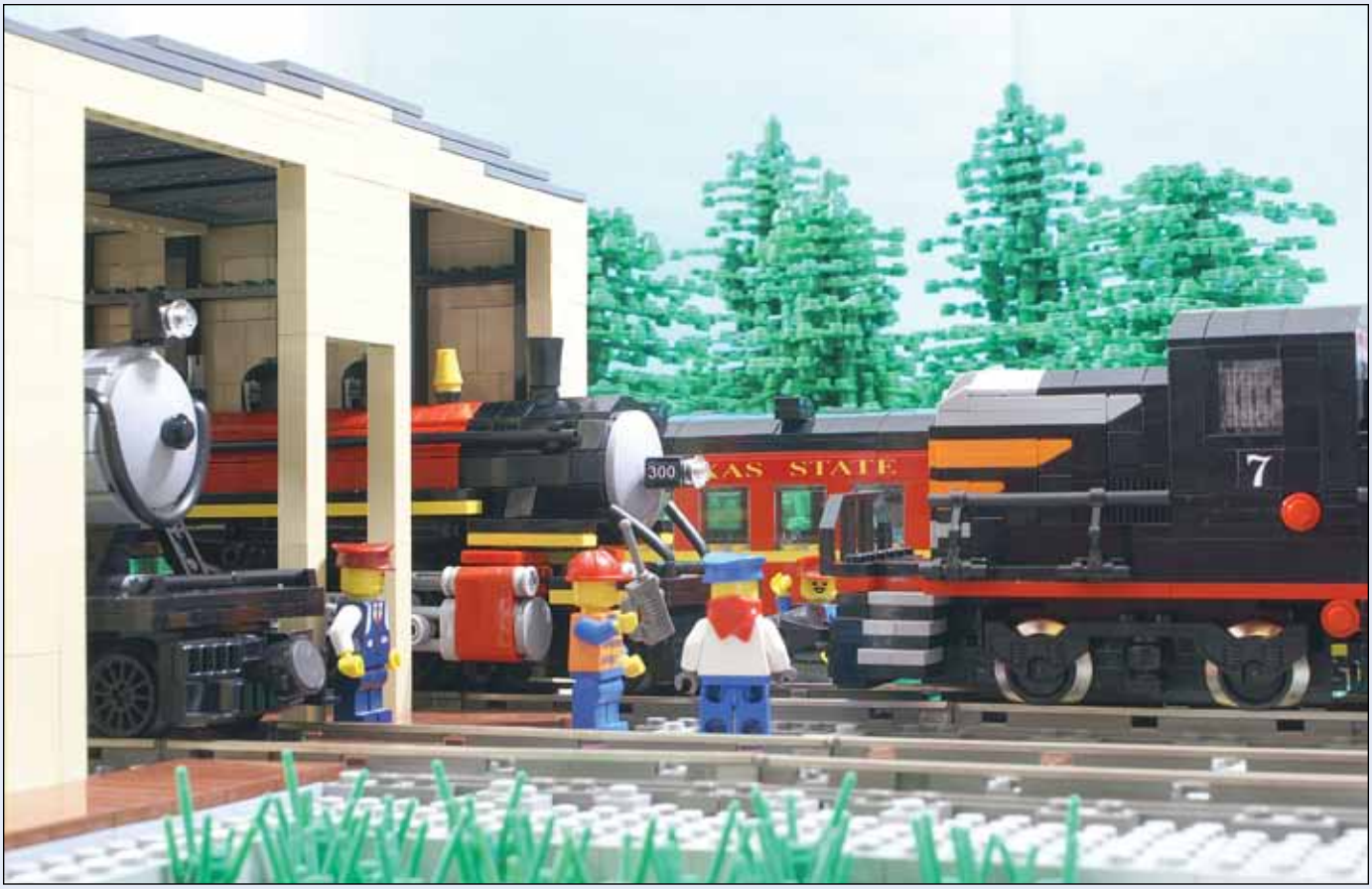
BEHIND THE TOUR: Creating the Sava Railways Scenic Tours

By Anthony Sava

About a year ago, the RAILBRICKS staff decided to create a calendar full of LEGO train facts, figures, and photos. Each member of the team was asked to submit at least one photo for consideration; some offered photos from shows, others created photos just for the calendar. I decided to do the latter and I named the resulting photo "Railfanning," which eventually was chosen for the cover. With that success, I became inspired, and have since created enough photo gems to nearly fill a calendar of my own. They became so popular on their own that I gave them a name – the Sava Railways Scenic Tours.

Now that the time for the RAILBRICKS 2011 Calendar is nearly upon us, I have been asked to write a quick "how-to" on just how I take these types of photos. For the purposes of this article, I will be focusing on one of my most recent photos, named "Stirring the Giants;" a scene depicting a diesel engine pulling a steam engine out of a shed. I will be describing how I go about building, lighting, and photographing my Scenic Tours.



The first step in any of my photos is to pick a subject, a "main character" of sorts. This can be nearly anything – a locomotive, a minifig, a building – anything you can build a scene around. For my photo I chose two main characters – my Texas State Railroad locomotives #7 and #300. I had just completed #7, so I wanted to make sure it would be showcased in my picture.

The next step is to build the location in which the characters will be placed. In Palestine, Texas, the Texas State Railroad has a very non-descript engine shed in which they store #300 and use locomotive #7 to pull different engines and equipment in and out. The building is a simple tan colored steel building with few features, so not only would it be appropriate but construction would not be difficult. Unfortunately, upon further inspection I did not have the pieces, at least not for a complete building. For this photo, however, I didn't need a full building, just enough of it to be seen in frame. So I began constructing two partial walls and a partial roof – just enough to simulate the engine shed. With such a boring exterior, I made sure to include some of the internal framing and details to add a bit more realism. Adding in part of a yard and some track and my shed was finished.

It is said that every picture tells a story, and like in any good story the main characters need supporting ones. Minifigs, passenger cars, even trees and animals make a good supporting cast. My engine shed had two bays, but only one was filled. I needed to hide some unfinished areas anyway, so I added in TSRR #500 to the second bay. With only her nose peaking out, she added just a bit more life and interest to the scene. Additionally, if #7 was pulling #300 out from the shed, there would certainly be some workmen on the ground assisting #7's driver, so I added in a crew. A few spotters, #300's driver and a conductor added much needed perceived movement.

Now that my foreground was complete, my attention turned to the background. Many years ago I was inspired by John Neal's giant brick-built trees and created my own versions, albeit significantly smaller, for TexLUG use. There really isn't a more convenient background than a few trees, and I've relied on them for nearly half of my Scenic Tours. Since my scene is only meant to be viewed from the front, smaller trees would be lost behind taller ones, so I made sure to keep that in mind while adding them. I create sky by using blue cardstock suspended on an empty LEGO set box, but I would recommend purchasing a large piece

of blue poster board, as it would be much easier to work with. I wanted the "forest" behind the scene to look lush and full, so I didn't want sky to peak through the short trees near the ground. A small baseplate set on its side is a cheap, fast, easy way to fill in the empty holes through the tree limbs with enough green to simulate dense vegetation. After looking at the scene, I decided the short trees, by themselves, looked too busy behind the locomotives, so I threw in Passenger Coach #42 to add a little monotony.

The only thing left is to add a few details to fill in the obvious holes. Flowers, flower stems ("grass"), minifig accessories and other small items work very well to hide or distract from blank or open areas. My goal for the majority of my Scenic Tours is to never have to use post-processing to fix problem areas, so I try to have everything in its place before I take a picture. Sometimes it is necessary to use your camera's view finder to help find these areas; I've even gone so far as to place grass and other details while looking through my camera.

To take a good photo you need proper lighting. Lighting can almost be considered a major character in and of itself, especially in photos where shadow positions and ambient lighting are crucial. For this shot I was less concerned with specific lighting choices, so I chose my "standard" setup – a combination of my two home-built light stands and my 4-bulb ceiling fan, all equipped with fluorescent "curly" light bulbs. The two stand lights are clustered together, creating directional lighting, like sunlight, and the ceiling fan, which has smaller bulbs, provides ambient lighting. I have chosen these bulbs specifically because of their color temperature – 5000K. All light bulbs have a color temperature – the lower the number the more red or "warm" the light appears. Most incandescent bulbs have a very low number, probably in the 3000K-4000K range. Most standard fluorescent lights, including most "curly" bulbs have a high number, close to 6500K, which makes them appear more blue. It can take a lot of work, but I spend as much time as it takes to find bulbs with a color specifically in the 5000-5500K range, which is as close to absolute white as you will find. Unfortunately many manufacturers do not place much value on this information and don't advertise it on the packaging. For nearly all the bulbs I have purchased, it was necessary to read the small print on the base of the bulb to find the color temperature. If you are unsuccessful in finding the right color bulb, don't fret. Using a combination of a warm colored incandescent bulb and a cool colored fluorescent bulb will give you just about the same effect – artists have been using it for decades.

Finally we turn to the camera itself. There are plenty of rules when it comes to great LEGO photography, but only three of them are critical:

Rule #1 – Use a tripod.
Rule #2 – Use a tripod.
Rule #3 – Use a tripod.

Using a tripod will not only give you nice, clear photos, but it will allow you to take consistent photos enabling you to make minor tweaks to your scene without changing your field of view. If your camera has a remote shutter or a shutter delay, this will also help you obtain sharp photos.

As for the camera itself, while it helps to have a big, fancy, highfalutin camera with all the bells and whistles that money can buy, great photos can still be taken with point-and-shoot cameras. Bells and whistles can compensate for poor lighting, so if you're using just a point-and-shoot you will probably need to be sure you are using more light than you think you'll need.

Depth of field is a term describing how much of what you see in your photo that is in focus. If everything in your photo is in focus then the photo has a wide depth of field. Conversely, if your subject is in focus but everything in front of and behind it is fuzzy, this is considered a narrow depth of field. Many factors determine a picture's depth of field, but as a rule of thumb, the more you zoom in on your subject, the narrower your depth of field will become. Depth of field is a powerful tool you can use if you wish to force the viewer to view everything as a whole, or if you want their focus on one particular object in a scene. For my photo I chose a relatively narrow depth of field, mainly to hide the seam in my blue sky that I could not hide behind a tree.

As I've said before, for my Sava Railways Scenic Tours series, I do my best to limit the amount of post-processing, or photo editing, as possible. So far most all of my Sava Railways Scenic Tours have not been changed except for a little brightening and resizing. Only two of them needed to be cropped, and one was created almost entirely in Photoshop. This isn't a necessity, but a personal choice and a fun challenge.

I hope this article will inspire you to try your hand at creating your own Scenic Tours. Building train MOCs is great fun, but half the fun of building trains is playing with them too. For those like me, who do not have home layouts, dioramas such as these can be a good creative outlet.

To see more of Anthony's work, visit: http://www.flickr.com/photos/savatheaggie/sets/72157622779934628/

PF and 9V Trains

The Best of Both Worlds

By Thorsten Benter

A

I am a true "LEGO 9V train" system believer – nothing will ever adequately replace this system and there is no reason in the world not to reinstall that product line (TLC: Do you read me? The answer should be: Loud and clear!). I don't like the all plastic rail system, nor the first generation RC train system, nor the first generation RC train motors, and I don't like the idea of completely depending on batteries at all.

Wow, what an opener – none of the introductions I have written so far were as negative … but I swear: I do love LEGO. Well, let's face it: 9V train is over. Over and out. TLC has pulled the plug. The ridiculous plastic tracks are cheaper to make, RC/PF train motors are cheaper to make, and that's it. They can sell the cheap stuff at whatever price they want – revenue has to be huge in many regards. And that is all the reasoning necessary. TLC is a globally operating enterprise after all. Too bad.

There were claims from TLC, some LEGO train communities, and other groups that new exciting elements of the Power Functions series (consisting of mechanical elements, motors, lights, infra red light receivers controlled by remotes) would mediate the – if you'd ask me – catastrophic situation created by TLC when phasing out the 9V train system. Hmm. I purchased some PF elements in 2009. Mediate? Not really. Battery powered trains remain battery powered trains. Over the past couple of weeks I have learned, though, that some PF elements, particularly the rechargeable Lithium polymer battery (#8878) very nicely improve the functionality and also design options of LEGO trains. Maybe …

This article addresses a few things that may be worth mentioning in this regard – along with some minor hardware changes necessary get the best of both worlds, PF and 9 V.

One has to admit: The PF series IS way cool. In 2009, the Lithium polymer rechargeable battery box (let's call it LiPo) appeared as an addition to the existing PF elements on the S&H website. In summer 2010 I ordered one, after I had carefully studied Brian Williams' article in *RAILBRICKS*, Issue 6 (Page 17, *http://www.railbricks.com/media/railbricks_6-print.pdf*) and Philo Hurbain's

photographs of the opened LiPo shown on BrickShelf (*http://www.brickshelf.com/cgi-bin/gallery.cgi?f=399263*). This raised a couple of questions:

1) Is TLC's (strongly voiced) suggestion that you should only use the LEGO 10 V DC power supply to charge their LiPo exactly that: A suggestion? At a retail price of $24.99 in the US (€24.99 in Old Europe, as of 2010) this suggestion should be seriously questioned. LEGO is a fairly high-priced "toy" – with a couple of good reasons. But when it comes to electronics, usually no super-precise injection molding machines based in Denmark's Billund are involved in the production process. Rather some folks in low income countries. And: Who on earth came up with 10 V DC as the charging voltage? There is no single piece of electronics coming easily to my mind running on 10 V DC.

