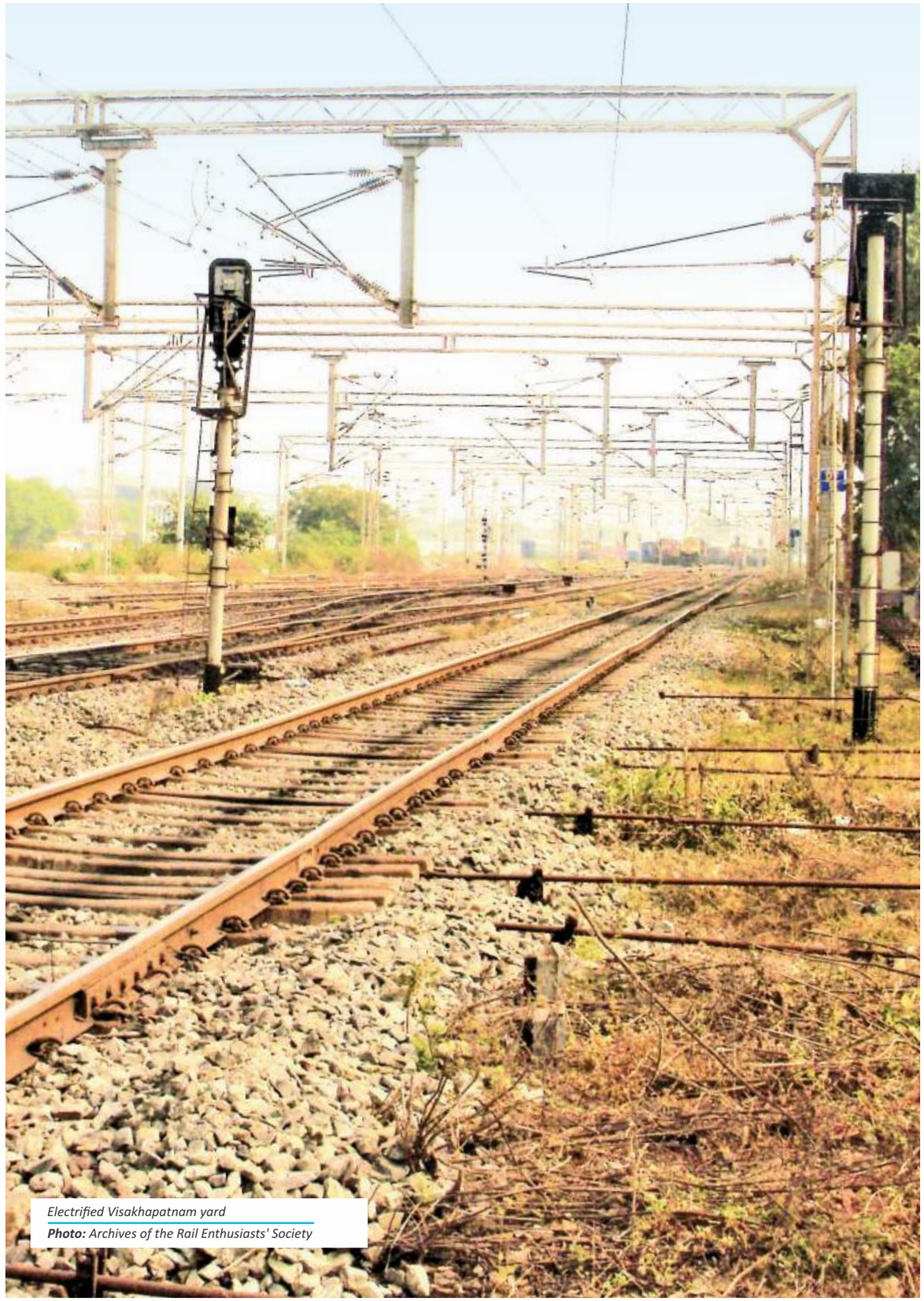


Electrified Visakhapatnam yard

Photo: *Archives of the Rail Enthusiasts' Society*

Free e-Magazine

the rail enthusiast

Vol. 5 No. 3 August 2020

The Rail Enthusiasts' Society Quarterly

ELECTRIFICATION

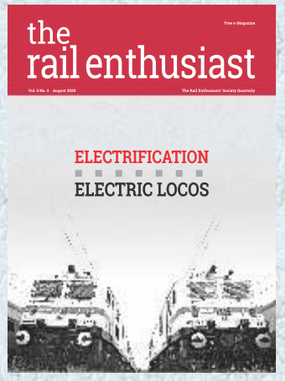
ELECTRIC LOCOS

The **WAM4**

As the name implies, the WAM4 is a Broad Gauge AC Electric locomotive suitable for passenger as well as freight traffic. This loco heralded “Make in India” for electric traction in the 1970s as it was designed by the Research Design and Standards Organisation (RDSO) and the Chittaranjan Locomotive Works (CLW) of the Indian Railways and subsequently built by the latter. Starting manufacture in 1970, 500 of these locomotives were built between 1970 and 1983, the last being No. 21399 aptly named '*Anant*' as the legacy of this class lives on.

The WAM4 was a rugged successful design that served the India Railways for half a century for both freight and passenger services. At its time, it was the most numerous class of electric locos in the country. It was only the advent of 3-phase technology that sounded its death knell. Earlier this year, in January, the last four WAM4 units of the Tata Loco Shed were withdrawn from mainline service. Today a few locomotives are being used for shunting and departmental work.

Photo: *Courtesy Somsubhra Das*



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by the Rail Enthusiast &
for the Rail Enthusiast

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Musings of the Editor...

I remember the journey very well. It was somewhere in the middle of 1956 and I was traveling by train from Nashik Road to Mumbai with my parents. I was all of 10 years old and this was my first journey to the Western metropolis. My father was in the Indian Army and posted at the Artillery Centre at Nashik.

The train left Nashik Road station with the sound of the familiar “Chhook-Chhook-Chhook'' of the steam locomotive ringing in one's ears. Those were the days when there were no air-conditioned trains; you kept your windows open and not only the sound of the locomotive but also all other sounds from the station and the surroundings could be heard clearly. After one halt at Devlali and a run of roughly an hour and a half, the train steamed into Igatpuri. It looked like a small town but the halt at the station was for around 30”. I had climbed down from the train with my father and as I looked towards the front of the train, I noted that there was no steam loco and a box-like engine was being attached to the train.

“That's an electric engine,” my father told me. I learnt that from Igatpuri till Mumbai, we would be hauled by an electric loco. I learnt much later in life that this line to Mumbai and a similar line from the latter towards Pune along with a short stretch from Chennai, were the only electrified lines in the country. Together, these lines totaled 388 kilometers.

We have come a long way since then. It is interesting that even these 388 kilometers of electrification had been completed by 1931 and there was no further movement in this direction till massive electrification was taken up in Eastern India in the late 1950s. There was no looking back after this and rail electrification today covers 40,000 kilometers of the 68,000-kilometer route of the Indian Railways, as the table below indicates.

ZONE-WISE STATUS OF RAILWAY ELECTRIFICATION (including KRCL) AS ON 01.04.2020

SN	RAILWAY	Total Route Kilometres				Route Kilometres Electrified (BG)	Percentage Electrified (%)	
		BG	MG	NG	TOTAL		BG to BG	TOTAL/ TOTAL
1	CR	3853	0	299	4152	2928	75.99	70.52
2	ECOR	2774	0	0	2774	2774	100	100
3	ECR	3883	265	0	4148	3336	85.91	80.42
4	ER	2804	0	13	2817	2235	79.71	79.34
5	NCR	3222	11	289	3522	2569	79.73	72.94
6	NER	2994	483	0	3477	1738	58.05	49.99
7	NF	4112	1	87	4200	319	7.76	7.60
8	NR	7057	0	261	7318	4816	68.24	65.81
9	NWR	5083	500	0	5583	1801	35.43	32.26
10	SCR	6058	176	0	6234	3744	61.80	60.06
11	SECR	2099	0	178	2277	1863	88.76	81.82
12	SER	2713	0	0	2713	2392	88.17	88.17
13	SR	4834	247	0	5081	3381	69.94	66.54
14	SWR	3566	0	0	3566	731	20.50	20.50
16	WCR	3010	0	0	3010	2525	83.69	83.89
16	WR	4805	1155	559	6519	2578	53.65	39.55
17	METRO RLY	27	0	0	27	27	100.00	100.00
18	KRCL	737	0	0	737	109	14.73	14.73
	TOTAL	**63631**	**2838**	**1686**	**68155**	**39866**	**62.65**	**58.49**

Electrified track between Howrah and Kharagpur
***Photo:** Archives of the Rail Enthusiasts' Society*

In other words, virtually three out of every five kilometers of the Indian Railway network is now on electric traction. The Ministry of Railways has already announced that the entire network is planned to be electrified. When this happens, perhaps the only lines that will not be electrified are some of the hill railways. Even among the latter, there is a proposal to electrify the Nilgiri Mountain Railway and run steam trains on it only on special occasions or when such a train is chartered.

It is for this reason that we thought it appropriate to bring out an issue of this magazine with the theme: Rail Electrification and Electric Locos. You have this issue before you now.

What was true of the first trains in the country has been equally true for rail electrification. The first commercial train on the Indian sub-continent ran on the 16th of April 1853 from what was then Bori Bundar and later Bombay VT; the first electric EMU train also ran from Bombay VT 82 years later on the 3rd of February 1925. Although what was then Madras beat Calcutta to launch electrical train services, large scale electrification radiated out of Calcutta in the late 1950s, the first train running on the 1st of December 1957 from Howrah. In this issue, two of our regular contributors, Annavarapu Ramarao and Rajendra B Aklekar, tell us about the start of electrification in Eastern India and the Mumbai area respectively. While a phenomenal increase in commuter traffic was the reason for the shift to electrics in both areas, trains out of Mumbai had also the challenge of climbing up the Western Ghats. Steam was not suitable for this and hastened electrification in the West.

With the introduction of electrification, you also needed electric locomotives. Almost immediately after independence, one of the first factories to be set up in the country was one to manufacture locomotives. The Chittarnajan Locomotive Works commenced production of locomotives, albeit steam, in 1950. By the early 60s, it had been converted to the manufacture of electric locomotives and today produces more electric locomotives than any other plant in the world. Its story of development has been penned by Aritra Chatterjee. The variety of engines - steam, diesel and a host of electrics - it has produced is quite amazing.

If you travel by a passenger train today, chances are that the train would be hauled by a WAP7 class locomotive. What is not well-known, perhaps not known at all, is the fact that this iconic locomotive was developed in house from an imported design and was more or less given up till a dedicated team of die-hard engineers of the Indian Railways saved it from extinction. Get the story from the horse's mouth in the words of Sujeet Mishra who was one of the key members of the team that worked on re-designing this loco and placing it among the work-horses of the railways.

There have been many eminent persons who have contributed to the setting up and expansion of the railway in India. To highlight the contribution of such stalwarts, we are starting a series called "Eminent Railwaymen" starting with this issue. And there is no better person to initiate this series with than Rowland McDonald Stephenson, the pioneer who set the ball rolling for the East Indian Railway. For this, we are reproducing an article written by the ever-green chronicler, Annavarapu Ramarao, in his book "Trailing Window".

The magazine includes other features as well ranging from a trip report by Somsubhra Das to two book reviews. The latter include books that every rail enthusiast must go through: "Train to Darjeeling" by Sanjoy Mookerjee, and "Indian Railways - A Visual Journey" published by DK. You will also find a report on the now closed Mayurbhanj Railway by Anil Dhir.

Last but not the least, South Western Railway continues to be one that has an abiding interest in heritage. It was the first zonal railway to become a corporate member of the Rail Enthusiasts' Society and today has taken the lead in not only renovating, reviving and resurrecting the rail museum at Mysuru (earlier Mysore) but also setting up a brand new one at its headquarters at Hubballi (earlier Hubli). You can see both the museums in this issue through a large number of pictures accompanied by lucid text. The museum at Mysuru was already one of the better ones outside New Delhi; it is now certainly a must see by rail enthusiasts and others alike.

Since Covid-19 lock-downs have been eased considerably, we are in a position to publish a physical magazine. Posting them from here is also not likely to pose any problem. However, well-informed sources have advised us that there could be a problem for postmen to deliver the magazine or for the recipient to receive it. We are therefore going in for an eMagazine once again as we had done in the case of the May issue of the magazine. We eagerly look forward to your feedback to this and previous magazines. We hope that the next issue will be a normal physical one.

Happy rail-fanning,

(J L Singh)
Editor

CONTENTS

Railway Electrification in Eastern India

Annavarapu Ramarao

(This article has been reproduced from "Trailing Window" by the same author)

Robert Davidson of Aberdeen built the first known electric locomotive in 1837 using batteries (galvanic cells). Davidson later built a larger locomotive named Galvani which was exhibited at the Royal Scottish Society of Arts Exhibition in 1841. The first electric passenger train was presented at Berlin in 1879. However, the limited electric power available from batteries prevented its general use on the railways. The first mainline electrification was on the Baltimore Belt Line of the Baltimore and Ohio Railroad (B&O) in 1895. This four-mile track connected the main portion of the B&O to the newly built line to New York.

Railways had already come to India in April 1853, with the first train running from Boribunder (now Chhatrapati Shivaji Maharaj Terminus in Mumbai) to Thane, while the first train in Eastern India ran from Howrah to Hooghly in August 1854. Very soon thereafter, as soon as it became available, British Indian railway companies were attracted to the new mode of rail traction, i.e. electricity, because it was a better alternative to run suburban trains to cater to the heavy suburban traffic in both, the western metropolis of Bombay (now Mumbai) and the eastern city of Calcutta (now Kolkata). It was also realised that steam locomotives would be incapable of hauling heavy freight trains across the Western Ghats with the high gradient of 1 in 37 on both the Igatpuri and Pune routes.

As early as 1913, railway engineers in India began to consider the electrification of Bombay & Calcutta Suburban areas. Messrs. Merz & McLellan, who were engaged as consultants, submitted their first report in March 1914 recommending electrification of the suburban lines on Indian Railways. This was followed by another report prepared by the Great Indian Peninsula Railway (GIP) proposing electrification from Bombay to Igatpuri on the one hand and Bombay to Pune on the other. Further action on these reports was, however, prevented by the onset of the First World War. Following the second report of the same consultants, submitted after the War in August 1924, an electric train ran out from the GIP's Bori Bundar railway station to Kurla via the Harbour branch of the suburban system on February 3, 1925. The Bombay Baroda and Central India Railway (BB&CI) too electrified their suburban line between Colaba and Borivali and the first electric train ran on January 5, 1928. (Colaba station was later demolished and the southern-most terminus of BB&CI was built at Churchgate). In the South, the section between Madras Beach and Tambaram too was electrified on May 11, 1931.

Railway electrification in Eastern India, however, lagged behind. The consultants' second report of 1924 found the traffic density of the Sealdah-Kanchrapara section too low to justify electrification. The consultants submitted their final report in 1930 and this time found that electrification of this section could be justified but the great economic depression had set in and, predictably, the report was shelved. The proposals were revived again in 1939 and it was almost decided to go ahead with the scheme but it had to be abandoned yet again as World War II intervened.

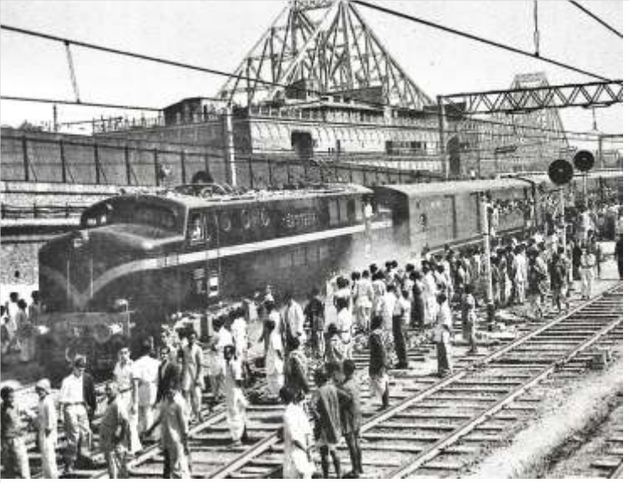
After Independence, a team of senior railway officials was sent abroad to study the problems connected with Railway Electrification in European Countries and to recommend a system which could be adopted in India. This team submitted its report in February 1954 recommending adoption of 3000 Volt Direct Current (DC) system for electrification in eastern India. In June 1954, the Railway Board sanctioned about ₹ 12 crores for electrification of Howrah-Burdwan main line and Sheoraphuli-Tarakeswar branch line on 3000 Volt DC system. Global tenders for electric rolling stock, equipment & structures were invited in 1954 and orders placed by mid-1955. The field work for electrification of this section started the same year and the first section from Howrah to Sheoraphuli was energized and formally inaugurated by Pandit Jawaharlal Nehru in December 1957.

