MODELLING OF RAILWAY ROLLING STOCKS
in 1:87 scale

1 in 87 scale Model of "Tsunami" M2, No. 591 "Manitoba"

GENERAL INFORMATIONS

HIGH SPEED TRAINS & RAIL CARS

HEAVY & MEDIUM HAUL DIESEL LOCOMOTIVES

AMERICAN & BRITISH STEAM LOCOMOTIVES

SRI LANKAN STEAM & DIESEL LOCOMOTIVES

ADVISABLE ROLLING STOCKS FOR UPCOUNTRY SERVICE

Model Railway Exhibition held February 2010 at Ceylon-German Technical Training Institute
Moratuwa, Sri Lanka

by Dr. Frank Wingler, Germany

MODERN DEVELOPMENTS of DIESEL LOCOMOTIVES

Technical it is nowadays possible to pack up to 6000 hps in one diesel locomotive, but the relation of costs/reliability and yield becomes unfavourable with the power increase. Today the perspectives in diesel powered locomotives are longivity, fuel efficiency, emission control and low life cycle costs. For higher tractive efforts multiple locomotives synchronised by microprocessor remote control can be dispatched within heavy haul trains (up to 30.000 tonnes train weights).

Modern developments deal with liquified gas (compressed integrated natural gas; CINGL), as fuel.

In Germany *VOITH TURBO* penetrated the 4000 hps market with a dieselhydraulic Locomotive "*MAXIMA 40CC*" with an tractive effort of 519 kN, max. speed 160 kmph.

VOITH TURBO startet also with a new family of MonoCab B'B' Locomotives (W3 Type) with hydrodynamic transmission in the power range of 1500 to 2000 hps with the "*GRAVITA*". The German Federal Railways have already ordered 140 items.

VOITH TURBO is in preparation to build this locomotive for the worldmarekt in India and China.
The W1 had been a tailor made locomotive for Sri Lanka, engineered by Henschel in Germany. Why not to look out from *VOITH TURBO* for a new generation of tailor made track friendly MonoCab B'B locomotives, advisable for the "*upcountry service*" matching with the track stability parameters ?

Electronic parts become very quick obolate. SLR already got stuck in this maintenance problems of a modern AC dieselelectric locomotive with the M9 and will face for sure sooner or later the bottleneck of maintaining the S10 power sets.

Priority should be given to Sri Lanka Railways for diesel - hydraulic or - hydromechanical transmission over dieselelectric transmission.

High speed rail goes global

NETWORKS More than 13 000 km of high speed lines will be in operation by the end of 2009.

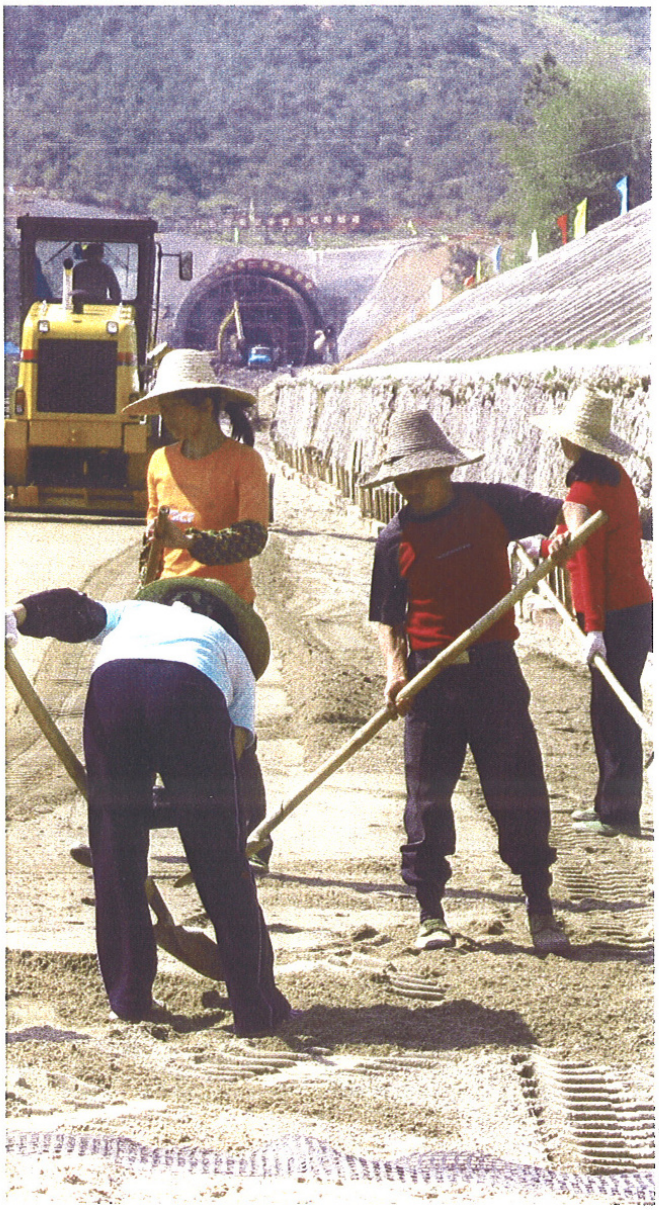
According to the Paris-based International Union of Railways, just over 10700 km of high speed railways were in service by mid-2009. By the end of the year, another 3130 km of high speed infrastructure is expected to open, taking the total length of high speed railways to more than 13000 km.

The high speed story began in 1964 when the then Japanese National Railways opened the 515 km Tokaido Shinkansen between Tokyo Central and Shin-Osaka. Just one year later trains were scheduled to run between the two cities at a start-to-stop average speed of more than 160 km/h. The now legendary blue and ivory bullet trains were by far the fastest trains in the world, and their arrival triggered a revolution in railway development.

Nearly 45 years have elapsed since the debut of the bullet trains, and in the year to April 2008 Central Japan Railway carried a phenomenal 151 million passengers on the Tokaido Shinkansen. The network of Shinkansen routes has grown too, and there are now five other lines which together carry another 190 million passengers a year.

From Japan, the high speed revolution spread to Europe, with France opening its first LGV from Paris to Lyon in two stages in 1981 and 1983. Other French cities clamoured for their own TGV services, and high speed lines were built to serve western and northern France. The original LGV was gradually extended southwards, reaching Marseille on the Mediterranean in 2001.

Germany developed its own high speed technology, opening new lines linking major cities in 1991. Italy too had begun a programme of high speed



A huge high speed railway construction programme is underway in China. The 968 km Passenger Dedicated Line between Wuhan and Guangzhou is scheduled to open before the end of the year.

