Locomotive modeling

(Electric Locomotives 1)

Preface

Ver1.0 of “Locomotive modeling” was edited in 2001 including 15 models by scale (mostly) 1/45. After 17 years, another 16 model locomotives are complete and I thought it was high time to revise, producing Ver2.0.

Ver2.0 is divided into three parts and “Electric Locomotive 1” is two of the three.

Ce 6/8 II (14253) SBB Modeled in 1987, Scale =1/50

Year of construction 1921. 15KV, 16 2/3Hz.
Overall length between buffers 19760mm, Height 4500mm(with downed pantograph), Width 3100mm.
Weight 128t, Driving wheel diameter 1350mm, Running wheel diameter 950mm.
Output 1650KW, Manufacturer SLM/MFO.

This is one of the most famous locomotives between railroad enthusiasts. The whole body is constructed with three parts - motor hoods at both ends and main body -and they move according to the curve ; hence, called “Krokodil (crocodile)”.

It was a long time ago when I first got to know (by a picture) this remarkable locomotive. My first impression was “How can it move with these strange rods ? ”.

I started modeling this one in 1987 and this was the second model after a long blank from the first one - UP’s Big Boy. So, I was not sure at all if I could make it. I started making the most difficult parts - the spoked driving wheel - as a sort of experiment. And it turned out to be easier than I had anticipated. Then I tackled the whole locomotive taking nearly a year, without even the slightest idea that I would see the original next year.

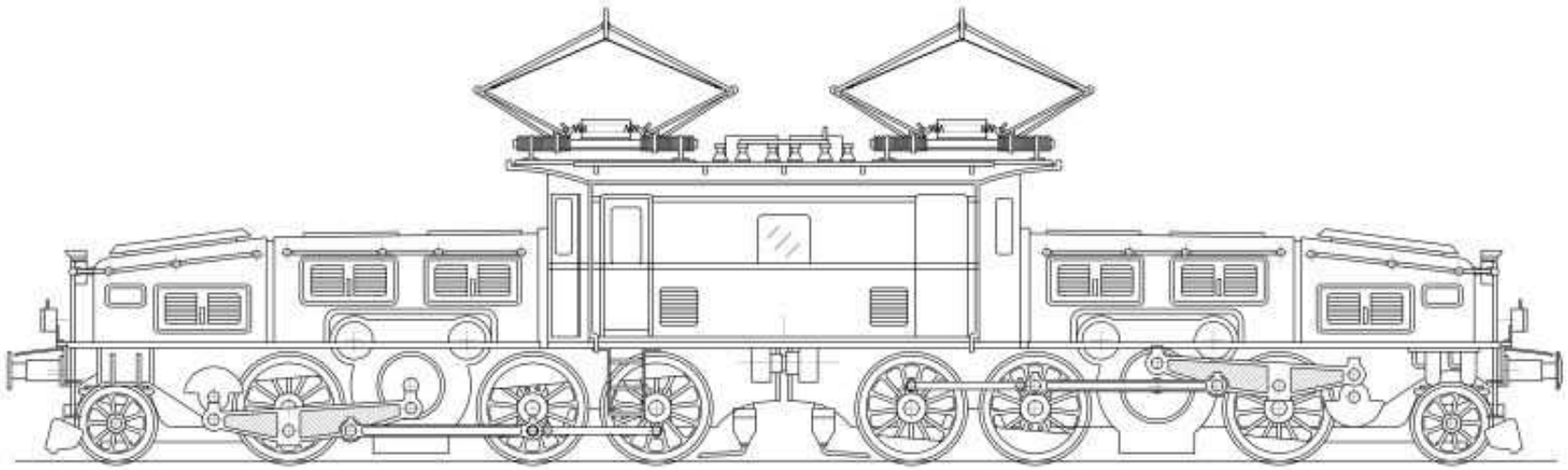
In 1988, I had a chance to stay in Brussels for four months by business and I went to Europe with a strong resolution to visit Erstfeld during my stay. So, my wife, my old friends and I were visiting Erstfeld depot where Krokodil was preserved. While I was taking pictures and inspecting the real one, my friend got a permission to actually visiting the depot itself. Inside the depot, there were some other locomotives as well as the preserved Krokodil in working order. The people at depot very kindly showed us the inside of the locomotive and several other ones, finally asked me if I would like to see something else. And I just asked if I could see the roof of the locomotive because the layout of roof equipment was never clear until the end of the modeling. To my astonishment, they brought a ladder and here we were - on the roof of 14253 (exactly the same number I modeled). To my chagrin, the layout and design of the roof was somewhat different from my assumption.

Main transformer is actually dropped from the roof and has no cover over it (I assumed that transformer is housed in the body). High tension power cable is directly connected to the transformer which has fins for radiation as well as air grill for ventilation.

Even that small disappointment, I had one of the happiest time in my life.

This model doesn’t move smoothly because of relatively poor skill at that time, but overall success made me continuing model construction until today.

Most attractive mechanism of all electric locomotives.



As a model, the smooth operation is very difficult if only external rods are equipped. At first, this locomotive could not run both direction smoothly at all.

Gears to connect all related wheels were installed later, and it worked fine for the first time. Particularly, shaft with the counter weight at the front cannot be driven by two rods only, since the force is only applied by rods. On the other hand, the driving wheels can be driven by rods only even for the models because there is something common; rails.

Side view ; Both side has slightly different design - because of transformer location, perhaps. The other side has no center window.

The model was originally build with very simple controller - the speed and direction is controlled by the DC voltage and polarity fed to the rails. But now it has been converted to digital control system which is housed in the center body. Two coreless motors are mounted within the hoods at both ends. The running power is transmitted from driver to the driving wheels with rods as original design. That was the reason of the poor operation with this model. Inaccuracies in construction and too much plays between driving rods made it pretty difficult to operate smoothly. Later, internal gear train is equipped and the rods are just working passively.

References;

H.S.Stammer, Marklin Krokodil, Gebr.Marklin & Cie. GmbH., 1984.
Jorg Hajt, Das Grosse Krokodil-Buch, HEEL Verlag GmbH., 1998.
F.J.G.Haut, The History of the Electric Locomotive, George Allen and Unwin Ltd., London, 1969.
SBB Lokomotiven und Triebwagen, Bern, 1995.
Hans-Bernhard Schonborn, Krokodile, GeraMond Verlag, Munchen, 1999.

Class EF64 Japanese National Railways (EF641001) Modeled in 1988, Scale = 1/40

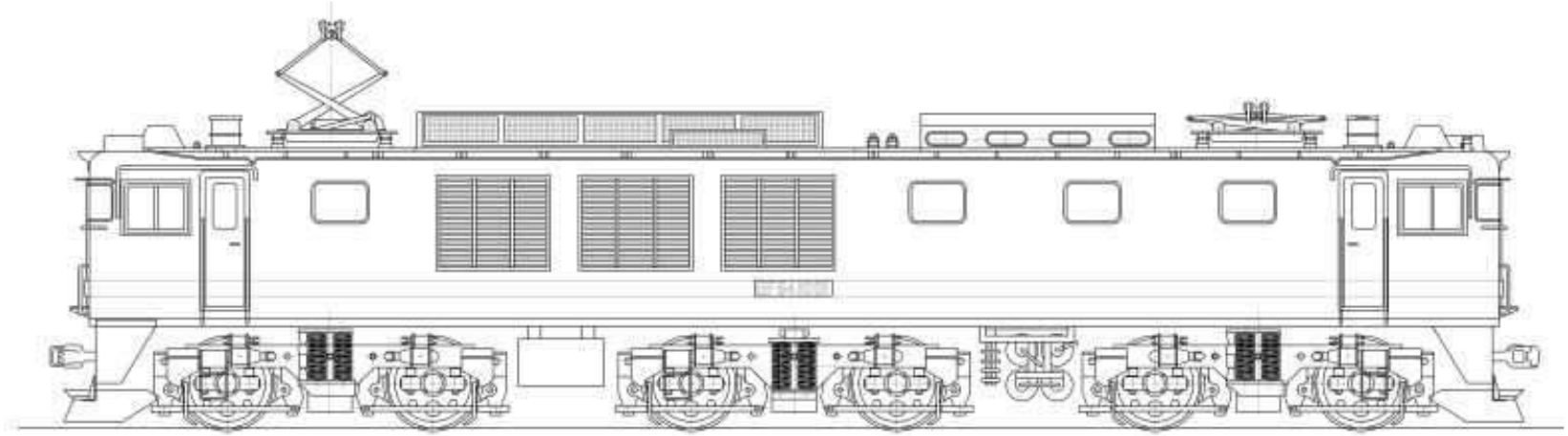
DC 1500V, Bo'Bo'Bo', Gauge = 1067mm.
Year of construction 1980.
Overall Length 17800mm, Height 4062mm (without pantograph), Width 2900mm.
Weight 96t.
Driving wheel diameter 1120mm.
Hourly output 2550 kW.
Manufacturer Kawasaki, Toyo Electric.