2) Is it possible to use the LiPo more or less as an "uninterruptible power supply (UPS)"? Charge it when having DC power at hand and simultaneously run stuff off the 7.4 V PF power terminal? Whenever DC is not available (e.g., caused by rolling power black outs in Southern California)…

3) … or rumbling over stretches of all-plastic RC train tracks) simply switch automatically to battery power? Brian suggested such things already and did some inspiring experiments. In this regard: Is it possible to efficiently run 9V trains PF receiver controlled on mixed RC and 9V track? Again Brian's article strongly suggested exactly that.

Well, many of these questions have been already discussed in articles, blog contributions, discussion groups, forums, etc. The following is a brief summary, some additional experimental data, and some future ideas on the usage of PF elements for train operation.

1) The LEGO 10 V DC power supply as LiPo charger

The pictures on the LEGO S@H home web site suggest that the LEGO 10 V DC power supply is a more or less plain vanilla "wall wart". It could be a stabilized DC supply, but is it more than that? And 10 V DC is really strange. Maybe LiPo technology asks for such a strange voltage? Lithium polymer rechargeable batteries are relatively new on the market.

A brief Google inspection reveals: LiPos do need fairly sophisticated charging electronics to make them long-lived and essentially non-explosive devices. On the other hand: There are virtually endless lists of integrated circuits for LiPo charging available. And these are dead cheap – most probably because they sell in millions. Laptops use LiPos, cell phones use LiPos, model racing cars use LiPos, and endless other small main stream devices as well. LiPos are amazing. They can store electrical energy at a breath taking low weight to power ratio; when charged appropriately there are basically no memory effects (which were well known from the NiCd days), and output power is relatively stable over time. In addition, virtually all LiPo charger ICs run on a broad input voltage range, most up-to 18V, some even up-to 32V.

So where is the charger electronics hiding? Within the wall wart? Certainly not! Philo's photos clearly show that the charging electronics is built into the LiPo battery housing (well, I guess safety regulations make that simply a necessity, particularly with this type of "universal" input jack). Although TLC made sure that we do not readily recognize the integrated circuits used, we can make some general observations.

Figure 1: A copy of Philo's photograph of the printed circuit board (PCB) present in the LEGO LiPo rechargeable battery (#8878) (http://www.brickshelf.com/cgi-bin/gallery.cgi?f=399263)

With reference to figure 1:

(A) The input appears to be protected from wrong charging voltage polarity by the SMS 140 Schottky barrier rectifier diode (this little thing features a reverse max. voltage of 40V, a max.

forward current of 1 A, and the voltage drop is only 0.5 V at 1 A!

(B) There appears to be a smart text-book LiPo charging circuit, note the inductivity, diode, and capacitor combination along with the nifty IC (numbers printed on it don't make any sense) used in typical "step-down buck converters".

(C) There appears to be a text-book pulse width modulated (PWM) diver circuit section connected on the reverse side of the PCB to the PF terminal.

With this and the lack of a bold "10V-DC-input-voltage-required-or-this-device-will-fry-and-TLC-cannot-be-held-responsible" label next to the input jack strongly suggest that we can use a wider range of input charging voltages. Here is the plan: Hook up a stabilized adjustable laboratory DC power supply capable of delivering 5 A (if the LiPo should die, it won't suffer) at up-to 24 V to a flat LEGO LiPo.

The cable required for this experiment is easily fabricated from the pieces of a $8 "wall wart" type power supply and the adaptor plugs that typically come with it, see figure 2.

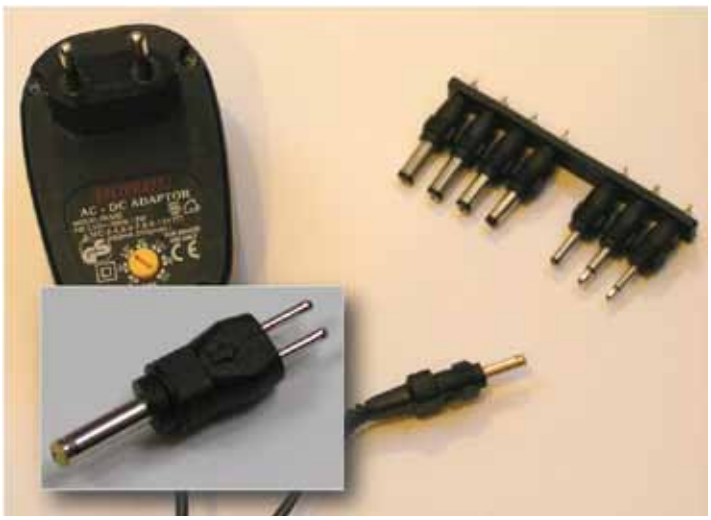


Figure 2: Photograph of a typical "wall wart" type power supply and the plug used for the charging experiments. Such power supplies often come with a variety of adaptor plugs. Insert: The 3.5 mm x 1.35 mm (x mm length, not important) plug works best with the LEGO PF LiPo.

The results are shown in figure 3. Below 9 V, nothing much is happening. At 9 V, the LiPo "charging LED" started flashing. According to some rumors, the charging time may be longer than the 4 hours time given in Brian's referenced RB article with the original power supply[1]. This makes sense, since the maximum charging current at 9 V is only 300mA. At 10 V, the maximum charging current was peaking at 550 mA. Increasing the input voltage to 19 V was completely ok with the LiPo electronics – it always charged nicely. At the same time, the maximum charging current was decreasing. At 20 V input voltage "something" bad happened – all lights went out and the LiPo electronics appeared to be completely dead. Opening the device[2] and doing some measurements on the PCB "somehow" reanimated the LiPo electronics, but I don't know exactly how ... I did it again and now I can't reanimate it anymore. The price I had to pay for this research …

So who came up with 10 V? My best guess is some smart marketing people at TLC. There are only very few (if at all) cheap 10 V DC power supplies in the stores. I did not find a single one at Fry's or Radio Shack. The cheap ones are usually rated 3-4.5-6-9-12 V or similar. You know what: Who cares? 12 V works beautifully well. I frequently use the power supply shown in figure 2 to charge my LiPo "off-line"; it's a 6 € and 50 cent device.

Summary: There is no need and no apparent reason for buying the $24.99 LEGO 10 V DC supply from S@H. That thing is a (very) good marketing joke. Go to your favorite electronics store, pick-up the cheapest (unregulated) universal power supply rated at 800 mA or above you can find and you are all set. Even lower (but overload protected!) amperage will work – charging time will go up then though. I recommend going to 12V; even if the output voltage is not regulated and you'd go with a "nominal" 12 V device (these may generate up-to 15 V DC with no load present), it will work fine. It may very well be that you have such a power supply already somewhere in the house.

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1 Apparently the LEGO service department claimed that the charging time is roughly 1 ½ hours, which was discussed in the German MBRF forum http://www.mbfr.org/smf/index.php?topic=189.0, cf. answer #3 (in case you understand German ...). In answer #4 user Lithologe calculated that this charging time leads to an average charging current of about 750 mA. However, I doubt the 1 ½ hours. My LiPo charged for about 3 hours before the LED stopped flashing.

2 Just use a sharp drill bit, drive that slowly one or two turns into the plastic plugs in each corner on the base hiding the screws fastening the lid, pull out the plastic plug, get the screws out and carefully remove the top part.

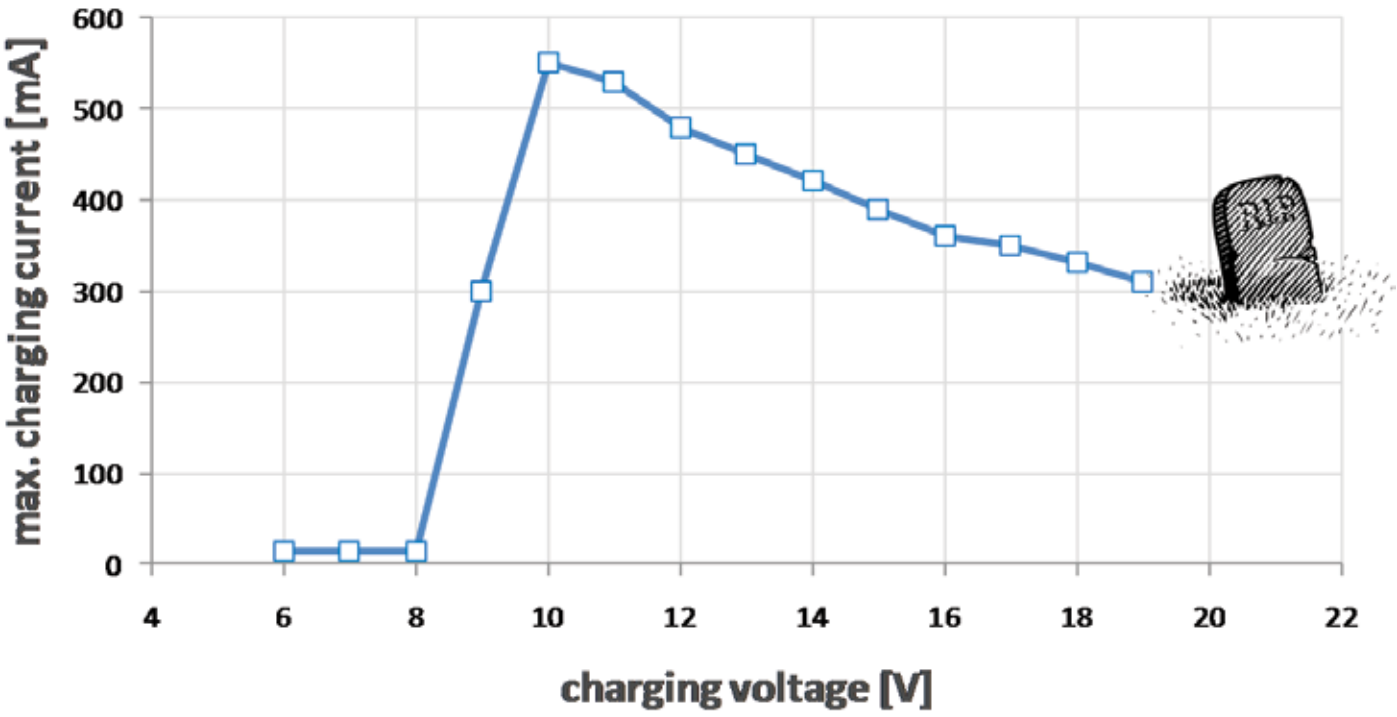


Figure 3: LiPo charging voltage vs. maximum "charging" current measurements. The maximum current was measured with a stalled PF XL motor present on the LiPo PF terminal set to full forward.

2) Using the LEGO LiPo as an UPS

The LEGO LiPo is rated with 7.4 V/1.1 Ah. The experiment described in 1) was also used to monitor the LiPo output behavior: Changing from 9 V to 18 V input charging voltage did not affect the output characteristics at all: A PF XL motor (#8882) was constantly rotating, the brightness of a LEGO 9 V light brick (#6035) was constant, as well as that of the PF lights (LEDs, #8870). In other words, the LiPo is indeed a very nice voltage regulator! Furthermore, suddenly pulling the DC charging plug does not change the output characteristics to any significant extent; the LiPo is in fact a fully functioning UPS!

3) Using the LEGO LiPo for mixed PF/9 V train operation

The best of both worlds – how about using the LiPo as a power source for PF trains which are running on mixed PF/9 V track? Here is the plan:

a) Modify a 9V train motor as power pickup device.

b) Fabricate matching cables to direct the power from the motor to the LEGO LiPo.

c) Connect the LiPo to the charging line and to a PF receiver and run RC, PF and/or modified 9 V train motors from the PF receiver outputs.

Here is a more detailed description of the required modifications:

a) Modify a 9V train motor as power pickup (from continuously powered track).

The first version is the "pick-up and motor" modification; alternatively, burnt motors can be used as "power pickups only". The former needs a little more work (see e.g., RailBrick Journal Issue 3, page 53 and references herein), the latter just needs removal of the burnt motor. In both cases you need to open the motor though. It is worth the effort!

b) Fabricate matching cables to run the power from the motor to the LEGO LiPo.

We do need a proper connection to the LiPo input – the required plugs usually come with the cheap power supplies, as already discussed. Furthermore, a bridge rectifier should be integrated into the charging line; this way you don't have to pay any attention at all to the input charging voltage polarity. The LiPo wouldn't take any harm from wrong charging voltage polarity (see

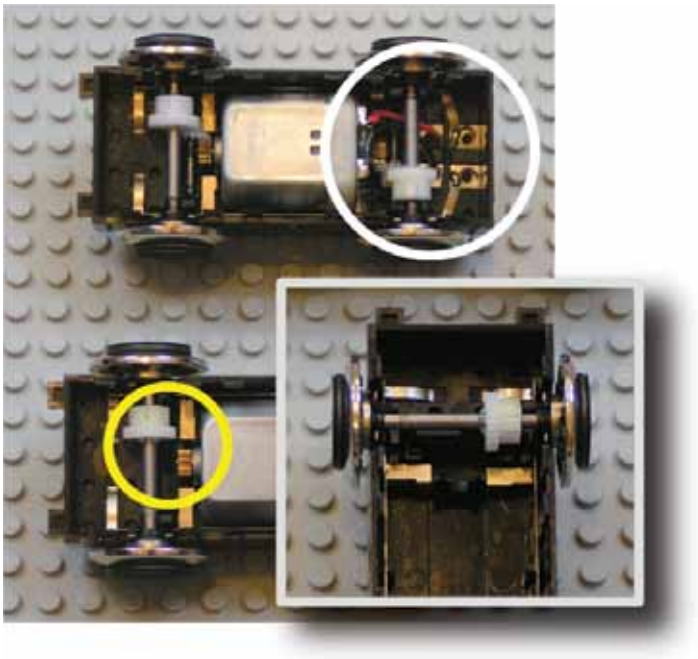


Figure 4: Photographs of modified 9 V train motors.

