

Lister Rail-Truck

for 2' 3" Narrow Gauge

By Richard Maxted

Introduction

This is a "work in progress" to develop a series of 2'3" narrow gauge items & assets as a FREE resource for Railworks. The gauge was chosen to enable use of the already existing Railworks assets developed for the Tallylyn and Phorum Peninsular payware routes.

The Lister Rail & Auto Trucks

In the beginning there were steam locos - and as handsome as they were - they were also expensive to run, needed to be started long before work, and left steaming all day. They were often very heavy for the power they supplied. It was inevitable that internal combustion engines that could be started (relatively) easily and stopped when not needed would have many advantages. Like it's cousin, the Simplex, the Lister Rail Truck became one of the workhorse engines for lighter and smaller industries.

In 1925 the fabulously named Auto Mower Engineering Co Ltd of Bath demonstrated it's design of an Auto-Truck at an agricultural show. At the time the Lister factory was using horse drawn vehicles and looking for a solution to moving loads of up to a ton around its' works in confined spaces. Lister's factory tried the new Auto Truck, liked it and brought the patents, designs and rights to manufacture.



In 1926 Listers started making the Auto-Truck to a basic standard design of two trailer wheels and a single steerable and powered wheel. The aim being a design for under £100 that could be easy to alter to suit the customers needs. In fact there have been more than 3,000 different versions made. However, very quickly, the demand came for the same basic design to be fitted to a narrow gauge chassis and the first recorded sale of the Lister Rail-Truck is in 1928. By 1938 more than 10,000 Auto and Rail-Trucks had been sold and this continued for the next 50 years or so.

The initial engines were provided by J A Prestwich & Company who also produced fine motorcycle and aircraft engines. Two petrol engines were offered, a 600cc single cylinder and a now rare 750cc V twin engine version. The JAP engines were largely phased out by the

1955 as Lister's started to fit their own air cooled diesel engines. Lister's themselves also made petrol engines for agricultural pumps but these were never fitted to Rail-Trucks.

Power was not a strong point of the Listers. The engine had 2 gears in forward and reverse to harness the mighty 6HP developed. On the level this 1.5 ton loco had 24 tons of tractive effort. In first gear it could reach 2.5mph and 5mph in second. There are more performance statistics in the Finer Technical Points section.

Whilst customers could order made to measure - the "off the peg" designs fell into two broad categories. The Classic design seems to have been introduced some time in the 1930's and includes the unique Sanding Controls at the back of the loco and the side weights inlaid with Listers name. The earlier design did not include these features and it would seem that this became the "Light" version available all through the production period. In addition to the basic designs a number of options could be selected from bigger front and rear weights, alternative couplings, the most common being the slightly Heath-Robinson canopy with it's cloth sides.

Version Control

As mistakes are rectified I will issue a new version of each series. Each release will contain all the stock previously released so that you will only need to keep a copy of the latest release in each Series.

Version	Description	Date
1 & 1.1	Original release of BASE models (Classic & Light) with single cylinder JAP engines. 1.1 is a fix to include missing sound file.	November 2011
1	Canopy versions of Classic and Light Jap Engine Series 1 V2 released as a separate pack	July 2012
2	File redundancy reduced, new sounds added	July 2012
3	Combined Canopied and Open versions. Updated sound and physics	August 2015

Conditions & Licence – PLEASE READ THIS

For freeware that you develop for yourself or for release as freeware on any website or system, you have an absolute and total right of ownership. This package contains only assets made by me – it does not need any other downloads. It does use unmodified generic Railworks wagon sounds and a driver. You may use it, clone it, modify it, rebadge and rebrand it.

It may not be used where payment is sought or other commercial activities. I reserve absolutely the right to determine what is commercial. Charityware is commercial but is likely to be granted access.

If you release this stock modified then please do keep in mind that others will be using it in an original form. Please don't use the exactly the same names as mine in a public release just add your own. This is only to stop other folks having difficulties.

Lister Rail Truck - Classic



This is the DEFAULT loco that is absolutely essential as all other series require some bits of this loco's files.

It is modelled using scale drawings but resized to a 2' 3" gauge - the drawing was for a 2' gauge.

The Classic is newly painted in British Lawn Mower Green and is shiny ! The front of the loco has Lister's famous Auto-Truck panel with the cut out Lister logo and air holes modelled. There is also the side weight with Lister's name that was bolted on to add traction.