Driving wheel is so called “Boxpoke” type. 1001 means that the locomotive belong to subclass of EF64 class with serial number 1.

The biggest problem making this model was the scale. JNR adopts 1067mm gauge and if the gauge is scaled to 32mm, it should be 1/33 and that makes the whole model too large. Therefore, I compromised to 1/40 for body, but then the scale of the gauge is incorrect. Modeling itself was not difficult – nice drawings are relatively easily available, ample space for controllers and pantograph drivers and driving wheels don’t have spokes. And I could refer to the original quite easily – but I didn’t. Availability of spray paint was easy as well. Because exactly same color used for locomotive and railway rolling stocks are sold for hobbyists.

Color scheme of this locomotive is perhaps the oldest color used for JNR electric locomotives. The color has been thought to be out of date in 60’s or 70’s, but again it revived – although not entirely the same way, that is, white line was added to give nice accent.

Each bogie has two motors and the torque is transmitted via pinion and spur gears to the wheel. Inside the body, DC/DC converter is equipped which converts 20V from the rail to 5V for logic and 8V for motor driver. Also, decoder and some logic circuit is carried as well. These converter and decoder/logic circuits are almost identical for other locomotives.



Big ventilation grilles and asymmetric design is the character of this locomotive. JNR adopted Bo'Bo'Bo' style wheel arrangement quite intensively rather than Co'Co' arrangement. Of course, the center bogie has some lateral freedom.

Characteristic of this locomotive is a very big side ventilators which are asymmetrically located, and the longish look body. Also, pantographs maybe unique.

Reference ;
Train (Extra issue June, Part5) , 1985, Tokyo, Press Eisenbhan.

SNCB/NMBS Series 27 (2730) Modeled in 1989, Scale = 1/50.

Year of construction 1981.
DC 3KV, Hourly output 4250KW, Continuous output 4190KW.
Overall length between buffers 18650mm. Height 3600mm. Weight 85t.
Maximum speed 160Km/h.
Manufacturer BN(Mechanical part), ACEC(Electrical part).

This series is one of the standard Belgian Electric locomotives and there are some different versions by different power systems. The basic body looks quite similar with each other, but roof equipments are fairly different.

Series 11 ; 3KV/1.5KV. Series 12 ; 3KV/ 25KV, 50Hz. Series 21 ; 3KV. Series 27 ; 3KV.

Characteristic of this locomotive is the long body for Bo-Bo driving wheel arrangement, and because of that, the cab ends are slightly tapered. When I was staying in Brussels in 1988, I have taken several photographs of this series among others with no particular plan of modeling. So, I didn't realize this tapered cab ends which annoyed me when I started modeling. This point was not obvious by photographs I have taken as well as documents which contain rough drawings. But having looked into as many photographs as available very carefully, I finally got to the conclusion that the cab ends are tapered.

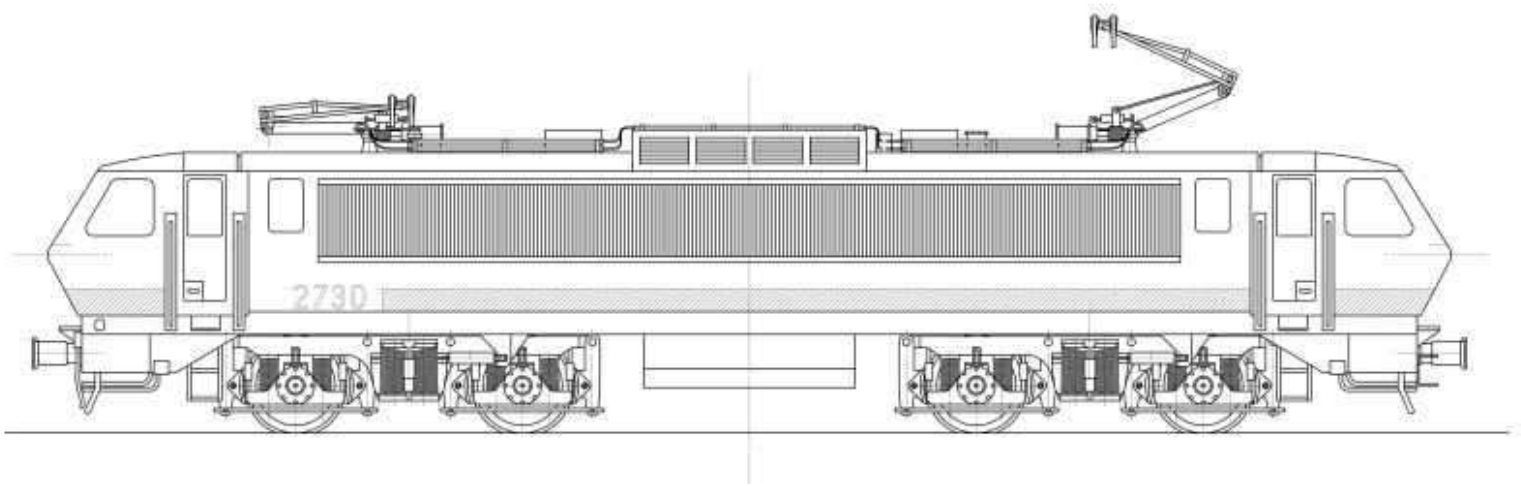
Another difficulty was the arrangement of roof equipment. The roof equipment for the AC version is too complicated and I had no hope to get enough information, I have chosen DC model which was the series 27. Even then, I found some difficulties about the roof and my old friend in Brussels have taken some more pictures which shows the roof and, above all, acquired very good information for me.

When I got the detailed information, I have been modeling the roof, but I removed several parts and did it again.

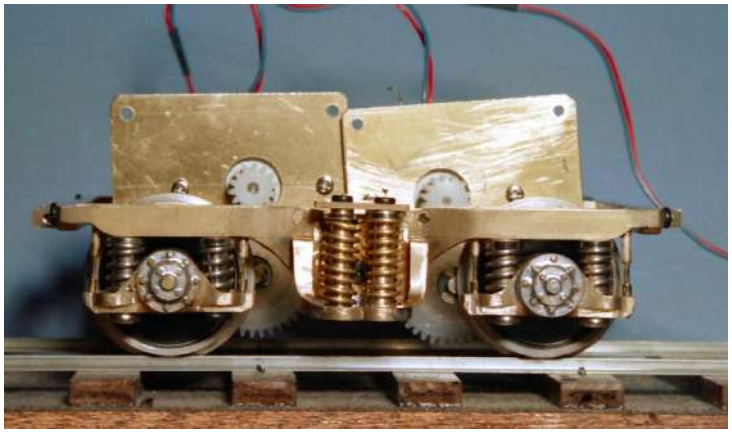
Color scheme was difficult as well. I think I have the image of the color, but the problem was no good spray paint was available. So I used transparent blue paint after green paint. The result was tolerable. However, digital cameras and printers can't reproduce somewhat difficult color of this series.

Since this locomotive was one of my early models, the pantographs are not motor driven and head lights are just dummies.

When it was built, the motors are controlled by DC voltage applied to the rail, but later it was modified to meet the current digital control system. But pantographs and lights remains as they were and hence do not move up/down nor light up.



Class 27 is to be withdrawn in 2021 after serving forty long years. Front end design seems to be unique and something similar is found nowhere in the world.



Longish body line is clearly observable.

Interesting thing about the bogie is the symmetrically wound springs. (See white springs supporting the body; right winding and left winding springs are used in pair.)
Coil spring born bogies are fairly common in many locomotives as well as electric multiple units, but as far as I know, same kind of springs are usually used.

By modeling, sometimes original construction becomes clear. In this series, the cabs are constructed quite independently from chassis and docked later. The line above the door shows this construction.