Typically, DC locomotives run at relatively low voltage (750 to 3,000 volts); the equipment is, therefore, relatively massive because the currents involved are large in order to transmit sufficient power. Power must be supplied at frequent intervals as the high currents result in large transmission system losses. The catenary voltage is limited by the design of DC traction motors to 1500 Volts. With two motors in permanent series connection the maximum voltage is thus restricted to 3000 Volts.

During the intervening period, the French National Railways (SNCF) had been developing a system of electrification using 25000 Volts Alternating Current (AC), single phase, at industrial frequency of 50 cycles per second (50 Hz). At 25000 Volts, catenary voltage was first stepped down and then rectified to DC, to feed the traction motors. Since it was then at an experimental stage, other advanced countries, including the British Railways, were not in favour of this system as they did not consider it entirely safe and prudent for adoption. With further developments and experience by the SNCF, the system became increasingly attractive and economical compared to the DC system.

However, when the International Railway Congress met in London in 1954 to deliberate on, among other subjects, the

Electrified rail track between Howrah and Kharagpur. A 12-car EMU can also be seen



First DC 3 kV electric locomotive on its inaugural run from Howrah

choice of system, no railway administration was willing to change its system of electrification, which in the main comprised the high voltage, low frequency AC or the two DC systems of 1500 Volts and 3000 Volts.

The London Congress agreed that:

"the new (i.e. 25 kV AC single phase industrial frequency system) was ideal where the traffic was light or infrequent."

But the Congress could not agree that the same conclusion would necessarily apply for heavily loaded lines, or where the cost of electrical clearance was excessive, because it was thought that the savings to be derived from the cheaper fixed equipment would be absorbed not only in obtaining clearance for catenary construction but higher cost of AC electric rolling stock. It is of interest to recall that at the time of the London Congress, SNCF were trying out three different options of AC locomotives, of which the use of rectifiers was one. The London Congress observed that:

"Of the types of locomotives used in 50 cycles AC traction, the one using rectifier on locomotives has indications of future prospects; but no definite opinion can be expressed before gaining adequate experience."

In the following years, only the rectifier type AC locomotive really met the test of trials despite its share of teething troubles. The reservation and caution in the adoption of AC traction was perhaps justified, notwithstanding the experience in subsequent years. Further, AC traction on single phase gives rise to imbalance on the power system and all the equipment connected with the network. The permissible limits of the imbalance and the ability of the supply system to cope with it were burning subjects pondered over by electrical engineers in India during the initial period, as the national grid was not developed and the installed generation capacity was not high.

Encouraged by their success, the SNCF went ahead with 50 cycle electrification and brought it into service over Valenciennes-Thionville line, which was the first major scheme of main line electrification to use this system. At a gathering at Lille in May 1955, SNCF disclosed the admirable and powerful performance of AC locomotives over DC locomotives. On a ton for ton basis, an 82-ton AC locomotive has a performance comparable to a 110-ton DC locomotive.

The Indian Railway Board took a bold decision in November 1957 that 25 kV AC, 50 cycles single phase system should be the future standard system for electrification on Indian Railways. South Eastern Railway (SER) was instructed to electrify the iron ore carrying Rajkharsawan-Dangoaposi Section with the new traction system, instead of 3000 Volts DC. In December 1959, electrical engineers of SER watched with bated breaths, their lips chanting prayers, as the first train ran on the new system. They need not have worried. The trial was a resounding success. 25 kV AC, 50 Hz traction had arrived in India, only the second country after the Soviet Union to accept the technology from SNCF.

Despite the Railway Board's decision, however, some electrical engineers still believed in the superiority of the established DC system over the new untried AC system. For example, the Tambaram-Villupuram Electrification Project would not have met the stringent norms of financial justification but for the fact that it was sponsored by the then Deputy Minister for Railways himself. The DC lobby in the Railway Electrification Project sent a proposal for 3 kV DC traction on this line but the Railway Board disagreed and approved it on 25 kV AC traction, saving headaches for future generations. By this time, work on Howrah-Burdwan section was nearing completion. It was, therefore, decided to electrify the main line beyond Burdwan on the ER and the Howrah-Khargpur-Rourkela section on SER on the AC system.

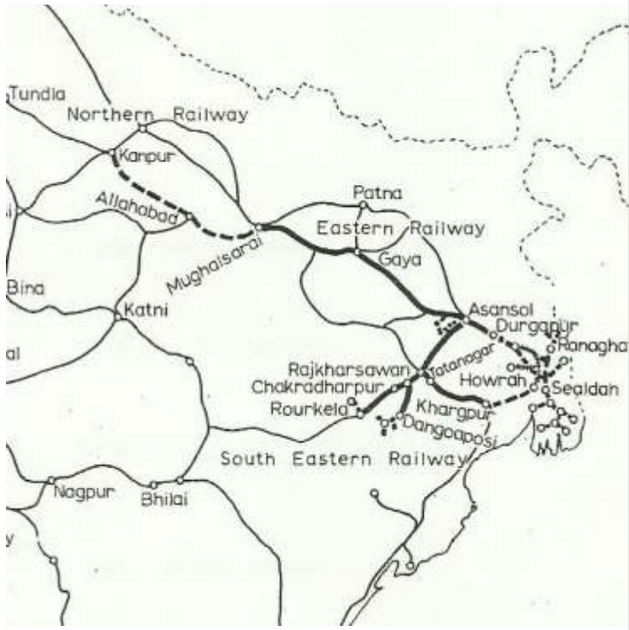
As a corollary, it had to be decided whether the sections already electrified on 3000 Volts DC should be retained as such, with further electrification carried out on the AC system, or to convert the DC system also to 25 kV AC at a later date. The first alternative was costlier. Retention of the DC system involved a number of technical and operational problems also. For example:

1. Howrah-Burdwan chord line, which was to be electrified on AC, runs close and parallel to the main line between Howrah and Belur for 6 km, and again between Saktigarh and Burdwan for 14 km. Such long parallelism between DC and AC would be fraught with the possibility of induced high voltages in the DC system.
2. The Naihati-Bandel section of the Eastern Railway, to be electrified on AC, meets the Howrah-Bandel main line, already electrified on DC, at Bandel, creating problems of junction arrangements. Further, Howrah station yard alone would have two systems, with Howrah-Kharagpur section to be electrified on AC. Arranging change of traction at these junctions would become a knotty problem.
3. The locomotives which were to be operated on the main line beyond Burdwan would have to be of dual voltage type, suitable for AC as well as DC systems. This was a very costly proposition.

After considering these problems, Railway Board took a decision that though the section up to Burdwan would be completed on the DC system, electrical clearances and insulation on the remaining sections from Memari to Burdwan, Singur to Tarakeswar, where work was in progress, should be provided to suit 25 kV AC system also. Equipment for the electrification projects on the 3 kV DC system, received from abroad in the interim, were transferred to the Bombay area where DC system was still in vogue.

This proved to be a decision of great vision and foresight as the conversion was accomplished smoothly in contrast with the painful and slow pace of conversion on the Central and Western Railways. The electrification works on 3000 Volts DC, with the feasibility of conversion to AC system, was completed in August 1958. The conversion was sanctioned by the Railway Board in December 1962 and resulted in considerable saving in the working expenses.

Originally it was decided to convert the whole section in one stage but the yard re-modelling and route relay interlocking works at Howrah station would be completed only by 1966. It was, therefore, decided to convert the section in two stages rather than wait till 1966, so that the full benefits of AC electrification could accrue to the main line beyond Burdwan, chord line via Dankuni and the Bandel-Naihati sections. The section from Bandel to Burdwan was programmed to be completed by early 1965 and the remaining sections, Howrah-Bandel main line and Sheoraphuli-Tarakeswar branch line, one year later to coincide with completion of the works at Howrah.



1964 map showing Railway Electrification works

The conversion work was undertaken by the Railway Electrification Administration which was entrusted with the responsibility of carrying out 25 kV AC electrification on the Eastern, South Eastern and Northern Railways. The field work for conversion of the Bandel-Burdwan section was initiated in July 1962. This consisted mainly of improving the AC section insulators, modifications to overhead equipment under overlying structures like foot over bridges, road over bridges, through bridges, etc., provision of return conductors with booster transformers throughout the route to suppress induction effects of 25 kV AC on the telecommunication lines running close to the electrified tracks; modifications to signal and telecommunication equipment and transferring of overhead communication circuits to underground cables. To control switching operations of the 25 kV AC system, new switching equipment had to be provided and new remote-control equipment suitable for 25 kV AC had to be installed. All these works had to be carried out during the night departmentally under traffic and power blocks without any interruption to traffic.

To supply power at 25 kV AC, 50 cycles single phase for the new system, a 132/25 kV substation was set up by the West Bengal State Electricity Board at Bandel. Memari-Burdwan section was energized on 25 kV AC on May 23, 1965 and the Memari-Bandel section on June 27, 1965. Suburban trains

Electric sub-station at Karamtola

A view of the sub-station

on Howrah-Burdwan section began to operate, on 3000 V DC system between Howrah and Bandel and on the Sheoraphuli-Tarakeswar branch, and on the 25 kV AC system between Bandel and Burdwan. Thus, Bandel station became the junction point for the two systems of traction. Change of traction was arranged till such time the sections from Howrah-Sheoraphuli-Tarakeswar were also changed to the AC system. To avoid changing of trains for commuters at Bandel for those travelling beyond this station, 28 DC EMUs were converted in ER's Kanchrapara Workshop, for operation on both AC and DC systems. EMU trains running on DC between Howrah and Bandel could run on the new AC system between Bandel and Burdwan, change over from one system to the other taking place while the EMUs were on the run. Although dual voltage, and even multiple voltage locomotives, were working in Europe hauling the Trans-Europe Express from Rome to Amsterdam, transitional dual voltage EMU stock was introduced in India for the first time in the world. When Howrah-Bandel and Sheoraphuli-Tarakeswar sections were also converted to 25 kV AC, these dual voltage EMUs were able to operate purely on AC system without any further modification. The conversion work was completed in 1967.

With the electrification completed all the way from Howrah and Sealdah to Mughal Sarai, introduction of electric traction for passenger carrying trains, to provide cleaner travel on faster schedules caught the attention of the Indian Railways. The first train to be put on electric traction was the Asansol-Bareilly passenger, saving 112 minutes in the UP direction and 83 minutes in the DN direction between Asansol and Mughal Sarai. This was followed by Kalka Mail on which the saving was 65 minutes in the UP direction and 50 minutes in DN direction. As the entire route from Howrah to Mughal Sarai was not provided with AC electrified traction, this train was hauled by a diesel locomotive between Howrah and Asansol. This continued until the section between Howrah and Bandel was also converted from 3000 volts DC to 25 kV AC. Pathankot Express, originating from Sealdah could, however, be run on electric traction all the way from Sealdah to Mughal Sarai, saving 60 minutes in the UP direction and as much as 125 minutes in the opposite direction.

ER and SER took to electric train operations for freight with zeal and by the middle of 1966 more than half the goods traffic on these railways was moving on electric traction. Simultaneously, the entire suburban sections of Howrah and Sealdah Divisions of Eastern Railway and Kharagpur Division of South Eastern Railway also came on electric traction, to the considerable relief of commuters using them.

The magnificent achievement by the Indian Railways in the field of electrification in a short span of time, is perhaps unparalleled in the history of railway transportation, and shows the close coordination and unity of purpose between three Railway Administrations: Railway Electrification, Eastern Railway and South Eastern Railway. It is worth noting that in 1962, V R Vajramusti, Chief Electrical Engineer, Railway Electrification Project, was awarded a Padma Shri for his contributions to railway electrification in Eastern India, a rare case of a railway officer being recognized for his work by the Central Government.

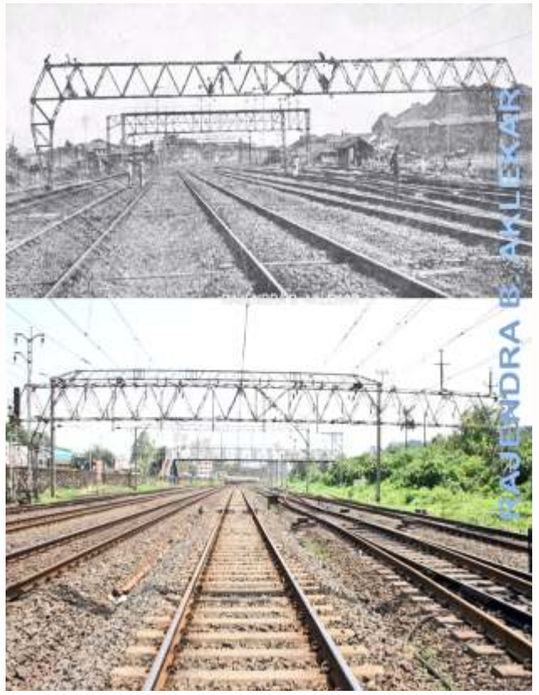
Map: *Courtesy the author*
Sub-station photographs: *Courtesy CPRO Eastern Railway*
Other photographs: *Archives of the Rail Enthusiasts' Society*

History

India's First Electric Railway

Rajendra B. Aklekar

A notice from Central Railway on December 6, 2013 broke my heart! It stated that on the intervening night of December 7-8, 2013, "a special night traffic and power block" of 3 hours 15 minutes would be taken on all the six lines (Up and Down slow; Up and Down fast and Up and Down Harbour lines) for removal of a signal gantry at Km 14/13. This section of Mumbai was a part of the first electric passenger railway in India that started in 1925 and 88 years later (in 2013), there had been proud relics still standing that had been a witness to this glorious history.



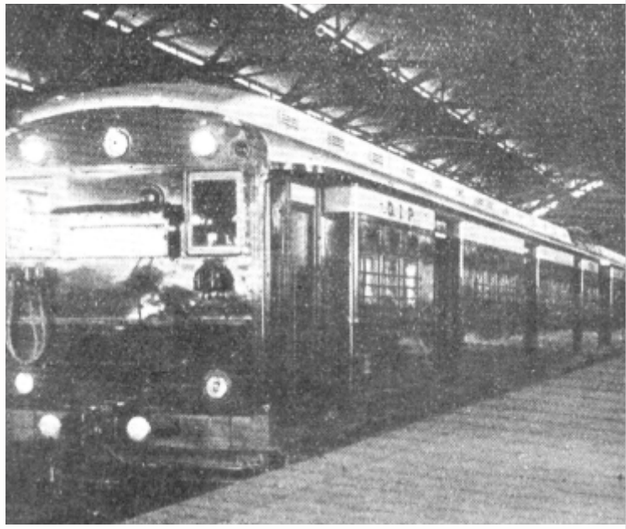
The heritage gantry at Km 14/13

This particular gantry was a part of that magnificent era. It had been historically important, being about 129-feet long iron holding overhead wires, spanning over eight tracks located at km 14/13 from the headquarters, that is, Bombay Victoria Terminus (Bombay VT), today called Mumbai Chhatrapati Shivaji Maharaj Terminus (Mumbai CSMT.) Reporting on the inauguration of the first electric railway in India between Bombay VT and Kurla, the GIP Railway Magazine of 1925 had termed this particular mast as the largest traction span in the world at that time. It stood sturdy to touch as a maze of iron bars, skillfully wound together into a cage, standing out amid the single poles, were something like a crown over the eight lines.

Sometime in 2012, the Central Railway had decided to retain the mast and put up a plaque to highlight its importance, but this notice of 2013 had shocked me. My attempts to save it proved not only feeble but futile and it was lost to the mighty demands of development and safety. Parts of it could have been saved, but that would have reduced the scrap value and it was gone. Every time I pass the stretch, I remember it and today as we discuss railway electrification, I could not miss mentioning this.