Photo: Arcadis

New lines in operation at 250 km/h or more

Opened	Country	Route	Length *km*
1964	Japan	Tokaido Shinkansen	515
1972-75	Japan	Sanyo Shinkansen	553
1977-90	Italy	Rome – Florence *direttissima*	246
1981-83	France	LGV Sud-Est (Paris – Lyon)	355
1982-91	Japan	Tohoku Shinkansen	535
1982	Japan	Joetsu Shinkansen	303
1987-91	Germany	Mannheim – Stuttgart	99
1989-90	France	LGV Atlantique (Paris – Tours)	280
1991	Germany	Hanover – Würzburg	327
1992-94	France	LGV Rhône-Alpes (Lyon – Valence)	114
1992	Spain	Madrid – Seville	471
1993-96	France	LGV Nord (Paris – Lille – Calais)	333
1994	France	LGV Interconnexion (Paris bypass)	102
1997	Japan	Nagano Shinkansen	117
1997	Belgium	LGV 1, Antoing – Halle	75
1998	Germany	Hanover – Berlin	264
2001	France	LGV Méditerranée (Valence – Marseille)	241
2002	Japan	Morioka – Hachinohe	97
2002	Germany	Cologne – Frankfurt	177
2002	Belgium	LGV 2, Leuven – Ans	95
2003	China	Qinhuangdao – Shenyang	405
2003-07	UK	High Speed 1 (CTRL)	109
2003	Spain	Madrid – Lleida	481
2004	South Korea	Seoul – Daegu	224
2004	Japan	Kyushu Shinkansen	127
2005	Italy	Rome – Naples	225
2005	Italy	Turin – Novara	85
2005	Spain	Madrid – Toledo	26
2006	Germany	Nuremberg – Ingolstadt	83
2006	Spain	Lleida – Tarragona	83
2006-07	Spain	Córdoba – Málaga	169
2007	Taiwan	Taipei – Kaohsiung	339
2007	France	LGV Est Phase 1 (Paris – Baudrecourt)	300
2007	Spain	Madrid – Valladolid	180
2008	Spain	Camp de Tarragona – Barcelona	108
2008	China	Beijing – Tianjin	118
2008	Italy	Milan – Bologna	182
2008	Turkey	Ankara – Istanbul Phase 1	251
2009	Belgium	LGV3, Liège – Aachen	36
2009	China	Hefei – Nanjing	156
2009	China	Hefei – Wuhan	357
2009	China	Shijiazhuang – Taiyuan	190
2009	China	Qingdao – Jinan	366

line construction, completing the *direttissima* between Rome and Florence in 1990 after long delays caused by financial and technical problems.

Spain opened its AVE (*Alta Velocidad Española*) route between Madrid and Seville in 1992, at once sparking a fresh interest in the rail mode. Politicians were quick to spot the benefits of a high speed rail service, and plans were drawn up for a national network of high speed lines, and this is now nearing completion.

After permitting Eurostar trains to trundle gently through the Kent countryside and share tracks with all-stations commuter services for nine years, the UK opened the first part of its high speed line from the Channel Tunnel to London in 2003. The 109 km route to St Pancras was completed — at a total cost of £5·2bn — in 2007, finally linking the capital to the expanding European network of high speed lines. Eurostar now quotes a 70% share of the air-rail market on both the London – Paris and London – Brussels routes.

Using TGV technology, South Korea opened its first high speed line in 2004. Three years later, Taiwan launched a 300 km/h service between Taipei and Kaohsiung using Shinkansen-derived trains, but the project had relied on private-sector funding and is now in financial difficulty. Turkey joined the group of countries running high speed trains in 2008, when a 250 km/h line opened over part of the route between Ankara and Istanbul.

Next in line could be Saudi Arabia, which in February 2009 awarded contracts to build the 444 km Haramain High Speed Railway to convey pilgrims between the holy cities of Mecca and Medina via Jeddah. Construction of the 320 km/h line is due to be finished in 2012.

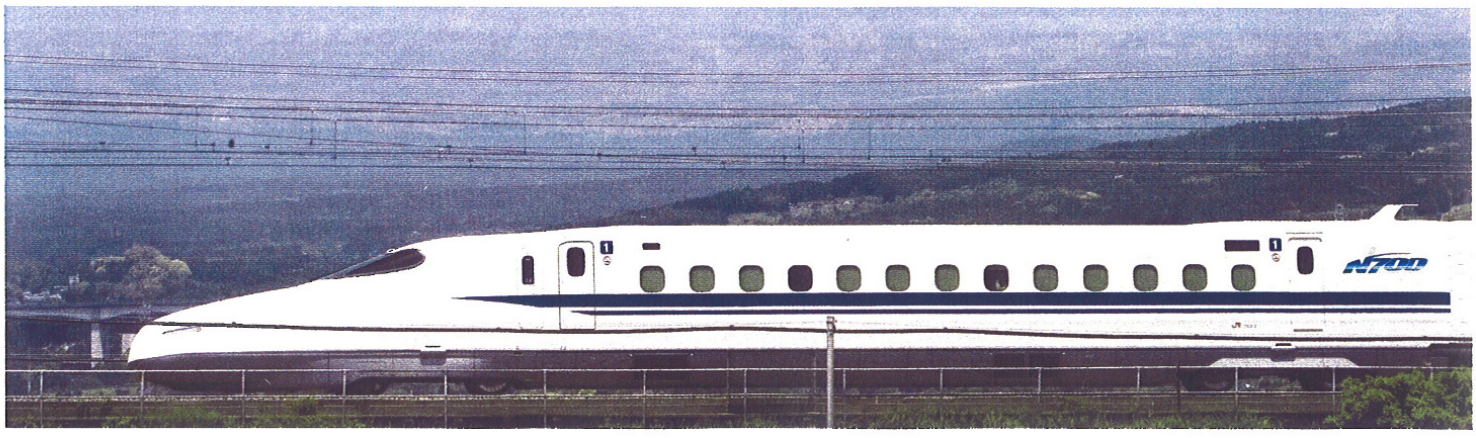
Perhaps China has made the fastest progress in building high speed lines. After opening its first Passenger Dedicated Line in 2003, it has forged ahead with a gigantic high speed railway construction programme, with a 16000 km network planned for completion by 2020.

Not all high speed line projects run smoothly — and when a major project goes wrong there is always a high price to pay. Perhaps the most striking example is the HSL-Zuid project linking Amsterdam with Rotterdam, Breda and Brussels.

Inadequate specifications for the train control system in the Netherlands and Belgium led to multiple delays in completing the line, which has yet to enter service two years after the planned opening date. Not only that, but the trains being built in Italy for the *Fyra* high speed shuttle service between Amsterdam , Rotterdam and Brussels are so far behind schedule that a temporary service of conventional trains is due to start 'in autumn 2009'.

New lines under construction for 250 km/h or more

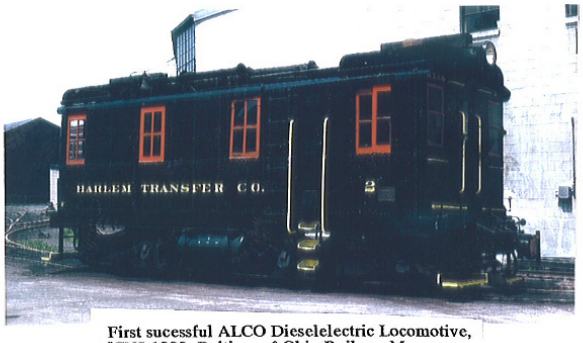
Opening	Country	Route	Length *km*
2009	Belgium	LGV4, Antwerp – Dutch border	40
2009	Netherlands	HSL-Zuid (Amsterdam – Belgian border)	85
2009	China	Wuhan – Guangzhou	968
2009	Italy	Novara – Milan	40
2009	Italy	Bologna – Florence	79
2009	Spain	Madrid – Valencia – Alicante	914
2009	China	Ningbo – Wenzhou	282
2009	China	Wenzhou – Fuzhou – Xiamen	571
2009	China	Zhengzhou – Xi'an	456
2009	China	Wuhan – Guangzhou	968
2010	Turkey	Ankara – Konya	306
2010	China	Guangzhou – Shenzhen	105
2010	France	LGV Bretagne-Pays-de-la-Loire	182
2010	Italy	Florence cross-city tunnel	7
2010	South Korea	Daegu – Busan	129
2010	France/Spain	Perpignan – Figueras	45
2010-11	China	Shanghai – Hangzhou – Ningbo	310
2011	Japan	Hachinohe – Shin Aomori	81
2011	China	Harbin – Dalian	904
2011	France	LGV Rhin-Rhône (Dijon – Mulhouse)	140
2011	Japan	Hakata – Shin Yatsushiro	130
2011-12	China	Beijing – Shanghai	1318
2012	Spain	Barcelona – Figueras	132
2012	Italy	Milan – Verona	137
2012	Japan	Hokuriku Shinkansen, Nagano – Toyama	162
2012	China	Beijing – Shijiazhuang	281
2012	China	Tianjin – Qinhuangdao	260
2012	Italy	Verona – Padua	80
2013	Italy	Milan – Genoa	114
2016	Germany	Nuremberg – Erfurt – Halle/Leipzig	313
2017	South Korea	Osong – Mokpo	230
2018	Japan	Shin-Toru – Nagasaki	118
2019	Germany	Stuttgart – Ulm	60



Japan pioneered high speed intercity services with the Tokaido Shinkansen in 1964. Tokyo – Osaka trains are today operated by N700 trainsets.