References;

Max Delie, Jean-Pierre Schenkel. Elektrishe Lokomotiven. G.Blanchart & Cie, Brussel. 1988.
Benelux Rail 3. Frank Stenvalls Forlag. Malmo. 1986.
Locomotives electriques de la S.N.C.B. Fiches descriptives. 1983.

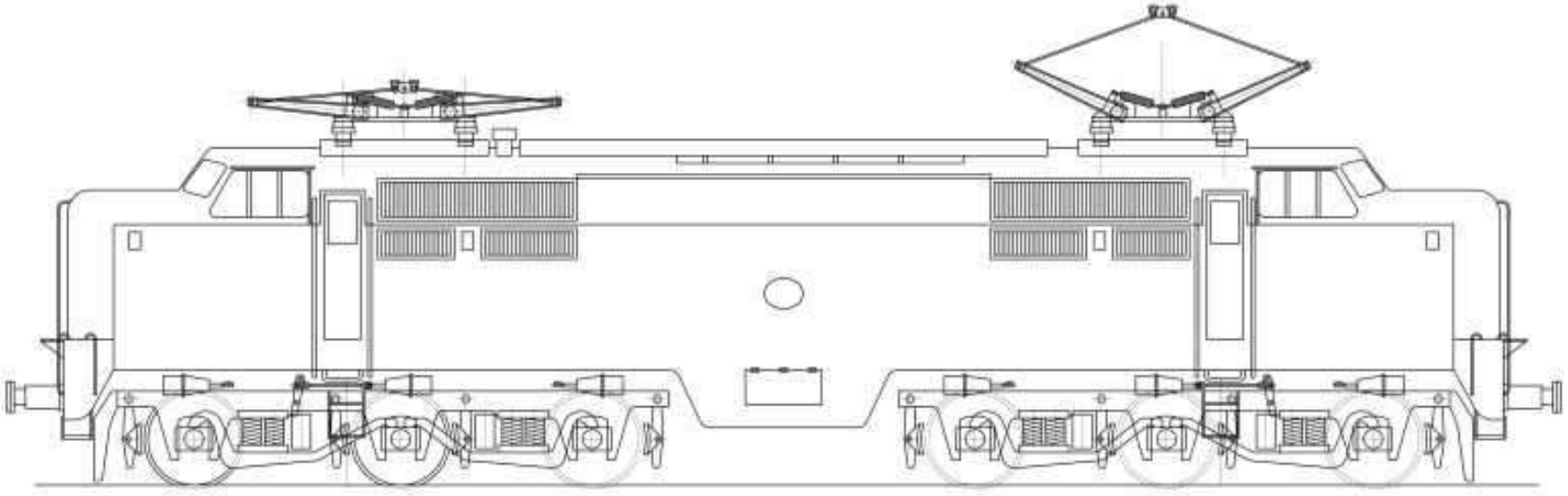
NS series 1200 (1211) Modeled in 1991, Scale = 1/45

Year of construction 1951.
Hourly output 2315KW, Continuous output 2160KW.
Length between buffers 18085mm, Height (without pantograph) 4553mm, Weight 108t.
Maximum speed 135km/h.
Driving wheel diameter 1100mm.
Manufacturer
Mechanical part Werkspoor (licensed by Baldwin).
Electrical part Heemaf (licensed by Westinghouse).

Three axes driving bogie with coil spring and big equalizer.
Since the design of this locomotive was American origin, it was easier in referring to American locomotives to investigate the construction of this bogie.

Front view; Fairly different image from American bonnet locomotives. Note the slant buffers because of their weight unbalance. (of course, this model intentionally slanted them.)

Close up of pantograph.
Although it is not observable, it has a mechanical coupling to the driving mechanism inside the body. In this model, pantograph and its driver are mounted to the base which is removable from body. It is a bit cumbersome to adjust the moving range of pantograph - particularly, adjusting two pantographs to move similarly with each other.



Although the original has a Co'Co' wheel arrangement, the model is only driven two axels out of three per bogie. Hence, four nose suspended motors are installed.

This was the first model that I tried digital control and moving up/down of pantograph. After successful operation, I made later models with the same circuitry as well as the control until eventually all the control was replaced by a microprocessor.

This model was not so difficult to make. Relatively simple bogie with ample space in the body. The only point a bit tricky was the curves of bonnets. They were all made from 0.3mm brass sheets with cutting, bending and soldering. However, one thing I am not sure is the driving wheel. I suspect that the driving wheel has spokes. And I actually asked for the information to the museum at Utrecht. But the answer was that they had no spokes and the model above was equipped with that one. 1988 was pre Internet era and I couldn't survey more.

For this model, control is complete. Speed and direction of the running, up/down of pantographs and on/off of head lights are controllable. Both pantographs can be folded down while running - which means that the controller inside is not so intelligent.

References ;

M.L.Vocke, F.J.Janssen, J.B.Th. van't Grunewold,.
De Moderne Tractie bij de NS in Kleur.
Schuyt, Haarlem, 1988.
Carel van Gestel, Bert van Reems,.
Elektrische Locomotiven in Nederland.
De Alk bv, Alkmaar, 1988.

3000V DC, Bo'Bo'Bo'.
Length between buffers 18290mm.
Hourly output 4320kW, Continuous output 3780kW.
Weight 112 t.
Driving wheel diameter 1250mm.
Manufacturer Breda.

Original locomotive seemed to be built as E646 025 and was renumbered (perhaps with some modification) to E645 005 in early 60s. Many components were standardized and used commonly with other type of locomotives. Hence they have Bo'Bo' version of this one as well (but with single body).

Each bogie has two motors which drive wheels by gear train. Pantographs are motor driven and they work quite satisfactorily but they were a bit oversized. I realized it later when I was watching about the finished model. A pity, but I have not a resolution to build it again until today.

Older Italian locomotives always remind me “Iron mask” although I have never met him in person, nor met this locomotive. And I painted it with old livery even if many of the same class have been painted with new color scheme at the time of modeling.

Unique point of this class is that the body is separated sharing the center bogie. And that gives this locomotive an excellent manouevrability. This construction is fairly common practice in Italy and I wonder that the rails of Italy are forced to have relatively steep curves.

One of the difficulties in modeling was the flexible covering between two bodies. Eventually it was made by black paper with metal hooks which attached to both body. Another was the air intakes at the side of body. In order to make them, I made a press die by brass and it worked all right but the die was worn out just after the final pressing.

This locomotive has different side view (see next photo) which might cause trouble in modeling. But in this case I had a very nice drawings at hand.

The iron mask. Not only the shape, but the color also enhances that impression. The drawing above clearly shows, the manoeuvrability is excellent. Every bogie needs to turn just around the pivot.

This side has some grilled ventilators as well. I think this locomotive has very well balanced design. Relatively simple bogies are placed in very compact way and all the bogies seem to be identical. (One is tempted to design the center bogie differently from the others because of the articulation.) Italy is quite famous by their design in many ways and one wonders why (older) locomotives were designed like that ? I have no answer, but I have to say that the younger generation locomotives are terribly handsome and beautiful in color. And I am hoping to have them some day s in future - but they have terribly complicated components on the roof and very long ventilators ....