The story of India's electric railway began in the early days of the 20th century. Though railway electrification had been the talk of the town, it could not immediately materialize first due to financial problems and later due to the First World War that put a lot of strain on the railways. (Note: The first electrically operated tram car had already appeared on Bombay's streets by then – since 1907 itself). In 1904, the idea to electrify the railway network was proposed by W H White, Chief Engineer of the then Bombay Presidency

EMU ready to leave Bombay VT



government. He proposed electrification of the two Bombay-based companies, the Great Indian Peninsula Railway (GIP) and the Bombay Baroda and Central India Railway (BB&CI) – now known as CR and WR respectively. He also proposed a joint terminus of both the railways. Both companies were in favour of the electrification, but there were differences on the idea of a joint terminus. However, it took another year to obtain necessary permissions from the British government and to upgrade the railway infrastructure in Bombay city. The Government of India appointed M/s C H Merz as a consultant to give an opinion on the electrification of railways. Merz was the one who had designed the London Underground, the world's first electric railway in 1890. But Mr. Merz resigned before making any concrete suggestions, except recommending replacement of the first Bassein (Vasai) Bridge on the BB&CI by a stronger one. Moreover, as the project was in the process of being executed, the First World War broke out and put brakes on it. The First World War placed a heavy strain on the railway infrastructure in India. Railway production in the country was diverted to meet the needs of British forces outside India. By the end of the war, Indian Railways were in a state of dilapidation and disrepair, but by 1917 works picked up pace and quadrupling (four-tracking)

Locomotive named after Sir Leslie Wilson, Governor of Bombay. This locomotive can be seen at the National Rail Museum, New Delhi

of the line was completed till Kalyan. This had been one of the prerequisites for electrification. Two years later, in 1919, the Bombay Municipal Corporation passed a resolution making it mandatory for GIP to electrify its lines till Kalyan. The railways turned back to Merz. By 1920, he had formed a consultancy firm of his own with a partner, Mr. MacLellan. The government retained his firm and drew up plans for rolling stock and electric infrastructure for Bombay-Poona/Igatpuri/Vasai and Madras-Tambaram routes. The Secretary of State of India sanctioned these schemes in October 1920. 1500 Volts Direct Current power mode was adopted for its higher start-up power and easy speed control with various combinations. The power was to be supplied by the Tata Company for traction purpose and GIP also built its in-house power generating plant at Thakurli near Bombay. All the inputs for the electrification, except power supply, were imported from various companies in England. Thus, similar to the running of the first ever railway train in the country from Bombay to Thane on April 16, 1853, the first-ever electric train in India also ran from Bombay. The debut journey, however, was a shorter one. It ran between Bombay VT and Kurla, a distance of 16 kms, on Tuesday, February 3, 1925 opened at the hands of Bombay Governor, Sir Leslie Orme Wilson (Governor from December 1923 to March 1926). There had been initial plans to inaugurate the service on January 1, from Sandhurst Road to Kurla, but it was later postponed to February 3 to complete electrification works and include VT station. The inaugural function was held on Platform 2 of Victoria Terminus station and Sir and Lady Wilson were received by little Miss Idina Powell, the daughter of Mr. Powell, head trial driver from Parel's mechanical department. The line was thrown open after Sir Wilson signaled the power sub-station at Wadi Bunder to throw the conductor wire into circuit to commence the public service.[1]

Sir Wilson's name was later given to one of the first electric freight locomotives that came on Indian soil in 1928, classified as EF/1 and later WCG-1. These locomotives were built by Swiss Locomotive Works with electrical equipment by Metropolitan Vickers, England, and were very useful on the strenuous ghat sections. The locos have been phased out long back but the one titled Sir Leslie Wilson has been preserved at the National Rail Museum at New Delhi. The first railway, electrified on 1,500 Volts DC, was powered by Tata and Sons who had set up a hydro-electric plant. The power was delivered from the Tata Mains to sub-stations at Dharavi, Thana and Kalyan at normal pressure of 22,000 volts. From Dharavi, the supply was transmitted to railway sub stations at Kurla and Wadi Bunder by means of underground cables. The electric coaches (electric multiple units or EMUs) that had arrived a month before to be run on the line were then the widest in India, with 12 feet width and 68 feet length. Each unit with four coaches, including a motor coach attached with automatic couplers, was capable of running at a speed of 50 miles per hour (80 kmph), smoke free! The third-class coaches had 96 seats

Among the first EMU coaches to ply in Bombay. This EMU, No. 35B, is now at the National Rail Museum at New Delhi

each. They were provided by Cammell Laird and the 1898-founded German train builder Uerdingen Wagonfabrik, now a part of Siemens. The era of clean transport over steam lines had just begun in Bombay and so was the birth of electric multiple units that still run, over-crowded with packed commuters to become the lifeline of the city. The first motorman was Jahangir Framji Daruwala. The same year electrification of the harbour link to Bandra too was completed. India became the 24th nation to have an electric railway and the third one in Asia.

One of the first locomotives to run on Indian soil. Named Sir Roger Lumley, this loco can be seen at the National Rail Museum

About the Author: *Rajendra B Aklekar is the Assistant Editor, Midday. He is also the author of Best-Selling books on India's Railway history, heritage and trains, including one short-listed as the Best Non-Fiction at the Bengaluru Lit. Fest. 2015. He is the biographer of Dr. E Sreedharan, the Metro man. His book, "A Short HIstory of the Indian Railways", has been reviewed in this magazine. The above write-up includes excerpts from his book, "Halt Station India". All pictures have been provided by the author except the picture of Sir Leslie Wilson and the EMU. These are courtesy National Rail Museum. The picture of the historic mast was taken by the author himself.*

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[1] Official Souvenir of the seminar on Transport Technology on the occasion of the Platinum Jubilee of electric traction. Article titled '75 Years of CR Electric Suburban Service (1925-2000)' by Dr. AK Arora. Pages 1-9

WAP7 at Sealdah Electric Loco Shed

Somsubhra Das

The 26th of June 2020 was a historic day for Eastern Railway as it got its second 3-Phase Passenger Electric Loco Shed (ELS) at Sealdah. Thus, it is the City of Joy's very own 3-Phase ELS; technically, the earlier shed with WAP7s was at Kolkata's twin city, Howrah. The first two of the 25 WAP7s transferred from HWH to SDAH – 30203 and 30329 – have been given the nomenclature of *Mangal* after the Indian soldier connected with the Great Uprising of 1857, Mangal Pandey, and *Aurobindo* after the Indian philosopher and nationalist Aurobindo Ghosh, respectively. These locomotives were freshly painted at Howrah ELS which is to continue to lend support to Sealdah regarding this matter.

The list of 25 Howrah WAP7s which got transferred to Sealdah include 30203, 30204, 30205, 30295, 30300, 30305, 30308, 30311, 30321, 30322, 30323, 30327, 30328, 30329, 30330, 30369, 30370, 30371, 30372, 30490, 30492, 30493, 30494, 30676 and 30698. All these are Non-Head-On-Generation category locomotives. The decision came at a time when the Howrah-New Jalpaiguri route via the Sahibganj Loop got energised a few months ago and most of the North Bengal bound trains will soon begin to run with electric traction.

Name of the locomotive displayed boldly

Sealdah ELS has its roots in the Beliaghata Diesel Shed which homes some WDS6R shunting locomotives and also acts as the Trip Inspection shed for WDM3A locomotives and DEMU Power Cars. It also serves as the Trip Inspection location for WDP4/WDP4D locomotives.

Sealdah is the latest shed of the Indian Railways to home WAP7 locos and the 19th such shed in the country.

Photos: *Courtesy the author'*

WAP7 class loco, No. 30203, named 'Mangal' at Sealdah Electric Loco Shed

The **WAP7**

Sujeet Mishra

The frontline passenger locomotive, WAP7, a thousand of which haul important passenger trains today, completed 20 years in service on 10th May this year. All the same, there was a time in 2002 when the WAP7 fleet was on the verge of being scrapped. This is the story of how it was saved.

On 10th May 2000, a 6000 HP passenger locomotive of the WAP7 class was flagged off by the then Union Minister for Railways. This locomotive had been indigenously adapted from an imported freight locomotive, the WAG9. The flagging-off ceremony was the culmination of an audacious experiment by the Indian Railways (IR). Today, this locomotive is a flagship passenger locomotive and can also serve on high speed premium freight trains, an emerging category of business by itself.

As part of the core team which worked on its design, Sujeet Mishra reminisces the challenges, and shares here the exhilarating success of this locomotive. Read on…

Indian Railways signed a contract in July 1993 for the transfer of technology for two locomotives – a 4 MW high-speed passenger, and a 4.5 MW freight – with the then M/s ABB (Transportation Division), Switzerland. The passenger locomotive (WAP5) was meant to be capable of speeds of 160/200 kmph with about 5400 HP on wheels, and the freight one (WAG9) of speed of 110 kmph with 6000 HP on wheels. The contract mandated the supply of some fully assembled locomotives and some in CKD/SKD form along with the necessary technology transfer to manufacture them at the Chittaranjan Locomotive Works (CLW), Chittaranjan, West Bengal.

A WAP5 class locomotive. The imported locomotive class that hauled the Prayagraj Express

The freight locomotive, the WAG9 class which was modified to create the WAP7

This was the era when big ideas and plans were being talked about in government circles. The road and telecommunication networks were undergoing massive upgrades and India had just gone nuclear. The Indian Railways (IR) also had big dreams of speeding up its network as it sought to meet the challenge of defending its modal share. Discussions centred around building locomotives for heavier, longer and faster trains.

The Prayagraj Express between Allahabad (now Prayagraj) and New Delhi became the first train to have a 24-coach composition, making IR evaluate possibilities to give all long-distance trains 24 coaches. This composition was run with the imported WAP5 class of 4 MW locomotive. The then frontline locomotives, the 5400 HP machines, had the conventional Direct Current (DC) drive. These had to sacrifice power to achieve higher speeds. Operationally, it translated to lower acceleration at higher speeds.

So, the question was, how to make 24-coach-long trains run at higher average speeds even on graded sections of the then Central Railway's route of Delhi-Bombay (now Mumbai) and on ghats of the Eastern Railway on the Delhi-Calcutta (now Kolkata) route. The frontline team for this project was led by a soft spoken, down-to-earth, legendary engineer, V Sadasivan. His team consisted of a handful of young engineers, including your chronicler, who was then a youthful unmarried engineer.

In the meantime, on 14 November 1998, based on transferred technology, the first 4.5 MW (6,000 HP) freight locomotive of the WAG9 class, christened *Navyug*, was turned out by CLW.

The 4 MW WAP5 class locomotive, on which the 24-coach Prayagraj Express was then running, was received as part of the contract with the Swiss company. This gave more power than the flagship WAP4, but it was geared for 160 kmph passenger operations with capability to go up to 200 kmph service speed, which compromised its accelerating capabilities on longer trains working at lower speeds. Also, it had four powered axles, two less than the WAP4. So, even

though it had more power, we discovered that a Purva Express running on a more powerful WAP5 lost time vis-a-vis running on WAP4 (which had lower power).

We needed something on six axles delivering 1,000 HP on each axle at a maximum operating speed of 130 kmph, the speed of Rajdhanis and Shatabdis. Thus was born the idea that we could reconfigure a six-axle freight locomotive from the WAG9 class, and make it work for 130 kmph service. This locomotive, if and when built, would be of the WAP7 class.

The challenge was, how?

Earlier, such reconfiguration was limited to essentially changing the gear ratio and designing new gears. But now, what we had were computer-controlled locomotives with multiple tiers of control which needed reprogramming. Though IR's engineers were being trained in Switzerland to handle the software for the WAP5 and WAG9, the source code for the same was not with IR and was being offered to us at a hefty price. The Swiss company had deemed its transfer outside the scope of its contract.

However, through astute negotiations and sheer genius, Sadasivan managed to get this software at zero cost from the Swiss.

Now we had the software, but the proprietary development tools were based on a German version of DOS, and we had to figure out its installation on our computers. It took a bit of ingenuity and ultimately we could install it on the computers at CLW in a newly created lab (in a storeroom) which we named the Traction Software Development Lab. Having access to PCs was a challenge and given its geographical location, access to Chittaranjan itself was also a severely limiting factor.

A WAP7 class locomotive manufactured at DLW. Earlier manufacturing diesel locomotives, DLW now turns out electric locos only

Next in the line of challenges was to take out printed copies of the code which was graphically written. I recollect the eureka moment when we could manage to take out these printouts!

Making something like what we were trying to, was deemed outside the scope of the Swiss company's contract. So it was supposed to be solely IR's project. But as a gesture of good will, an engineer who documented and later upgraded the software, was informally attached to this author to answer specific queries (but which were not binding on him to answer).

Now, we had to hunt for changes that had to be made in the software. Part of the identified software was in German. Line by line, dependencies were seen and changes identified. This was the time when Microsoft Excel had started making its presence felt; so we had an easily accessible calculator in it. Having identified the changes to be made, the software was modified and the down-loadable files generated. Now, we were itching to test the software. For that, we needed a working WAG9 locomotive, as there was no simulator available.

And here was the risk. Essentially, the WAG9 fleet consisted of under-warranty locomotives: who would have been accountable if something went wrong with them and that too with a rookie engineer (your chronicler) tinkering at the helm? It was then that the visionary head of CLW, N K Chidambaram, ruled in favour of going ahead. People turned to Sadasivan to get reassurance, and he okay-ed the scheme as well.

The plan was to test the software on a WAG9 freight locomotive available in Gomoh (the place from where Netaji undertook his historic train journey in 1941, escaping police). Going to Gomoh from Chittaranjan was itself a challenge those days and the journey took four to six hours at times. As part of the ongoing Golden Quadrilateral project, the Grand Trunk Road was completely dug up and the stretch after Dhanbad (Topchanchi area) was Naxal infested.

An Ajni-based WAP7 locomotive

The amiable Swiss engineer was engaged and he accompanied me to Gomoh, where I downloaded the WAP7 software in a working WAG9 class locomotive and carried out our trials in the yard. The whole exercise was designated as a training exercise being carried out in the services of IR, with IR agreeing not to make any warranty claims and also take responsibility, if something went wrong.

It worked. The trials returned positive results.

Now, we had to wait for an actual WAP7 to be turned out and be available for trials. When ready, this loco was fondly named *Navkiran*. After we tested the code on it, the loco was pressed into service. The then Minister for Railways flagged it off on the 10th of May 2000.

However, the story did not end there. When *Navkiran* was pressed into service after trials, over sometime, it was found that the trains it hauled started losing time. This became a cause of major embarrassment and initially we were clueless as to why this was happening.

Numerous trials were conducted. The stopwatch did show loss of time, though the computers reported tractive effort which should have made the acceleration much higher. So, if Newton was right, and if the recorded data was correct, there was no reason for the trains to lose time. Meanwhile, the chorus grew louder in IR circles that the project was undertaken without necessary prudence.

We did not give up. A test scheme was thought out. We decided to haul the Prayagraj Express first with a WAP5 and then with a WAP7 and compare the results.

It was soon realised that the measured results consistently followed the ratio of the gear ratios of the WAP7 and the WAG9. This meant that somewhere deep in the software, where we did not have access, the gear ratio of WAG9 was coded. This quirk meant that the actual delivered traction forces were less than what was reported by the computers. Deliberating on this problem over a bowl of Maggie noodles, of which Sadasivan was a fond exponent, we came up with the idea of bluffing the layer which was acting cranky and by late that night, the control software was ready.

The day of reckoning arrived. We got a WAP7 moved to Allahabad. I reached Allahabad by the Purva Express with a trusted assistant, Sankha Sinha. We located the locomotive and hauled the equipment to the place where the locomotive was placed. We wired the WAP7, and reconfigured it to the new software. We had enough confidence in our solution that we pushed the locomotive to deliver 353 kN (kilo Newton) instead of the standard 323 kN.

Having readied the loco, we had it placed to haul the Prayagraj Express on the evening of 23 July 2002. Our trial methodology was simple. We asked the driver (now called a loco pilot) to come on the mainline, stop, and then go full throttle to a maximum speed of 110 kmph.

We would record the data on ramshackle equipment with a broken screen.

The driver placed the train on the mainline and we started our stopwatch with a pad in hand. The driver moved the throttle to 100% power. He was used to taking more than five minutes to reach a speed of 110 kmph with the regular WAP5 (322 seconds). Earlier, it had taken 390 seconds on the older control software of WAP7 to reach the same speed. We were staring at certain death if this new class of passenger locomotive, so to speak, was not able to improve upon this.

On 23 July 2002, we did this in 229 seconds!

We kept a straight face but inside we were elated and wanted to scream, “We did it!” The driver politely commented that we were accelerating unusually fast. Perhaps that was his way of complimenting us. This would have been a record acceleration of a passenger train of IR then.

The rest of the journey to New Delhi was routine recording. This trial finally validated the wild idea we had regarding the WAP7 and this great class was thus saved from being guillotined.