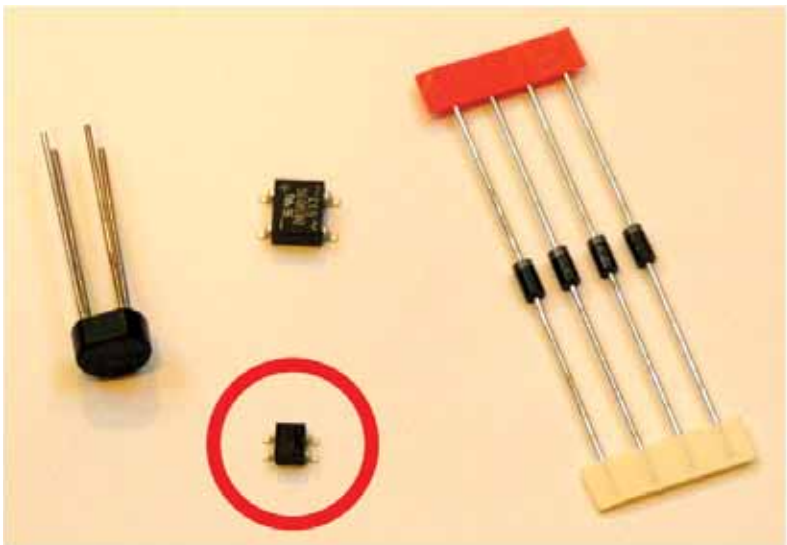
Top: "power pickup and motor" version. This has been described elsewhere. The electrical terminal is cut and the wipers are connected to the outer two electrical studs. The motor is connected to the inner two studs. The original functionality of the motor is fully re-stored, when you connect a 2x2 electrical brick to the modified terminal, as you would do anyway when running a classical 9 V train. So no harm is done here at all!

Bottom and insert: A burnt 9 V train motor is still good for the "power pickup only" ver-sion. Either just remove the small gears to disconnect the (burnt) motor from the wheels (yellow circle) or remove the entire motor, see insert. The former solution gives the pick-up some weight; the latter is "cleaner". There is also considerable space left.

above); it would simply not charge. Wikipedia has a nice description (*http://en.wikipedia.org/wiki/Diode_bridge*) on how the bridge rectifier works for AC but it works of course for "changing" DC polarity as well.

The bridge rectifier should have a rating of 20 V and 1 A or above. These are very safe numbers, cf. figure 3: The average maximum charging current at 12 V is 0.55 A with a stalled (!) PF XL motor or train motor present the output. Even with a shortened output, the average charging current does not exceed 0.55 A at 12 V charging voltage. Philo's measurements clearly show that the motors should draw much more than 0.55 A when stalled, particularly the PF XL motor (*http://www.philohome.com/motors/motorcomp.htm*). In other words, the LiPo electronics keeps you always on the safe side with respect to charging power drawn from the track. This is simply beautiful and makes life so much easier for multiple train operation! Since there are so many different kinds of bridge rectifiers just pick one that fits your needs. I prefer the SMD type circled in red on figure 5.

To make the charging cable, simply cut off the plastic base of the matching DC adaptor plug,



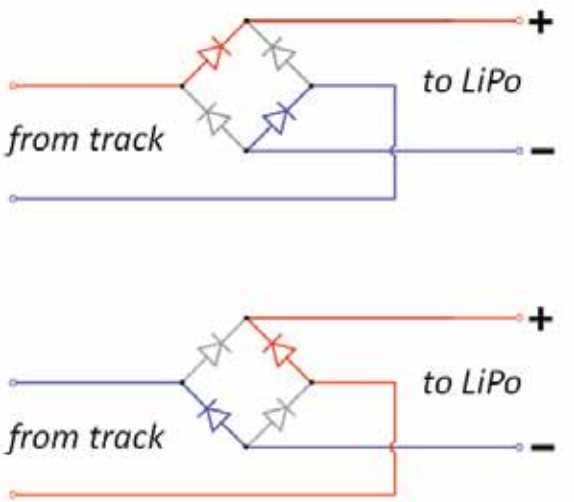


Figure 5: Left: Various types of bridge rectifiers; you could also use 4 discrete diodes shown on the right. I prefer the SMD type circled in red. The rated maximum current should be 1 A, just to be on the (very) safe side.

Right: Principle of operation of a bridge rectifier. Adapted from Wikipedia (http://en.wikipedia.org/wiki/Diode_bridge)

see figure 6. You can of course order the plug directly as separate piece; the size 3.5 mm x 1.35 mm (x mm length, not that important) works best. Then a scrap 9 V LEGO electrical wire is soldered to the plug. As next step I recommend incorporating the bridge rectifier into the charging cable. The "+" terminal is soldered to the center contact and the "–" terminal to the outer contact of the plug. Next, both "~" (or AC) terminals of the bridge rectifier are connected to a 1x2 electrical plate, polarity does not matter, see figure 6 for details. Note: For the "pick-up only" motor, see figure 4 bottom, you could also use 9 V wire with 2x2 electrical plate.

When you go with the "power pickup and motor" version (figure 4 top), then you need to make another wire for the connection of the PF receiver output to the motor "in" terminal. You can either use a standard LEGO 9 V wire, as shown in figure 7, or directly use a cable with a PF terminal (e.g. a #8886 PF extension wire). I recommend using the 9 V wire though since it is far more flexible than the PF wire and as a result, the train motor pivots much easier.

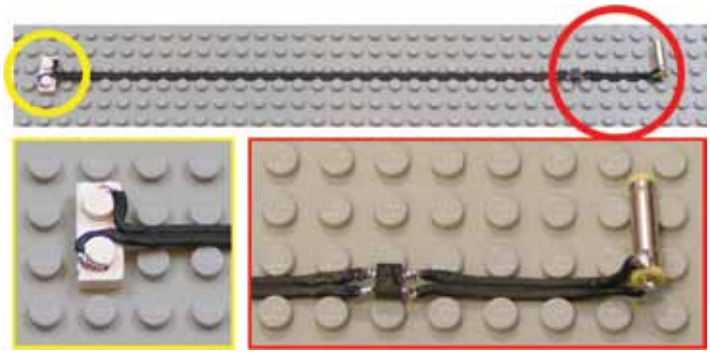


Figure 6: Photographs of the LiPo charging cable. Top: Complete assembly. Bottom: Close-ups of the soldered parts. Left: 1x2 terminal for the "power pickup and motor" version (see figure 4, top). Right: Bridge rectifier and DC plug.

Figure 7: Photographs of the modified 9 V train "motor-in" cable.

c) Connect the LiPo to a PF receiver and the charging line.

With the two custom cables and the modified motors we can assemble a "best of both worlds" PF/9 V train. Figure 8 shows the principle of operation.

Only two combinations are shown in figure 8, others work as well: You may combine modified 9 V train motors and RC motors as you wish, figure 9 shows one example. Since the LiPo/PF receiver combination easily handles two of these on one output, the second channel is always free for other stuff.

4) Performance measurements

I used such a set-up to build a rather compact 2-motors-PF-receiver-controlled "test bed" shown in figure 9 to assess the performance of the LiPo in a mixed PF/9V environment.

The train was running on a fairly large stretch of 9 V track. It pulled a total of 10 cars, as shown in figure 10. The layout featured two reversing loops, each electrically insulated with one piece of curved RC plastic track and some non-powered sections between the points of a 4-switch point cross over. Passing the reversing loops lead necessarily to a polarity change of the voltage picked up by the modified motor. The 9 V rails were powered at several points with train connection wires (#10067) to prevent voltage drops along long stretches of track. As far as I am concerned, this represents a fairly tough test track.

Experiment 1: No power on the tracks. The LiPo battery was fully charged. The PF output power level was set to "3" on both PF receiver output channels. The train started readily and pulled the cars steadily through serious curves and some sections of straight track[3]. The brightness of the LED lights never changed. I measured the time required for one round repeatedly. Well, it was boring. After 2 hours I thought I was done, since the train stopped. I soon figured out that this was just the internal LiPo timer, which turns the electronics off after pretty much exactly 120 min when there is no DC charging voltage present … after 4 hours, the round time increased significantly and soon after that the LiPo was entirely flat. 4 hours runtime, wow! I have to admit, was deeply impressed.

3 The layout is built into my office under the roof of our house; it goes "through" book shelves and underneath my desk. As illustration, see the end of this video taken with a camera mounted on a train: (*http://www.youtube.com/watch?v=wTP6WtcnQbg*)

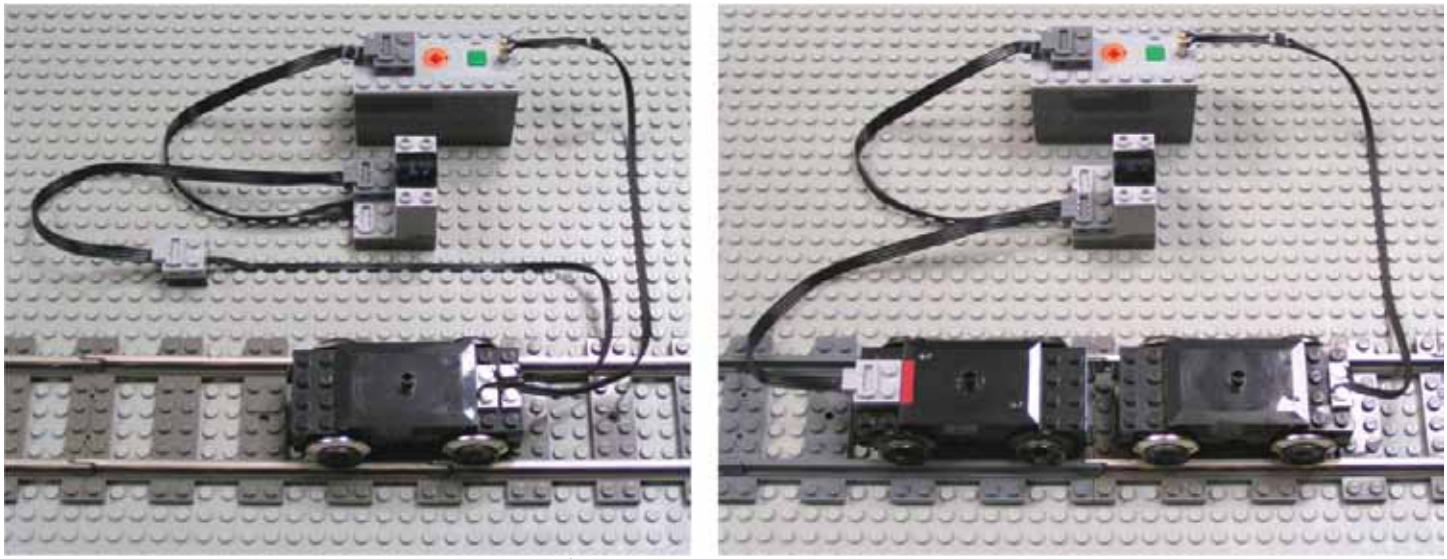


Figure 8: Principle of operation of combined PF/9 V trains. These are just two examples. Other combinations work as well. Left: "Power pickup only" version + RC motor. Right: "Power pickup and motor" version.

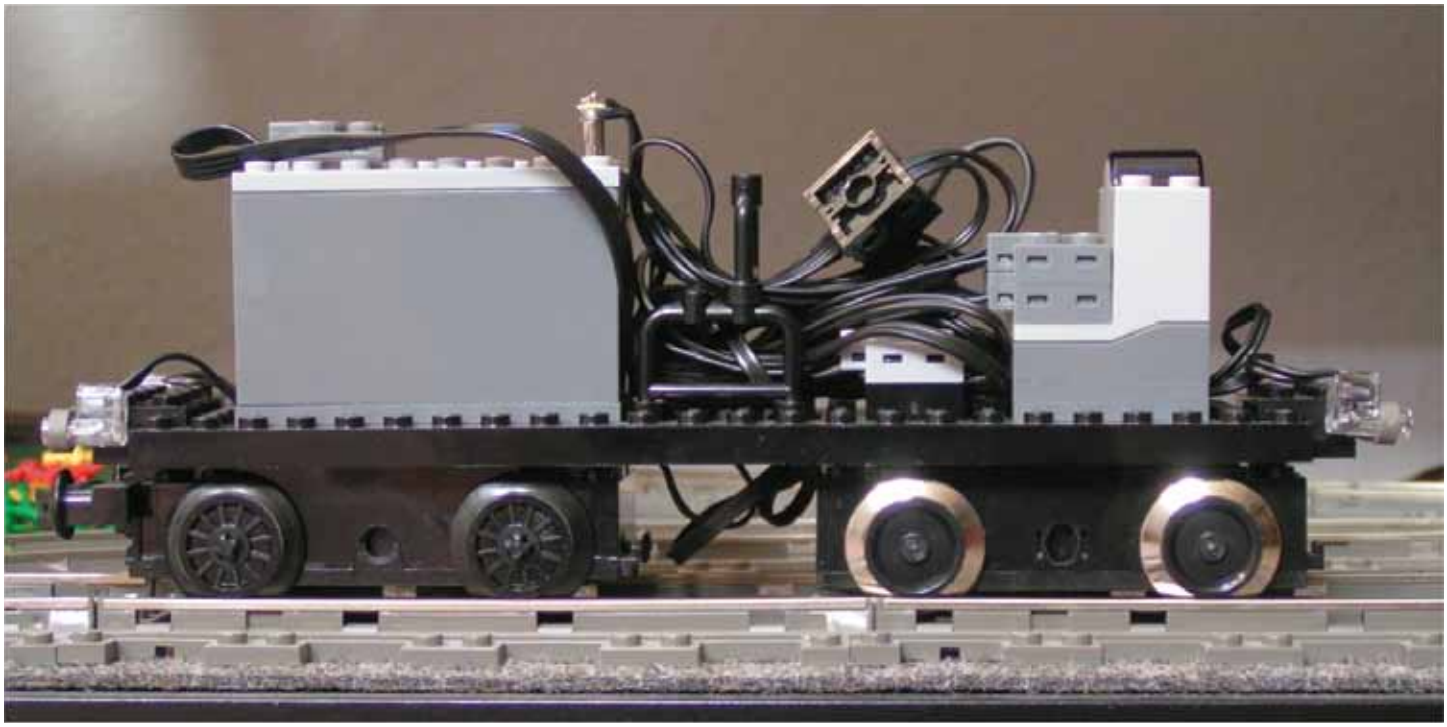


Figure 9: Compact PF/9 V "test bed" used for LiPo performance assessment. A modified 9 V train motor (power pickup and motor version, right) and an RC train motor are connected to output A of the PF receiver. Front and back LED lights are connected to output B. The receiver easily handles two train motors on one output.