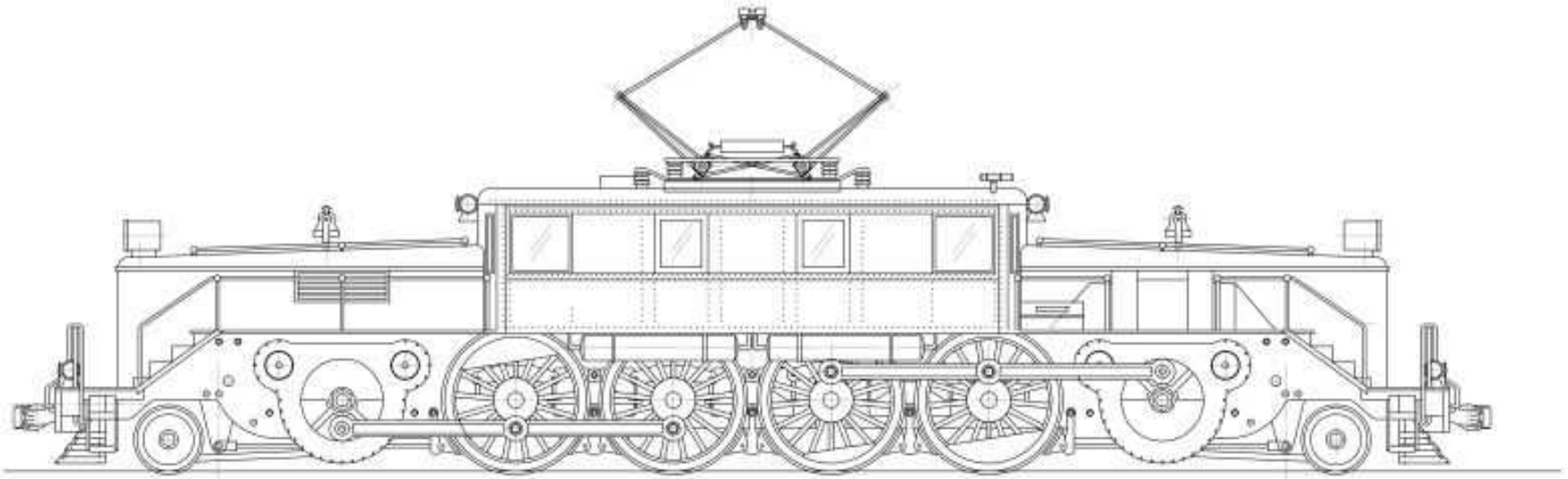
References ;
FS-Italia, Locomotive Electriche E645 E646, Edizioni Elledi, 1985.

Class L5 Pennsylvania Railroad (3930) Modeled in 1993, Scale = 1/45

11kV, 1phase AC, 25Hz. Year of construction 1924. Output 3500hp. Overall Length 20790mm.
Height 4740mm(pantograph down). Width 3200mm.
Max speed 112km/h.
Manufactured at Altoona works, PRR.

This locomotive is lesser known even among Pennsy railroaders. The reason I think is that the performance was not what it should have been and, hence, had relatively short life (about 20 years). So, not much information was available. Particularly, no color photos seem to be available and I knew later that the actual color was black (by Internet).

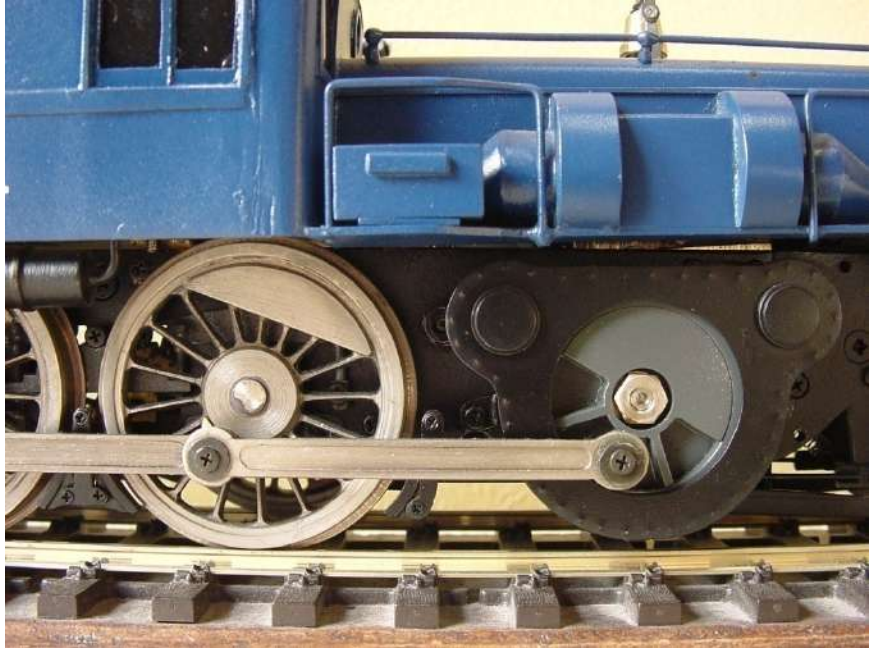
I feel that this is American straight forward design -large diameter for speed, four driving wheels for tractive effort and house big motors with good adhesive weight for rigid heavy chassis. These all added up to long wheel base and heavier force to tracks which certainly not was welcomed by maintenance people. If one think an alternative, one would split chassis into two like Krokodil, but then motor weight should be distributed to leading wheel considerably and lessens the adhesive weight. I can feel the designers' dilemma here.



Thickness of the connecting rods are remarkable. Diameter of the driving wheel exceeds 2000mm, the cab is positioned very high indeed.

3930 seemed to have been equipped with high hood (almost level with the roof) with two pantographs in some period.

American massive design is very significant from this angle. When I painted this locomotive, I thought it looked like dark blue, but later turned out to be black. If it had been painted black, almost nothing would have been observed other than a black mass. And worse still, sometimes (or some locomotive) they had red paint on the window sills which, well, you are lucky without actually seeing them.



Massive driving mechanism. If you compare the driving mechanism with the one used by Krokodil, you can easily notice the significance of the American practice.

Two center driving wheel seemed to have no flanges for the original. But, having simulated that I found it was no good for running. I later added flanges to two driving wheels with quite a nice labor.

Thinking about long rigid chassis and two heavy motors mounted fairly apart from the center, it must have experienced difficult manoeuvrability. And that becomes quite apparent when running this model.

Reference;
Electric Locomotive Plan and Photo Book,
N.J.International Inc., 1987.

Series CC14000 (CC14001), SNCF Modeled in 1995, Scale = 1/45

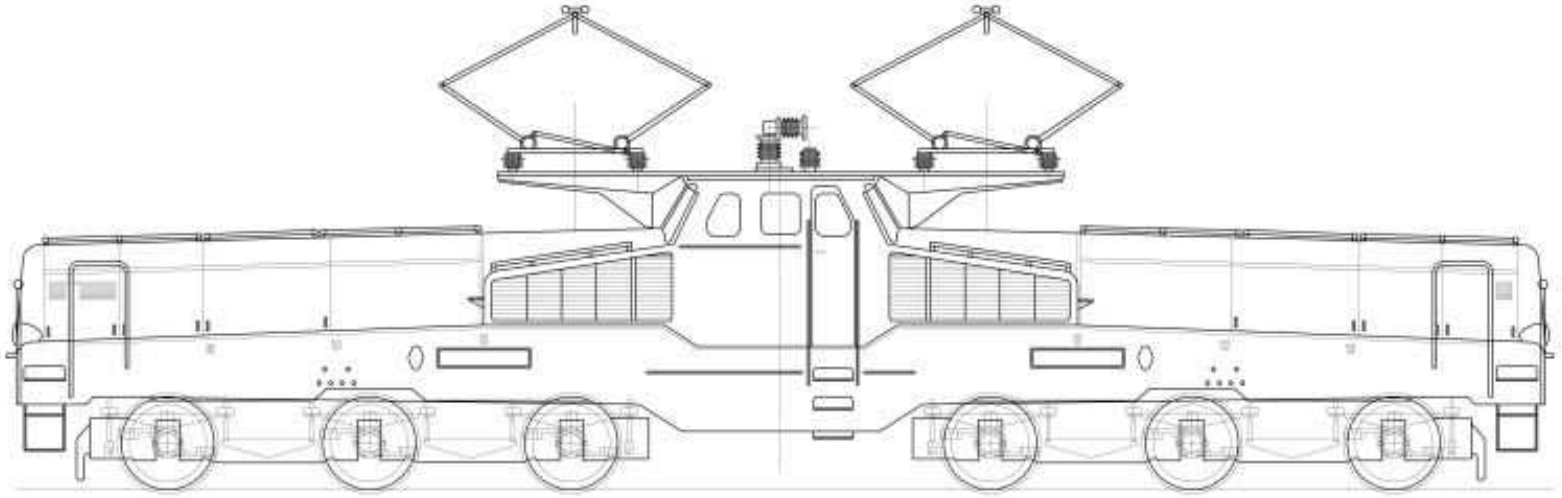
Year of construction 1954, 25kV, 1 Phase, 50Hz.
Length over buffers 19890mm, Width 2968mm, Height (without pantograph) 3695mm.
Continuous output 2642kW, Hourly output 3032kW.
Maximum speed 60 km/h.
Driving wheel diameter 1100mm.
Weight 124 t.
Design/manufacture Oerlikon and Batignolles, Fives-Lille.