The WAP7 has come a long way since the days when it was close to death. Today, it is the flagship passenger locomotive of IR, with more than 1,000 in service, at a total investment of almost ₹ 15,000 crore. In a push-pull mode, where one WAP7 pulls at the head of the train and another pushes at the rear end, all existing trains can be speeded up, just as a few Rajdhanis already have.

The post-Covid-19 scenario is likely to see more high-speed, premium, light-weight freight moving to IR. This locomotive eagerly waits to haul high-speed, premium freight at 130 kmph in addition to performing regular passenger service.

Photos: *Courtesy Somsubhra Das*

About the Author: *Sujeet Mishra is a serving railway engineer, currently posted as the Chief Design Engineer (Electric Locomotives) at the Diesel Locomotive Works (DLW), Varanasi. Interestingly, despite the name, DLW is now manufacturing electric locomotives.*

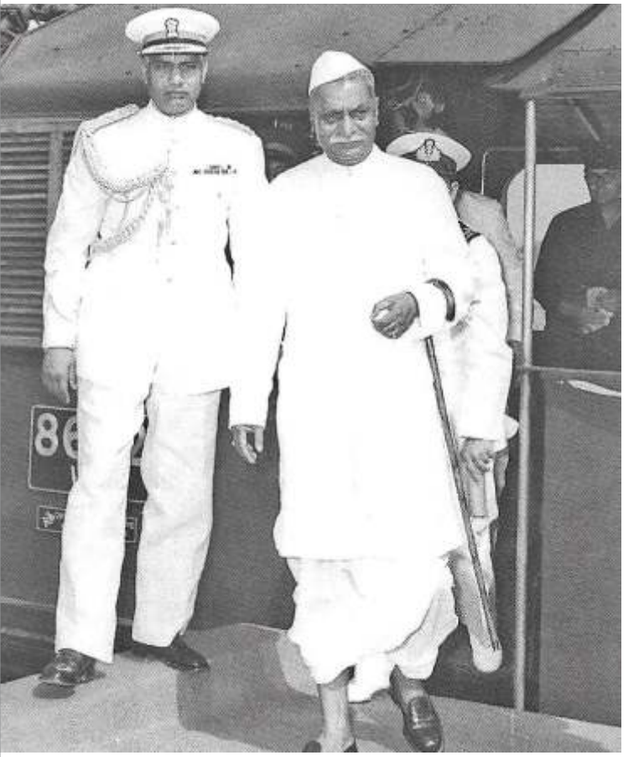
Chittaranjan Locomotive Works

Aritra Chatterjee

*Rail electrification has two components: electrification of the line, and the necessary locomotives (and/or EMUs) to work on the line. The second component, the locomotives, have been provided largely by the country's first rail production facility – the Chittaranjan Locomotive Works (CLW). It is interesting to note that planning for this unit started even before India became independent and within three short years of getting our freedom, the first locomotive, albeit a steam, rolled out of the works. The story of CLW's growth from humble beginnings with steam in the 1950s to the **'Limca Book of Records'** recognizing it as the largest producer (402) of electric locomotives in the world in 2018-19 makes fascinating reading. The number of locomotives produced was increased to 431 in 2019-20, even though the last few months of the year saw a drop in production owing to the spread of Covid-19.*
Read this story in the words of Aritra Chatterjee...

Perhaps the most noteworthy achievement of the Indian Railways over the last seven decades is the near total self-sufficiency in rolling stock, including electric locomotives, that the country has achieved. While locomotives and coaches as well as wheels and axles are produced in the railway's own plants, freight wagons are produced outside the railways but to designs produced by the railways.

Dr. Rajendra Prasad, India's first President, at CLW for the flagging off of the plant's first locomotive in 1950



Till independence, the policy of the railways, privately held or government owned, was to import all rolling stock from Britain. With regard to locomotives, apart from a small number produced by Jamalpur and Ajmer workshops, manufacture was not part of rail policy. However, after World War I, public opinion had begun to demand that arrangements should be made for the manufacture of locomotives within the country. As a result, in July 1939, a committee was appointed, consisting of J Humphrey, a mechanical engineer, and K C Srinivasan, a finance officer, to examine the scheme of starting the manufacture of locomotives in India. Of course, at that time, the locomotive to be manufactured would be steam powered, as the only electrification in the country then had been limited to 388 kilometers, primarily around Bombay (now Mumbai) and a short section at Madras (now Chennai). The committee submitted its report in 1940, but by this time World War II had started, and all such projects had to be shelved.

In 1945, therefore, a provisional site at Chandmari near Kanchrapara in the then undivided Bengal (now in West Bengal) was selected for setting up a green-field facility for locomotive manufacture. After independence, the present site where CLW is located was finally chosen. Rich tribute should be paid to the genius, vision and foresight of India's pioneering planners who helped transform our first Prime

'Antim Sitara', the last steam loco built by CLW. It is now on display at the plant itself

Minister, Jawaharlal Nehru's dreams of economic independence into reality. This was one of the earliest projects set up by the then newly free nation.

The workshop and the attached township were set up at Mihijam in West Bengal but very near its border with the state of Bihar (present day Jharkhand). Besides Mihijam, the township was formed by covering the area of three other villages, viz. Sundarpahari, Fatehpur and Amladahi. The main considerations underlying the choice of the site were an expansive area of land that was available, a natural elevation suitable for town planning, a good climate, easy availability of water, proximity to coal and steel producing centres, and the Maithon Dam of the Damodar Valley Project. At the time it was set up, the CLW factory in terms

Locomtoive 'Deshbandhu', a 2-8-2 WG, the first loco turned out from CLW. This is also displayed at the plant

A Narrow Gauge diesel-hydraulic loco manufactured by CLW on display at the plant

of layout and design was one of the most modern industrial units in the country.

The initial few years of CLW's development read like a fairy tale. Set up in collaboration with the North British Locomotive Company of Scotland, UK, construction began in 1948 and the first structures were ready in the same year. On January 26, 1950 production work was inaugurated by Basanti Devi (wife of Desbandhu Chittaranjan Das, freedom fighter after whom the township was named). The formal *'Namkaran'* (or naming) ceremony of the works was conducted on November 1 of the same year by the then President of India, Dr. Rajendra Prasad. On that very day, the first steam locomotive 'Deshbandhu' was turned out and flagged off from CLW by the President. This locomotive, a 2-8-2 WG with number 8407, has been preserved at Chittaranjan itself.

Till the year 1961, CLW manufactured only steam locomotives. Production of steam locomotives continued

The main administrative office building of CLW, from where the General Manager directs and administers the factory

for 21 years during which 2351 locomotives were produced. They comprised of five different classes of which the 2-8-2 WG and the 4-6-2 WP were paramount as they hauled all important goods and passenger trains respectively till the advent of the more powerful diesel and electric locomotives. The last steam loco, a WG, appropriately named *Antim Sitara*, was turned out in 1971. In the interim, manufacture of diesel-hydraulic locomotives was also taken up in 1968 and a total of 842 such locos were turned out comprising of seven classes that included Broad and Narrow Gauge locos. Diesel loco production was discontinued in 1993-94 after which only electric locos have been built. Another significant event was the establishment of a steel foundry in 1961.

With the Eastern region getting electrified in the late 1950s, it was a matter of time before CLW undertook the manufacture of electric locos to meet the demand of the newly electrified lines. At the same time, the needs of the DC electrified areas around Mumbai were also there. It was therefore a red-letter day when, on the 14th of October 1961, the first 1500 V DC electric Loco was turned out. No less than the then Prime Minister, Pandit Jawaharlal Nehru, commissioned the locomotive, "Lokmanya", named after the country's well-known freedom fighter Lokmanya Tilak. Since future electrification was to be 25 kV AC only, AC loco manufacture was taken up and within two years, the first AC loco was turned out on the 16th of November 1963 - a BG WAG-1 class locomotive christened 'Bidhan'. This loco was rated at a massive 2840 HP and was capable of running at 80 kmph.

'Lokmanya', WCM5 class locomotive, the first 1500 V DC loco built by CLW. It can now be seen at the Rail Heritage Park at Howrah

After this, there was no looking back and over the next 6 decades, 15 classes of locos were built going up to 6000 HP and speeds of 160 kmph, including freight and passenger locos. A number of dual voltage AC/DC locos were also built. The first AC/DC loco, named *Vallabh*, was turned out in 1972. Locos for the Rajdhani Express, which had been worked with diesel locos till then, were started in 1980 (WAP1) followed by the WAP3 in 1985.

(Cont'd on Page 28)

A Kalyan-based WCAG-1 dual voltage locomotive. This loco has been marked 'Unfit for DC' but had been built for AC and DC

(Cont'd from Page 25)

Along with the locos, ancillary requirements were also not neglected as can be gauged from the fact that in 1967 CLW turned out its first traction motor from a facility that was the largest in the country at that time. Technology upgradation was also looked at. For instance, in the year of 1990, CLW entered into the era of CNC (Computerized Numerical Control) machines with such high precision machines being installed in Traction Motor Shop and Wheel Shop.

Other significant milestones are too many to be all listed here. Among them were the high adhesion 5000 HP (WAG-7) *'Shantidan'* which was christened by the Nobel laureate, Mother Teresa, in 1992. In the year 1994, CLW turned out the first electric Loco (WAP-1) *'Pragatisheel'* to be provided with Hitachi Traction Motors and later that very year flagged of the first 5000 HP (WAP-4) *'Ashok'*. Two years later, in the year 1996, CLW flagged off the first modular WAG-7 *'Karamvir'*.

The year 1996 saw CLW adopting the latest 3-phase technology (from ABB) and the first such locomotive, the 6000 HP WAG-9 (CKD/SKD) was flagged off on

A Valsad-based WCAM-1 locomotive. No such dual voltage locomotives are in operation now

Pandit Jawahar Lal Nehru, India's first Prime Minister, examining the controls of an electric locomotive at CLW in 1961

27th December 1996. Later, an indigenous 3-phase 6000 HP WAG-9 (first CLW-built state of the art loco *'Navyug'*) was built in 1998. In 1999, the first batch of six CLW-built 1000 HP traction motors for the WAG-9 class were manufactured. CLW ended the 20th century, i.e. the year 2000, with innumerable land marks. It built the first 3-phase traction motor type-6 FXA-7059 for the WAP-5 class. Later in the year, CLW rolled out three locos, viz. *'Navkiran'* (first WAP-7), *'Navodit'* (first WAP-5) and *'Navshakti'* (first WAG-9H). It also commissioned a new facility for polyurethane painting (PU painting) of the locos with grit blasting and oven drying facilities that year. In the year 2004, a crew-friendly Drivers' Cab Loco *'Yugantar'* was manufactured. In the year of 2006, CLW introduced new loco types, with satellite remote diagnosis system 'Dr. Silver' in coordination with ISRO.

The year of 2010 was marked with the inauguration of 2nd Insulated-Gate Bipolar Transistor (IGBT)-based Loco WAG-9i and the first fully IGBT-based 3-phase loco. Indian Railways first HOG (Head-on Generation) loco was produced in Chittaranjan on 3rd June 2010. Head-on Generation is an electrical power supply system where electrical power for catering to the hotel load of the train, including train lighting, air-conditioning and other passenger interface requirements working on electrical

(Cont'd on Page 34)

A WAM-4 class locomotive of Visakhapatnam shed. Before the advent of 3-phase technology, this class was the most numerous

Electric locomotives of the WAP-1 (top left), WAP-4 (bottom) and WAP-7 (top right) class

A WAP-5 class locomotive. CLW is working to use these locos in push-pull mode

(Cont'd from Page 29)

power supply are supplied from the locomotive. With introduction of this scheme, heavy under-slung power generating equipment on the coach gets eliminated. Further, it also reduces use of diesel generating sets employed in power cars in End-on Generation systems. In 2011, CLW flagged off a 3-phase loco with an air-conditioned cab. In the following year, CLW achieved a major milestone by turning out a 3-phase locomotive equipped with IGBT-based propulsion system and Train Communication Network compliant Vehicle Control Unit.

The last few years have seen many notable achievements. In May 2015, CLW was certified for OHSAS 180001 for occupational health and safety. Later, in August of the same year, CLW inaugurated the last WAG-7 shell. In 2016, it rolled out the first loco from its ancillary unit at Dankuni near Kolkata. In the month of June 2017, a water closet system in a WAG-9H locomotive was inaugurated by the General Manager of the works.

Another significant milestone in 2018 was the conversion of a diesel locomotive to an electric one. In the same year, CLW produced the first WAP-5 Loco with aerodynamic design capable of running at 200 KMPH. Commissioning of WAG-9 HH (9000 HP) loco was done in 2019.

Presently, CLW has been working on the Push-Pull operation (WAP-5) for high speed trains like the Tejas Express. This involves two locomotives at both ends of the train, one pulling and one pushing. This doubles the power, i.e. 6000+6000=12000 HP. Apart from reducing the running time, this also saves time at the terminal stations since moving the locomotive from one end of the train to the other is not required. Higher acceleration is obtained as well as coupler forces are reduced. There is better braking as well.

To ensure that quality standards are maintained and do not fall along with keeping a safe and green environment, CLW achieved ISO-140001 certification in 2002 for environment management, ISO-9001/2000 in 2003 and later the 9001/2015 version, for quality management, OHSAS-18001 in 2015 and later ISO-50001 in 2018, for occupational health & safety management, ISO 3834 for welding and 5-S certification for workshop management.

Recognition and accolades have been coming CLW's way at regular intervals. Among them was the conferring of the Golden Peacock award in 2006 for environment management. The record production of 402 electric locomotives in the year 2018-19 has been recognized by the **Limca Book of Records.**

Photos: *Courtesy CLW, Somsubhra Das and the archives of the Rail Enthusiasts Society*

A WAG-9 class locomotive. CLW adopted 3-phase technology on this class

Eminent Railwaymen

Rowland McDonald Stephenson – The Pioneer

Annavarapu Ramarao

One area where India, as a nation, shows up in poor light is documentation. To begin with, we do not document, and subsequently, we tend to destroy what little we have documented without examining its heritage value. One exception that proves the rule is Annavarapu Ramarao. Whether it is a book or his blog, he has documented his experiences and his research extensively. We begin this feature on 'Eminent Railwaymen' with a reproduction of his article on Rowland McDonald Stephenson, the pioneer who set the ball of introducing the railways in India rolling. This article appeared in his book ***'Trailing Window'****. We have already reproduced two of his articles in previous issues of our magazine. The article appearing on Page 6 is also from the same book.*

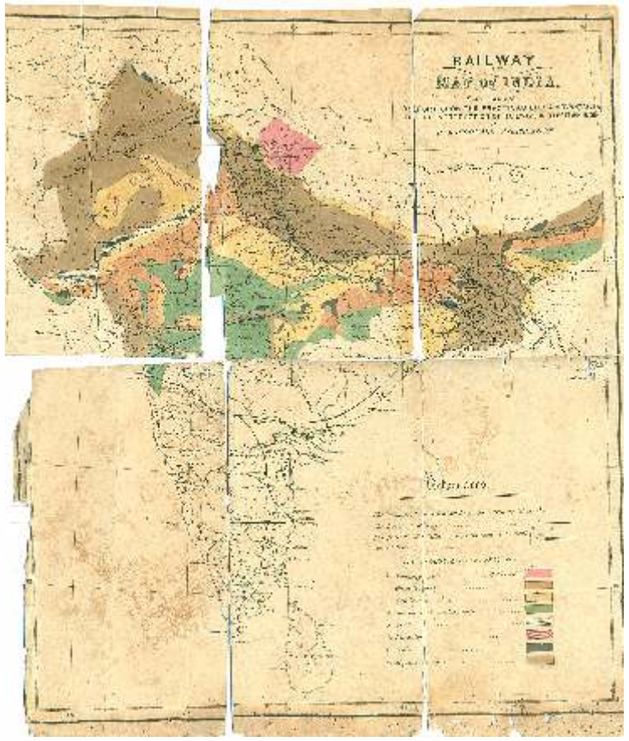
Rowland McDonald Stephenson

The name of Lord Dalhousie is inseparable from the early history of railways in India. Some writers even credit him with being the first to conceive a railway system in the country. Dalhousie did indeed play a significant role in crystallizing ideas on a wide range of aspects of railway construction and management in India, but neither during his association with British Railways as head of the railway department of the Board of Trade in 1845-46 nor later as Governor General of India is there any record of his having initiated any proposal for a railway line of any significance. That honour should surely go to Rowland McDonald Stephenson, the founder of the Calcutta-Delhi line and the first agent of the East Indian Railway.