Experiment 2: The LiPo was completely flat from experiment 1. Upon turning on the 12 DC track power, the LiPo readily started flashing the "charging LED". After a couple of seconds, I turned the LiPo on and the train was started at power level "3" on both channels. Again, it ran smoothly and hauled the cargo for hours, and hours, and hours. Round time decreased over time, possibly indicating that the LiPo was net-charging and delivered power in a very controlled fashion to the motors. After 7 hours I had it. No interruption at all, the LiPo stays "on" forever when connected to DC. Each round, the charging voltage polarity changed twice when crossing the reversing loops – no effect. I even figured out that one curved segment under my desk did not have a proper power connection – here the charging LED stopped flashing. This means that such a test-bed set-up can very efficiently be used for sniffing power problems on a 9 V track layout. This approach appears to be much more reliable than using a volt meter since

Figure 10: "Train" used for the LiPo RF/9 V performance measurements.

the charging LiPo and the running motors represent a considerable local load and any voltage drop becomes much more pronounced. Just drive around and watch the charging LED. If it stops flashing, you have a non- or poorly powered track. I was even more impressed with the LiPo performance.

Experiment 3: After 7 hours of continuous operation, I simply pulled the DC plug. The train showed no sign of fatigue at all, it just kept going. After 2 more hours the LiPo automatically turned off again … and so on, and so on. After three hours, round time was going up again, and soon enough, the LiPo was flat. After 10 hours of train operation and serious family issues, I called it a day. Figure 11 summarizes the results.

Experiment 4: So what about some heavier load? Figure 12 shows the set-up. The first engine is a GP40_RCX, as shown on the RailBricks website (building instruction, diesels) with one modified 9V train motor (power pickup and motor version). It features an on-board RCX, but that one was entirely disconnected. The weight of the engine is considerable since the RCX carries 6 AA type batteries. The second engine is a GP38, equipped with another modified 9V train motor (power pickup and motor version); here only the "motor-in" connection is used. The PF "test bed" carrying the LiPo battery and the PF receiver was coupled between both engines. The

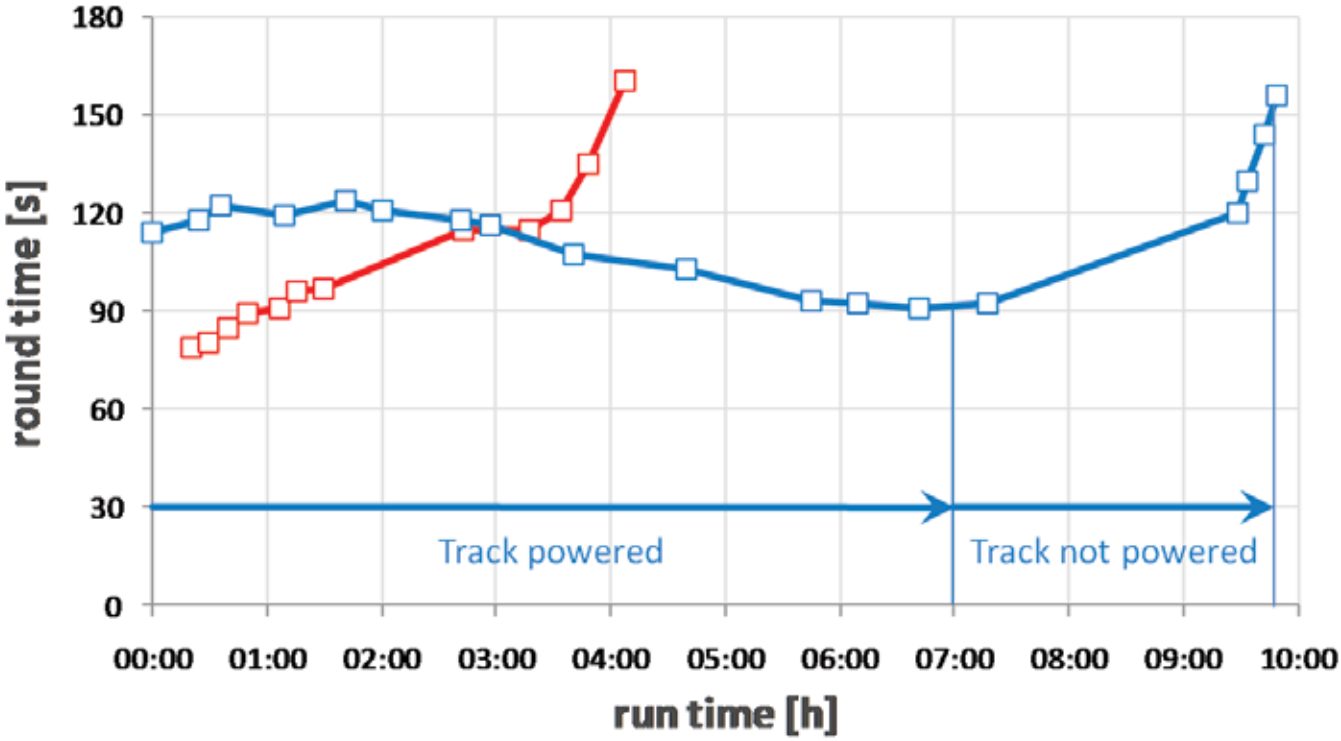


Figure 11: Round time measurements using the test set-up shown in figures 9 and 10.

Red curve: Fully charged LiPo battery, start at t = 0, no charging voltage present. After about 3 ½ hours, the round time increases significantly, shortly after 4 h the LiPo was flat.

Blue curve: Flat LiPo at t = 0. Charging voltage 12 V DC. After 7 hours, charging power was removed.

PF receiver operated both 9V motors from one output and the GP40 head light from the other. The modified motor of the GP40 delivered the 12 V DC charging track voltage to the LiPo. The two trains hauled a total of 18 rail cars: all of the 10 in the previous experiments and 6 TTX type cars plus two 2-axle cars - the total length of the train was limited to my track layout – particularly due to the limited length of the reversing loops.

Again I used the flat charging LiPo as power source and again the train started smoothly, without any sign of fatigue. After a couple of hours the LiPo seemed to be net-charging again, as judged form the decreasing round time. Again, I pulled the plug and again it kept going …. There is only one thing I can say: Wow.

5) Summary

1) The 7.4 V/1.1 A LEGO PF Lithium polymer rechargeable battery can be charged with a broad range of DC input voltages ranging from 9 V to 18 V. 10 V or above is recommended, since the full charging current is minimizing charging time. 12 V seem to represent the best price-performance ratio, as judged from the availability of cheap "wall wart" type power supplies. For large train layouts, new or used computer power supplies are perfectly well suited; they deliver easily well above 10 A on the 12 V line. 12 V car lead batteries would also work well for many, many hours at high currents. There are many more options.

2) The maximum LiPo charging current was calculated to be around 750 mA based on information from the LEGO service department and the web (1 ½ hours charging time, 1.1 Ah capacity). The present measurements suggest a maximum charging current of 550 mA, even with stalled XL motors either directly on the LiPo or PF receiver output, respectively.

3) The LiPo works well as uninterruptible power supply; the output characteristics remain pretty much constant, regardless of charging voltage. The transition from DC to battery power is smooth and without any problems.

4) The LiPo is a PF element with nicely combines the best of both worlds, PF and 9 V. Modified 9 V train motors are required though ("power pickup only" or "power pickup and motor" versions):

- Due to the relatively stable output of the LiPo, train driving characteristics are virtually constant when going over powered 9 V or plastic track.

- More than one train can be operated on one stretch of powered 9 V track.

- Charging of the LiPo is automatically enabled on powered stretches of 9 V track; no access to the charging jack is necessary.

6) Outlook

Maybe you own one of the train engine "sheds" (#10027; it really is a fully blown train maintenance station), which came out in 2003 with four straight 9V rails in the box. Now you integrate the shed into an all-plastic PF super layout, somewhere in a "general maintenance" area. Power the shed 9 V rails with 12 V DC (or the like). Whenever your train suffers from low LiPo battery power, just direct it into the shed and wait. After 2 to 3 hours you are ready to go again, without touching the train at all. Your train design doesn't need to provide any access to the LiPo charging jack, which may give you even more construction flexibility.

How about the best of three worlds? The 12 V train system may also be incorporated into the PF world (I never had any 12 V train stuff, I am dreaming this up): 12 V is what the LiPo likes very much! So you just need to power up your 12 V track layout, install the beautiful 2x4 train power pickup block (#x552), use exactly the same pickup cable that we have made for the 9 V system (see figure 6), connect that to the 12 V pickup and the LiPo and you are all set. If you'd additionally install a 9 V modified motor, you can easily make a hybrid train that runs on 4.5 V, 9 V, and 12 V track! Depending on what stretch is powered, the LiPo would charge. On all non-powered stretches the battery function kicks in. Building across multiple themes – the entire LEGO train world united by Power Functions!

Even further down the road: PF uses 38 kHz modulated IR light for remote control operation. TLC appears to love 38 kHz IR light: The Manas use that, the RC trains use that, and some of the programmable bricks (PBricks) of the Mindstorms line Scout, Spybot, and RCX use that as well along with the Mindstorms remote, to name a few. In each case, the bit protocol is of course

different; otherwise chaos would result, e.g., during a Manas attack on the RC ICE train. But it would be cool to control the not-so-intelligent devices (Manas motor, PF receiver, etc.) from intelligent PBricks. In other words, PF receiver controlled operation of LEGO trains or other devices may not only be possible with the IR remotes (#8885 for bang-bang operation, e.g., switch points, or #8879 for power level controlled applications) but also with the LEGO NXT PBrick. I have played with the implementation of PBricks for 9 V train operation (see RailBricks Journal, issue 3, page 44). I also whined about the fact that the NXT is not designed along the "playing across multiple themes" philosophy. Well, I was wrong (not at that time though …): With the introduction of the HiTechnic IR Link sensor (#MS1046), quasi simultaneous PF, RC, and RCX/Scout communication (!) has potentially become possible. All we need to do is getting it to work.

Imagine this: You have a mixed RC/9 V/12 V layout. Maybe some loops are entirely 9 V, some are 12 V, and some other sections are all-plastic. There are RC trains, PF receiver controlled trains, and some exotic RCX or Scout controlled trains on the track layout. Even better, if you have free PF channels, switch points may be remotely controlled as well. The RC trains are running on battery only, the PF either on battery, LiPo, or LiPo + 9/12 V pickup power. All powered track is hooked up to a car lead battery or a 12 V … 18 V DC power supply. The NXT PBrick is equipped with the HiTechnic IR Link sensor. It talks via BlueTooth to your laptop computer. Here you have a control program running, which simply instructs the NXT to send: "Set RC train #3 to power level 5" and then "Set switch point #4 to straight". Should the NXT sensor not put out enough IR light intensity to reach distant layout regions: Use a relatively cheap IR extension available for TV/DVD remotes. Or two or three.

Wow, I need to go; this may be a dream coming true …

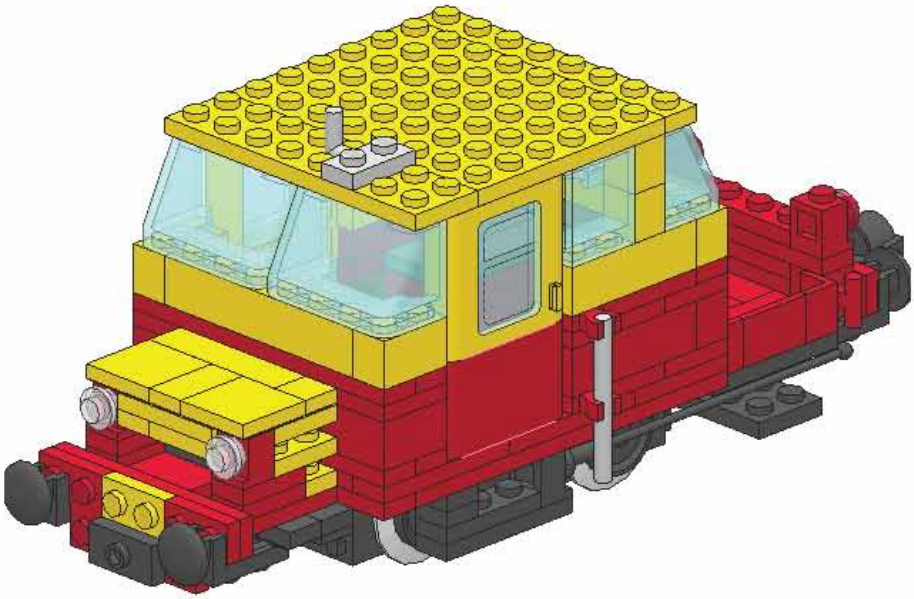
Thanks for reading and Play well!