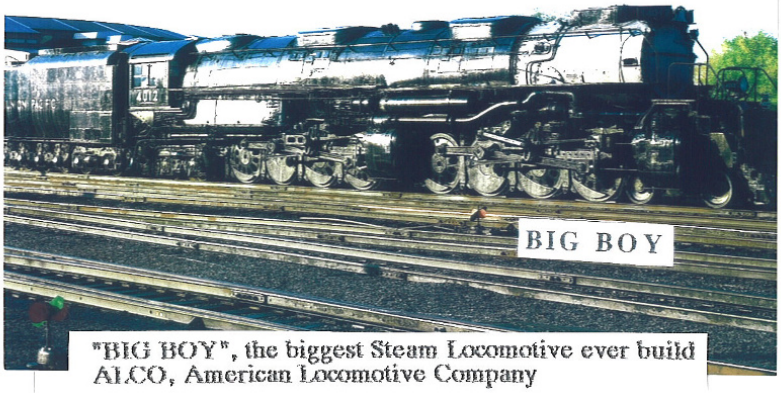
US LOCOMOTIVE BUILDERS

AMERICAN LOCOMOTIVE COMPANY (ALCO):
ALCO was created 1901, when eight companies merged in USA in order to better compete with the expanding ***BALDWIN LOCOMOTIVE WORKS.*** Montreal Locomotive Works and Rogers Locomotive Works joint later. In 1925 ALCO joint a cooperation with General Electric and Ingersoll Rand for the pioneer construction of the Diesel locomotive CNJ 1000, a 300 hps switcher (shunter). 1937 came the 1000 hps turbo engine and 1950 a 1600hps Diesel. The ALCO Diesel were more successful than Baldwin's or Lima's, but they could not jeopardise the GM EMD's products on the long run. ALCO build its last steam locomotive 1948. 1969 came the end of diesel locomotive production under the ALCO trade mark.



First sucessful ALCO Dieselelectric Locomotive, "CNJ 1000; Baltimor &Ohio Railway Museum

GENERAL MOTORS ELECTRIC MOTIVE DIVISION (GM EMD); now firming under *ELECTRIC MOTIVE DIESEL*:
The origins of the company are in Electro-Motive Corporation, which was engineering petrol-electric railcars in the 1920s manufactured by subsideries. General Motors (GM) purchased it 1930 along with the Winton Engine Co. EMS, the chief petrol motor supplier. GM developed together with Winton reliable light weight diesel motors. The first GM diesel locomotives were market in 1935 through these two subsidaries. The first mass production model was the FT, introduced in 1939. With 4 unites coupled together they developed 5400 hps. The dynamic brakes provided a big advantage over steam locomotives, when hauling heavy freight trains down gradient. The



"BIG BOY", the biggest Steam Locomotive ever build ALCO, American Locomotive Company

EMC and Winton were merged by GM 1941 and became the Electro-Motive-Division of GM. For more than 40 years other manufacturer could not challenge the EMD's leadership in production of Diesel locomotives. From the F series 7600 items have been sold. The 1750 hps "General Purpos" GP9

had been sold 4000 times. The Srilankan M2, build in Ontario, is a simplified and sturdy derivative. Such longlasting sturdy and easy to maintain Dieselelectric locomotives are not any more available on the world market. Electronic parts become very quick obsolate. German loco builders, ***VOITH TURBO, VOSSLOH, GMEINDER,*** have conquered the niche for smaler and more track friendly B'B' locomotives by Dieselhydraulic transmission.
Recently EMD had been sold to an invest company and is firming independantly from GM under the same abbreviation EMD. "D" stands now for "Diesel".

EMD DDA40X

alle DDA40X überlebten ihre Ausmusterung. so auch #6930 im Illinois Railroad Museum. Union, IL. Mai 1

asynchrone AC traction and installed for each motor one inverter, together 6 on one AC4000CW locomotive. But GE continues to build the DASH 9 with DC traction for the American/Canadian as well for the heavy haul world market. Many companies favour still the sturdy DC traction because of less invest and maintenance costs. Althoug Diesel engines can nowadays be build in the 6000 hps range, the 4000 hps range provides an optimum rin regard of cost-yield relation.

GENERAL ELECTRIC (GE):

For a long periode GE was a supplier of electrical equipments to many other locomotive manufacturers. From 1925 to 29 GE was partner in a consortium with Ingersoll Rand and ALCO. GE's own production started in the 1930s with industrial shunting switchers and continued with heavier models. Perhaps the most successful design was the U25B, introduced in 1960. GE needed only three years to capture rank 2 between EMD and ALCO. Purchasing in 1989 the Bombardier production facilities in Quebec, GE entered the Canadian market. In 1993 GE introduced

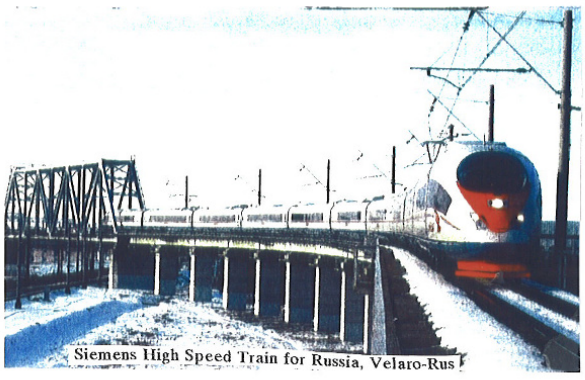
5 GE DASH 9 haul freight train
Arizona, USA, 27.07.09

HIGH SPEED TRAINS & RAIL CARS

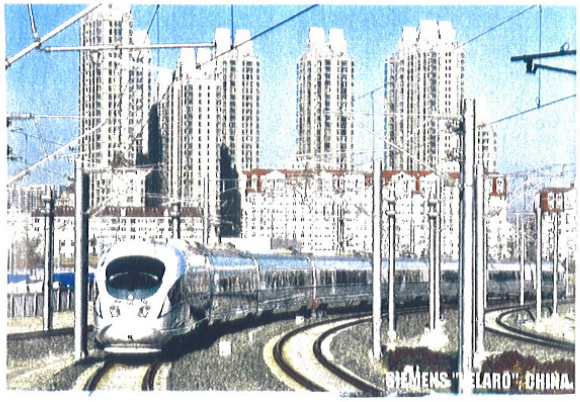
SIEMENS ICE3 HIGH SPEED TRAIN

This is the lates version of the German "***Inter City Experimental***" High Speed train. The development of HIGH SPEED TRAINS started already in the 1920ties in Germany. Sheduled trains with Diesel powered articulated multible units run already 1935 in Germany with a ruling speed of 160 kmph, maximum up to 250 kmph. Te articulation rested on the socalled "*Jacobs Bogie*" with two coach bodies resting on one bogie. This gave the train excellent track running stability and saved weight. Whereas the French Engineering of ALSTOM utilised this principle for the french TGV, Eurostar and Thalys trains, the "*Jacobs Bogie*" had been given up by the German engineering executive committe in favour of two conventional bogies under one coach body. This provided more room and more comfort in the coaches but on the other hand created technical problems by the socalled "sinuidal movements" and vibrations, a well known problem of of conventional bogies. Althoug the first experimental trains had been run upto 400 kmph in test trials, wrong

