The old Warrior Class M 1 Loco back on the Track

What is the advisable Wheel-Arrangement and Wheel-Base for Upcountry running Locomotives?

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The Calamity with the French/Alstom build Class M9

A Feature Article elaborated for a Technical Railway Exhibition and a Seminar with Students of the Richmond Hill College, Galle, Sri Lanka, October 2014

- **by Dr. Frank Wingler, August 2014, revised August 2016**

Pict. 1: Class M1 No. 560 at Ratmalana

Srilankan Railway Enthusiasts have waited long for the renovation of Sri Lanka`s first Main Line Diesel-electric Locomotive **(see Pict. 1)**, the Class M 1 Loco No. 560. Railway Enthusiast Dr. Frank Wingler had put this Class **"M1"** Loco as a 1 in 87 scale model in running condition back on the track.

Railway Enthusiast can now admire the **"Old Warrior"** Class M1 at the National Sri Lanka

Railway Museum at Katugannawa, opened for public viewing on 14th December 2014**; Pict. 2**:

Pict. 2: Restored M1 at National Railway Museum, Katugannawa; **Pict. by Primal Matusanka, 28.04.2016; for more Pictures see:** http:// www.ceylonrailway.com

The locomotives weighed 89 long tons, had a 1000 hp (746 kW) V12 Mirlees JS12VT four-stroke engine. Ceylon Railways (CGR) had a fleet of 25 of these Class M1 locomotives, which began introduction in 1953 and were removed from service from 1983; see also Sahan Jayasuriya in: http:// www.ceylonrailway.com.

The **CLASS "M1"** Locos, build by the British **BRUSH BAGNALL TRACTION LTD** in Loughborough UK between 1952 and 1955, mark a milestone in the British development of Main Line Diesel- electric Locomotives. Until 1950 the Brush Group's interests in Diesel-electric rail traction were confirmed to build shunting locomotives up to 500 horse-powers, but the Company's engineers had closely studied the developments in more powerful Main Line Locomotives occurring in several other countries notably in U.S.A by General Motors and ALCO.

The Technical Director of Brush, Mr. J.H.R. Nixon, made an extensive visit to North America in 1948 and reported favourably on the prospects for Diesel-electric traction after studying the operating records of American Railways equipped with Diesel-electric locomotives for Main Line services. Accordingly, the Company decided on a policy of entering the market of Diesel-electric locomotives, and they were successful in obtaining in 1950 a first order for twenty-five 1.000 horsepower locomotives from the Crown Agent for the former Colonies for the Ceylon Government Railway at a cost of over £ 1.000.000. The first build Main Line Diesel Locos were literally sold off the drawing board in the face of keen competition from America and Germany. The order was accepted as a tribute to the technical ability of the Brush-Bagnall team.

In view of the importance of the order and the special operating conditions in Sri Lanka, which included tracks with ruling gradients of 1 in 44 rising to an altitude of more than 6.000 feet with sharp 5 chain (100 m or 17.5 Degree) curves as well as tropical humid climate conditions along the sea coast, two Brush Engineers, J.H.R. Nixon and E.P. Hubbard, made a complete survey of the Railway System in Sri Lanka. They travelled on every mile of the track, visiting workshops and in collaboration with the famous Chief Mechanical Engineer of C.G.R., **Mr. B.D. RAMPALA**, made detailed notes of every possible feature of operation to be taken into account in final design of the locomotives.

The first Engine **No. 539** went into service in 1953 for proofing-trials and training of drivers and other staff. Since there had been no 5 ft. 6 in broad gauge Rail Track in England, the first experimental run had to be undertaken in Sri Lanka. And there are several stories about the maiden run with the famous late **Mr. B.D. RAMPALA**, who had to make repairs by his own hands in order to drive back the first Loco from Galle to Colombo.

The **M1** Locomotive is of the type designed as "A1A'-A1A'". **"A"** denotes **"one driven axle"**, **"1"** denotes "**one non-driven idling axle**" and the symbol **" '** " marks the "**rotary frame or bogie"**. This means, the superstructure is mounted on two bogies, each bogie having three axles of which the two outer axles are motored, whereas the centre axle is for carrying purpose in order to lower the axle weight to approx. 16 tons. From the modern technology view point, this idling axle between the driven axles increases the strain on the rails in tight curves and leads to check rail-bolt spreading and gauge spreading. Better would have been to lower the axle load by a pony wheel like on steam locos. The wheel base of 3.20 m or 10 ½ feet is too long for the tight 17.5 Degree broad gauge curvatures. The wheel bases should have been limited to 2.65 m. 10 ½ feet for an up-country running Locomotive had been a misconception stipulated by the former famous B.D. RAMPALA; **see Pict. 3**:

Pict. 3: *Down the Memory* Line: Two M2 hauling Upcountry the Udarata Menike

But is still a sacrilege to challenge Rampala`s stipulation. 10 ½ feet is based on the wheel-base of former Sri Lankan Steam Locomotives. An advisable up-country running

locomotive should have only two driven axles per bogie of a wheel-base not exceeding 2.65m.