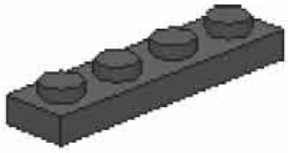
Figure 12: Heavier load test set-up. The PF test bed is coupled between both engines. It uses a "power pickup only" motor. The PF LiPo/receiver combination is powering everything, both 9V train motors (front truck of GP40, rear truck of GP38) and the GP40 head light.

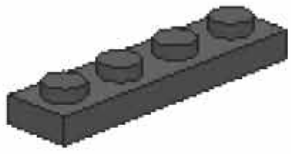
Draisine DU 65

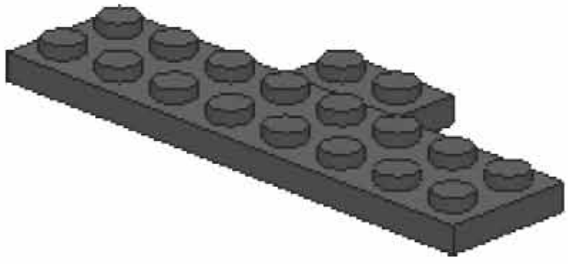
During the fall of 2008, some FreeLUG members were invited to exhibit a LEGO train layout in Estivareilles, France as part of a model railroading exhibition. Their day would not have been perfect, had they not taken a ride on the historic train driven by a light railcar : the Draisine DU 65.

Jérôme “JAC” Teissier has recreated one of this draisine with LEGO bricks and offers you the building instruction for it.









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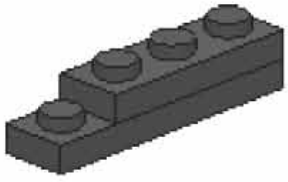

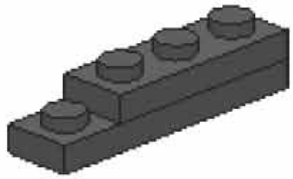

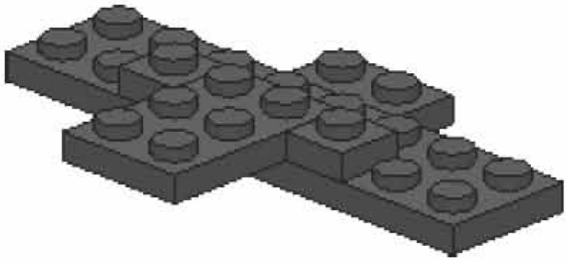

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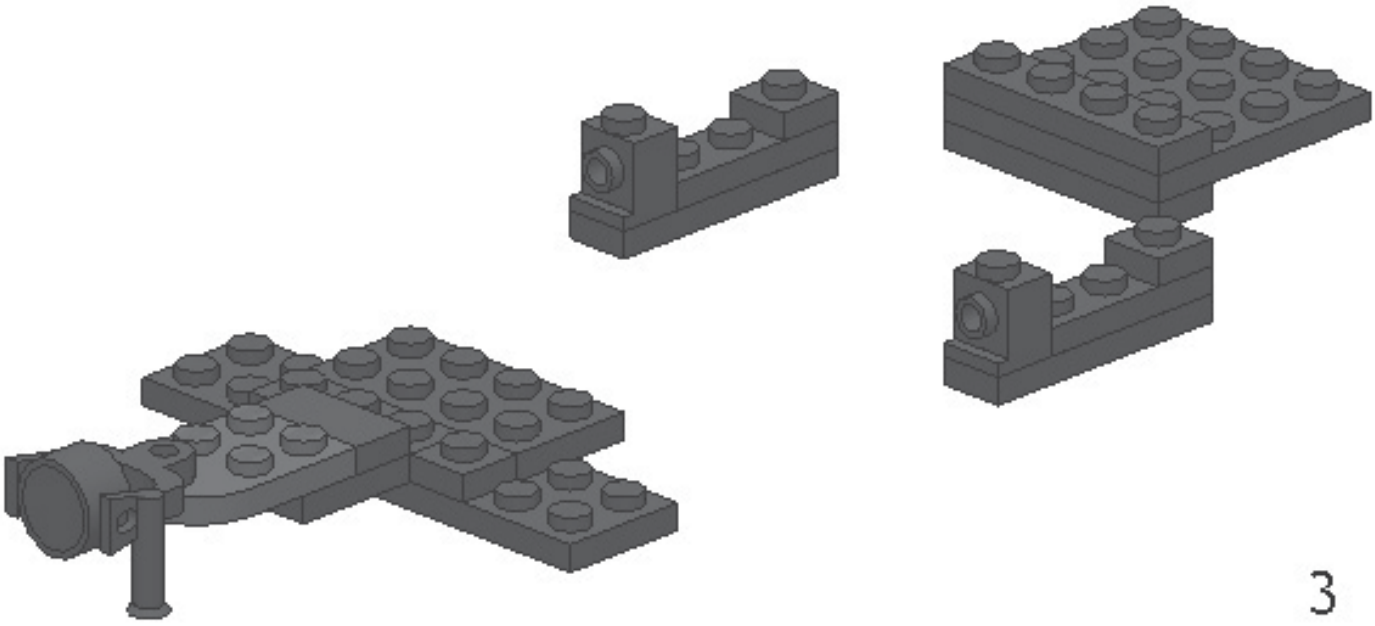

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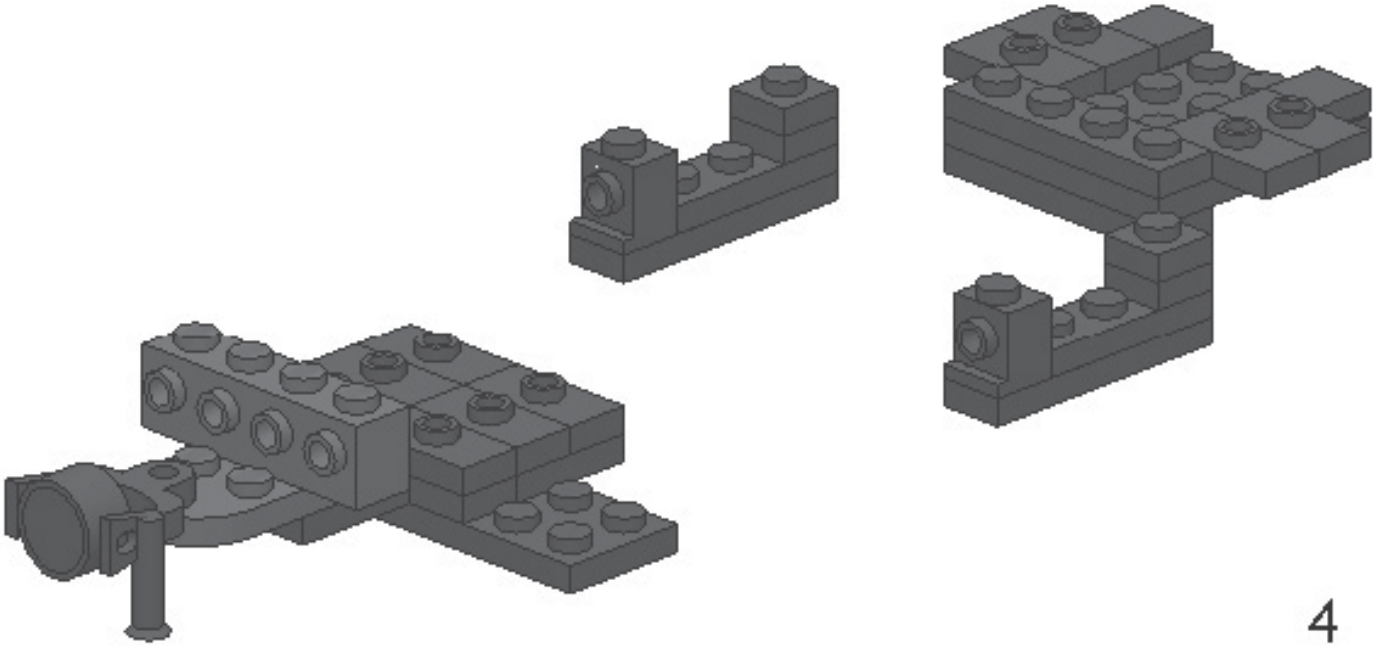

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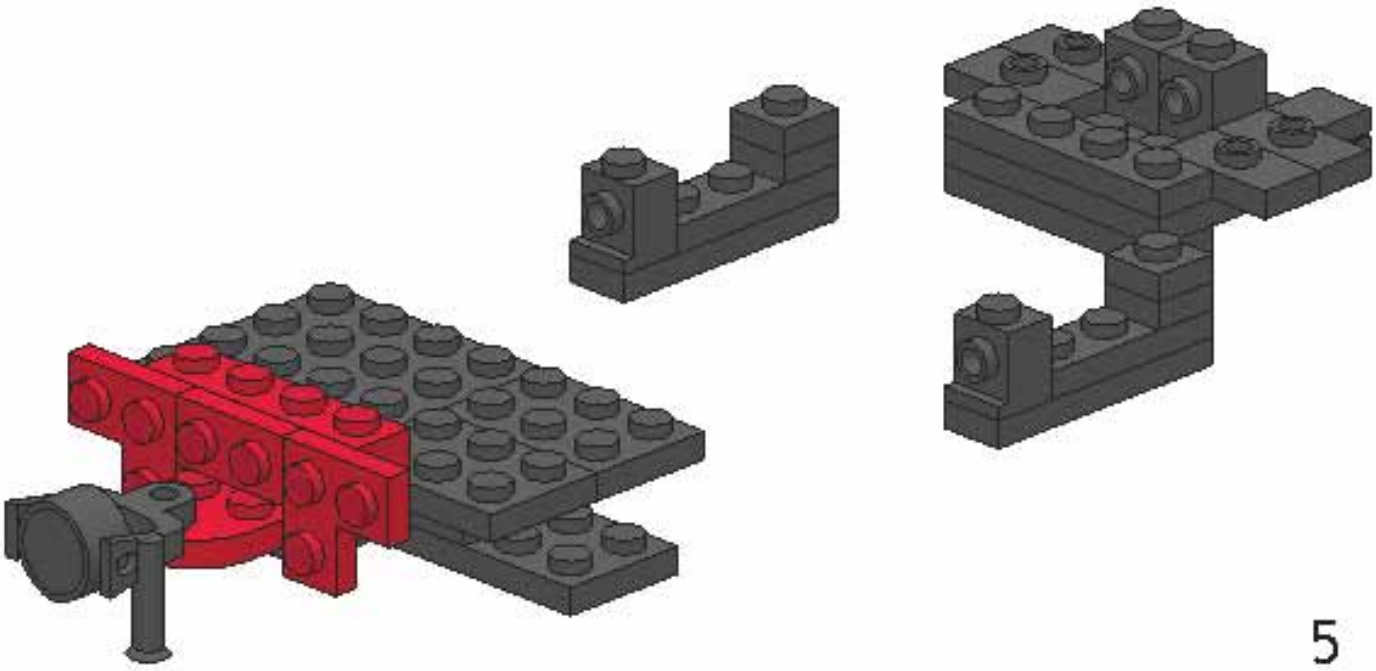

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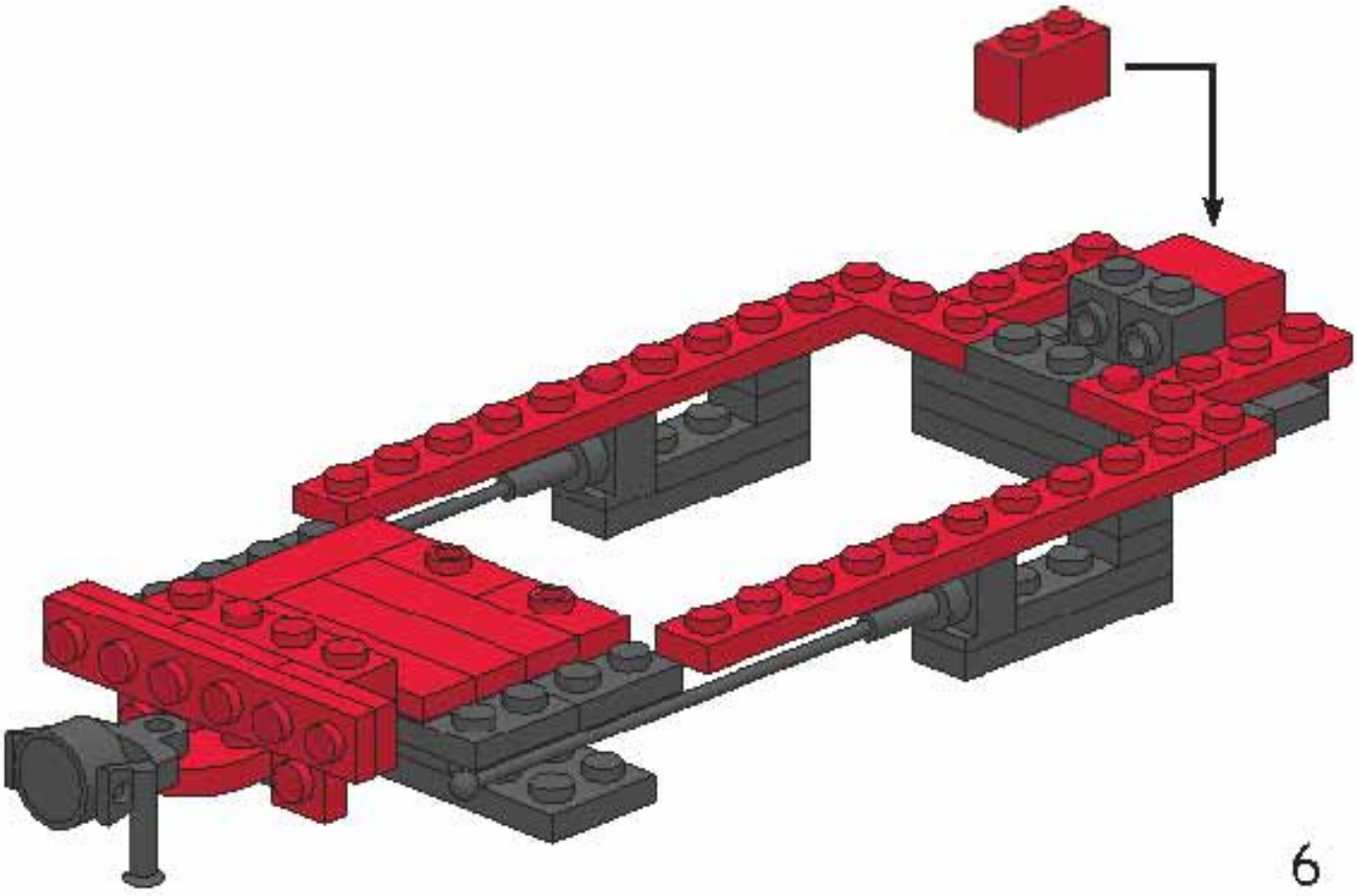