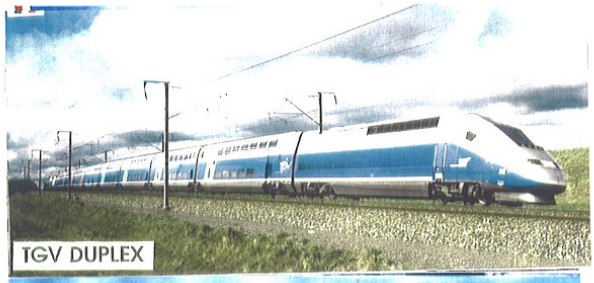
engineering and lack of surveillance and maintenancee let to the tragic Eschede Train Desaster where an ICE train derailed with a broken wheel tire over a point with 200 kmph and crashed in zig-zag formation into a collapsing overhead road bridge, killing over 125 passengers. The ICE has a new propulsion technology with every coach driven by electric motors. The ICE 3 is a Rail Car without locomotives at the front or rear developing a traction rating of 2400 kW (3300 hps) per coach (19.000 kW, 26.000hps per train set). The 1 in 25 gradients (steepest ruling gradients in Sri Lanka are 1 in 41) on the new high speed track between Frankfurt and Cologne in Germany create no problems for the 300 kmph running trains. On this "roller coster" montainous high speed line, conventional locomotive hauled trains can not run because of the steep gradients The wheelset/axle stabilities still create maintenance problems and let recently to a brocken axle, which derailed by "low speed flange climbing" on a 25 kmph speed restricted bridge section. At high speed the gyroskopic effect kept the defect wheel running in the given direction without flange climbing (the physical explanation why the srilankan M8 derails mostly at low speed by flange climbing but never at higher speed). Nevertheless, this engineering design had been choosen for 350 kmph trains for Spain, Russia *(Velaro Rus:* China. The higher interior comfort and spacing is an advantage over the French articulated TGV design.



Siemens High Speed Train for Russia, Velaro-Rus



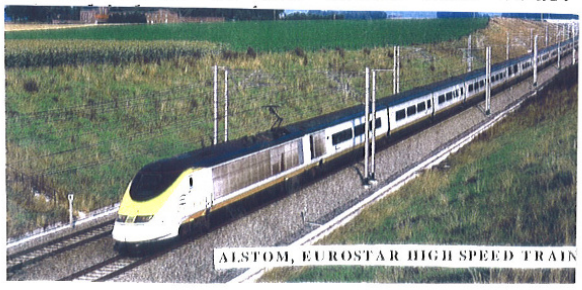
ALSTOM HIGH SPEED TRAINS: TGV, DOUBLEX, EUROSTAR, THALYS



TGV DUPLEX

ALSTOM TGV DUPLEX

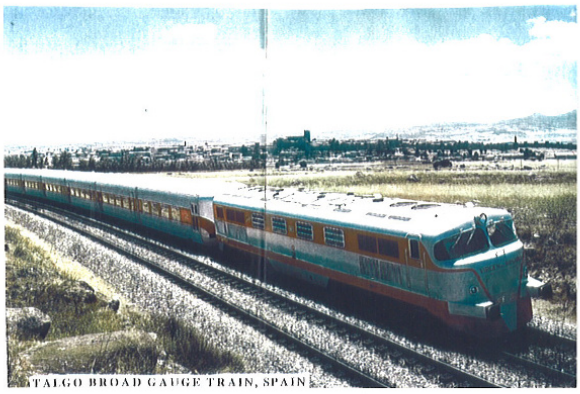
The french ALSTOM engineering makes use of the "***Jacobs Bogie***" and train articulation. This creates less stability problems for the bogie run at higher speed, creates less stress to axles and wheels and prevents a derailing train to end up in a zig-zag formation (as already known in the 1920-ties). The maximum commercial speed of those trains is 300 kmph. The 8800 kW is distributed on two integrated locomotives at the front and rear.



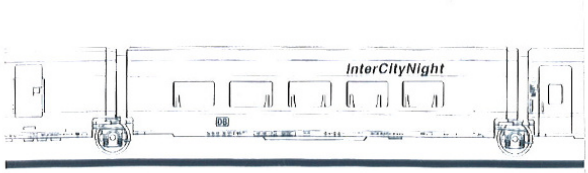
ALSTOM, EUROSTAR HIGH SPEED TRAIN

The high speed train world record had been reached recently by an experimental ***TGV*** with over 570 kmph. The Double Decker ***TGV Doublex*** can transport more passengers without making the train longer (without elongation of station platforms). It serves the long flat land routes in France and between France, UK, Netherlands and Germany, but the train sets can not run on the new German "***roler coster***" high speed track in mountainous regions.

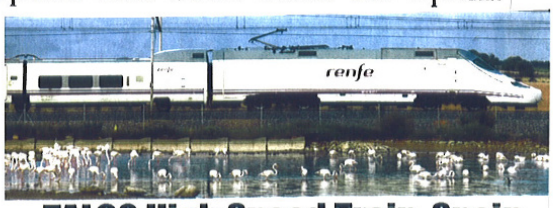
TALGO TRAINS



The Talgo concept, developed by aeronautic engineers in Spain 1942 for the gruelling Spanisch broad gauge tracks, comprehends articulated short, light weight coaches with a low point of gravity mounted on single axles. It had been designed to run in Spain on broad gauge with high speed over sharp curvatures. There is no angular friction of wheels running over curves. Advantages are the low wear of wheels and rails, low energy consumption, high train acceleration and retardation. Special fast running dieselhydraulic locomotives have been build in Spain on basis of the German dieselhydraulic locomotive V200. Talgo trains run in Spain,



France, Swizzerland, Germany, Russia and America. In tests Talgo Trains reached 500 kmph. A high speed train for 350 kmph shedulded speed had been build for Spain.

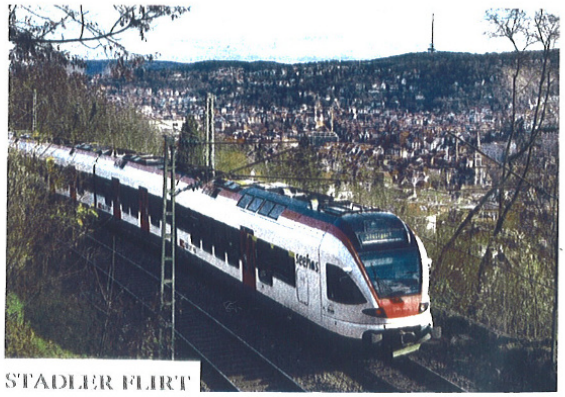


TALGO High Speed Train, Spain

For the Srilankan difficult upcountry track a light weight *TALGO* coach set hauled by a light weight locomotive would be the optimal solution. Train speed could be increased with less stress on the track. We show an advisable model train set.