What is significant of this locomotive is that it has almost no horizontal lines. Main chassis is constructed all by inclined structure and the bonnets at both ends have inclined lines as well. Almost only horizontal line is the small roof both for cabs and pantographs.

I imagine it must have required unnecessary effort in making drawings and actual manufacturing. On the other hand, the structure of bogie is simple - particularly, if compared with complicated mechanisms utilized in later locomotives of SNCF.

In the model, control circuitry are housed in bonnets at both ends and center cab contains two pantograph drivers and motors. Pantographs are pulled by wires connected to the drivers because, obviously, there is no space under pantographs to install driving mechanisms. Since space inside the body is very limited , it is full of electronic components.

The box underneath the center cab is actually a gear box which original doesn't have. Since the space is very limited, two motors are placed in center and the torque is transmitted by propeller shafts. Pinion gears fixed to the propeller shaft drive crown gears of the wheel. Only two driving wheels out of three are driven for each bogie. Therefore, the torque transmission mechanism of this model is completely different from the original.



The roof is extended to mount the pantograph. Also, the support is clearly visible. I understand this small cab is the point of esthetic interest of this locomotive, but there can be some another solution suitable in a sense of human engineering.

Maybe, the design was experimental at first, but the success lead to mass production.

The original locomotive was one of the first prototypes made for the AC electrification with commercial frequency. By the success of this experiment, SNCF decided to use AC electrification with 50Hz quite intensively.

Bo'Bo' version of this series were also produced which had bigger power output and they were used in Northern border of France as well as in Luxembourg.

Impressive angle for this locomotive to look at. Long bonnet is emphasized.

Front emblems were difficult to make. Freehand drawing of the negative on brass which was etched later.

Reference ;
Pascal Dumont, Les Locomotives Electriques Monophasees de l'artere Nord-Est, Les Editions du Cabri.

OBB class 1044 (1044.14)

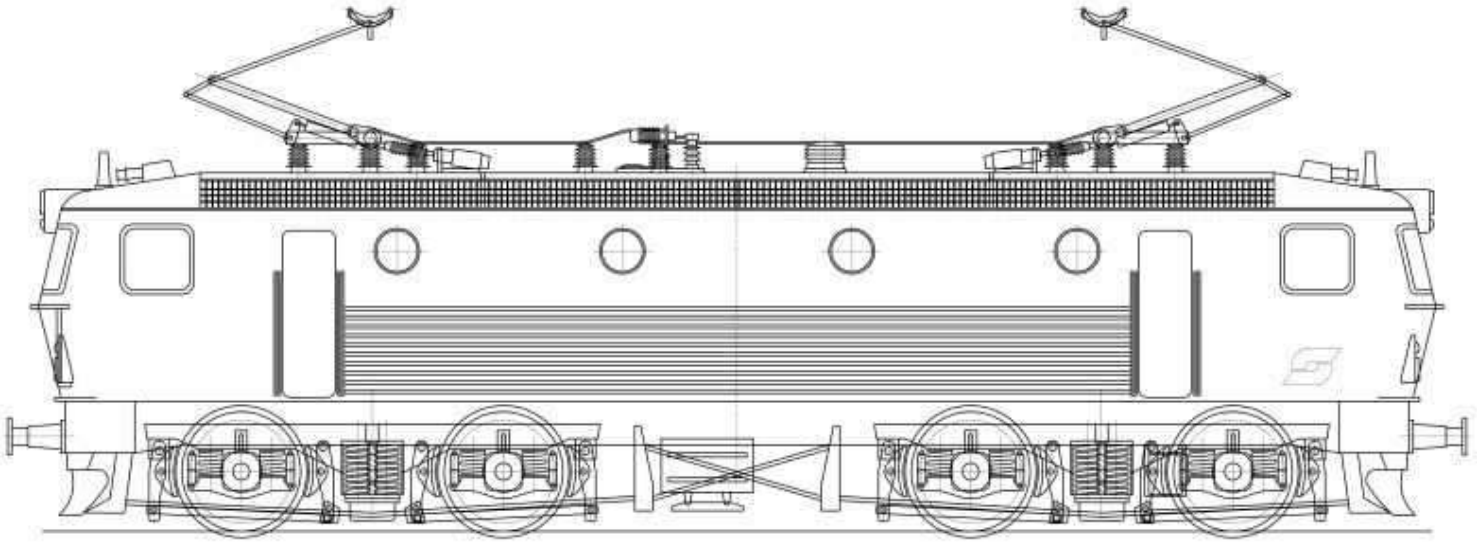
Modeled in 1996,
Scale = 1/45.

Year of construction 1977.
Length over buffers 16060mm, Width 3117mm, Height (pantograph down) 4505mm.
Weight 84 t.
Driving wheel diameter 1300mm,
Output 5200kW. Maximum speed 160km/h.
Manufacturer (mechanical part) Simmering Graz Pauker, (electric part) OBBW, Elin-Union, Siemens

This locomotive was relatively easy to build. Wheel arrangement is Bo-Bo and can expect very stable run. Body space is enough to house controller. The only tricky thing was the corrugated body and roof. Those part were made by etched brass plate of thickness = 0.5mm. I don't remember how etching resist was made, but that was most difficult. Etching was done by the solution of ferric chloride($FeCl_3$).

The pantographs are motor driven - that is, it can be controlled from outside. Heads lights are also turned on/off by controller. Red small lights (tail light ?) are LEDs.

Each wheel is driven by a motor via pinion and spur gears. It contains four small motors in total for driving.



I once encountered this locomotive during my travel from Lindau(Germany) to Zurich(Switzerland), because the line crosses Austria just for a short distance. Starting from Lindau by German locomotive, then changed with this class, and again changed Swiss locomotive at the Swiss border.

I suppose that the design of this one is based on the Swedish locomotive class Rc by ASEA. Side view of the body is quite similar. But the cab looks distinctly Austrian.

As a model, it has not much impact when looking at. But the original looks terribly beautiful in Austrian scenery.

References ;

J. Michael Mehltretter, Elektrische Triebfarzeuge, Motorbuch verlag, Stuttgart, 1986.

Typenblatter Osterreichscher Elektro und Diesel locomotiven, Verlag Otto Slezak, Wien, 1981.

OBB 1082 (1082.01) Modeled in 1997, Scale = 1/45

Year of construction 1930
Length over buffers 15654mm, Height (without pantograph) 3900mm.
Weight 119 t, Output 1650kW, Maximum speed 60km/h.
Driving wheel diameter 1350mm, running wheel diameter 1034mm.
Manufacturer Siemens-Schukert, WLF Florisdorf.

Solitary experimental ELECTRIC locomotive. Perhaps, one of the most bizarre looking locomotives ever built. Fed by AC15KV, 16 2/3Hz, the locomotive converts current to DC by rotary converter which is housed in the boiler like body and drives three DC motors.