Sri Lanka has the tightest Broad Gauge Curvatures in the world. In India on Broad gauge tracks the curvatures is restricted to max 10 Degree. ***"Degree"*** nominates the angle of the curve-arc between the touching points of a 100 feet or 30.5 meter chord. 1750 divided by the angle in Degrees results in the Curve-Radius measured in metres.

The **M1** is a **DIESEL-ELECTRIC** 88 tons heavy Locomotive powered by a Mirrlees, Bickerton and Day, V-type 12 cylinder V12J812VT, turbo charged four stroke Diesel-engine coupled with a dynamo producing the electric current for the four 226 hp., 315 Volt and 610 Ampere electric traction motors mounted next to the axles in the bogies (so-called *Axle-hung Drive*).

The Locomotive has a front and rear bulky nose, protecting the Driver`s Cabin like a "Crash-Box" in case of a collision.

The service period of those 25 warriors from the beginning of the new Diesel Loco area lasted nearly 31 years until end of 1983. The lack of spare parts, the high maintenance costs and the insufficient traction effort forced the Department to take the Locos out of service after nearly 31 years.

Even if the left and restored Loco No. 560, preserved at the National Railway Museum Katugannawa, is of historical value, there is no realistic chance to bring this warrior back on the tracks in working conditions to pull trains as before 1983. The Railway Authority faces nowadays many other worries, like to keep the recent procurement of 10 French ***ALSTOM*** Locos in working condition. Out of the 10 French Locos only 4 are running. The remaining locos covered already with weed or got vandalized for spare parts in order to keep the remaining four Locos alive.

Even nowadays it is easier to rebuild a 100 years old steam engine than to rehabilitate a Diesel-electric Loco, for which special spare parts are needed. The **M1** marks the beginning of the Diesel-electric traction area with a technique of 1950, which can not compete any more with the standards of this millennium.

As a small consolidation for the Railway Enthusiasts, Dr. Wingler has put the M1 No. 559 and 560 in working condition back on the track but as a 1 in 87 scale model. To build the model replica he used a photo of the Loco No. 560 published in a feature article from Mr. Ravi Fernando in SUNDAY ISLAND, September 28, 2003 on page 14, and the Driver's Handbook printed by BRUSH BAGNALL for the Ceylon Government Railway. Undercarriage, motor and transmission have been used from a commercial available similar HO ***"Nose Diesel Loco"*** Model, from a so-called ***"NOHAB"*** Loco designed in the same period of the 50-ties by General Motors in USA to be manufactured in Norway for the European market.

When designing the M1 the Brush engineers had been inspired by this developments of General Motors in U.S.A. Whereas the life span of the British build pioneer Locos ended already in the 80-ties in Sri Lanka, some American designed ***"NOHAB"*** Locos are still running in Hungarian, Belgium, Denmark, Sweden and Norway and Germany (some as vintage Locos; see 1 in 87 scale **Model Pict. 5; below**).

The two models **(see Pict. 4; below)** are running on 16.5 mm rails with 15 Volts DC or AC. One is equipped with a digital ***"LOK PILOT"*** microprocessor chip for remote control run. The control signals are send through the rails and via the wheels to the Loco-Decoder.

The Decoders had been developed Motorola on basis of mobile phone technology. Similar technology is also used nowadays even to control full size Locomotives in multiple Traction.

The models had been exhibited February 2010 at a Model Railway Show at the Ceylon-German Technical Training Institute, Moratuwa, and October 2014 at a Technical Railway Exhibition and Seminar at Richmond Hill College, Galle, Sri Lanka.

Pict. 4: 1 in 87 Scale Model of Class M1, No. 559.

Pict. 5: 1 in 87 Scale Model of a Nohab Nose Diesel-electric Locomotive

Unlike such a great care for the procurement of the M1 Locos in the 1950-ties the evaluations for new locomotives during the election period of Chandrikha Kumaranatunge have been more dominated by ***"commission hunting"*** than by track realities and operational conditions.