SWISS STADLER "*FLIRT*" RAIL CAR

"***FLIRT***" stands for FAST LIGHT INNOTAVIE REGIONAL TRAIN-sets conceived 2004 for Switzerland. The FLIRT developed since into an internaional sales success. Already over 500 have been ordered throughout Europe. FLIRT sets run even nowadays in Algeria. FLIRT is of a modular design and comes in 2 -6 racks depending on requierements. Key figures of FLIRT are impressive acceleration, powerful bracke force and low weight. The 160 kmph fast Flirt can be coupled to form multible traction. Although the FLIRT is an electric power set, a diesel version had been designed to run without overhead electric supply.



STADLER FLIRT

LINT 41 Rail Cars (Light Inovative Regio Railcars) are light weight hydrodynamic multible units conceived by ALSTOM for regional traffic upto 120 kmph, build in Germany since 199. 400 of this multible leight weight B'+2+B' unites with two 430 hps MTU engines are already plying over european tracks. For the demonstration in 1:87 scale a srilankan S10 livery has been chosen. Light weight rail cars could serv in Sri Lanka as luxury Intercity trains between Kandy and as well Matara and Colombo.

ALSTOM LHB LINT 41

ALSTOM LINT 41

HEAVY & MEDIUM HAUL DIESEL LOCOMOTIVES

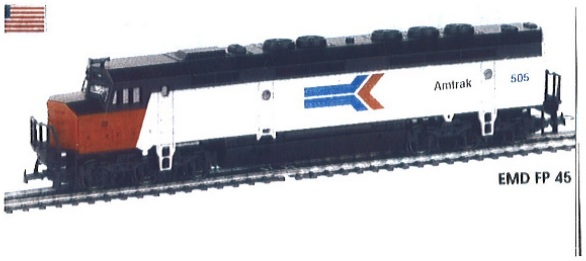
ALCO PA2

The PA series from Alco marked the begin of reliable US main line passenger dieselelectric locomotives for the American market. Remarkable was the streamline body. The A1A'A1A' locomotive had been coupled in multi traction. Each unite of 20 m length developed up to 2250 hps. 297 items have been build until the 1970ties. But Alco could not compet with EMD. The last locos where send to Mexico.

AMERICAN EMD FP 45

This 3600 hp, 20 cyl. Co'Co' locomotive had been first ordered in 1967 by Santa Fe, followed 1968 for passenger service by Milwaukee

Road. For passenger service a steam generator was installed on the locomotive to feed the passenger coach heating system. The locomotive had been used for freight as well passenger service. There had been some "mysterious" derailments of the HT-C bogie. The 177 tonnes and 20.1 m long locomotive with an tractive effort of 434 kN, a speed of 114 kmph served with AMTRAK, SANTA FE, Baltimor & Ohio, Milwaukee and AT &SF.



EMD DDA40X

47 Items of this biggest ever build monoframe dieselelectric Do'Do' locomotive with a length of 30 m and max. axle load of 31 tonnes have been build by General Motors Electromotive Division (EM, EMD) for Union Pacific. Two installed engines developed together 6600 hp. The 4 axle bogies created problems, therefore the lifespan was short. No 4930 survived in the Illnois Railway Museum.

alle DDA40X überleben ihre Ausmusterung so auch #6930 im Illinois Railroad Museum Union IL Mai 1992

General Electric Dash DC Dieselelectric Locomotives

Railway Companies in America and in other countries prefer still today the sturdy DC traction over the modern three phase asynchronous AC traction mode. The electronic of a DC locomotive is less complex than that of a modern AC locomotive. The GE Dash 9 series have ben build since 1993 in power ranges of 4000 to 4400 hps. Characteristic is the wing like radiator on the rear. They haul worldwide (USA, Mexico, Brazil, Africa, Australia) heavy iron ore and coal trains for mining corporations with a starting tractive effort of up to 640 kN.

ore train en route from Cloud Break to Port Hedland

BOMBARDIER, GENERAL ELECTRIC, AdTRANS "*BLUE TIGER*"

The first BLUE TIGER, developed and build 1990 on basis of a Henschel dieselelectric AC Locomotive with Henschel "Flexifloat" Co'Co' bogies, conected to the frame over push-pull bars (to avoid frond axle deloding under heavy rating) settled an new level for modern heavy haul diesel locomotives. The 22 m long locomotive provides excellent driving dynamics and high class run qualities. It is powered with a reliable GE 7FDL engine in a power range of up to 3.280 kW (4400 hps) in a service range of 108 to 132 t and within a speed range of 120 to 160 kmph in Egypt, Pakistan, Germany.

VOSSLOH Co'Co' Class 333.3

This dieselelectric heavy haul Co'Co' "*designer*" Locomotive is a complete new construction of the Alstom Prima DE32 locomotive (Class M9) running in Syria, Israel and Sri Lanka. The interior of the EURO 4000 is a new engineering after the German Locomotive Manufacturer bought from the French State the bankrupt Alstom Workshop in Valencia, Spain. The interior is complete new engineered with a GM EMD 16-710 engine. The 123 tonnes loco has a rating tractivity of 4000 hps and developes a starting tractive effort of 400 kN. With this the locomotive is next to the "Blue Tiger" the most powerful dieselectric locomotive on the european continent. It hauls freight trains in Portugal and Spain on broad gauge and in Scandinavia on standart gauge under harsh winter contitions with temperatures droping sometimes to -40 °C.

GENERAL MOTORS EMD JT 42 CWR

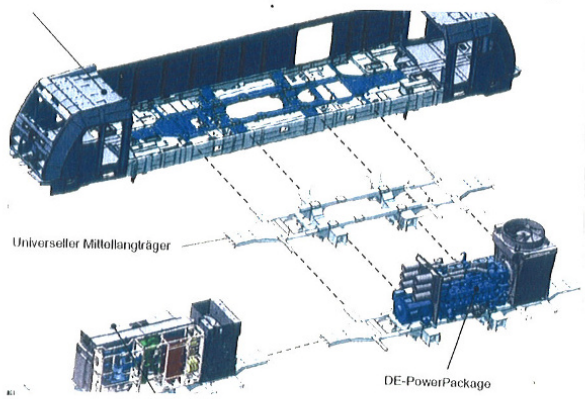
The dieselelectric freight Co'Co' Locomotive, ***Class 66***, was developed from GM EMD in Ontario, Canada for the European Rail Freight Market. The first Locomotives appeared 1989 in UK. The British customer EWS ordered 250 items. Later this Locomotive appeared also on the european continent. The Locomotive estabilished itself through reliability and low operation costs. In Germany this Locomotive operated by private Freight Operators is called by Permanent Way Engineers the "*Rail Slicer*" because of its track unfriendly three axle bogies. The 1:87 scale model represents a British Version.

MODULAR DIESELELECTRIC Bo'Bo' LOCOMOTIVES build by SIEMENS and BOMBARDIER

In Europe ther is a demand for medium power range fast running Diesel locomotives, which can be used for passenger as well freight trains. The concept is to convert electric locomotives to Diesel utilising as many parts as possible.

The Siemens Kraus-Maffei ***HERCULES*** or ***EUROSPRINTER Class 2016*** is fittet with a 2000 kW MTU 16 V 4000 RH engine, develops 23.5 kN with 20 t axle load and runs up to 140 kmph. Austria is the main buyer.

The BOMBARDIER 82 t ***TRAXX*** (Transnational Railway Applications with eXtreme fleXibility) Class P 160 DE develops 270 kN by a 2200 kW engine and hauls passenger trains with 160 kmph. The TRAXX is a converted electric locomotive. The electric PowerPackage is resting on the identical exchangable frame as the Diesel-PowerPackage.