Early ideas of a railway in India go back to the 1830s and several proposals, some impractical and some even fraudulent, were put forward in the 1840s. But it was Stephenson who first saw the significance of a line connecting Calcutta, the British capital and centre of British governance in India, with Delhi and the North Western provinces – then in the grip of military activity due to the Afghan wars – the line passing through the Ganges valley, the area with a large concentration of population and of high military importance.

The similarity of names has often led to a mistaken belief that he was the nephew of the legendary George Stephenson, considered the father of the railways. George Stephenson was the son of a collier, while Rowland's father was a Member of Parliament and a well-known businessman. One of his ancestors, Edward Stephenson, served the East India Company and visited the Mughal court in 1715-17 to negotiate a trade agreement. Rowland went to Harrow and later qualified as a civil engineer. In 1840, at the age of 32, he became Secretary of the East Indian Steam Navigation Company, which unsuccessfully bid for a royal charter for a steam service to the East but lost in the end to the Peninsular & Orient Shipping Company, owners of the famed P&O liners. Stephenson then turned his attention to the introduction of railways into India. His first proposals made in 1841 were dismissed “as a wild project” by the East India Company which felt that “India was hardly prepared for a railway”. In 1843 he sailed for Calcutta to pursue his objective by direct interaction with officials of the Government of India.

In India, Stephenson launched a systematic campaign for his project but first he canvassed the benefits of railways by publishing in local journals, both English and the vernacular, the operating results of European railways and their effect on the general economy and social conditions. At the same time, he assiduously collected information on the state of commerce and trade in the country, with particular reference to the routes between Calcutta and Mirzapore. He contacted leading merchants in Calcutta, both European and Indian, through letters or in person, and made friends with key officials in the Government of India and the Bengal Presidency. In 1844, he was ready with his



Map of India showing projected railway lines

pages, Stephenson argued his case for a railway network in India. Supporting documents ran to over fifty pages or more. Quoting extensively from one of his articles published in *Englishman* on 1st January 1844, he put forward the following reasons for immediate construction of a railway line connecting Calcutta with Mirzapore:

1. As a military measure for better security, with less outlay, of the entire territory.
2. From a commercial point of view, to provide the means of conveyance from the interior to the nearest ports, and to transit back manufactured goods of Great Britain, salt, etc.
3. For providing ready access to schools established "on the European principle" in several sanctoria in India.

A map showing the proposed railway lines, which was originally published to accompany the article in *Englishman* was also attached to the report.

Stephenson proposed a network of railways in India connecting Calcutta through the coalfileds with Mirzapore and Delhi (with an extension to Ferozpore), with Bombay via Allahabad and Madras via Hyderabad, with another link to Bombay via that city. Lines were also proposed to connect Madras with Calicut through Bangalore and Mysore and Cape Comorin via

project which he proceeded to enunciate in a publication entitled "Report on practicability and advantages of the introduction of railways into British India". It was a remarkable report in many ways. In fifteen closely printed

Rajmahal station, one of the key stations on the first route, as it is today

The erstwhile Burdwan, it was always planned to be on the Howrah-Mirzapore alignment

Arcot, Trichinopoly and Tirunelveli. A basic network comprising some five thousand miles and encompassing the whole country was thus proposed. American economic historian, Philip Dornier, applauds the breadth of vision displayed by Stephenson:

"At a time when the whole concept of railways was new in India, a lesser man might have confined himself solely to the great project of a line from Calcutta to Delhi and the Punjab."

Knowing the impossibility of all lines being taken up for construction immediately, Stephenson nonetheless felt impelled to propose the whole network at this stage so that the relationship between the 1200-mile Calcutta-Delhi line and the country's eventual requirements of railway communications were clearly established. The report is distinguished by the large volume of information and opinions collected from various sources, both Government and private. A large section of the British trading community responded to the letter addressed to them by Stephenson and gave freely from their data and of their views. Some of the views appear to be based on conjecture rather than on reliable information, but on the whole the information collected was authentic. The report presents vignettes of the conditions in Eastern India:

- Calcutta imported over 75,000 tons of sugar and over 20,000 tons of saltpeter originating West of Ghaziabad and about 15,000 tons of grain and pulses originating between Ghaziabad and Rajmahal. Agricultural and forest produce of Burdwan was transported in bullock carts and horse carts to the nearest river ports, then by boat down the Hooghly to Calcutta.
- Transportation of coal was both tedious and expensive. Coal was mined in the Damodar and Ajay river valleys 10 to 20 feet below the surface at a cost of less than one rupee per ton. It had to be transported by boat to Amta and Katwa respectively, only during the monsoon, boats making no more than six trips during the season, and then onwards to Calcutta down the Hooghly. At Calcutta, coal cost more than five rupees per ton. Coal mined in other months accumulated in the Ghats awaiting the next monsoon.
- A passenger travelling by road in a horse drawn vehicle traversed about 14 miles in a day. It took about five days to travel from Calcutta to Burdwan, a distance of 70 miles, and cost about five rupees.
- Goods vehicles, called hackeries, carried sugar from the interior to Calcutta, each carting about 10 maunds (a third of a ton), and returned with salt.
- Sugar as well as rice, indigo and other forest produce were transported to Triveni, 30 miles from Calcutta and then to that city over the Hooghly. Thus, the bulk of traffic moved over the river.
- It was estimated that in a year about 67,000 tons of merchandise consisting mainly of saltpeter, sugar and cotton and about 24,000 passengers moved down the river in about 14,000 boats. From Calcutta about one lakh tons of goods, mostly salt, moved up the river in about 16,000 boats.

Prince Dwarkanath Tagore

To ascertain the cost of construction, Stephenson solicited the opinion of a number of Civil Engineers, both in the Government and outside. The most important of these were Charles Vignoles and Samuel Ashburner, the latter experienced in building railroads in America.

Stephenson also relied on the views of J McLelland, who was engaged at the time in a survey of coal. Most of those who advised Stephenson seemed convinced that it would be cheaper to build railways in India than in Europe or England because of:

- Absence of "parliamentary expenses"
- By and large level profile of the line, and
- Cheap labour

Stephenson estimated that it would cost £ 6,000 per mile to lay the line, compared to a heavy £ 40,000 per mile in England.

The traffic anticipated on the line was worked out on the basis of existing road traffic and riverine traffic where relevant. Some of the correspondents suggested that existing traffic alone in not the correct index of anticipated traffic as the new mode of transport was bound to stimulate growth. A comparison was made with the traffic in the U.K. and it was concluded that the extent of traffic would not be less than that in England, as, under conditions then existing in India, travel was both tiring and expensive; the new form of transport would reduce costs to about one-fifth and the transit time to a fraction.

While most correspondents agreed that unlike in most countries, passenger traffic in India would be less, because Indians preferred to walk than spend on travel, Babu Ram Gopal Ghosh expressed a different view. Admitting that religious prejudices of the Bengalis and their poverty prevent the Hindus resorting to a new form of conveyance to a certain extent, he foresaw that a number of people, for whom time is valuable, would prefer expeditious travelling, particularly the growing class of educated Indians. He also emphasised the religious connection between Hindus and the holy cities of Benaras, Gaya, Allahabad and others, which could fill the trains with hundreds of passengers.

Stephenson visualised a stellar role for the railway of his dreams and the construction of the line from Calcutta to Mirzapore, which he recommended to the Government to start immediately, to serve as a crucible for getting experience. Accordingly, he suggested a comprehensive title for the company, viz., The East India Railway Company, to carry out the several lines of railway in India, which may appear desirable.

To ascertain the best possible route for the rail line from Calcutta to Mirzapore, Stephenson consulted A.S. Waugh, the Surveyor General of India, who brought his considerable knowledge of the geography of the country to bear upon the question. Waugh expressed the views that the rocks in the high land country, which would have to be crossed in the direct route to Mirzapore, are "impenetrable except at vast expense", that the route would be "inexpedient on account of the poverty of the country", and also because it would have to cross the Damodar twice. He preferred a route little eastward, lying between the Damodar and Ajay rivers, as it "offers few obstacles and the immediate connection of the coal districts is in itself a great object". Beyond Parasnath, Waugh thought, "the use of fixed engines would be indispensable" to haul the trains up the hilly tract up to "Lhanva Pass", after which the line would be level upto Sasaram, but involved the crossing of the Sone, "a formidable but not insurmountable obstacle".

Babu Mutty Loll Seal

A third alternative was to "outflank the hilly range altogether" by moving North-West from Burdwan to Rajmahal with a branch to the coal mines from Burdwan. Beyond Rajmahal, Waugh foresaw "great difficulty as far as Monghyr", because of obstructions from great obdurate igneous rocks of the Rajmahal hills, swamps and creeks and shifting nature of the river. If it was not found possible to "creep along the foot of the Rajmahal and Bhagalpur Hills", Waugh suggested crossing the Ganges below Rajmahal and moving Westwards on the North bank of the Ganges, crossing the Gandak, Ghagra, Gomati and other rivers. Waugh concluded by proposing a survey to determine the most suitable route.

Stephenson's other correspondents opted for one or the other route, but the opinion seemed to generally favour the

Khana station today. On the original route to Mirzapore, this is now the junction on the main line from where the Sahibganj loop takes off

Burdwan-Rajmahal route. In his report, Stephenson did not advocate any particular route. He strongly urged that "having completed the collection of the documents which pertain to the line of the country between Calcutta and the great central entrepot for the merchandise and produce of all descriptions at Mirzapore", construction of this line should be commenced without delay and while it was in progress, statistics for other lines to be considered in the future be compiled. He also suggested initial construction of the line up to Burdwan which would be required in any case, while a detailed survey was undertaken to determine the exact route to be followed beyond Burdwan and up to Mirzapore.

Prince Dwarkanath Tagore, grandfather of Rabindranath Tagore, was at the time a towering member fo Bengal's mercantile community. Stephenson consulted him through William Theobold, a close associate and later EIR's local representative in Calcutta. A set of queries designed by Stephenson was passed on to the Prince for his comments, covering the extent of traffic, cost of transportation, prospects of traffic by railway, etc.

Theobold reported that the Raja was willing to raise one-third of the capital for the line connecting Calcutta with Burdwan collieries if undertaken immediately. Other Indians who gave information and their views were Babu Mutty Loll Seal, Syed Abdollah, Ram Coomall and Manekji Rustomji, apart from Babu Ram Gopal Ghosh mentioned earlier.

Annexed to the report was a letter from Stephenson to the Deputy Governor of Bengal which, *inter alia*, declared that "no pecuniary aid was required" for the project and at the same time sought clarification on the grant of land for the railway, issue of a charter and appointment of Government Directors. In response, the Deputy Governor promised to recommend incorporation of the company and supervision of its work, in lieu of appointing Government Directors, as requested by Stephenson in a subsequent letter, but did not agree to permit the company to buy land directly. Stephenson now approached the "Honourable Company" directly on 2nd December 1844, submitting his report buttressed by the promise of support from the Government of Bengal; and asked for a guarantee of a minimum dividend of four per cent on the lines "so successfully introduced by the French Government". In subsequent letters, he reduced it to three per cent and even that only to cover the experimental line from Calcutta to Burdwan, but the company refused to bite. Instead, on 7th May 1845, its Court of Directors, realising for the first time the importance of introducing railways into India, sought the views of Lord Hardinge, the Governor-General. At the same time, the Court expressed its fears that "remuneration of rail-roads in India must for the present be drawn chiefly from the conveyance of merchandise and not

Sahibganj station. The first route was via this station, but is now on the eponymous Sahibganj loop

Asansol station, a Divisional Headquarters today

from passengers," because of their perception, "the people of India are poor, and in many parts thinly scattered over extensive tracts of the country". Obviously, they did not take the views of the likes of Babu Ram Gopal Ghosh seriously. The Company also feared that there were many insurmountable difficulties in climate and circumstances for building railways in India, among them,

- Periodical rains and inundations;
- Violent wind;
- A vertical sun;
- Ravages of insects and vermin upon timber and earthwork;
- Destructive effects of spontaneous vegetation;
- Difficulty and expanse of securing the services of competent and trustworthy engineers.

Yet, the Court was willing to encourage railways whenever they could be "advantageously introduced and maintained". The Court accordingly announced its decision to send a skilful, experienced railway engineer from England to undertake a survey and asked Lord Hardinge to depute two qualified engineers under the company in India to assist him.

Meanwhile, in December 1844, Stephenson and his associates had formed themselves into a Provisional Committee for the East India Railway Company under the Chairmanship of Sir George Larpent. The letter of the Court of Directors encouraged him to think that the Court had conceded the advisability of railways for India, but apprehended, in view of the Court's firm and continuing opposition to a guarantee, that the "Honourable Company" may decide to undertake the construction of railway directly, despite the indication in the Company's letter of its willingness to consider some other form of pecuniary aid after receiving the Goevernment's report. Stephenson's Provisional Committee thereupon formally established themselves as a joint stock company in May 1845, called East India Railway Company, with a most impressive Board of Directors drawn from East India House, shipping interests, a retired British Indian administrator, a retired officer from the British Indian army, bankers and engineers from the British Railways. George Larpent continued as Chairman, Bazett D. Colvin was Vice Chairman and Stephenson was named its Managing Director. A portion of shares was reserved for allotment in India and Stephenson requested his old friends and supporters in Calcutta to serve on the Bengal local committee of his company.

Stephenson felt that further investigation was unnecessary and treated the deputation of an expert from England as an indication of lack of confidence on the part of the "Honourable Company" in his pioneering efforts in Bengal. The EIR accordingly wrote to the Governor-General suggesting that Stephenson be associated with the survey being undertaken by F W Simms, the engineer appointed by the East India Company. It was stated on behalf of EIR that in view of his work in the past two years, "Mr. Stephenson can perform the duties to be conferred on the commission with the same impartiality as any other member". The Government of Bengal rejected this suggestion, but Stephenson nonetheless travelled to India on the same ship as Simms – in September 1845 – and returned to England only in June 1846, after Simms and his associates presented their report to the Government of India in March 1846. In April 1846, Stephenson and his three well qualified assistants submitted a report to the Directors of EIR on their work in India complied "with diligence and discretion which cannot be too highly commended" and in words of the Directors, "so great and persevering were the exertions of himself and his staff that in April 1846 the surveys of the whole line were completed; important statistical information obtained and an elaborate report transmitted to the Directors in London".

Protracted negotiations with the East India Company now followed and while these were in progress the EIR held its first meeting of shareholders on 12th April 1847. Soon afterwards, EIR was formally constituted as a company by deed of settlement and renewed its demand to the "Honourable Company" for better terms. In June 1847, the East India Company at last offered a five per cent guarantee for a period of twenty five years and it was time to make arrangements to start construction. Stephenson, Adam and Breston sailed for India on 20th September 1847 to be local managers of EIR along with eight engineers, the departure of the party being hailed as epoch making in the British Press. "No mission ever sailed fraught with more momentous interests to a vast population than that which is to depart from our shores on the 20th of next September," wrote *The Times*.

Notwithstanding the high expectations aroused in England, the work in India was far more difficult than was imagined. A series of misfortunes delayed EIR's fulfilment of the preliminary conditions laid down in the agreement with the "Honourable Company" and the latter foreclosed it on this account. Meanwhile, a strong group emerged within EIR which urged the liquidation of the company and objected to the "enormous expenditure" incurred by Stephenson and his staff. Stephenson returned home to meet the new difficulties. In 1849, EIR directly approached the British Prime Minister, Lord John Russel, quoting *inter alia* five reasons given by Stephenson to emphasise the need for urgent attention of the British Cabinet to the question of railways in India, viz.

- The need to defeat the efforts of Britain's commercial rivals to supersede her;
- Possible efforts to take India from Britain;
- Disaffection within India;
- Possibility of war against Britain by half of Europe and perhaps the USA as well; and
- Military value and savings of railways.

Differences between the East India Company and EIR were eventually resolved at the intervention of the Prime Minister and a formal agreement was signed on 17th August 1849. Stephenson sailed for India for the fourth time in March 1850, along with George Turnbull, the resident Engineer-in-Chief. Within a year of their arrival, they determined fully the first section of the proposed line of the railway. The Board of Directors of the company sanctioned construction of the Howrah-Pundooah line with a branch line into the Raneegunge collieries soon afterwards.