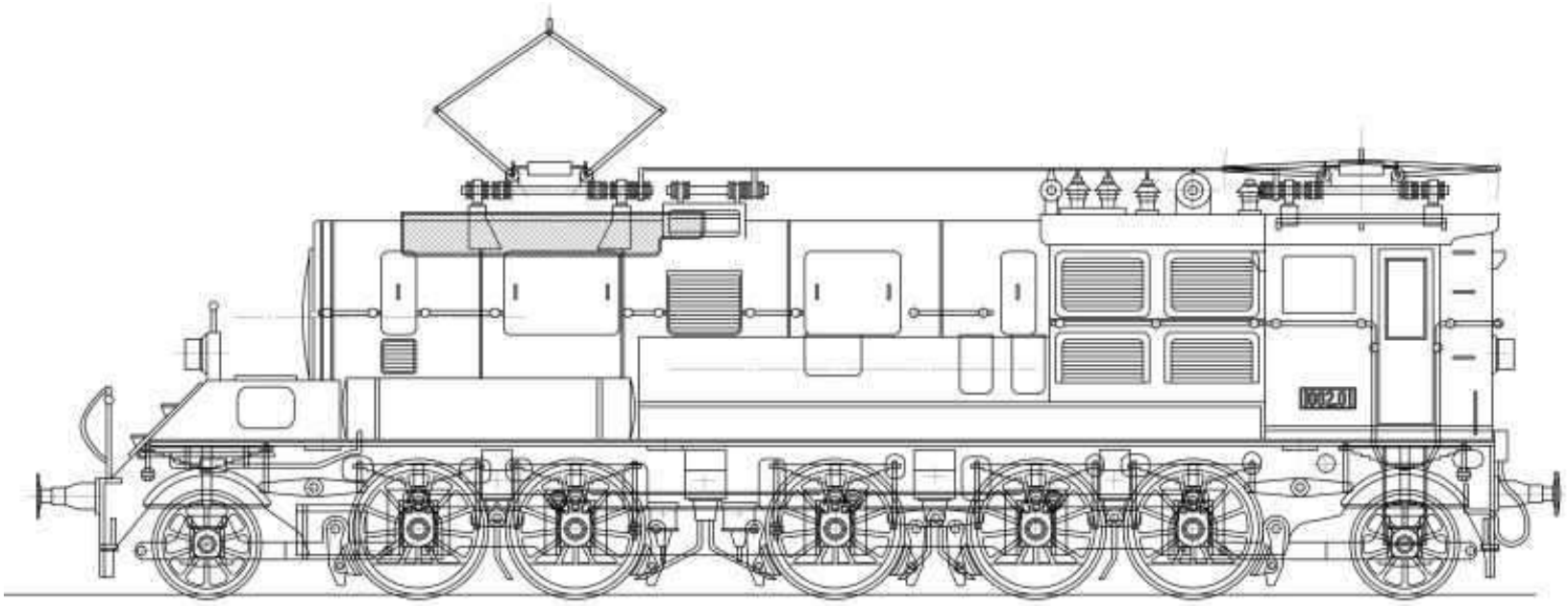
It does have a steam locomotive's look, but it is an *Electric* locomotive all right. And I suppose this is the front although rear provides much better visibility.

I had no information about the color scheme of the original locomotive, I painted green which were used to other Austrian locomotives in those days.

Since this locomotive has long wheel base, the first and the fifth driving wheels have some side plays which is activated in accordance with the leading and trailing wheels. That is, the leading wheel and the first driving wheel is connected mechanically so that the leading wheel change the displacement of the driving wheel at curves.

It is much serious in models. In the model above, leading wheel and the first driving wheel actually make a bogie and driving wheel is not driven at all. The crank is free from the driving wheel inside ! Same with trailing wheel and the fifth driving wheel. Only three wheels are driven and the rods at the first and fifth are just dummies. However, without connecting axles between two cranks at both ends, it is impossible to move rods. In order to cope with this situation, the first and the fifth cranks are gear driven by the neighboring cranks.

Indeed, this model has the most complicated driving mechanism I ever made.



Just under the pantograph, a mesh shield is attached on both side of the “boiler”. Obviously, one can touch the pantograph quite easily without it.

For the original model, the three DC motors drives 2nd, 3rd and 4th driving wheels; the 1st and 5th driving wheels are driven by the rods only. Presumably, this is due to the Krauss - Helmholtz bogie for the 1st and 5th driving wheels.

Driving wheels have counter balance, and the picture above shows that the counter balance of the fifth driving wheel which can't happen in original. This shows that the last driving wheel is actually free wheeling. (I wanted to correct by devising some sync mechanism with cranks, but that was too difficult because of space and the movement of the wheel at curves.)

Even with those flaws in principle, I think this model was done fairly satisfactorily.

References ;

Typenblatter Osterreichscher Elektro und Diesel locomotiven, Verlag Otto Slezak, Wien, 1981.
Josef Otto Slezak, Die Lokomotiven der Republik Osterreich, Verlag Josef Otto Slezak, Wien, 1983.
H.Griebl, J.O Slezak, H.Sternhart, BBO Lokomotive-Chronik, Verlag Josef Otto Slezak, Wien 1985.
F.J.G.Haut, The History of Electric Locomotive, George Allen and Unwin, London1969.

GG-1 Pennsylvania Railroad (4935) Modeled in 1999, Scale = 1/45

11kVAC, 1phase, 25Hz.
Year of construction 1943.
Wheel arrangement 2-Co + Co-2.
Total length 24230mm, Weight 137 t.
Continuous output 3680kW .
Maximum speed 160km/h..
Driving wheel diameter 1448mm.
Manufacturer General Electric Juniata shop.

This is one of the most famous locomotives in the world. Designed by Raymond Loewy, it's chic color scheme is quite a nice sight to see. And the performance was also excellent and have been working until recently.

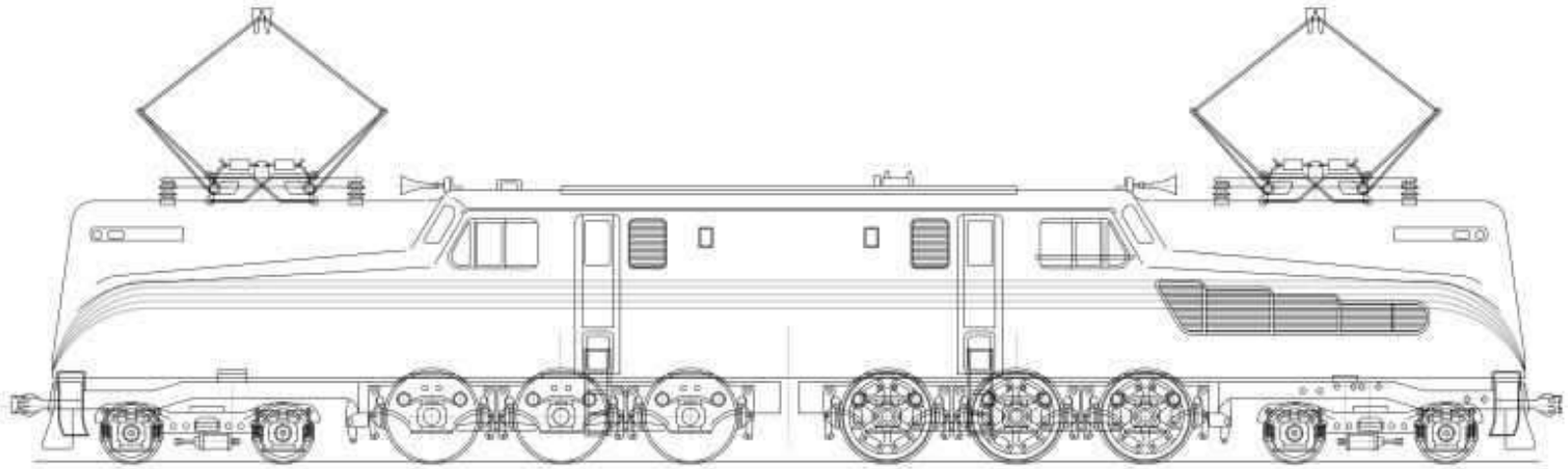
Some of the difficulties in modeling this were the shaping of body and painting. Since body has very subtle curves at both ends, I couldn't finish by just one trial. I made some corrections after basic body was complete and I had to content with some flaws. Painting was difficult as well, particularly the converging golden lines were most difficult to draw. Not only converging curved lines were difficult to draw, but they were converging at body ends where painting by hand was tough. And the shape of the body end was not perfect, it was hard to keep less inconsistency with lines.

However, those golden lines do make this locomotive very beautiful - I have been painted my locomotives many times but I never experienced this dramatic difference a painting could make. I really felt a professional designers sense here.

Compared with original, paintings by Amtrak in later years were just an eyesore. The color is called Brunswick green, but I had to use something similar.

Another difficult - or laborious - point was the driving wheels. Since they have driving springs between spokes, the wheels not only needed spokes but some simulated springs as well -for *TWELVE* wheels. So, I need some nice resolution to tackle these kind of laborious models.

No4935 is preserved at the Railroad Museum of Pennsylvania at Strasburg.



Observing the drawing above, there seems to be no idea to make the locomotive compact.

The roof looks simple. Cover on top of the center of body must have been used to drop the main transformer into the body.

Since the main transformer used PCB, the transformer has been removed from some of the preserved locomotives. And this is the reason that this class has no possibility to run on the track again.

The emblem of PRR was written by freehand. Lettering underneath was by instant lettering but the font was a bit different from the original. Five golden lines were drawn by hand.