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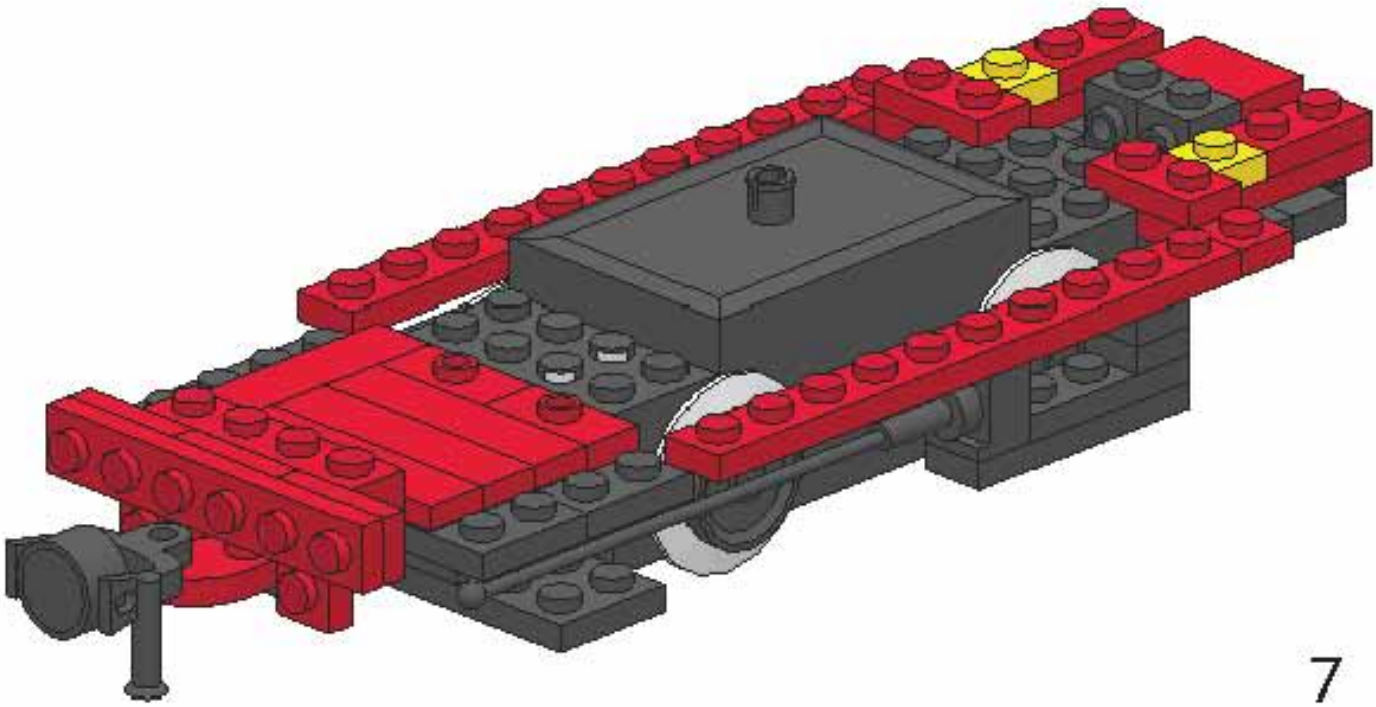

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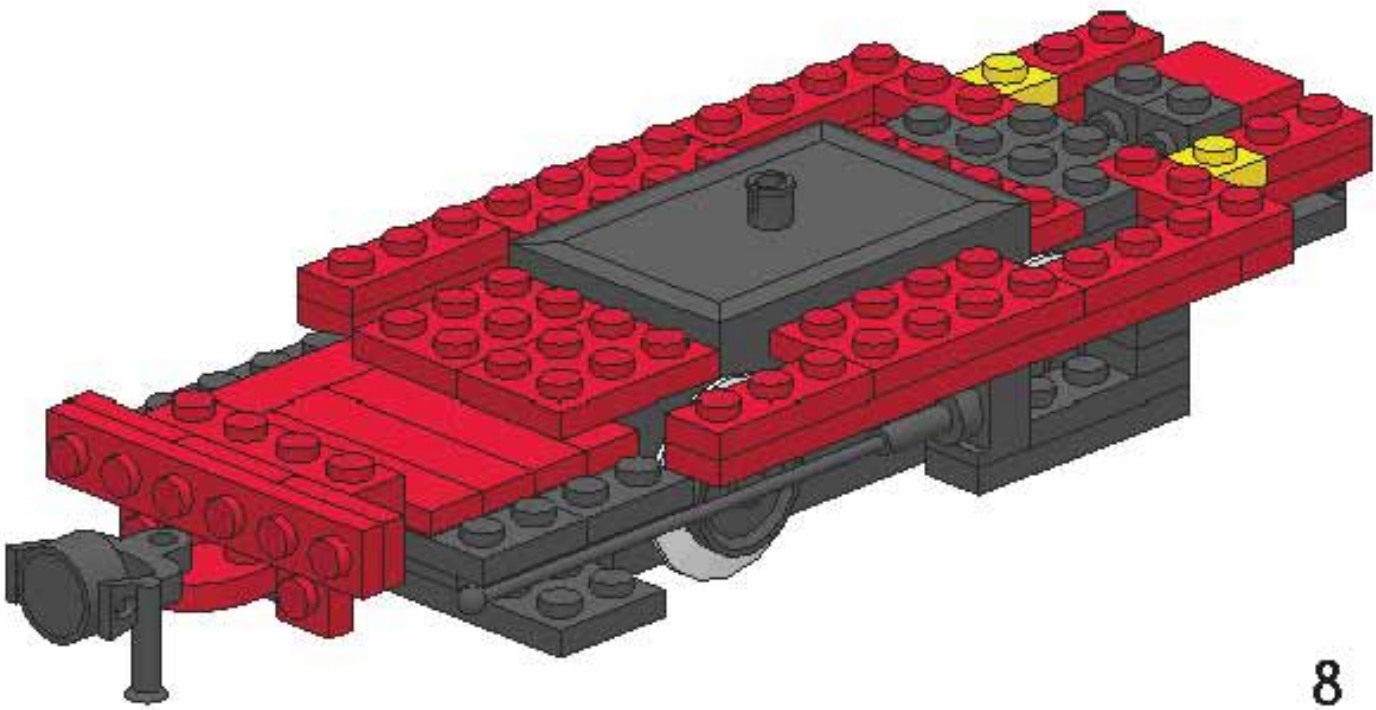

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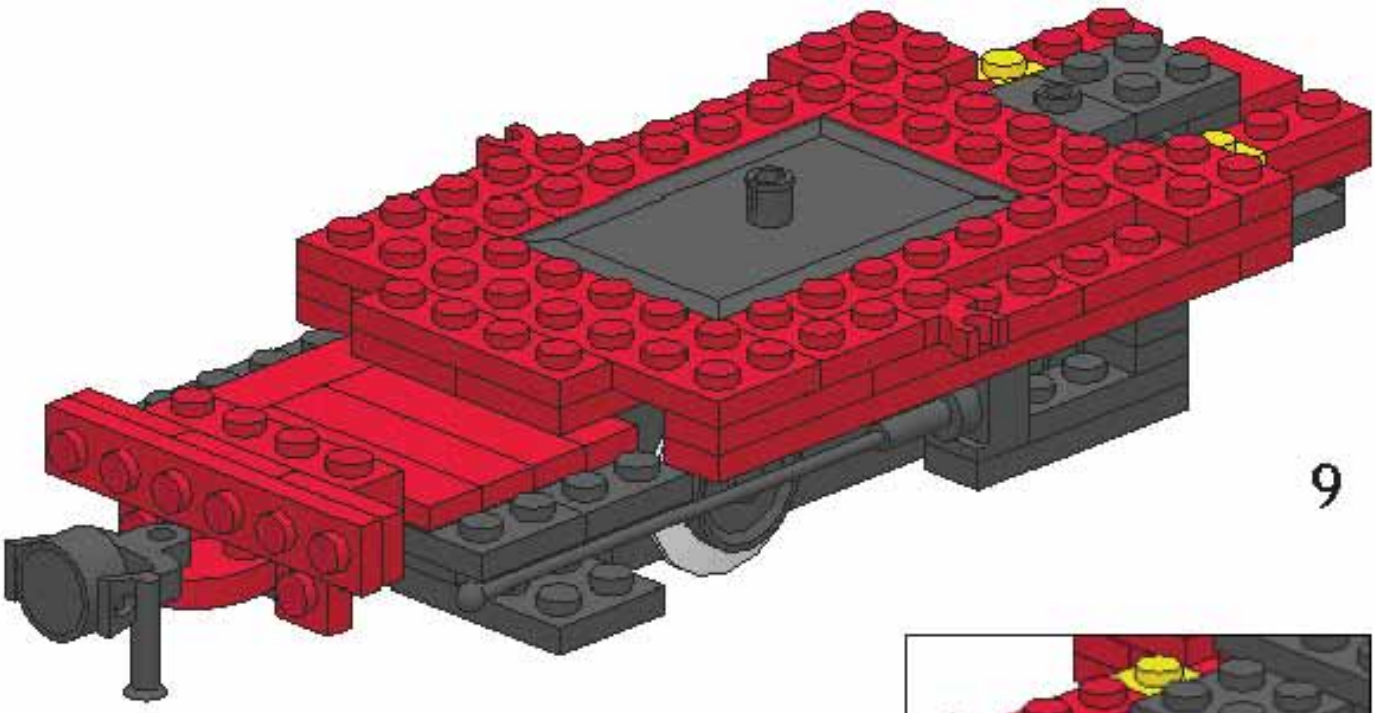

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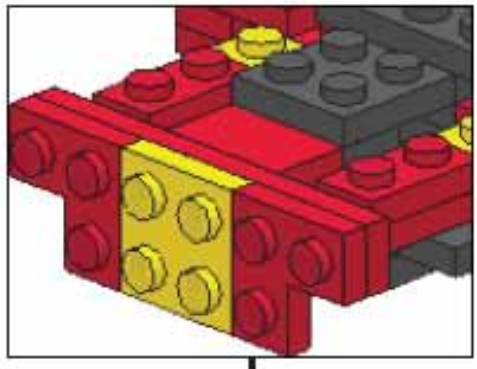