Stephenson continued to spearhead EIR's activities in India until after it was formally inaugurated on 3rd February 1855. According to one chronicler, "the keywords of his speech on this occasion may be said to have been 'modesty' and 'appreciation', modesty in alluding to his own achievements and appreciation in referring to the good work of his staff". He reminded those present that "out of the 20 previous years of his life devoted to the service and interests in India, the first six had been spent in contributing to secure steam navigation between Great Britain and India, while the last fourteen had been steadily directed to those results, the first instalment of which we have this day assembled to commemorate". The work took a heavy toll of his health, however, and he left India for the last time in 1856 to join the Board of Directors in London, where he later became the company's Vice Chairman.

Stephenson's vision of railway development in the British Empire extended beyond the Indian subcontinent. He conceived a plan to "girdle the world with an iron chain" to connect Europe and Asia from their farthest extremities with one colossal railway as a means of effecting the influence and extending the commerce of Great Britain, both in Europe and throughout the vast empire of the East. He envisaged the plan in three phases, viz.:

1. A railway line from a port on the English Channel in Europe to a port on the Persian Gulf, a total distance of 2800 miles, the passage to Bombay being made by steamer, and from Bombay to Calcutta by rail.
2. A railway line from the Persian Gulf across Persia and Baluchistan to the Indus, a distance of 1100 miles, connecting Asia with the large network.

A view of Raniganj station as it is now

3. A connection between the Indian Railway network and the Chinese Railway network by a link through the Nepalese range of the Himalayas up to the river Tsangpo.

Dalhousie considered the project would be “a gigantic undertaking”, but conceded that, once completed, it would be “a great step in the progress of the world. He had no doubt that the Government of India would be willing “at the proper time” to assist in “respect of surveys and otherwise”.

Stephenson's vision of railway development was recognised in an article in *Calcutta Review* in 1856.

“In 1840, the success of the Peninsular and Oriental Company convinced him (R M Stephenson) that the time was ripe for a yet more extended project. He conceived it possible to girdle the earth with an iron chain, to connect Europe and Asia from their farthest extremities by one colossal railway. A portion of this scheme is still too far in the future for us to do more than indicate its vastness. The remainder, all that falls within our scope, was to connect so much of the two continents as should enable a locomotive to travel from Calcutta to London with but two breaks, one at the Straits (of Dover) and one at the Dardanelles.”

The shareholders of EIR gratefully acknowledged his services when in 1849-50, they voted a compensation by way of a percentage on the net profits over and above 5% received by the shareholders, in consideration of the services by Mr. McDonald Stephenson to this company and of the extraordinary exertions made and the risks encountered by him in introducing the railroad system into India, embracing three journeys to India and the survey of many hundred miles of railroad.” Moreover, when the railway was purchased by the Government, 34,000 Pounds were voted to Stephenson in commutation of pension, out of the money which had remained with the shareholders.

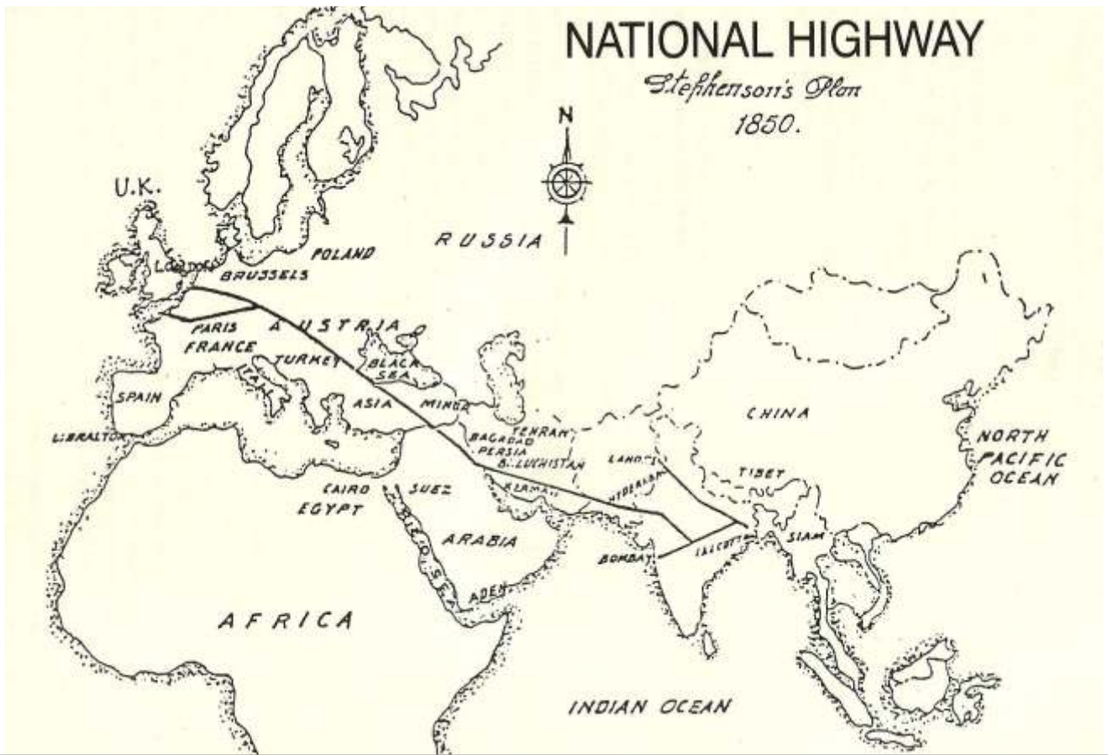
Stephenson died in November 1895, aged 87. The *Times* obituary read:

“Sir Rowland McDonald Stephenson, who died at his residence Holmfield, Rusthall, Turnbridge Wells, aged 87, was born in London and after being educated at Harrow, entered, in 1830, the engineering profession. He became secretary to the association established in 1838 for securing steam communication with India and for many years he was Managing Director and subsequently Deputy Chairman of the East Indian Railway Company. It was in recognition of these services that he received the honour of a knighthood. He was the author of occasional contributions to scientific publications and he also wrote the article 'Railways' in Weale's Series.”

Maps & Stephenson's picture: *From Annavarapu Ramarao's original article*

Station photographs: *Courtesy CPRO Eastern Railway, except photo of Khana station which is courtesy Sourosakshi Maji*

Stephenson's “Iron Chain” from London to Calcutta



Innovations

Hybrid Electric Locomotive

Kanchrapara Workshop of Eastern Railway has successfully developed a Dual Mode Shunting Locomotive (Battery/Electric). The workshop converted a condemned Vishakapatnam based WAG5 conventional locomotive, which was earlier a WAM4B Class locomotive of Vijaywada Electric Locomotive Shed bearing Road Number 21127. The hybrid locomotive is capable of operating in both 25 kV AC wired sections and unwired lines for shunting 24 coach rakes and freight trains of 58 BOXN consist.

Since the locomotive can operate in two modes – OHE and Battery – the driver can select one mode at a time by selecting one additional key which is provided on the driver's desk. When on 'OHE mode' the 25 kV OHE will feed traction power and simultaneously charge the batteries and when on 'Battery mode' the batteries will feed traction power. Ni-Cd batteries (Nickel-Cadmium) of 3.6V and 199AH having high energy density, better thermal efficiency and fast charging capability, have been used to fulfil the requirement of starting as well as running the locomotive.

Four battery sets (72 batteries in each set), two traction battery chargers and two battery contactor panels have been incorporated in the locomotive over and above the existing equipment to convert it into a battery-operated shunting hybrid locomotive. The locomotive can operate with its full capacity in OHE mode except for dynamic braking and field weakening facility, which have been removed.

This development of the hybrid locomotive *'Ojas'* bears testimony to Eastern Railway's initiative to “Go Green” after West Central Railway which had tread the same path and converted a condemned New Katni Junction based WAG5, with road number 23015, which earlier belonged to LDH, into a dual mode shunting locomotive named *'Navdoot'*.

Text and photograph: *Courtesy Somsubhra Das*

Locomotive 'Ojas', announcing its dual modality, at Kanchrapara

Trip Report

Gwalior Light Railway

Somsubhra Das

During the 18th and 19th centuries, India witnessed the meteoric rise and dominance of many Maratha dynasties. The Maratha Confederacy was at its zenith under Peshwa (Prime Minister) Madhav Rao-I. For efficacious management of the large empire, Madhav Rao-I awarded semi-autonomy to select chieftains who ultimately established semi-autonomous Maratha states. Among these were the Scindhias of Gwalior, the Holkars of Indore, the Peshwas of Pune, the Gaekwads of Baroda (now Vadodara) and the Bhonsales of Nagpur. After the third Anglo-Maratha War in 1818, where the British defeated the Marathas, the Maratha clans were handed internal sovereignty under British paramountcy in the form of Princely States under the colonial government. Subsequently, many of these princely states built railways to facilitate the movement of people and goods across their far-flung 'empires'. The Gaekwads were pioneers in this field and the 2'6" Narrow Gauge alignment from Dabhoi to Miyagam Karjan under the then Baroda State Railway was the first Princely State-owned railway line, opened in 1862. Decades later, the Scindhias followed suit and the Gwalior Light Railway (GLR) came into being. Until 1950, GLR was under the ambit of the Scindhia State Railway but is now part of the Indian Railways.

Stretching 198.9 kms from Gwalior to Sheopur Kalan, the small town which was better known as the summer capital of the Scindhias, GLR's 2-foot (610 mm) gauge is often referred to as special gauge, narrower than the conventional 2'6" narrow gauge. The other two flanks of this royal railway (Gwalior-Shivpuri and Gwalior-Bhind) have already fallen prey to gauge conversion. Madho Rao Scindhia-II was the chief protagonist under whose regime rail construction started in 1895. The Gwalior-Sabalgarh stretch was complete by 1904 while the entire stretch up to Sheopur Kalan was completed in 1909. Better known as the Maharaja's Railway amongst the locals, GLR is still considered as a jewel in the crown, as it is one of those few railway tracks which was constructed without British assistance in the 19th century.

To gain first-hand experience of such a historic route across the rugged Chambal heartlands, I embarked on the

'B' class 4-4-0 steam locomotive plinthed at Gwalior

The puny NDM5 that hauled the train

Chambal Express from Howrah to reach Gwalior the next evening. I spent the night at the Gwalior Retiring Room to be prepared for the 'toy train' journey early the next day.

At daybreak, I squeezed out some moments to photograph the plinthed steam locomotive at the station complex which used to trundle down the tracks of GLR. This B class 4-4-0 locomotive was built by Kerr Stuart & Co Ltd., UK in 1895 and was initially used by the Maharaja of Gwalior. The locomotive was later acquired by IR, re-classified as NA 791, and was finally plinthed.

The only service to Sheopur Kalan is the solo 6.30 a.m. train, passing 22 stations before reaching its destination. Most coaches had no name boards – but had "Gwalior-Sabalgarh-Sheopurklan" written on them. A cute looking NDM5 #809 from Gwalior DLS was ready with its 7-coach load as people thronged the platform to get inside the train. Patronage was so high that I was only able to hang on to a door. After a while the semaphore signal obliged and the journey commenced. The train took an immediate right turn along the hillock adorned with bougainvillea blossoms. Soon we were passing through the corridors, courtyards and kitchens of the settlements that had almost clogged the railway track. After that phase, we opened up on the Fort Road. We reached Ghosipura where the overcrowding was so high that people waiting for the train straightaway climbed onto the roof without even bothering to look for seats inside. This train serves as the lifeline for small time traders. It was a real spectacle to watch people munching away dry foods while travelling on the rooftops with elan.

It did not take long before we reached Motijheel – a station abuzz with another good 50-60 waiting passengers. The carriage tops were already jam-packed. My physical endurance was also flagging as I found no place to cling on to but for the handrails on the side of the locomotive. Meanwhile, we had crossed Milaoli. On reaching Bamour Gaon, I approached the Loco Pilot (LP) for accommodating me in the cab. The LP and Assistant LP were impressed when they learnt of the purpose of my travel. Their kind gesture helped me to get onboard the locomotive footplate, which helped me realise my dream of footplating on a puny NDM5.

Going past a herd of barking deer we soon reached Sumaoli after Ambikeshwar where a Gwalior-bound service was awaiting our arrival. Sumaoli is a beautiful station but crowded. It was interesting to find locals offering drinking water to the thirsty. It was a voluntary service that broke all social barriers. It was a tough day as temperatures soared and the mercury was beginning to touch the mid-forties.

The space crunch inside the diminutive cab surprisingly did not bother the LP and ALP. They informed me that they performed both BG and NG duties in rotation. I asked the obvious question of rooftop travelling on this route. They affirmed that people travelled like that only – thanks to the paucity of trains and other modes of transport which were fewer and dearer. There were some accidents including fatalities but roof-top travel continued. One remarkable thing I noticed was that the track was dead straight at most places and had iron sleepers all through, barring the bridges.

Conversing away we ticked off Thara, Jora Alapur, Sikroda and Bhatpura. Of these, Thara and Sikroda literally had no platforms and only the inconspicuous station boards testified to their existence, while Bhatpura was more of a cluster of trees standing together and Jora Alapur had a very low-lying platform. Most of these stations lacked a proper station building. Kailaras was the upcoming station which had some settlements and a rural market adjoining the station. I had already made up my mind to limit my journey to Sabalgarh, so that I could return to Gwalior the same day. After touching Semai and Pipalwali Chowk, our train made its way to Sabalgarh, a small city of some historical significance. It earned its name from the Sabalgarh Fort – a noteworthy medieval monument. We were only an hour late at Sabalgarh.

Meanwhile, the hospitality of the LP and ALP did not end with the cab ride. Having completed the day's duty at

Sabalgarh, they took me to the Running Room and persuaded me to have lunch with them. They ensured that my bottle was full of refrigerated cold water and did another favour by advising the LP of the Gwalior-bound service to let me travel in the cab.

My return cruise took off in the dual-cabbed NDM5 #814. This is the smallest dual-cab locomotive of IR, a dual-cab NDM5 manufactured by the Central Railway Loco Workshop at Parel, which bears a striking resemblance with

Gwalior-Sabalgarh-Sheopurklan coach. Note the spelling of Sheopurkalan

the only dual cab ZDM4A #215 of IR and with those Kalka-based dual cab ZDM3s. I filmed this cute machine as one cannot find these tiniest dual-cabbed species elsewhere. Meanwhile, as temperatures soared, the radiator's heat added to the discomfort. Wonder how the LPs perform their duty under such extreme weather conditions. Once again, rooftop travel continued despite stencilled warning at coach-ends about attracting a fine of ₹ 500 or a 3-month imprisonment. The train often notched up 35 kmph speed, in stark contrast with our morning journey which hardly touched 20 kmph. We often crossed terrain with rocks jutting out and occasionally sighted highlands towards Ranthambore. There was not much else as agricultural fields and xerophytic vegetation enveloped the better part of the route. Apiculture seemed to be a favoured second choice after agriculture as many apiaries were found in action enroute.

A couple of major road cum rail bridges – one between Jora Alapur and Sikroda over Soan river and another before Kailaras over Koari river – were something unique: a common path was being used by the train and other conveyances. A Permanent Speed Restriction (PSR) of 5 kmph had been invoked on all those bridges. Low height of one of these old bridges meant that rooftop travelers needed to take evasive action – all seemed to be aware of this as they ducked under the iron structure for a safe passage. Dodging trees and negotiating curves – all seemed part and parcel of the rooftop sojourn.

Two crossings with Sabalgarh services happened enroute; all trains had huge patronage. A rake of 6 wagons loaded with stones was spotted at Bamour Gaon. Our LP informed that it had been lying there for ages. After another five and half hours of hard toil through the hot dusty tracks accentuated with another hour of delay, finally the iconic Gwalior Fort came into view. The day was nearing its end and so was my journey. In spite of the heat, such journeys are always welcome given the dynamics of time travel involved while moving at snail's pace in this fast world.

My experiences on this journey made me accept the fact that although all of us live on the same planet, there are worlds other than the one we live in. There is our world and the contrary world witnessed while traveling on GLR. Perhaps these are the two faces of our nation – India and Bharat. Perhaps this simple world will end once gauge conversion takes place. Never mind the speed, sometimes life in slow motion is like a worthy blissful humane touch which keeps the spirit of the land alive! This unique train is like a living fossil that has not only served the sons of the soil across generations but also tells tales about the inseparable aura of the royal entity that created it.