The Rail-Trucks were bolted together and it is part of the charm that they look so. I therefore decided to model as many of the bolts as possible rather than use textures. As a result the loco actually has

ended up being constructed in almost the identical way to the real thing. I am fairly sure there are no missing cross bars or braces as the whole structure is visible.

Access to the engine on the Classic models was by raising the bonnet lid (you will see the swan necked clips) and by dropping the side panels out onto their supporting clips - also modelled.

The engine itself powers a gear box by means of a chain - the wheels of which are animated. Selecting one of the two gears drives chains that turn the front and back axles. You can see the drive cogs. Unfortunately I have not yet worked out a way of animating the chains themselves so the only cogs turn to give the impression. Power was controlled by an accelerator pedal on the right and the gears engaged by the left hand clutch pedal.

The Rail-Truck has a top speed of 2½ mph in first gear and 5mph in second. It has a 1 gallon petrol tank and an equally sized oil tank - JAP engines were very oil thirsty.

All the locos are equipped with a driver (see Finer Technical Points for more info)



The canopy supplied by Listers was pretty primitive. I have modelled it without the cloth sides as these looked like lumps of wood when I tried. These canopied versions are separate locos called _ROOF.

Lister Rail Truck - Light



The "Light" version of the Rail - Truck is my own designation - in practice Lister's made no distinction. Looking at various pictures it is, however, clear that the earlier versions and many later locos lacked both the sanders and the side weights. I suspect this was to allow them to work on lighter rails.

So the light version is a "works" loco that has been outside in all weathers. It is still kept presentable but the paintwork has faded and rust is starting to appear on the bodywork as well as the chassis

As benefits a working loco the side panels have been either lost or got rid of as too much hassle.

The lack of sides gives a clear view of the JAP engine and also the two animated cooling fans that are powered by a fan belt running from the engine. Also visible is the single spark plug and the sheer simplicity of the engine design. There are no missing components in this model - it really was as rudimentary as this.

The sound that I have used is not from a Rail-Truck but is a JAP single cylinder engine fitted to a tractor - I think it is fairly close having listened to some YouTube clips.

The loco has the same performance as the Classic version.



Installing the Rail Trucks

Should be simplicity itself as I hope I have added an RWP file that works. Don't forget that if you have a good .zip file manager like 7-Zip you can actually open an RWP like any other file anyway. You will then need to go into your route editor and enable them using the infamous blue cube. My assets will always be under richardmaxted. All my Narrow gauge assets will be in the NarrowGauge tick box under this.

Driving the Lister Rail Trucks

The Rail Trucks will be found under the Loco symbol in the normal fly-out (as Lister...). They are all capable of connecting to each other and to other locos. The view from the locos is only from the driver's seat. However, to enable you to swap locos in a Free Roam activity it is necessary to include a head-out view. So I have included a view where you lean forward or back (to get a clearer view).

Starting and stopping

As always you will hear the engine start when you select the loco. There is no start button on the loco but I intend to do a bit of remodelling at some point and use the petrol tap as a start button. On the F4 HUD display you can switch the engine off and on and hear the appropriate noise. You will see the drive chain rotating with the engine - I can't as yet work out how to stop it when the engine is off - sorry.

There is no exhaust smoke - the JAP engines if reasonably well maintained do not smoke - I may make a well worn loco with oil burn.

Acceleration and Gears



On all the models there are four controls - only two of which are animated in the cab.

The loco can go either forwards or backwards in 2 gears. There is no way I can see to combine the animation for this and the gear selection using the gear lever or E on the keyboard. I have set the reverser controls to either forwards or backwards fully, there is no middle position, by using the standard controls only.

Select neutral in the gear box. This is the position closest to you and furthest from the engine (fully back). First gear is in the middle and second if fully forward to the engine. You will hear yourself grinding the gears as you move the gear stick. The clutch does not work and so you do not need to power down to make the gear change.

However poor gear selection will punish you. I have managed to get the correct speeds and power / tractive effort in each gear. This means that you simply won't pull a big load from standing in second and you may find yourself loosing speed rapidly going up hill. First gear also gives you really fine control for shunting.

Similarly the accelerator pedal is not animated as my attempt required you to push it and pull it which looked plain silly. However you will hear the engine rev up as you change the accelerator even if you are standing. As the loco's speed increases you will hear the grinding from the rails get louder. There is no speedo or rev counter on a Lister !