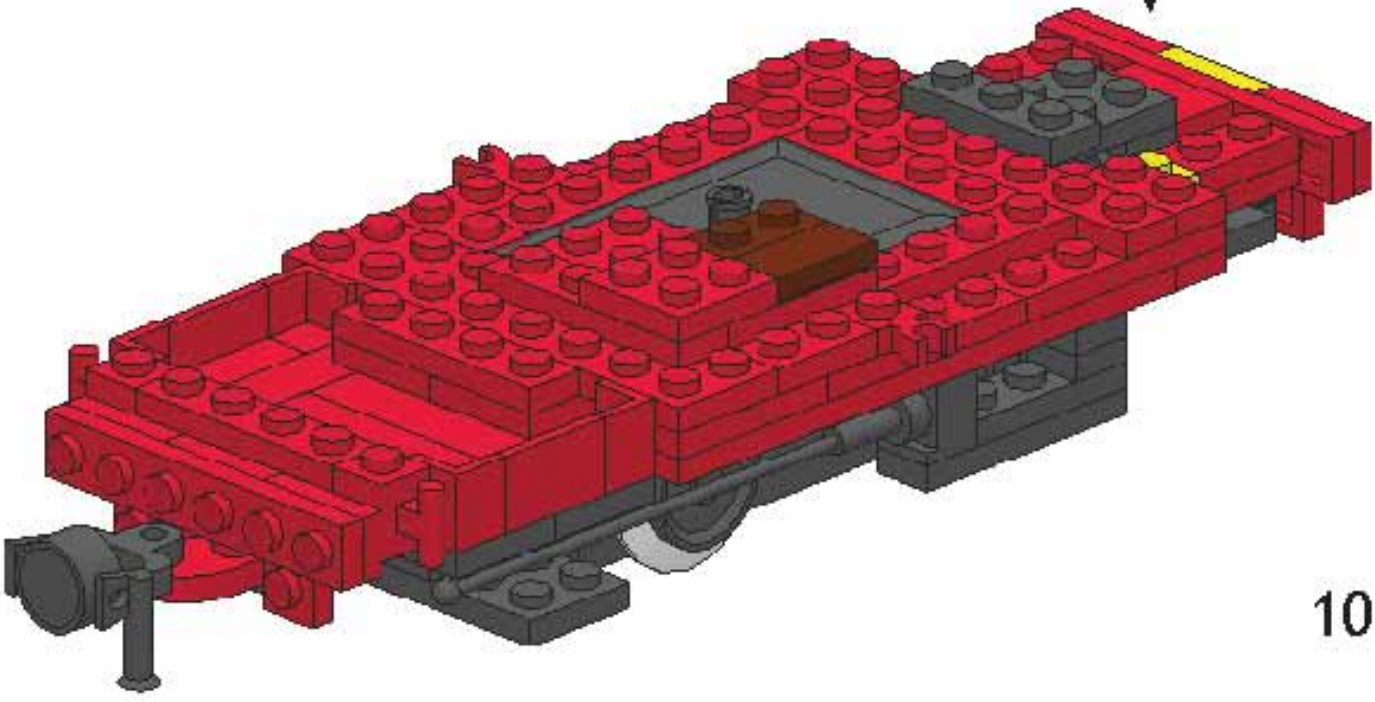

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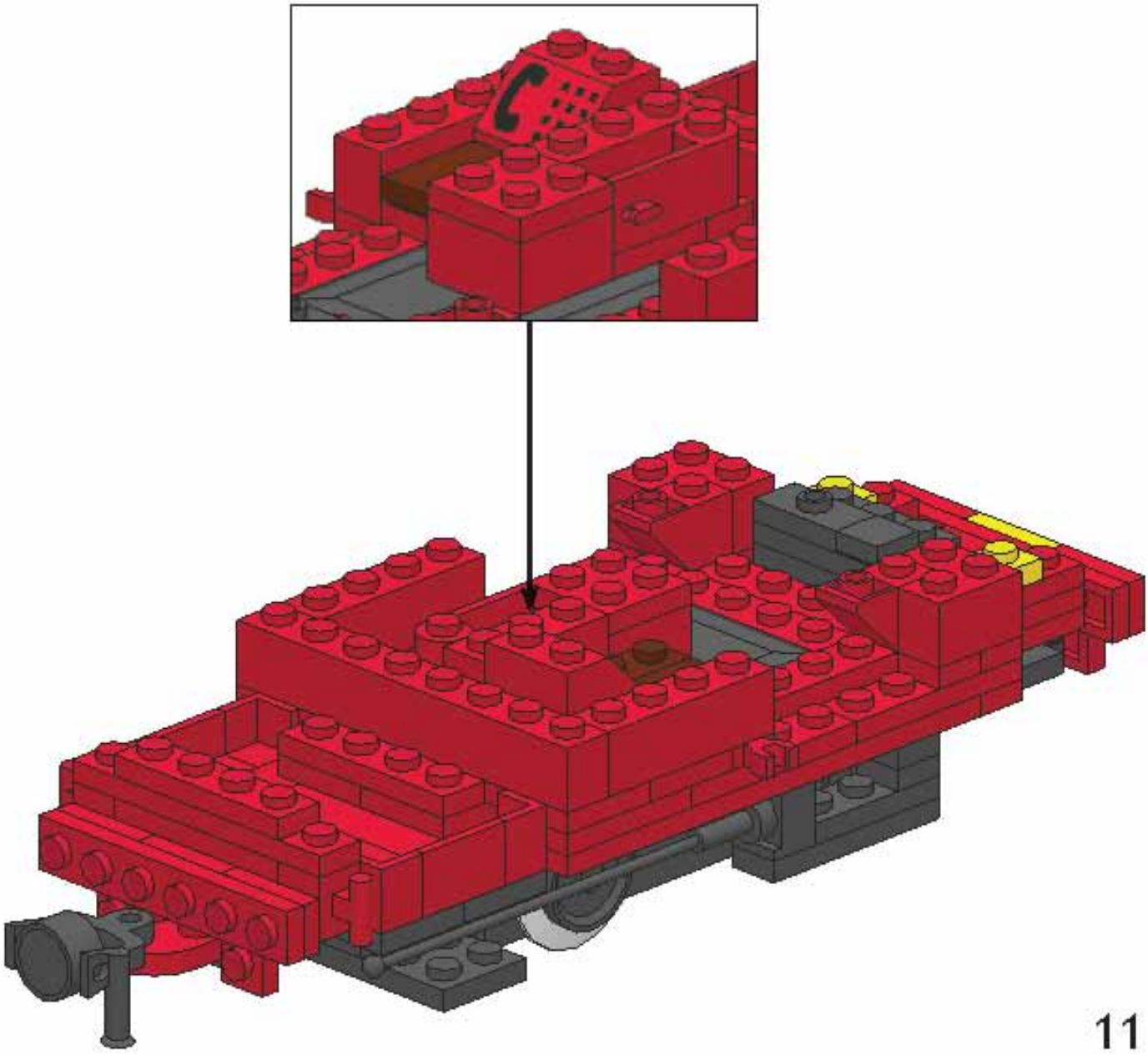

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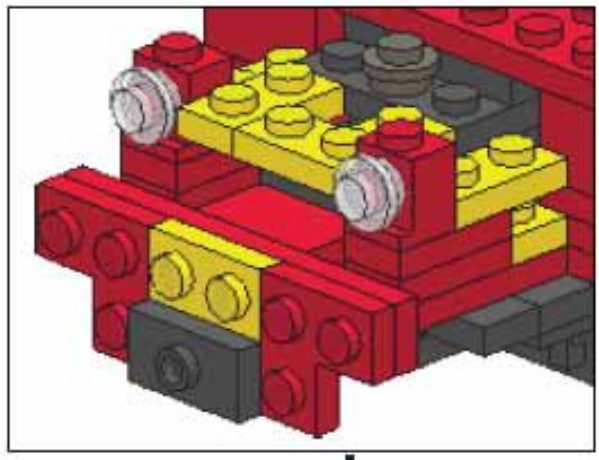

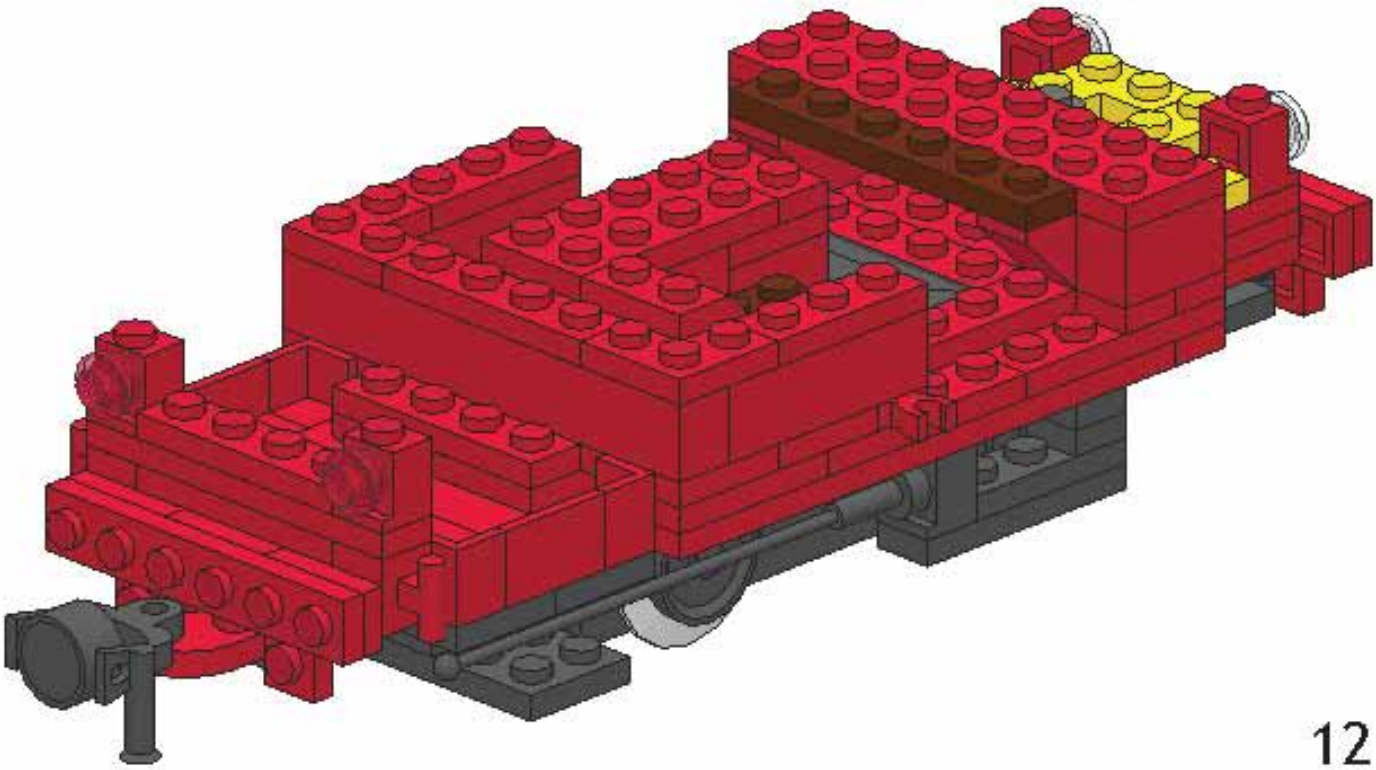

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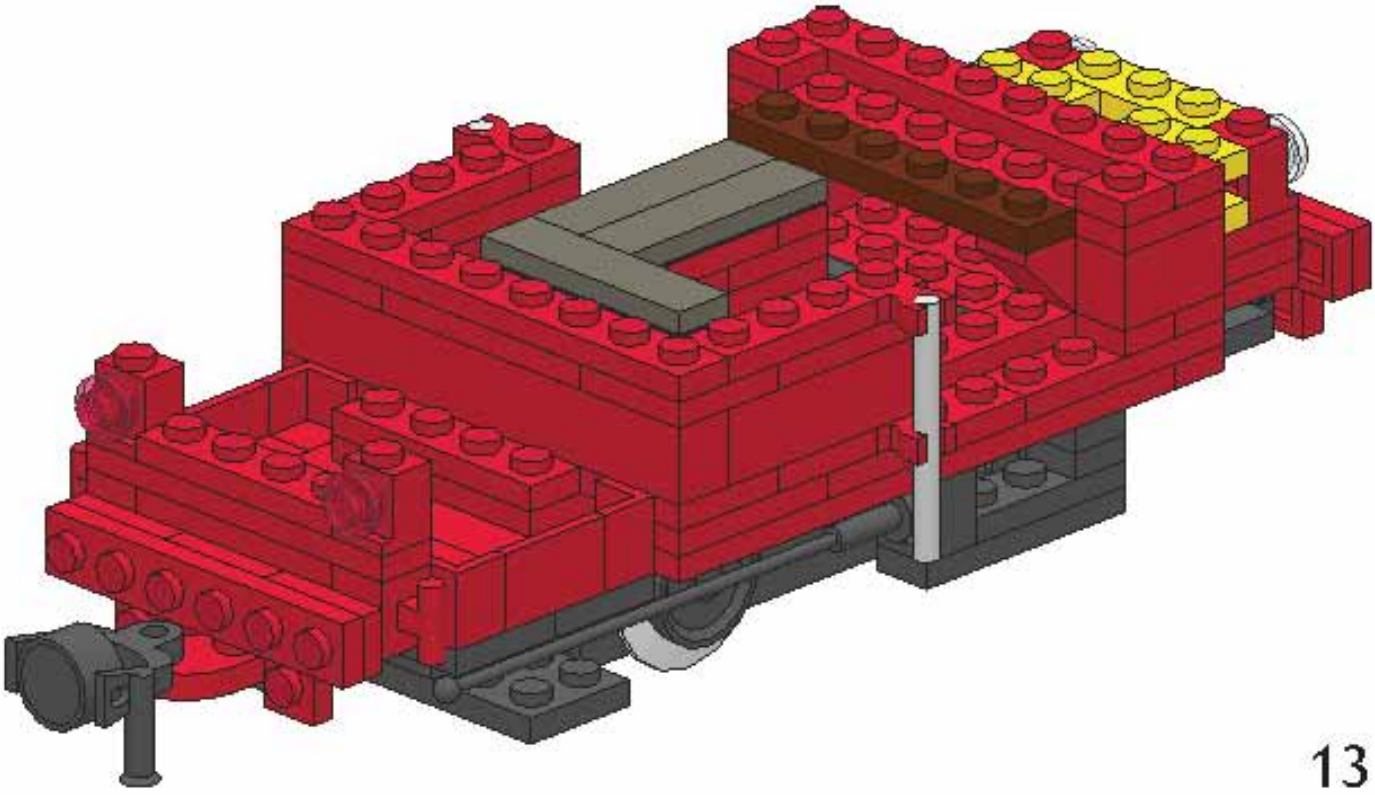