Photos: *Courtesy the author*

On the Gwalior Light Railway

Nostalgia

Mayurbhanj Railway

Anil Dhir

Half a century ago, it had 12 locomotives and a staff of 200. Today, all it has are three decrepit steam engines, a few battered coaches, some paraphernalia of the steam age and a glorious history behind it. More than a century old Baripada railway station still carries an aura of majesty of the British Raj. For old timers, its pure nostalgia of an era gone by, when every boy wanted to be an engine driver and blow the whistle.

A decrepit steam engine

The Rupsa-Baripada-Bangriposa Narrow Gauge line was started by the erstwhile ruler of Mayurbhanj, Sriram Chandra Bhanj Deo. The first section of 52 kms. from Rupsa to Baripada was inaugurated by the then Lieutenant Governor of Bengal, Sir Andrew Fraser, on the 20th of January 1905. Rupsa was the junction with the Bengal Nagpur Railway's Broad Gauge line. An agreement was signed on 2nd December 1918 between the Mayurbhanj State and Mayurbhanj Railway Company for extending the line to Talband, 615 kms away. This section was opened on the 15th of July 1920 and the management of the entire section was handed over to M/s Hoare Miller and Co. of Calcutta.

To work the line, the Railway chose 20 ton 0-6-4T locomotives, designated as ML class. The first two of these (No. 691, 692) were built by Kerr Stuart and Company. Later in 1924, two more locomotives (No. 693, 694) built by the same company were added. These locos were transferred to Naupada shed of Paralakhemedi Light Railway, while heavier CC class 4-6-2 locos of the Satpura Narrow Gauge lines were introduced on this line. These were built by North British Locomotive Company, Glasgow. Later, ZE class locomotives, built by M/s Corpet Louvet Maffei and M/s Kawasaki were introduced. All locos were homed at Baripada Loco Shed.

After independence, when the railways were regrouped, the Mayurbhanj State Railway was taken over by the Government. The Bengal Nagpur Railway, along with the Eastern divisions of the East Indian Railway was constituted into the Eastern Railway in 1952. Later, the newly formed zone was found to be too large for effective working and in 1955, the Bengal Nagpur Railway portion was separated into a new zone, the South Eastern Railway.

Till early 2003, there were two services in either direction. The first service from Rupsa (1RB) started at 06.45 hrs, reaching Bangriposi at 11.30 hrs. The second service from Bangriposi (2RB) started at 12.10 hrs reaching Rupsa at 17.05 hrs. Sometime in the late eighties, diesel locos took

Another view of the decrepit locomotive

over, bringing to an end the era of steam locomotives. Bowing to public demand, conversion of this Narrow Gauge line to Broad Gauge was sanctioned in 1995-96. The line completed its centenary year in 2005 but services were closed due to gauge conversion. Work was finally completed in 2005 and regular Broad Gauge services started in 2006.

In its heydays, the Baripada shed worked seven days of the week, the shed's fitters, boiler makers, machinists, turners, painters, loco cleaners and khalasis keeping themselves busy servicing the engines, cleaning parts, refilling their boilers with water and emptying coal from the fireboxes.

A CC class working a train in the heydays of the Mayurbhanj Railway

Another vintage Mayurbhanj train crossing an arch bridge

The engines took on 1 Tonne of coal and 2000 Litres of water and had to be fired up with 20 kg of wood and jute grass soaked in kerosene. The engines took three hours to build full steam.

The four original locos have survived the day. When they were transferred to the Paralakhemedi Light Railway, their nomenclature was changed from ML to PL. Thus, PL 691 has been plinthed outside the Southern Railway headquarters in Chennai. PL 692 is outside the BNR Hotel (now Chanakya) at Puri. PL 693 has been plinthed on the Ramakrishna Beach, Visakhapatnam while PL 694 is outside the Visakhapatnam station. All of them are in fairly good shape.

The Baripada steam shed can be converted into a prominent place on the steam map of the world. If properly restored, this heritage shed can be transformed from a ruin, lost and forgotten, to a grand museum. It will draw steam enthusiasts from India and abroad, who have come to enjoy steam locos in all their glory. There are many who have not seen a working steam loco in their lives. Seeing such huge machines at work is one of the most humbling experiences, and perhaps the most joyous one too.

I spent half a day at the shed, marveling at the glorious machines of a bygone age. I rode on the footplate of the old loco, reliving boyhood fantasies of being an engine driver and pulling the whistle cord.

Photos: *Courtesy the author, except the photo of Loco No. 693 which is from the archives of the Rail Enthusiasts' Society*

Locomotive No. PL 693, plinthed on Ramakrishna Beach at Visakhapatnam

Book Review

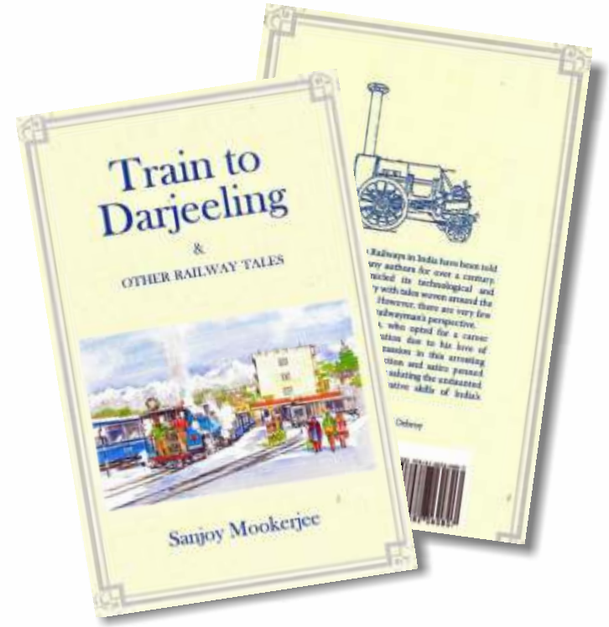
Train to Darjeeling

J L Singh

I first met Sanjoy Mookerjee when I called on him in his chamber in Rail Bhawan, the seat of the Railway Board. He was then the Financial Commissioner (FC) of the Indian Railway Board and at the peak of his career as a member of the Indian Railways Accounts Service. Be that as it may, I was not calling on him as the FC or as a railway man; my sole purpose of meeting him was that he was a rail enthusiast. This was in early 2016. I had been to Tinsukhia a year earlier and seen the excellent museum he had set up when he was the Divisional Railway Manager of the Division.

After introducing myself and exchanging pleasantries, I began by telling him about the new society that we had formed a few months earlier. The moment I gave the name of the Rail Enthusiasts' Society, he wanted to know how he could become a member and before you could say "Jack Robinson" he had paid the subscription in cash and was among our first members apart from the founding members.

Today, Sanjoy is managing the Rail Enthusiasts' Society's Kolkata chapter with elan and unadulterated vigour. His unmitigated activity embarrasses the rest of us who cannot match his ardour. In spite of his multitude of contributions in the field of rail heritage and enthusiasm, he added one more feather in his cap: he has produced a book - **Train to Darjeeling** - that has been published recently and is available on Amazon.



Historic Durand Railway Institute (built 1878), Asansol

A mixture of actual events and fiction, **Train to Darjeeling** is a microcosm of the Indian Railways penned in a light humorous manner in the form of standalone stories and tales. Don't get misled by the title; only the first chapter is a journey to the Himalayan hill station. The rest of the book covers diverse areas and takes you to varied locales. You will read of elephants shunting passenger coaches at Dudhwa, a Deputy Director of the Railway Board sweating under the gaze of an overbearing General Manager, an innovative officer being cowed down by rules, display of the Indian penchant for *jugaad* for printing the first computerised ticket at the Kolkata PRS, and many many more such events and anecdotes.

Three factual stories are worth mentioning. The first is the eponymous journey to Darjeeling that gives the book its name. Undertaken when Sanjoy was a lad of seven, and when there was no bridge at Farakka to cross the mighty Ganga, you can actually feel you are on the train with him. From the moment the train leaves Platform 8 at Howrah to the ferry crossing at Farakka, from Farakka by Broad Gauge

Steamer waiting at Sakrigali Ghat

and then the change to the 2-foot Meter Gauge, you feel and experience every nuance of the journey. Sanjoy has the ability of telling you a lot about the railways and its working while he is telling you his story. At the end of the train to Darjeeling, you will know all there is to know of this journey, history of the line, the type of train that then ran, what they did, etc. Not only this chapter, but the the entire book is illustrated by delightful sketches drawn by none other than Sudakshina Kundu Mookerjee.

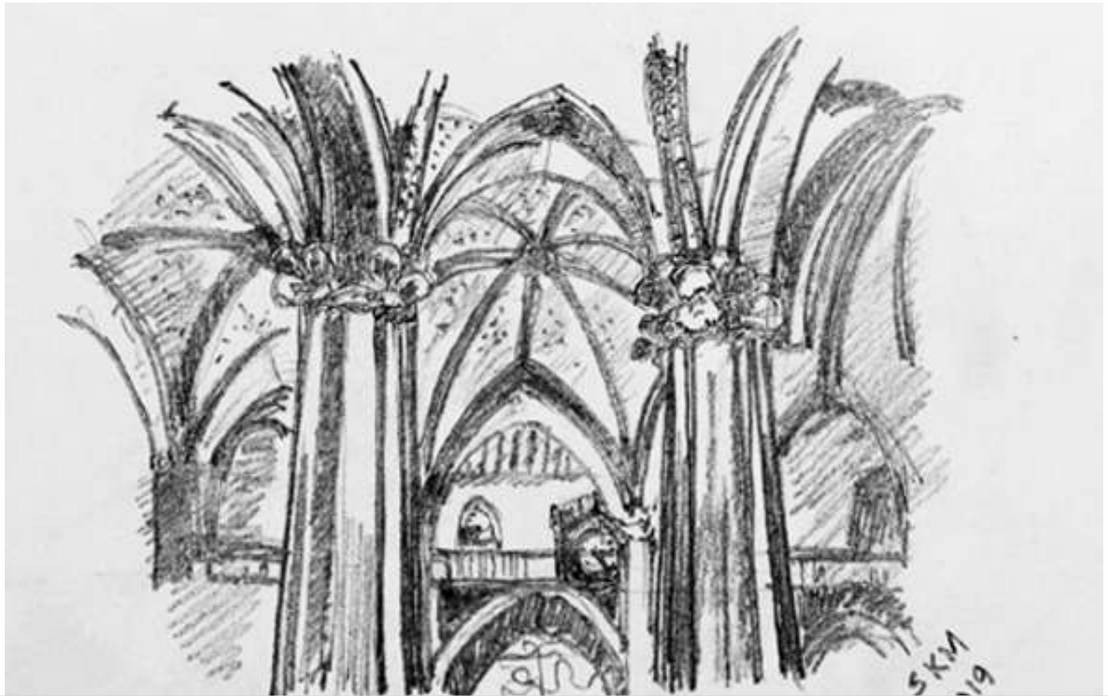
The second is an illustration of the Indian penchant for *jugaad*. *Jugaad* is a quintessential word in the Hindi language that does not have an exact equivalent in English. The nearest meaning would be innovation resorted to in the heat of the moment through means that are unconventional. This is the description of how the day was saved when the first computerised ticket had to be printed in Kolkata in November 1987 for the then Minister of State for Railways, Madhav Rao Scindhia. The fact that a ten rupee aluminium bowl saved the day has to be due to the Indian ability to resort to *jugaad* to save the day.

The third is a very moving and touching encounter Sanjoy and his wife had with an old Station Master at the desert town of Jaisalmer in the State of Rajasthan. The Station Master had lost his son to a sniper's bullet near Jaisalmer. He had asked for a posting at Jaisalmer to be near his lost son's place of death and cremation. It just happened that when Sanjoy, his wife and their son reached Jaisalmer, the Station Master and his wife felt this family was like the family of their son had the latter been alive. I will not tell you the rest of the story but Sanjoy's style of writing will certainly move you to tears or at least give you a lump in your throat.

The range and variety of stories and anecdotes that have been covered will satisfy the appetite of any person who has the fleetest of interest in the railways. A 'must read' for not only the rail enthusiast but any person interested in good stories. Without your realizing it, you will have the bonus of learning a lot about the railways.

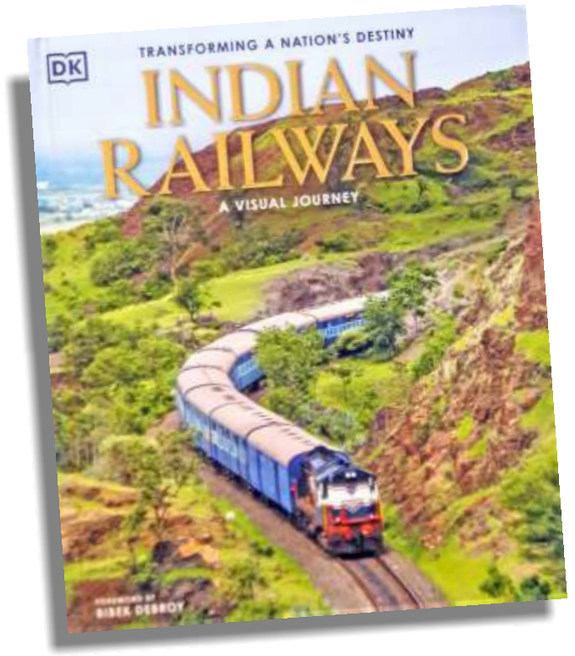
Sketches: *By Sudakshina Kundu Mookerjee. Examples from the book.*

The Star Chamber of CSMT, Mumbai



Book Review

Indian Railways – A Visual Journey



The Rail Enthusiasts' Society is not yet half a decade old. Its magazine, **The Rail Enthusiast,** completed four years only this month, i.e. August 2020, the first issue having been launched on the 6th of the month in 2016. Since then, 14 issues of the magazine have been published. In this short span, two books on Indian Railway history have been reviewed in the periodical – *Indian Railways: Weaving of a National Tapestry* by Bibek Debroy, et al, and *A Short History of the Indian Railways* by Rajendra B. Aklekar. There are a number of other volumes and tomes that give us a good account of the tumultuous history of this 160+ year old 'Lifeline of the Nation', the Indian Railways. The logical question that arises is whether there is a need for another history book, an additional treatise on the saga of the nation's railroad, one more title to adorn your bookshelf!

Dorling Kindersley (DK) Publishing Private Ltd. have done just that – brought out a new book on the history of the Indian Railways, titled *Transforming a Nation's Destiny: Indian Railways – A Visual Journey.* But it is a book with a difference. Most of the earlier works are either catering to the historian or serious rail researcher or providing light reading for the general reader. Most carry some pictures, but few are pictorial enough to be visual delights. *Indian Railways – A Visual Journey* has addressed all possible shortcomings in the earlier books and provided a volume that is a complete history of the railroad beginning before a single train ran in the country and taking you into the realms of the future. Along with this is an excellent collection of photographs, many of which have not been published before. The material is conveniently divided into seven significant historical periods, each of which saw varied aspects of the development of the railways. These periods cover the Beginnings (1830-1870), Development and Expansion (1871-1920), a State within a State (1921-1938), Partition and After (1939-1949), Railways of the New Nation (1950-1980), a Time of Transition (1981-1999) and, finally, the New Millennium (2000 onwards).

One feature of the book that stands out is a Time-line at the beginning of each section. This not only lists the major

events in that period concerning the railways, but also juxtaposes other external events of significance, so that the railway's journey can be viewed in the overall perspective of occurences not only in the country but the rest of the world as well. For instance, the time-line of the 1871-1920 period, apart from rail events, includes happenings like the diesel engine being patented in Germany, the Swadeshi movement starting in Calcutta and the partition of Bengal, Gandhiji's return to India and the start of World War I, among others.

As the name implies, the book is a visual delight. From pictures giving a panoramic view to detailed close ups, you will find them all. For any chronicler of past events, one of the most difficult tasks is finding accompanying and illustrative pictures, particularly in our country. DK have done an excellent job in this respect and there is no page that does not have a good relevant picture. In some selected cases, like the article on the iconic Mysore Maharaja's saloon, there are overall views of the saloon on one page, followed by two pages of details ranging from the fenced veranda and door knobs to brass chandeliers and sleeping berths. Drawings, maps and sketches have also been included to break the monotony of the pictorial visuals and to create a grand overall effect. Two illustrative leaves from the book have been reproduced on these pages.

While the main thread in the book is a historical perspective, many aspects of the railways have been covered in a holistic fashion without any specific period in mind. Thus, there is a write-up with good illustrations of steam locomotives. There is an equally good rendering of diesel and electric locomotives. Some iconic locomotives, like the Fairy Queen, WP 7200, WP 7161, the PSMT mono-rail, etc. have been given prominence. Other subjects have been covered similarly. These include areas like tunnels, bridges, stations, signalling, films, and so on. The human touch is not neglected with the hidden faces behind the railways also being given importance. Some events that are not very well known even in railway circles, like the roll of the organisation during the 1971 war against Pakistan, have also been included.