Brakes



The handbrake needs an oil. It should probably turn round and round several times, but I am having trouble animating that, so it turns $\frac{3}{4}$ to a full turn for full application. It isn't a great brake - it is powerful enough to hold the loco and some empty trucks on a slope but will fade with a load. I am not sure if this is correct but it makes driving fun.

The brake is modelled as a handbrake and uses the [and] to operate. It works as an "air brake type" so that you can release the brakes on other stock because light narrow gauge stock behaves very badly if left unbraked due to the physics model. However, I have managed to replicate a manual brake that you wind all the way to engage and release the brakes. If you find the brakes sticking then just wind them back on a fraction before releasing them.

Sanding



This is sheer indulgence as I have yet to need sand - but these are such iconic levers on the Listers that they had to have an animation.

Pull towards you to sand and listen to the grinding of a bent valve somewhere.

Bell / Horn

In Version 3 I have added a bell (B key) that sounds like one of those old fashioned school bells that teacher's swung to end play-time etc. Just the sort of thing to be carried on the loco.

Coupling



The coupling for Lister Rail - Trucks reflected the rest of the loco. In the early days it was a simple bent metal bar but most pictures from the 1930's onwards show a similar design of coupling which acts as both buffer and receiver for a chain.

I have used the same chain coupling as my Eezi-Tip skip wagons. The coupling chain is only shown when the wagons are hooked together. Because the chain is short, to keep the wagons linked closely I have had some problems linking them together which I hope has been solved.

Finer Technical Points

Where to find the files

All of my future and current 2'3" narrow gauge assets will be located in subdirectories of:

Assets/richardmaxted/NarrowGauge

So far as the Lister Rail Trucks are concerned the relevant directories under this are:

RailVehicles / ListerAT *contains all the Lister Series components*

RailVehicles / ListerAT / Default *contains the Classic*

RailVehicles / ListerAT / Light *contains the Light Series*

If you plan to reskin the locos you will need to be careful to pick the correct body and to realise that many of the files in the Default directory are read by the Light Series.

Swapping the Drivers

The drivers are the from the default KUJU/RailSimulator/Scenery/Characters directory. They are only referenced in the engines .bin file under the <ChildName d:type="cDeltaString">Driver</ChildName> reference towards the end of the file. Just overwrite the name and recompile.

Repaints and Additions

The texturing is quite simple and follows some fairly obvious ways. The aim being to make reskinning a bit easier. All the body textures have alpha layers so this will need care. The only really tricky thing is the Lister logo'd front where I needed to make some transparency for the logo and so had to use TrainGlass.fx which uses a simple black or white shader. At the same time I wanted to include the textures for the canopy in this bitmap as well so the rest of the texture will be used eventually as a TrainSpecEnvMask.

Suspension, Super-elevation, and Wobbly Track

There is no suspension in these locos and so I am not sure if they work with super-elevation or not.

The head wobble has also been strictly controlled to limit the forwards and backwards G force movement but to allow a certain swaying and jolting up and down over rough track.

Sounds

This is a major update. Wagons and all stock use three basic sets of sounds for the couplers, the bangs & clanks and the rail noises.

Lister Rail Truck Performance Data

The loco performance data is taken from a copy of the promotional literature found on the Lister Auto Truck website which has been a very valuable source.

Specification of Type "R" Lister Rail Truck

POWER UNIT—Standard 600 c.c. J.A.P. Engine; nominal rating 450 h.p., as fitted to our Auto-truck Specification.

UNDERFRAME—Side members and buffer beams of heavy R.S. Channel section, strongly cleaned and galvanized; additional cross and longitudinal members support the gear-box and power units; vertical R.S. angles carry the cast iron addition weights at each end. Forming rail guides. Cast steel axle-box guides are firmly fixed to the side members.

BUFFING AND DRAW GEAR—Centre buffers and couplings are fitted as standard, having a buffing height of 13½", and 3 coupling heights of 11½", 11½" and 16½" above rail level. Centre screw buffing and drawgear supplied if required.

WHEELS AND AXLES—Best chilled cast iron renewable tyres are bolted to cast iron wheel centres shrunk on to steel axles. The axles are carried in outside axle-boxes.

GEAR-BOX—The gear-box has two speeds in either direction giving forward and reverse speeds of 2½ and 5 m.p.h. All gears are machine cut, hardened and run in oil. The shafts are of robust construction supported on ball bearings.