BOMBARDIER is building this locomotive for the European market in the old Henschel workshop in Kassel, the birth place of the tailor made Srilankan Locomotives W1 and M6.

VOSSLOH G 2000

With the power of 2240 kW (3000 hps), max speed of 120 kmph and driving cabs on both ends this G2000 B'B' Locomotive represents a new range of powerful dieselhaudraulic locomotives for main line services.

The construction is based on Modul Components, the conditions for a low live-cycl-cost, simplified maintenance and high reliability. It is used in Europe by private freight operators.

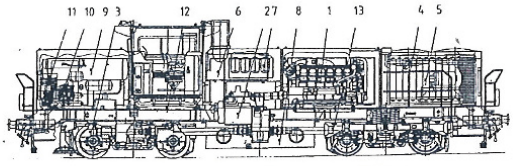
VOSSLOH-GERMANY G 1206/G1700

The dieselhydraulic and track friendly B'B' MonoCab Locomotives with Voith Turbo hydromechanical transmission, powered by MTU or Caterpillar engines in the range of 1500 to 1700 kW (2000 to 2500 hps)

VOSSLOH G 1206 B'B' Dieselhydraulic Locomotive

length: 15 200 mm; wheel base 2400 mm; height 4220 m, width 3080 mm (UIC 505-1); smalest bend: 3 chains; wheel diameter 1000/920 mm; traction effort 250 kN; power at side 1700 kW; max. speed 100 kmph; hydraulic gear VOITH L534zseU2; brakey systems indierkt pressure air brake for loco and train, direct loco pressure air brake, hydrodynamic retarder brake, spring prk brake; pneumatic horns; automatic spinning protection, low speed control 3 - 10 kmph; multiple traction with 3 locos provided; train protection ETCS Level 2, central diagnose system with display in cockpit

1 1500 kW Dieselmotor, 1800 HP
2 Hydraulic transmission gear
3 Wheel gear box 1:5.607
4 Cooling blower
5 Cooler blocks
6 Emmission silencer
7 Exhaustion air filter
8 Fuel tank
9 Main pressure air reservoir
10 Aircompressor
11 Brake board
12 Battery
13 Sandcontainer



MAK/VOSSLOH Dieselhydraulic B'B' locomotive

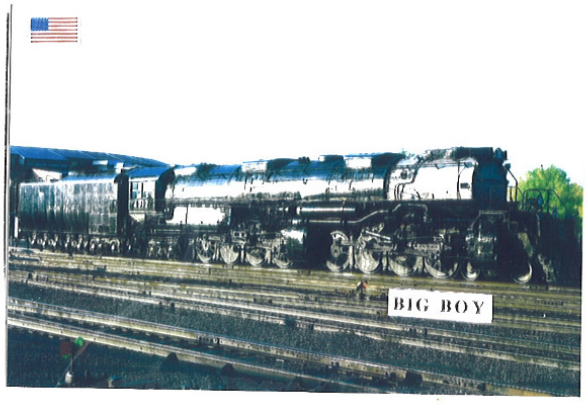
are based on a MAK-Siemens MonoCab Locomotive, which had its origine in the ThyssenKrupp Rheinstahl/Henschel B'B' MonoCab Locomotive build for Sri Lanka, the Class W1, later rehabilitated as ClassW3. The hydromechanic transmission allows a short track friendly wheel base of 2.40m . It provides a reliably dynamic retarder brake, essential on inclines. The Locomotives are an european success story on the medium power haul market and have been build over 500 times. The G1700 has been proposed as adivasble for the gruelling srilankan upcountry train service. The engineering meets the specification for a track friendly "*Upcountry Locomotive*" with a higherr rating power to replace the track unfriendly M6. The 1:87 scale models represent the lighter MAK version with 1360 hps, the MTU powered G1206 (1640 hps) as well as the Caterpillar powered G1700 (2300 hps) in srilankan W3 livery.

VOSSLOH 1700, Diesel-hydraulic B'B'

AMERICAN & BRITISH STEAM LOCOMOTIVES

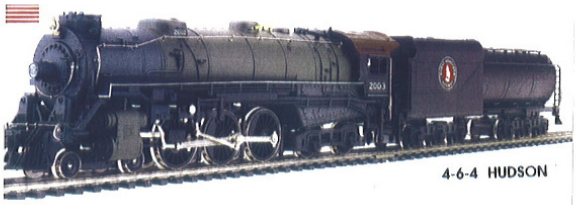
AMERICAN "BIG BOY" CLASS 4000

The Mallet type 2D+D2 (4-8-8-4) with an output of 7000 hps marks the end of the Steam Locomotive development in USA by ALCO (American Locomotice Cooperation).1941 ALCO was charged by Union Pacific with the building of a steam locomotive, that could convey 3600 tonne trains over the steep ascents with inclines of up to 1 in 56 on the route between Ogden (Utha) and Cheyenne (Wyoming) without costly helper locomotives. With its tractive effort of 610 kN and dimensions (total length 40.51 m; 32 tonnes axle load, total weight 540 tonnes), top speed 112 kmph, the ***Big Boy*** puts everthing before into the shade and is the largest steam locomotive ever build in the world. 25 items have been build between 1941 and 1944. But very soon, 1947, the area of the development of steam locomotives ended in USA. Two items have survived in not working conditions, No. 4005 in the Forney Transportation Museum in Denver, Colorado, and No. 4012 in the Steamtown Museum in Scranton, Pensilvania.



AMERICAN 2C2 (4-6-4) Steam Locomotives

The first tender steam Locomotive with a 2C2 wheel arrangement had been build by ALCO 1925 for the Milwaukee Road Company. It had been named the "***MILWAUKEE***"; but some documents refer to the nomination "***BALTIC***". This locomotive type became from 1927 on one of the favourite steam locomotives of New York Central and was named "***HUDSON***". Upto 1948 487 "Hudson" type locomotives have been build in USA. The **"Hudson"** was a fast running flat land locomotive. The last locomotives have been build 1948. The end came quick 1956 by dieselfication.



Southern, Pensilvania, Chesapeake & Ohio and Baltimore & Ohio Railways as a helper locomotive.

AMERICAN 2-10-2 (1F1) Decapod Steam Locomotive

This 5-coupler was a direct descendant of the 2-10-0 decapod. This new class of locomnotive was developed for helper service as a banking locomotive over the Raton and Cajon Pass. For better guidance when running backward down the incline the rear truck had been added. This type of locomotive had been named the "*IHC 2-10-2 SANTA FE*". It served as well on the

BRITISCH LMS 4-6-2 "DUTCHESS OF HAMILTON" Steam Locomotive

The British streamliner ***Princess Coronation Class*** Locomotive No.6229, designed by William Stanier, was build in July 1937 at Crew by the London-Middland and Scottisch Railways. The locomotive run in a test max. 182 kmph. It worked on the West Coast main line between Lodon Euston and Glasgow until 1964 and managed an average train speed of 96 kmph. In 1980 this locomotive has been restored to its original streamlined design at the Birmingham Railway Museum.

SRI LANKAN STEAM & DIESEL LOCOMOTIVES

SRI LANKAN STEAM LOCOS for the "VICEROY SPECIAL" No. 251 & 340

The preserved heritage locomotives of the "***Governer Class***" No. 251, Class B1a "***Sir Thomas Maitland,*** build 1927 by Beyer Peacock in England and 340, B1d "***Frederick North***", build 1945 by Stephenson in England and restored 1992, inspired to build 1 in 87 scale models in former bright liveries. The load of the coupled driving axles is 13.1 resp. 13.8 t with a wheel base of 10 ft.