The axle of the driving wheel has coaxial hollow shaft called quill and the quill is connected to motor via gears. And motor is mounted on a chassis which is sprig born by wheels. To absorb the vertical displacement caused by the spring between wheel and chassis, the driving wheel is equipped with another coil springs among it's spokes and the quill is connected to these springs. Thus the driving wheel has vertical freedom in the hollow shaft while driven rotationally by the hollow shaft. This is the original mechanism. Realizing this drive is almost impossible and the model here has only the dummy springs which can be seen in the picture above among the driving wheels.

Original has twin armature motors for each axle and the model is equipped with small 12 motors in total. This is American way design.

Reference ;
William D. Volkmer, Pennsy Electric Years, Morning Sun Books Inc., 1991.

Class Ra　SJ（846）

Modeled in 2000, Scale = 1/45

15kV, 16 2/3Hz.
Year of construction　1955.
Length over buffers　15100mm.
Width　3140mm.
Weight 60.8 t.
Output 2648kW.
Driving wheel diameter 1300mm.
Maximum speed　150km/h.
Manufacturer ASEA.

This is a very stylish electric locomotive which has been attracting my attention for many years. But information of Swedish locomotive was not easily available let alone that of class Ra.　The style is quite modern and looks, say, 20 years ahead of time, however they have been all withdrawn now.　I presume that during it's career, it has been modified very much – one door has been moved and one circular window has been filled.　The model shows the days before modification.

Thin frames of circular windows were made by lathe and then soldered to the side body.　Because it is not possible to make beautiful circular holes to thin brass sheet.　Number plate at the side body was made by etched brass.

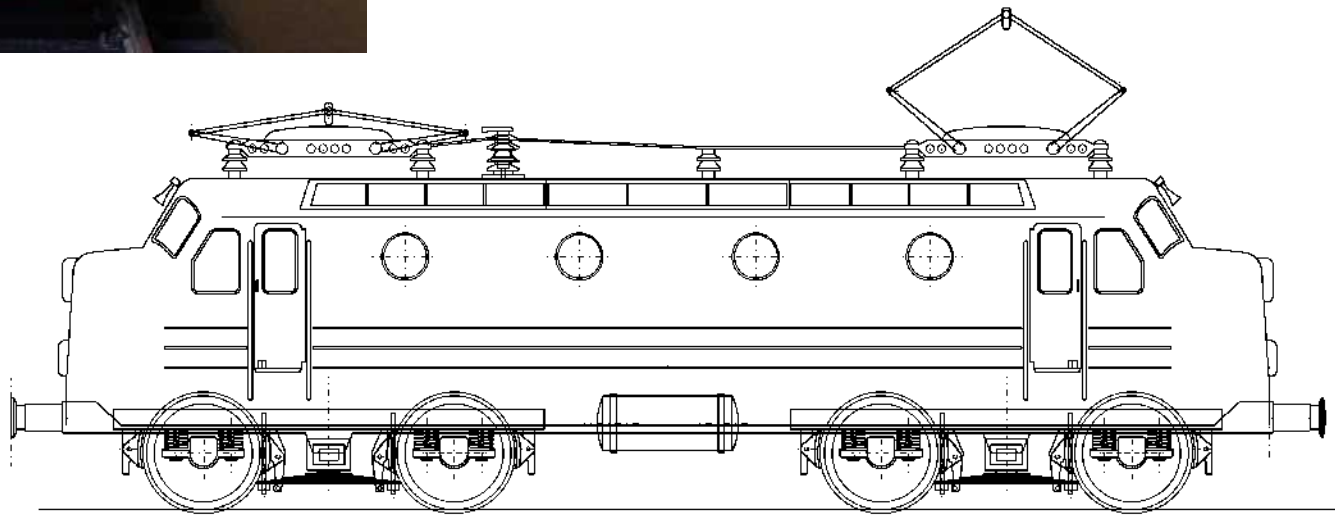
Each bogie has two motors and the torque is transmitted via pinion and spur gears.　Voltage for motor is down converted from 20V which is the constant supply voltage to the rail.

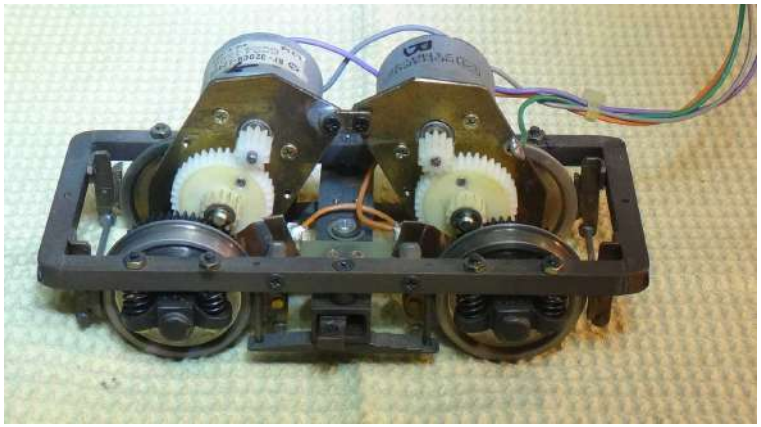
The most difficult part to build was the bonnets at both ends. Curves are made by cutting, bending and soldering as usual, but the result was not perfect. Another difficult thing was the painting of the markings under SJ and lettering of “RAPID”. They were all done by free hand using a drawing tool. Those marking and lettering was done last, the body was held face up by special jig and breath holding moments lasted.

Wind shield is made by smoked acrylic. This is the first time that I tried to bend acrylic by heating . But that was not so difficult. They were glued to the body by epoxy resin.

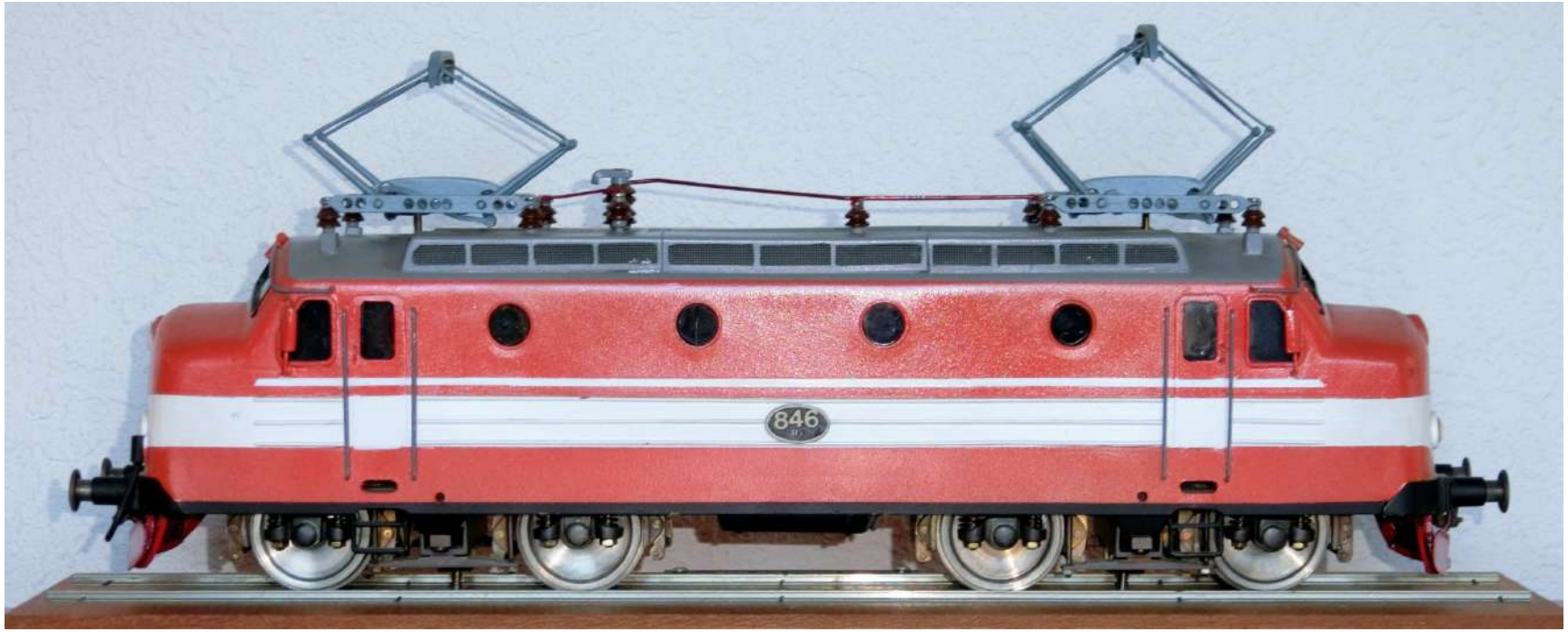
Driving wheels are simple disc type, and was easiest to lathe. And It has got only four axis – only eight wheels were necessary.