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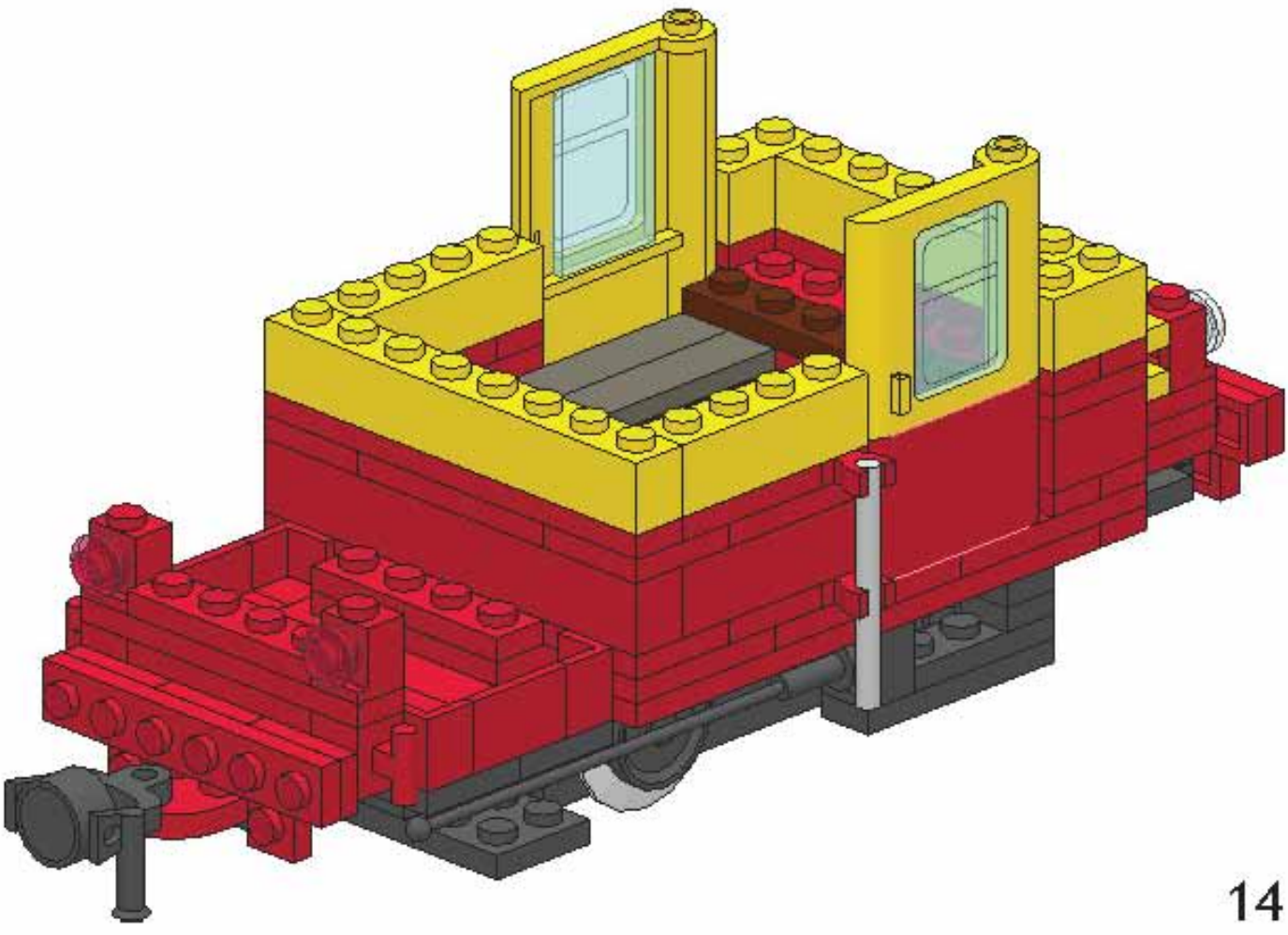

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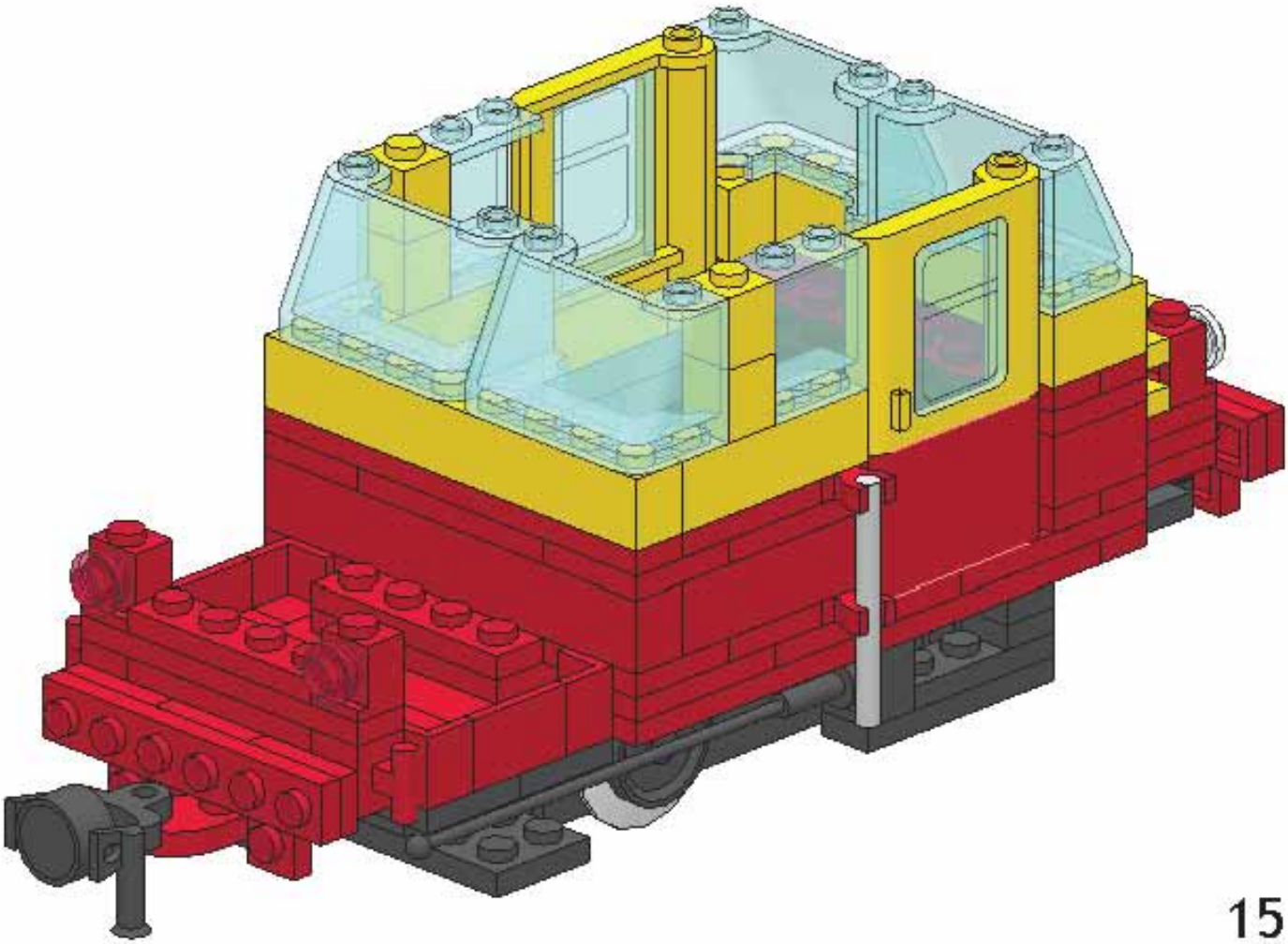

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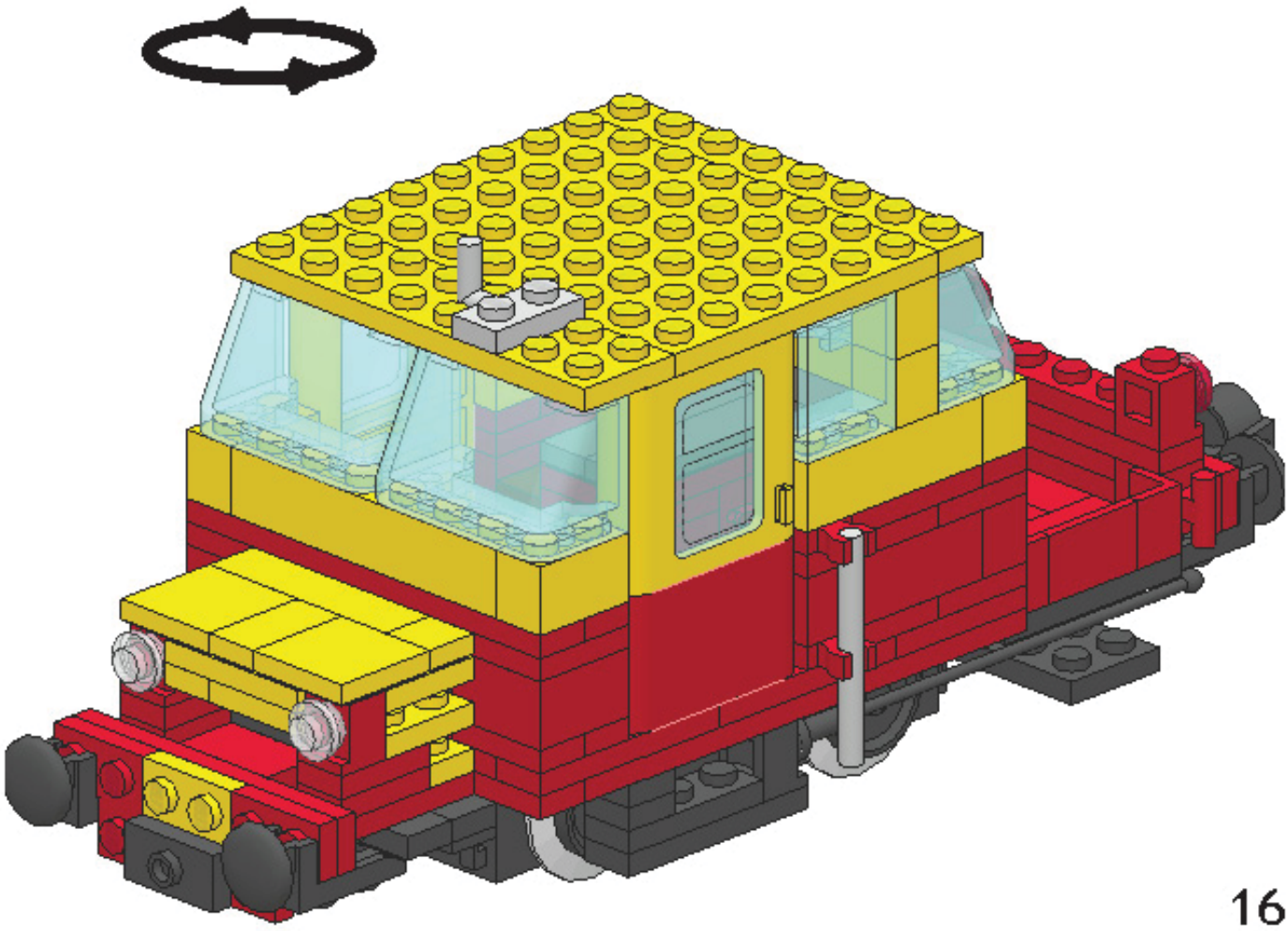

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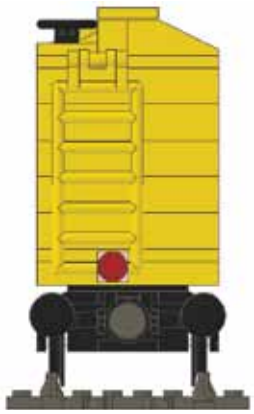


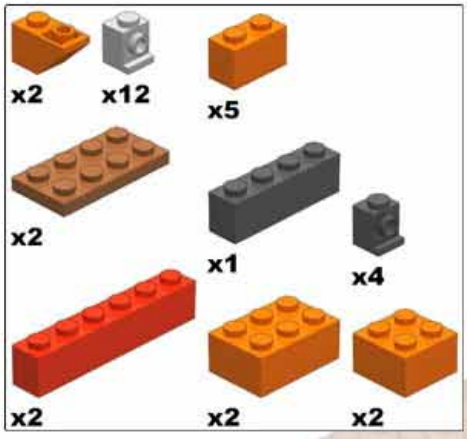
I hope you've enjoyed this issue of RAILBRICKS magazine. As one of our contributors wrote during the production, "RAILBRICKS is the top address for LEGO railroading material." As a new editor, a statement like that is both flattering and frightening. While the top is a high expectation for anyone, I sincerely agree with the statement, and I hope that what we've presented in the previous pages has exceeded the expectation.

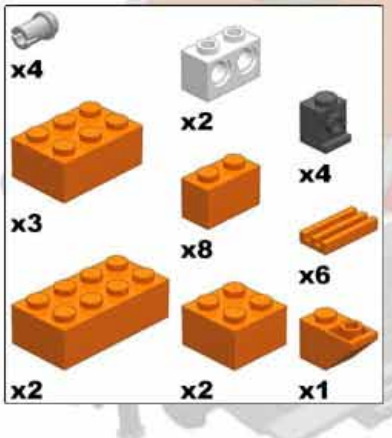
I'd like to thank the RAILBRICKS team and our article contributors for assembling a terrific body of material. Contributions are really what make this magazine great, and I'm continually amazed at the depth and breadth of the articles, instructions, and models that we see in this hobby. If you would like to submit an article for consideration for RAILBRICKS magazine, please do! We are always looking for new content, and the fans know best what fans want to see. Submitting an article is easy. Send it to us at *submissions@railbricks.com*, along with any photos.

Finally, I'd like to take a few words to thank the RAILBRICKS team, Jeramy Spurgeon especially, for putting their faith in me as our new editor. Most of the team has been working together since Issue 1, and I can only imagine what it takes for them to trust their project to the new guy. I'm happy that we have a great group to work with, and I look forward to working on many new issues in the future.

-Elroy

GET YOUR BUILD ON!





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