Class B1d, No. 340

CLASS M1, "*THE OLD WARRIOR*"

The Srilankan M1 Class, 1000 hps dieselelectric locomotive build in Britain by ***BRUSH BAGNALL TRACTION LTD*** arrived in Sri Lanka 1953. It was the first main line dieselelectric locomotive ever build in Britain after the engineers studies extensively the development of dieselelectric traction in USA of ALCO and General Motors and the rail track conditions in Sri Lanka. The M1 No.539 had been literally sold off the drawing board in the face of keen competition from America and Germany. There are several stories about the maiden run in Sri Lanka with the famous late *Mr. B.D. RAMPALA*, who had to make repairs by his own hand in order to drive this first loco from Galle to Colombo.

B.D. RAMPALA stipulated a wheel base of 10 1/2 ft (3.20 m) for the A1A' A1A' bogie with an idling axle to lower the axle load to approx. 16 t. This "***Rampala 10 1/2 ft wheel base***" for diesel locomotives is a misconcept based on the former wheeel bases of Srilankan steam locomotives. 3.20 m is too long for the weak sharp 17.5 D upcountry curves. The idling axle aggravates the situation. With the M1 track problems started upcountry, which SLR is facing still today with the M6 with even a shorter wheel base of 2.80 m of the A1A' A1A' type bogie with Henschel-flexifloat axle steering. But the "***Rampala 10 1/2 ft wheel base***" is cemented in the minds as an upcountry track friendly base even if the M2 A/B/D, the M4 , M8 and M9 can not run on the gruelling upcountry track. Even nowadays it is regarded as a sacrileg to challenge this unsuitable "***Rampala 10 1/2 ft wheel base***" with an idling axle. Experts in Germany are of the opinion, that an advisable track friendly "***upcountry locomotive***" should have only 2 driven axles per bogie with no idling axle and with a wheel base not exceeding 2.65m.
The remaining M1 No. 560, taken out of service 1983, is waiting in Dematagoda for restauration by railway ethusiasts, who hope to restore the heritage locomotive back to its former glory. But the technology is obsolate and therefore there is no chance, that the ***Old Warrior*** will run again by its own power over Srilankan tracks.
We put the M 1 No. 640 in working condition back on the track, but only in 1 in 87 scale.


M1 back on the track but only as 1:87 scale model

GM EMD build Class M2

Class M2, No. 569; "ONTARIO"; A1A'A1A'

The GM EMD, Canada, build Class M2 are regarded as the most successfull locomotives besides the Canadian build M4 by ALCO-BOMBARDIER. They are powered by a EMD 12 cylinder 1425 hps engine and introduced in Sri Lanka between 1954 and 1966. The M2 A/B/D have a wheel arrangement of A1A'A1A' with an idling axle inserted to lower the axle load from aprox. 20 tonnes to aprox. 13.5 tonnes. Because of poor adhesion (tractive effort) and long wheel base those locomotives can not run upcountry. For the upcountry service the Bo'Bo' version with a higher tractive effort and shorter wheel base, No. 626 "Montreal" and 627 "Vancouver" have been introduced 1961.

M2C, No. 626, "MONTREAL"

The M2 No. 591, "Manitoba" had been cought on December 26th 2004 by the Tsunami. The locomotive had been dismantled and the parts brought to Colombo. On December 26th 2008 the rebuild locomotive with a special livery in remembrance had been put again into service with the commemorative Matara bound train No. 8050. The model has been build in commemoration of this day.

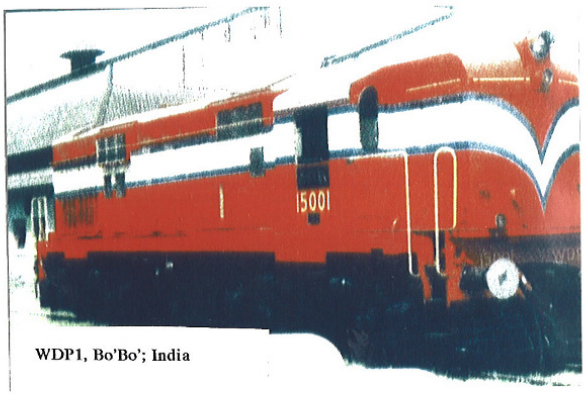
The most dreadful train desaster in world`s history
Telwatte, 26. December 2004

The M2 is based on the General Motors multi-purpose G8, G9 and G12, sturdy low cost dieselelectric locomotives build between 1954 and 1970. From the GP 9 more than 4000 items have been build for the american market. The basic points of the original design were defined in order to produce a versatile, simple, economic, multi-gauge (meter, standart, broad), multi-purpose locomotive for branch and main line services. The locomotives were released with a modified body and reduced engine output (to increase longivity and durability) for the world market both in A1A'A1A' and Bo'Bo' versions with and without dynamic brakes. They were sold all over the world to Brazil, Cuba, Mexico, Venezuela, Columbia, Chile, Argentinia, New Zeeland, Australia, South Africa, Nigereria, Tansania,

Indonesia, Egypt, Syria, Sri Lanka, Pakistan, Balkan, Israel to replace steam traction in those countries. The M2 type locomotives ring worldwide the death bells for the steam traction aegide.

One should be aware, that nobody in the world builds such a simple, sturdy and longlasting Locomotive any more. The dieselelectric locomotive which comes with its technical specification next to the M2C is the indian build, Diesel Locomotive Works Varanasi, Bo'Bo' Class WDP1 with a max. tractive effort of 200 kN, (adh= 0.25) axle load of 20 t and 2300 hps rating. The Locomotive is fittet with a compressed air & vacuum train brake system.

RDSO in India can be consulted to design on the basis of the WDP1 an upcountry track friendly 4 axle locomotive adjusted to the specific track stability parameters.



WDP1, Bo'Bo'; India

HITACHI BUILD CLASS M5

The Srilankan Bo'Bo' M5 introduced 1979 are with its 66 tonnes a leight weight and upcountry track friendly dieselelectric Locomotives. The limited dispatchable tractive effort (low adheason) did not met the expectations for longer trains hauled with a single locomotive on the upcountry service to Badulla. Two locomotives have been saved from scrab and rehabilitated 1997/8 with Caterpillar engines. The M5 s run. mostly between Matale-Kandy-Colombo and sometines haul the Ruhuni Kumari on the Coast Line.

Pictures show (top), the old locomotives and (below), the new-look engines after refurbishing and re-engineering.

"*HEAVY HAUL*" in Sri Lanka with the locomotives CLASS 4, 8 and 9

The weak tracks in Sri Lanka impose a restriction on "*HEAVY HAUL*". According *NEWTONS LAWS* the track has to take up the power, efforts, forces and stress developed by the locomotives. If track stability and excerted forces are not in complience it comes to a self destroying system. If the power developed at the wheels exeeds the adhesion between wheel and rail, the wheel start spinning. This happens frequent and the result are the " burn marks" on the rails" leading to an early rail fatigue and wheel treat spalling.

In curves the wheels trail angular. This causes a friction between wheel treat and rail head and develops sideway vectors spreading the gauge. The upcountry line is unique in the world for its sharp broad gauge curvatures, up to 17.5 D. In India broad curve curvatures are limited to 10D. The 10 1/2 ft (3.20m) wheel base and an inserted third axle on a traction bogie stipulated by the late *B.D.RAMPALA* prooved to be a misconcept for the upcountry line. Neither the A1A'A1A' Class M2 nor the Co'Co' Class M4, M8 and M9 with the 3.2m wheel base can run upcountry without distorting the track.