I always make drawings myself even if good minute drawings are available because those are not intended to modeling. Here is the side view and this one is eventually expanded into about fifty or so components.





Bogie of this model. Two DC motors are nose suspended and drives each axel by reduction gear train.



References ;
Tore Nordin, Lennart Wretman, Ove Grundstedt, Svenska Ellok, Svenska Jarnvagsklubben, 1998.
Y.M.Tassin, F.Nouvion, J.Woimant, Histoire de la traction electrique Tome2, La Vie Du Rail, 1986.

Class El16 NSB
(Norwegian State Railways)

Modeled in 2002, Scale = 1/45

15kV, 16 2/3Hz.
Year of construction 1977.
Length over buffers 15520mm.
Weight 80 t.
Output 4440kW.
Driving wheel diameter 1260mm.
Maximum speed 140km/h.
Manufacturer ASEA.

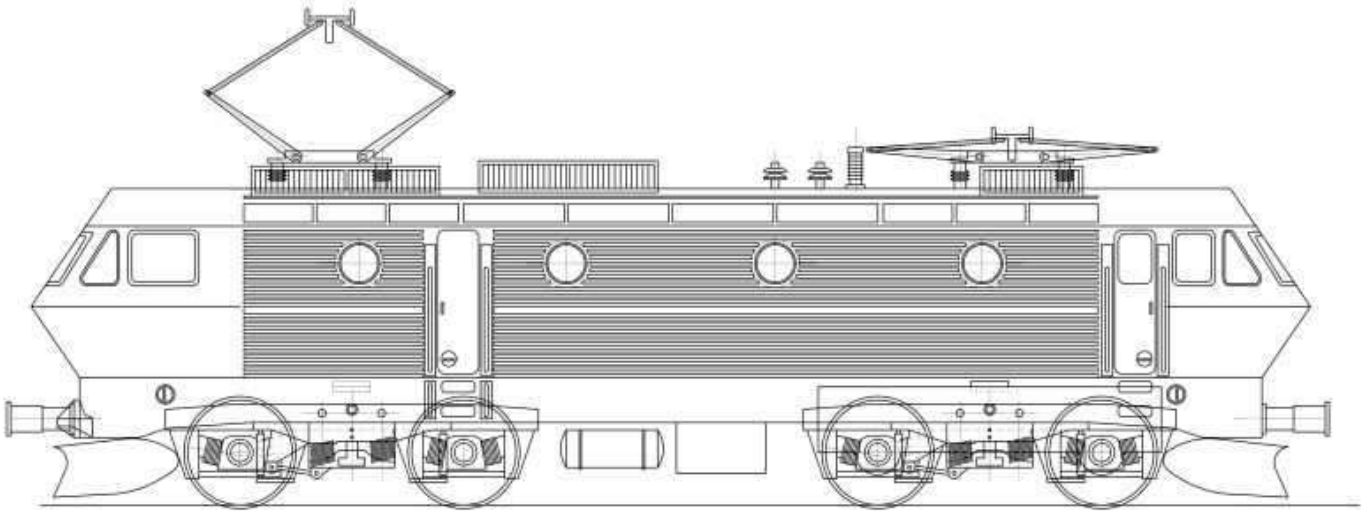
The original locomotive was planned for Bergen line which has steep slopes. The manufacturer was ASEA and this model is based on the design of Rc4 of the Swedish locomotive which is a very successive series and used in many railways, USA inclusive. Thus, the design is very similar to Rc4, but differing the steeper slant of the nose to cope with snowdrifts.

The original has thyristor chopper controller and the output is quite respectable with very compact body. The simplicity of the original locomotive is reflected to this model and one may think it easy to construct - which in fact is very much mistaken. In model locomotive scratch building, one of the most cumbersome point is the corrugation of the body.

The side view clearly shows the compact and modern design of the locomotive.

One of the features that attracts modelers eyes is the design of the driving wheel. By the look of the driving wheel, brake is applied to the side of the wheel rather than the tire.

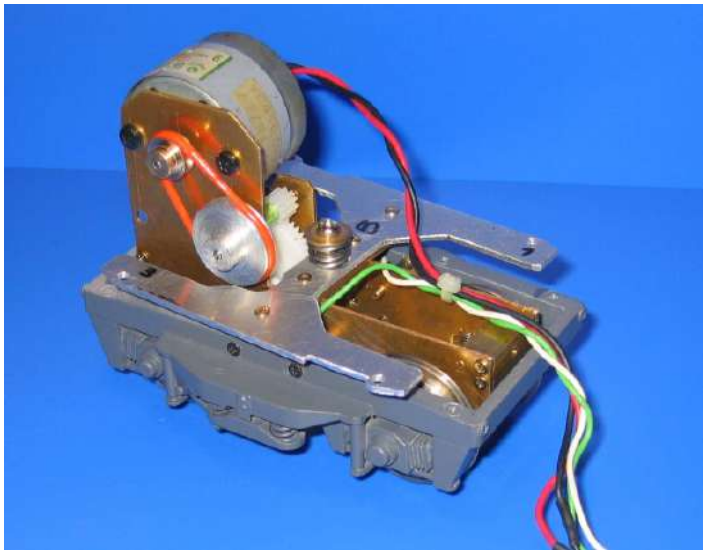
Of this model, the color scheme was not very satisfactory. Original color seems to be red, but not that bright red - somewhat darkish red commonly found in Nordic countries. That kind of color is hardly found in ready made spray and I chose somewhat brownish one as shown, but, well, …

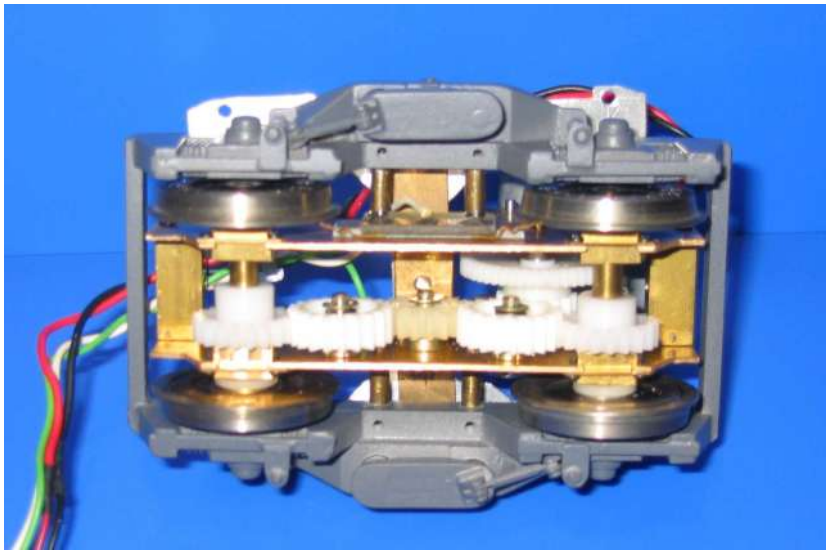


Bo'Bo' class locomotives designed by ASEA is very compact, yet powerful. Also, the design reflects engineer's common sense; something quite unexpected wouldn't happen. This must be one of the reasons that variants are exported to many countries.

On the other hand, from modelers perspective, something more would not be amiss.

These photos show how the bogie is made for this model. Each bogie has one motor driving an axle via belt and gear train. The other axle is driven by idler gears . The axles have some freedom to move vertically and the play of this displacement is provided by the bigger gear module which is 0.8.





Unlike the original, the voltage of the motors is controlled by a series regulator, but the input voltage of the regulator is controlled by a DC/DC converter. Speed, direction, headlight and pantograph up/down controls are all managed by a microprocessor.

References ;
Tore Nordin, Lennat Wretman, Ove Grundstedt Svenska Ellok, Svenska Jarnvagsklubben ,1998.
Oskar Froidh Jarnvagarna i Sverige , Frank Stenvalls Forlag, 1993.