Comprising 304 pages in a hard-bound cover, *'Indian Railways – A Visual Journey'*, is not a book that you go through once and forget. It is the kind of book that is a must in the collection of any rail student or afficionado, rail enthusiast or historian. It will satisfy all tastes. It is now available online as well as in stores.

Rail Museums

Hubballi

From humble beginnings, commencing with a maiden run of 34 miles (54 kms.) between Boribunder and Thane 167 years back, the railways in India expanded by leaps and bounds to the present 1,08,706 kms of track. A glance at the key operating statistics of the Indian Railways – 6853 stations, 2.3 Million passengers and 3 Million Tonnes freight per day – indicate the mammoth scale of the organisation.

It goes without saying that an entity as historical, large and diverse as the Indian Railways is bound to have a rich, varied and vibrant heritage. To collect, preserve and display this heritage – technical, operational and social – rail museums have been set up at many important places in India. Year 2020 will stand out in the history of heritage preservation of the South Western Railway (SWR) zone as it offered to the visiting public not one, but two rail museums.

The 'Selfie' point

A panoramic view of the museum

The first was the renovation and upgradation of the

Another comprehensive view of the outdoor gallery. Note the vintage lamp posts

Wheels of various types of rolling stock on display

museum at Mysuru. A write up on the museum follows this report. While the museum at Mysuru offers visitors of Southern Karnataka an opportunity to see and assimilate the fascinating past of the railways, the museum at Hubballi is the first of its kind in North Karnataka. It is located ideally next to the second entry of Hubballi Railway Station on Gadag Road, Hubballi.

A grand arch at the entrance welcomes one to the bygone era of the railway. Embellished with emblems of forerunners of SWR, the arch warmly invites one to take a

The tiled-roof ticket counter

Logos of various erstwhile company railways on display

sneak peek into the rail world of yore. A signature old structure with tiled roof serves as a ticket counter. A selfie point with the logo of the museum is provided so that visitors can freeze memories of their visit.

Exhibits of the museum are broadly arranged in three sections – in two cottages, named Malaprabha and Ghataprabha after two rivers in the region, and the landscaped outdoors.

All exhibits that run on track or are related to track are

Full-size statue of a Station Master at work

found in the outdoor gallery. Included in this area are locomotives, coaches, wagons, a tank wagon, permanent way material such as rails and sleepers, a level crossing gate, a push trolley, signals, etc. Among locomotives, a narrow gauge locomotive that worked from the East coast all the way to Hubballi, which is almost on the West coast, is one of the prime attractions. It enables visitors to get into the hot seat of the train driver, something every child dreams of, to have a real feel of a train engine. Another locomotive, brought from Vadodara region, is also displayed wherein a mannequin of a train driver can be seen.

A narrow gauge coach that ran on the Nagpur-Jabalpur section is decked up as a tableaux of "Unity in Diversity".

Apart from the displayed goods wagon, semaphore, colour light and shunting signals can be seen in this photograph

Vintage clock

Lifesize statues of the passengers belonging to various parts of country, along with modern day travelers, and curious school children, adorn this coach to illustrate that trains bridge distances and connect people.

A tank wagon that was used for storing water for emergencies in Hubballi Workshop since 1948 and a narrow gauge wagon that was used to transport coal and ballast can be seen. All these wheeled beauties have been illuminated with LED strips that lend a mystic glow to them during the night.

Colourful carriages steered by a steam engine are sure to entertain children and elders alike. A toy train, manufactured in house by Hubballi Workshop, takes you on

Passenger coach adorned with portraits of film personalities

a short trip. The train is equipped with sound and steam effects that will transport you to the past and awaken the child in you.

To simulate an actual yard, signals and points are provided adjacent to the rolling stock to depict the progression of technology in these areas. Important features of a level crossing gate and a point machine are provided in actual field conditions. A metal over head water tank is also displayed.

No railway station can be imagined without a platform. To provide access to the 'restaurant' and 'theatre' coaches, a platform with a tiled shelter has been provided. Remarkable features of this platform are ornamental platform pillars released from Dharwad - a century old station under re-modelling and a drum clock that has been ticking from the 1940s. The theatre coach shows short movies and videos that are both entertaining and educative at fixed show hours, while you can enjoy fine dining in the restaurant coach. The interiors of the latter are tastefully furnished to create an ambience that simulates traveling in a palace-on-wheels.

Two beautiful cottages constructed in 1907 have been converted to house indoor items. These buildings are classic examples of quintessential old age charm and are provided with aesthetic façade lighting that accentuates their architectural brilliance. At the entrance of the first, Malaprabha, a commissioned series of charcoal sketches is displayed on stone walls in the art gallery. These sketches present pre-independence station buildings and sights of stations in monochrome paintings of various heritage locomotives.

A booking office with vintage ticket tubes and rotating cash chests is also on display. As one steps into the station masters room, that is the first room in Ghataprabha, one is transported to an environment of the first half of last century. The room recreates station working with a comprehensive collection of artefacts that were actual working gear in the past. The equipment, along with records and registers maintained by a life size station master, evoke curiosity and excitement in visitors. Next is a modified waiting-cum-parcel room. With teak/rose wood furniture that used to be provided for travelers, this waiting room makes one feel nostalgic of bygone train journeys. The parcel office portion of the room is equally alluring, its prized collection being a weighing machine manufactured in 1883 and century old iron cash safes.

Ornamental platform pillars adorn the platform between the Restaurant and Theatre coaches

View of the ticket counter at night

An extensive collection of items ranging from old land plans, bridge name plates and permanent way fittings and tools are displayed in the next room. The adjacent room features the history and progression of train lighting and train electrification. A room that exhibits classic office working with interesting items of a comptrometer (an old mechanical calculator), old type-writer and service records of employees in the 1920s is an interesting sight. The evolution of permanent way, rails, sleepers, track fittings, signaling, telecommunication items is illustrated along the walkway.

Ghataprabha cottage features a model room with a running train. Interlocking can be seen at work for automatic signals, wherein the visitor can see signals changing on the passage of the model train. History of locomotives, wagons and coaches is presented along with antique equipment and tools used in workshops. Glimpses of the working of the railways on the medical and security fronts can also be seen. A children activity room is also part of Ghataprabha. A memorabilia counter where souvenirs of the museum can be bought has been provided. The highlight of this cottage is a 70+ year old card ticket printing machine. The machine still works and is used to print souvenir tickets.

To satiate the gastronomic needs of visitors, Suruchi Cafeteria offers a menu of regional delicacies that are synonymous with stations where they were first prepared: these include the Maddur *Vada*, Hubballi *Girmit,* Davangere *Benne Dosa,* etc. The cafeteria has been aesthetically designed using heritage cast iron pillars released from Hubballi station. Sitting on wooden logs transformed into chairs and tables, one can unwind by taking in glimpses of the surroundings, while sipping “Tea”, immortalized by calls of vendors that are an integral part of train journeys.

Another impressive outdoor feature is a display of paintings. The underlying theme is 'Rainbow of Journey'.

The exceptional feature in developing Hubballi Railway museum is that only inhouse resources have been used to collect antique items from all over the zone. All are welcome to visit and help us making it even more attractive in terms of preservation, education and entertainment.

Text and pictures: *Courtesy South Western Railway*

A ZDM3 locomotive tastefully lit up after dark

Rail Museum

Mysuru

Rail Museum at Mysuru (erstwhile Mysore), with a brand new look and added attractions, beckons you. The museum has been completely revamped on the 40th anniversary of its founding in 1980.

The moving spirit behind this remarkable make over has been Aparna Garg, the current Divisional Railway Manager of Mysuru Division. With her indomitable spirit and penchant for perfection, she took advantage of the sanctioned work which had been lying in cold storage for over a decade, and set out on a mission envisioning the radical transformation of the museum to match global standards and make it one of the best in the country. Of course, it can be safely concluded that she was the right person at the right place as, at this juncture, the backing of the headquarters of the South Western Railway of which Mysuru Division is a part, was readily available. The South Western Railway has also set up a a new rail museum at Hubballi in the same period.

For the renovated and upgraded museum at Mysuru, new settings were conceptualized so that the visitor has an experience of a life time. In addition to an imposing entry, an attractive welcome plaza and a well-stocked souvenir shop have been established. With wide open spaces, accessibility for differently-abled and a vast geographical spread, the new layout has exclusive galleries showcasing, *inter alia,* the evolution of block working as well in signal and telecommunication on the Indian Railways. Two areas that are normally not prominently displayed in rail museums - civil engineering artefacts and commercial matters - have been given dedicated spaces to provide an insight into these basic features of a railway.

Special care has been taken to provide basics like high quality public amenities. The effort put in to renovate the museum can be deduced from the fact that a metre gauge standard working turntable has been brought all the way

Entrance to the museum

The grand Welcome Plaza and the Souvenir Shop

All in vintage style: The tiled roof, the ornate pillars, the weighing machine, the benches, the clock, etc.

from Talguppa, a distance of more than 330 kilomters, to enliven and educate visitors about this very important but rarely preserved relic of the steam era. Turntables were necessary in the steam loco days as the latter was required to be turned to face the opposite direction at the end of each trip.

The outdoor track and signaling galleries help visitors connect to the fundamentals of railway working. Aesthetics

The Meter Guage turn-table

Life-size statue of a Station Master with Block instruments of yesteryear

and functionality have been balanced in designing pathways and overall layout. The gabled-style iconic station with vintage cast iron pillars and the view tower stand out prominently in the landscape. Information boards and an audio-visual gallery take the visitor through the evolution of the railways, especially in this region. Several environment-friendly features have been seamlessly incorporated in the overall design. Some of these are natural skylights in buildings, rainwater harvesting, abundant green cover, an open amphitheater, and so on.

A vintage tank steam locomotive that had worked on the North Western Railway

A Meter Gauge YP class steam locomotive at a water column. In the days of steam, these locos were the mainstay of passenger services

A Narrow Gauge coach of the Mysore State Railway

A 4-wheeler Inspection Car

Railway behemoths like locomotives, freight wagons and passenger coaches have been given a new lease of life with a complete overhaul including a fresh coat of paint. The iconic “Maharani Coach” has been refurbished in every detail and Sriranga Pavilion recast. An attractive and vibrant toy train, chugging along an extended circular track passing through a level crossing and a green tunnel, will be a memorable experience for young visitors.

Special mention must be made of some of the artefacts. These include a card ticket dating press, a card ticket printing machine and card ticket tubes. With computer-printed and virtual tickets now in vogue, bulk of the younger generation is not even aware of what a card ticket of bygone days looked like. Similarly, platform weighing machines, a solid iron safe, and intricately designed furniture of yesteryear, indulge the visitors in an enjoyable recollection of the railway's glorious past. Vintage clocks and insignia on display here evoke nostalgia symbolizing the chequered history of the privately-owned railway system in the Princely State of Mysore.

The coach café, with its warm interiors and an interesting menu, is yet another added attraction.

The fresh and gleaming revitalized Railway Museum is a must, particularly for all rail lovers. It has added a new facet to the rich heritage of the railways and complements the history and magnificence of the city of Mysuru.

Text and pictures from the Mysuru Division, South Western Railway

RAIL ENTHUSIASTS' SOCIETY

(Registration No: S-E/792/Distt. South East/2015)

The Rail Enthusiasts' Society, incorporated on the 28th of December 2015, aims to provide a platform for rail enthusiasts to disseminate knowledge, air their views and exchange ideas regarding the railways in India or overseas. Its first activity was to publish a magazine whose 15th issue you have in your hands. Owing to the Covid-19 pandemic, this is our second issue that is an e-Copy in PDF format and is free of cost. Other than issue of the magazine, we have organised enthusiast's trips/hikes, visits to construction sites, debates and quizzes amongst school children on the need for preserving rail heritage.

On the next page, you will find details of how you can become a member of the society. There is a membership form on page 64. If interested in membership, please send this form, duly filled, to the Secretary. In case you are interested only in the magazine, the subscription rates are as follows:

Single copy	**₹ 150.00**
Annual subscription (4 copies)	**₹ 540.00**
5-year subscription (20 copies)	**₹ 2400.00**

Note:

1. For overseas subscribers wanting a hard copy of the magazine, the rate charged will be as follows (to cover packaging and postage):

a. Single copy	**USD 9.00**
b. Annual subscription	**USD 32.00**
c. 5-year subscription	**USD 148.00**

2. For countries that do not deal in the US Dollar, please email a request to the Secretary of the society and we shall give you the rate in other currencies like the Euro or GBP.
3. The subscription rates for membership of the society for those residing in India include free delivery of the magazine as well. For members residing overseas, and wanting a hard copy, please email the Secretary and special rates will be fixed in each case to cover the cost of postage. Overseas members will get an e-copy free.
4. Libraries will be given an additional 5% discount over rates for subscription to the magazine.
5. Bonafide students' rates for membership, valid as long as they remain students, will be 50% of the normal rates. Such rates would not apply to Life membership.
6. For subscription to the magazine, please mail the completed form below to: The Editor, Rail Enthusiasts' Society, C-494, Defence Colony, New Delhi-110024 (India). A scanned copy can be sent by e-mail to **railenthusiast2015@gmail.com**

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RAIL ENTHUSIASTS' SOCIETY

(Registration No: S-E/792/Distt. South East/2015)

Membership of the Society

Membership of the society is open to individuals as well as Corporates. While individuals have the choice of three types of membership, for Corporates we have only membership for life.

Corporate Membership

This entails a one-time payment of ₹ 200,000/-. Membership gives the following to the Corporate:

- **Five copies of all magazines or supplements to the magazine that are published**
- **Concessional rates for any item such as artefacts, books or memorabilia on sale**
- **Invitation to 5 members of the organisation nominated by the corporation for any event or activity the society may organise**
- **Other benefits will be added in due course as and when more activities are added**

Rate for Corporate membership for foreign organisations will be US Dollars 4,000/-.

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- **Associate member : This gives you membership for one year. Subscription: ₹ 500/-**
- **Ordinary member : This gives you membership for five years. Subscription: ₹ 2000/-**
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- **Life membership : One-time payment: USD 200/-**

Please see the note on the previous page for overseas members wanting hard copies of the magazine.

Mode of Payment

Payment is acceptable by cheque, demand draft or cash. You can also do a direct bank transfer. All cheques and demand drafts should be payable to "Rail Enthusiasts' Society". For direct transfer to our bank, details are as follows:

- **Name of bank : State Bank of India**
- **Branch : Personal Banking Branch, New Delhi**
- **Address of the bank : E-4, Defence Colony, New Delhi-110024 (India)**
- **Type of Account : Current**
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For enrolling as a corporate or individual member, all you need to do is send an email or a letter to the Secretary of the society. The address is: **C-494, Defence Colony, New Delhi-110024 (India)**, while the email id is **railenthusiast2015@gmail.com.** You can also reach the Secretary at +91-8130111589.

Visit our website : **www.railenthusiastindia.org.in**

RAIL ENTHUSIASTS' SOCIETY

(Registration No: S-E/792/Distt. South East/2015)

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TO BE FILLED BY APPLICANT

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.....

.....

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C-494, Defence Colony, New Delhi - 110024 (India) Tel: +91-8130111589
web: railenthusiastindia.co.in

The WAG12

Before large scale electrification on the Indian Railways, in the decades of the 1960s and 70s and even the 80s, the WDM2 class of diesel locomotive was the workhorse of the Indian Railways. It worked most of the freight and passenger trains after steam locomotives were phased out. It was rated at 2,600 Horse Power (HP).

The advent of electrification saw the entry of locomotives with higher and higher horse power. The culmination of this increase in power was seen in May this year, when the new WAG12 class of electric locomotive was pressed into service. Its rating is a whopping 12,000 HP, far more than any other locomotive the Indian Railways is operating now.

Manufactured by the Electric Locomotive Factory at Madhepura in Bihar, this loco will change the way Indian Railways operate their goods services, specially when the Dedicated Freight Corridor starts operations. It can run a 6000 Tonnes train on a gradient of 1 in 150 and has a design speed of 120 kmph.

The locomotive has a twin Bo-Bo design, i.e. two units permanently coupled, each with two bogies with two powered axles each. 800 of these locomotives are planned at Madhepura.

***Photo:** Courtesy Somsubhra Das*