The Class M4 build by BOMBARDIER in Canada with ALCO engineering had been introduced 1975 and develops 1750 hps. It is a sturdy locomotive developed by Bombardier for the export. The locomotive runs also still under nearly "***no maintenance condition***" in Tansania.

M4 model, No. 751 "DIYALUMA"

The 113 t class M9 locomotives are reconditioned second hand locomotives from India build by the Varanasi Work Shops. In India this WDM2 Class locomotive is a standart Diesel locomotive with an 2400 hps ALCO engine, which develops a distinctive sound and also smoke. It is a reliable loco, but not fuel efficient. And the motor needs frequent decarbonisation.

M8 model; "Railroad Works at Ambalangoda"

The trench ALSTOM Prima DE32 locomotives (rating 2850 hps at side), originally ment for Syria, introduced as Class M9, prooved in Sri Lanka to be a failure. It was not possible to maintain this sophisticated locomotive properly. The three axle bogies without a push-pul-bar had the tendency to derail by low speed flange climbing of the deloaded front axle. Out of formerly 10 locomotives only 2 are in working condition. The others got partly vandalised for spares. This procurement under political patronage with its distinctive (sari)blue-yellow livery-design turned out to be a costly maintenance burden and therefore counterproductive for SLR.
Before procuring new locomotives comprehensive specifications have to be worked out matching the track stability parameters. Forces developed by the running wheels and rail/track moduli and stability parameters should be precisely known in physical terms, in order to give the answere, if they are in compliance without the socalled "***self destructive rail-whe eleffect***". With the wheel base the angular wheel trailing increases and with it the wheel/rail wear and gauge distortion.

Syrian "Prima D32" loco at the station of Ym Jame, February 23th, 2007, on the route between Damaskus-Homs-Hama-Allepo with a tourist train charterd by German Railway Enthutiasts.

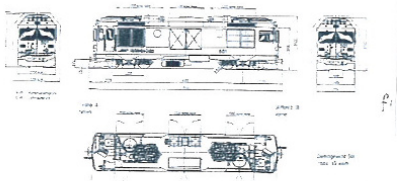
Alstom Dc 32 Loco painted in syrian livery and with "blue ribbon design" for Sri Lanka

ADVISABLE ROLLING STOCKS FOR UPCOUNTRY SERVICE

NEW BUT WELL PROOVEN CONCEPTS FOR ARTICULATED ADVISABLE UPCOUNTRY LOCOMOTIVES

Even today it is not well understood, that the gruelling upcountry track ment for a steam light railway can not tolerate high tractive efforts and long wheel bases with angular trailing wheels. The technical answere is reduction of the train weight by modern light weight coach technolog matching a limited locomotive weight and wheel base and/or articulation of the locomotive frames.

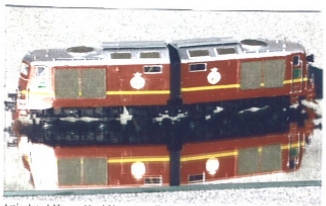
We show a model based on a swiss light weight 2000 hps 50 t dieselelectric concept with two installed lorry engines, that of the famous alpine "*Glacier Express*" route. The red livery with a yellow ribbon is a suggestion for a new "*upcountry design*".



Swiss Leight Weight Bo' Bo' 50 t Diesel Locomotive
2000 hps, for alpine GLACIER ROUTE

Proposals for Leight Weight Rolling Stocks designed according Leight Weight Rolling Stocks of Rhätische Bahn, Swizzerland
a. Leight Weight Diesel electric Locomotive; b. Leight Weight 1st Class Observation Saloon; c. Leight Weight Passenger Coach

To meet in a track friendly way with the sharp curvatures the reknown and proven articulation of the locomotive. We have prepared models on the platform of a



Articulated Heavy Haul Upcountry Bo'Bo'Bo' Diesel electric Locomotive on basis of an italian Loco Type

Articulated Bo'+Bo'+Bo' electric locomotive, Italy

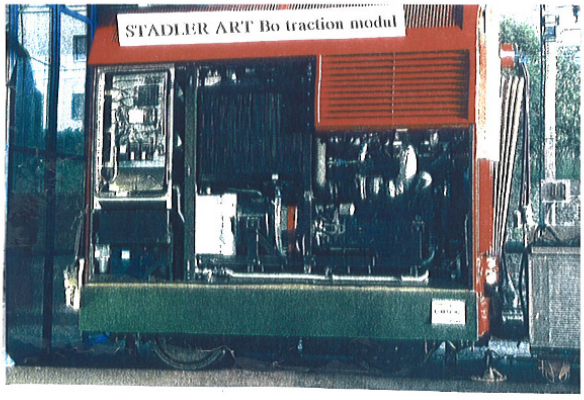
Bo'+Bo'+Bo' (6 driven axles) two frame articulated electric locomotive type running in Russia, Switzerland and Italy and of a diesel-hydromechanical "*Crocodile type*" B+B Mini Locomotive running in India on the famous NG "*Matheran*" and "*Darjeeling*" Hill Railways with its gradient of 1 in 20 and curves as sharp as 180D.

Articulated, B + B Crocodile-type Mini-Loco with two lorry engines

Models of advisable upcountry locomotive designs

MODELLING ADVISABLE SLR LIGHT WEIGHT RAIL CARS, System STADLER Switzerland

Most of the modern Light Weight Rail Cars have the traction unites installed underfloor. This leaves inside room in the racks but makes maintenance more difficult. The underfloor traction unites are exposed to dust, ballast impurities, sand ect, blowing (fuming) up from the tracks, especially from the Sri Lankan mudy and slurry tracks. One concept of ***STADLER***, Switzerland, is to install the dieselelectric traction unite above floor in a middle modul ,between the passenger trailers. The successful articulated GTW/ART is driven by a two axle Bo traction modul on which the front and rear coach bodies are hanging. The traction modul allows a free through passage. Such railcars run f.i in North Italy on an alpine route with 1 in 35 gradients up and down with 75 kmph.

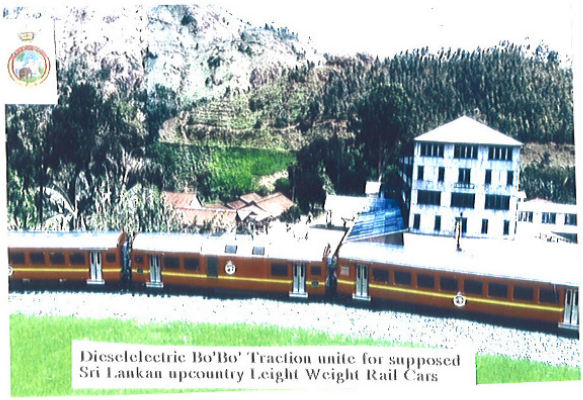



Passage through STADLER ART Bo traction modul

To lower the axle load and to take poor track qualities into account, ***Stadler*** hoisted the middle traction unite with 700 installed hps on a conventional frame with two bogies. This concept is used for a NG Light Weight Rail Car for a mountain railway in Greece.


New STADLER concept for Leight Weight Rail Cars for Mountain Railways with middle traction unite NG Rail Car BDmh27+4A/12 for OES, Greece

We expose two model rail car sets based on this ***STADLER*** concept. The middle traction unite serves also as a parcel van and can run without the trailers as an independent "***Mini Loco***".


Dieselelectric Bo'Bo' Traction unite for supposed Sri Lankan upcountry Leight Weight Rail Cars