Pict. 5: Alstom Prima DE 30 Locomotives build for Syria, modified for Sri Lanka at Belfort, France

The French/Alstom build Class **"M9"** 6-axle Locos of the C0`-C0` type ("**C**" denominates 3 driven axles, "**0**" = "ZERO" denominates that each axle is individually driven, and the symbol "'" tells about a bogie frame) have been engineered on the platform of electric **"Prima"** locomotives. The Diesel-electric version had been designed for **CFS, the Syrian Railways (see Pict. 5/6**,) to haul goods trains on standard gauge tracks from Iraq via Syria to the Mediterranean harbour Latakia and passenger trains from Damascus to Baghdad:

Pict. 6: Alstom Prima Locomotive with Passenger Train from Damascus to Baghdad

An early animation for SLR shows this *Prima* Loco in a light blue livery with a yellow ribbon and not in the ***"Syrian-Livery"*** with ("Chandrikha`s election-campaign Saree-Blue) instead of Red; **see Pict. 6 and 7:**

Pict. 7: Early Animation of M9 Livery for SLR

Whilst the earlier build Class 67 version for England, EWS, has a crankshaft to drive the auxiliary equipments, and has large ventilation grids, (**see Pict. 8/9**)

Pict. 8/9: B0'-B0' Alstom Prima Version for England with open Ventilation Grids

the Syrian version has no crankshaft any more and the hood is closed for noise reduction. Even before the designer Locos had been painted in Belford in white, yellow, blue livery for Sri Lanka (the Syrian livery is white, yellow, red) and before the Locos have been hoisted on broad gauge bogies (never testes on warped rails) for shipment via Antwerp in Belgium (**see Pict. 10**):

Pict. 10: Alstom build M8 waiting at Antwerp Harbour for Shipment to Sri Lanka

to Colombo, experts have warned, that the overpowered Locos will overheat when running upcountry, derail at low speed under load by flange climbing of the de-loaded front wheels and distort the weak Srilankan broad gauge tracks. And those Loco derailed and overheated when used upcountry, and one Loco derailed even on the straight track of Kalutara Bridge when accelerating. One Loco caught also fire; **see Pict. 11a**:

Pict. 11a: Class M9 after it caught fire at Talawa; **Pict. by Ceylonrailway.com**

Pict.11b shows a 1 in 87 scale model of the M9:

Pict. 11b: 1 in 87 Scale Model of the Class M9 Locomotive, No. 864

The Inspectors of Permanent Way are lamenting over the track distortion caused by this 101 tonnes heavy Locomotive. This Prima DE 32 Loco is running in Israel and in Syria in a 4 axles as well 6 axles Standard Gauge Version. Before the Syrian War one could see the Syrian Loco sometimes arriving in Baghdad with a weekly train from Damascus; **see Pict. 6; above**. After the calamity in Sri Lanka the Alstom Prima Diesel-electric Locomotive for

Iran got open cooling grids; **see Pict. 12 and 13:**

Pict. 12: Alstom Prima Diesel-electric Locomotive in Israel

Pict. 13: Alstom Prima Diesel-electric Locomotive with open cooling Grid in Iran

For Srilankan track conditions suitable and advisable **4 axle B'-B'Diesel-Hydraulic Mono-Cab Locomotives**, based on the 1967 W1 Henschel-Concept for SLR, are build in Germany for the world market from ***VOSSLOH*** and ***VOITH*** in a power range from 1200 to 2400 hp; **see Pict. 14/15.**

The power between Diesel-Engine and axles is transmitted by an oil-fluid-gear. The gear-box is connected to the axle like in a lorry by a crankshaft. This transmission is sturdy

against water, dust and corrosion. There are no electric parts, which might get obsolete by the time. Not so with **Diesel-Electric Transmission**, where the Diesel-Engine is connected to a Generator or Dynamo. The axles are driven with electric motors fed by the generator or dynamo produced electricity; see also Technical Railway Paper by Dr. Wingler "***From Steam to Diesel"*** in httt://www.drwingler.com.

Pict. 14: Vossloh build B'-B' Diesel-hydraulic Locomotive G1206 with Henschel Flexi-Float and Flexi-Coil Suspension; advisable for Sri Lanka Railways Track Conditions

Pict. 15: Voith build B'-B' Diesel-hydraulic Locomotive GRAVITA with Henschel Flexi-Float and Flexi-Coil Suspension; advisable for Sri Lanka Railways Track Conditions

The development for modern Diesel-electric Locomotives goes in the direction to use instead of one heavy Diesel-Engine several smaller and lighter Power-Pack Unites.