THE CLUTCH—Mounted on the gear-box primary shaft, is of the multiple disc type, the friction discs being made of compressed moulded fabric. The ball change speed lever and the clutch pedal are conveniently placed for operation from the driver's seat.

CHAINS—The final drive to the four wheels is by roller chains from a double sprocket on the gear-box secondary shaft to reversible chain wheels bolted to cast iron flanges shrunk and keyed on the axles. The chains are lubricated from the engine oil supply tank.

BRAKES AND SANDING GEAR—C.I. brake blocks act on the wheels simultaneously, operated by hand wheel and screw mounted on pillar in front of driver's seat. Sanding pipes to all wheels operated by two hand levers placed at side of driver's seat, one lever operates the sanding gear to each pair of wheels. Each sand box is opened and closed by means of a gas-metal valve.

DRIVER'S SEAT—Fitted so that the driver has a clear view in either direction, and all controls conveniently arranged. A seat box is provided.

CANOPY AND SIDE CURTAINS—A canopy carried on tubular supports is supplied if required; in addition canvas curtains can be supplied for attachment to the canopy supports. (Supplied at extra cost.)

GUARANTEED PERFORMANCE

SPEED Engine speed 1500 r.p.m.	LEVEL	TOTAL HAULAGE CAPACITY BEHIND DRAWBAR Theoretical maximum of rolling stock taken at 33 lbs. per ton (14.5 kgs. per tonnet)				
		GRADIENT				
		1% (1 in 100)	1½% (1 in 66⅔)	2% (1 in 50)	2½% (1 in 40)	3% (1 in 33⅓)
2½ m.p.h.	24 tons	15.5	11.25	7	5.25	3.75
4 m.p.h.	24.4 tonnes	15.8	11.45	7.15	5.35	3.85
5 m.p.h.	11.5 tons	7.25	5.25	3	2	1.25
8 m.p.h.	11.7 tonnes	7.35	5.35	3.05	2.05	1.3

The above loads are based on loading light stock in good working order on straight level under average conditions. Under good conditions these loads may be exceeded. If it is required to start the train on an incline, reduce the above loads to two-thirds.

Approximate Shipping Weights and Measurements

Grav. Wt.	Net Wt.	Dimensions	Vol. cu. ft.
3300	3200	96 x 54 x 53½	130
1300	1250	24½ x 11½ x 13½	2.68

PRINCIPAL DIMENSIONS (To suit 24" rail gauges)

Ball Gauge	Wheel Base	Length over axle-boxes	Length over buffers	Width over axle-boxes	Centre of Buffer from rail	Centre of Coupling from rail	Total Height	Ball Clearance (minimum) as fitted	Diameter of axle	Weight in working order
A	B	C	D	E	F	G	H	I	J	K
24 ins.	30	78	89½	37	13½	11½, 13½, 16½	44½	2½	12	3200 lbs.
61 cm.	76	198	226	94	35	28, 35, 41	112	5.7	30	1400 kgs.

TYPE—0-4-0

ENGINE h.p.—46

SPEEDS—2½ and 5 m.p.h.
4 and 8 km.p.h.

DRAWBAR PULL—
at 2½ m.p.h.—800 lbs.
.. 5 m.p.h.—380 lbs.
.. 4 km.p.h.—364 kgs.
.. 8 km.p.h.—172 kgs.

CURVE RADIUS (min.)
200 (67 m.). Recommended 300 (97.5 m.)
TRACK, LIGHTEST RAILS—
12 lbs. per yd.
5.95 kgs. per metre.
SLEEPERS, MAXIMUM CENTRES—
.. 8 m.p.h.—172 kgs.
.. 36 ins. 91.4 cm.

Used by—The Post Office. The London, Midland & Scottish Railway Company. Sims, Son & Cooke, Ltd.

This excellent source gives the following dimensions:

- weight 3800lbs
- engine 4-6HP
- Load Haul
- level at 2.5 mph = 24 tons
- level at 5 mph = 11.5 tons
- 1:100 at 2.5 mph = 11.25 tons
- 1:100 at 5mph = 5.25 tons

Drawbar Pull at 2.5 mph = 800 lbs and at 5 mph = 380 lbs

Using various other sources all agreed that a tractive force of between 840 - 900 lbs was about right for 2½ mph declining to about 380 - 400 lbs for 5mph.

When I put these numbers in and loaded up 24 tons of skip wagons we did just about get moving, but what is nice is that anything over 10 tons and you don't move at all from a standing start in second gear.