For Upcountry-Haulage an advisable alternative to the A1A'-A1A' Class M4 Locomotive might be a four axle B0'-B0' so-called "***Generator-Set***" or "***Genset***" Mono-Cab Locomotive. "Genset Locomotives" use multiple "Power-Packs" consisting of light weight high-speed Diesel-engines and generators, rather than a heavy single medium-speed Diesel-engine and a single generator. This modern development is more fuel efficient and is of lower and cleaner emission. Locomotives with Power-Packs are service friendly, because the Generator-Sets can be easily exchanged and serviced. The Diesel-engines used are conventional and in series build engines of heavy road vehicles. If less traction is needed, individual Power-Packs can be switched off

Forerunners for B0'-B0' Power-Pack or Genset Locomotives are in USA Railserve LEAF (**Pict. 16**) and National Railway Equipment, NRE (**Pict. 17**):

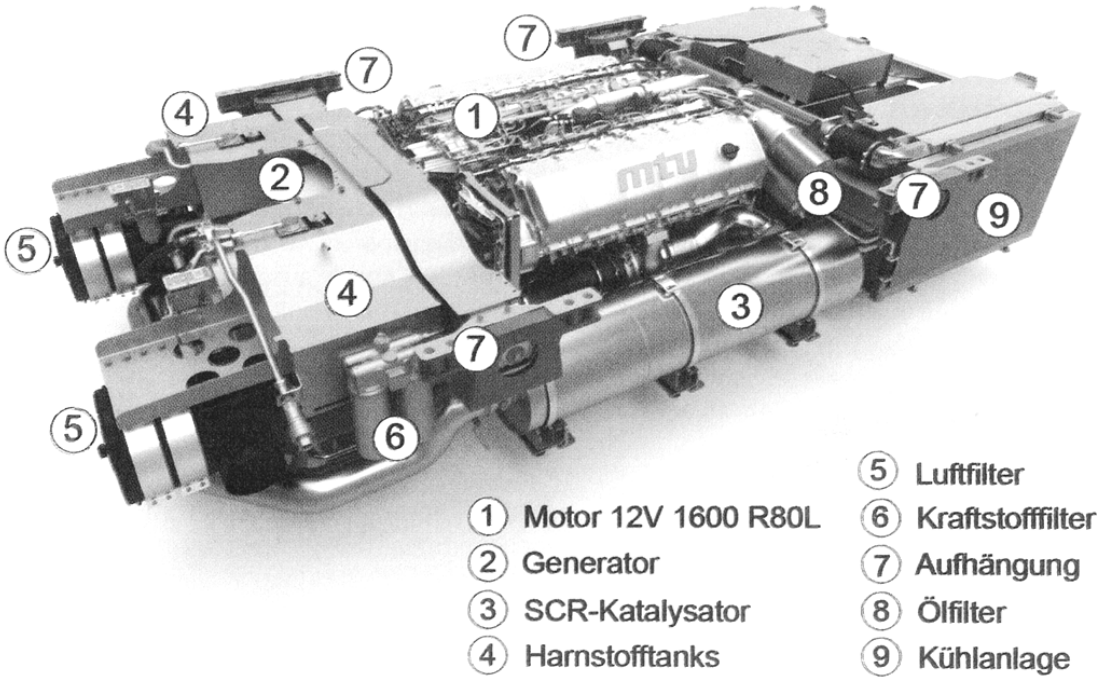
Pict. 16: Railserve LEAF Genset Locomotive with two Cummins QSX15 Power-Packs, "*Dual LEAF"*

Pict. 17: NRE 3GS21B with three Cummins QSK19 Power-Packs, rating together 2100 hp/1470 kW

US manufacturer Railreserve has recently delivered six Dual Leaf Genset Locomotives to Gabon in West Africa. The Leaf Locomotive design uses two Cummins QSX15 heavy duty Diesel-Generators rating each 600 hp, together 1200 hp. It reduces fuel consumption by 45-65 % over a conventional single Engine Locomotive. An automatic control can ensure the locomotive to operate on only a single Power-Pack when hauling lower load. The Railserve LEAF`s proprietary traction-motor control system automatically backs off to any one of the four axles, that are in danger of slipping. The axle-load of the export versions can be lowered according the customers track conditions; **Pict.18**. For further information contact: T.J. Mahoney LEAF@Railserve.biz ; see also Railway Gazette International June 2016, page 40.

Pict. 18: *Dual LEAF* Genset Locomotives for Gabon

MTU, Germany is providing light weight Diesel-electric Power-Packs with up to 900 hp as traction unites for Rail Vehicles in a unit with 12 cylinder V-Motor, Generator, Cooling System and Emission Cleaner; see **Technical Paper *LANKA ECONO RAIL (LER) PROJECT, AN ADVISABLE SOLUTION FOR SRI LANKAN RAILWAY CONSTRAINTS*** under http://www.drwingler.com :



Pict. 19: MTU 900 hp Power-Pack for Rail Vehicles