RAIL CANVAZ

A TrainTrackers' Initiative

Inaugural Issue
15th August 2020

CELEBRATING
INDEPENDENCE

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MEMU SERVICE

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MG RAILBUS

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MAVLI-MARWAR

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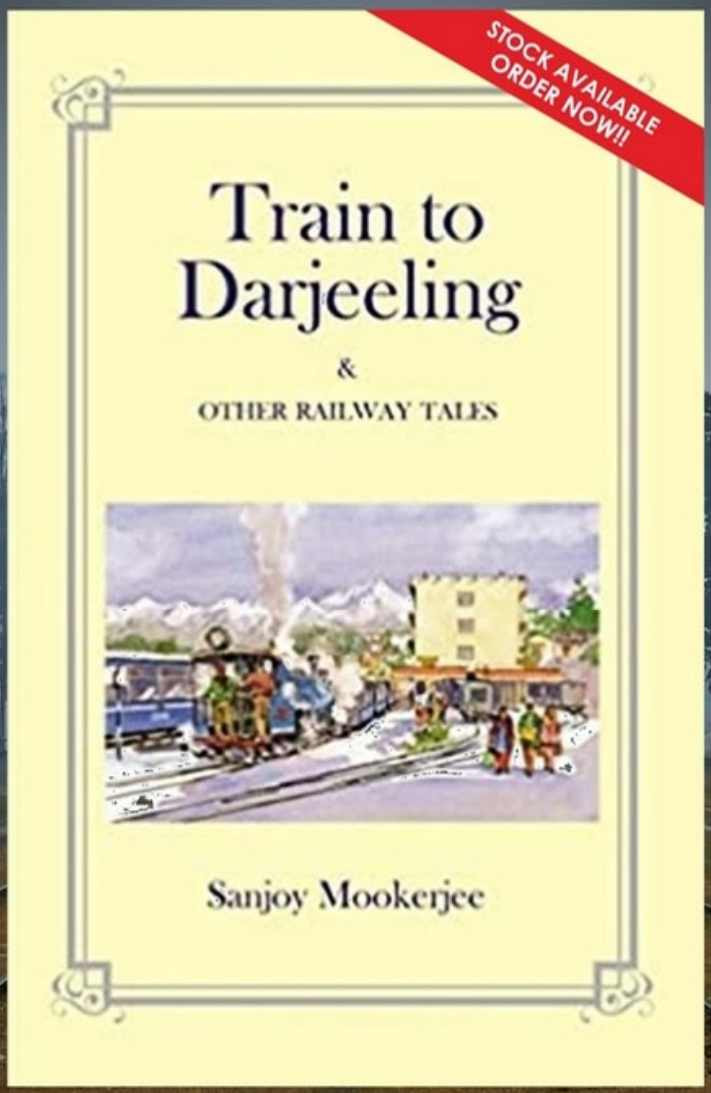

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EDITORS' DESK

"Our life is a constant journey, from birth to death. The landscape changes, the people change, our needs change, but the train keeps moving. Life is the train, not the station" **– Paulo Coelho.**

Right from the poetries of Tagore and the steely resolve of the Mahatma, through the canvasses of Satyajit Ray and to the great escape of Netaji, trains have always assumed the role of the chief protagonist. From the restless younger days to the monotonous daily routine, from a journey with family by "Railgari" to the business trips by Rajdhanis and Shatabdis, from the early days of black clouds of steam to the overhead catenaries and pantographs, 'Railways' have become synonymous with life.

Railways have not only captured the imagination of the entire state but also have been the principal driving force behind Ferroequinology – a parallel world of rail enthusiasts that has existed over ages. Gathering and sharing information about trains, locomotives, rolling stocks have been the forte for those pursuing this passion. Photographing and video-graphing trains have also come up as essential elements that have propelled the rail enthusiasts to undertake journeys and trips that drives their penchant for quenching their insatiable thirst.

But, with the outbreak of the novel corona virus and the social distancing norms inflicted upon us, pursuance of this unique passion has taken the back seat. This pandemic has changed our lives as most of us have remained confined to the riddle of the quarantine diktats. While reminiscing the past sojourns which remain etched in our minds as fond memories, we contemplated bringing out an e-magazine which, we feel, may lift us from this otherwise gloomy state of affairs.

Rail Canvaz is an endeavour of bringing together persons who are a part of this timeless and ageless 'passion'. We have strived to put together a publication which is a conglomeration of accounts from different rail enthusiasts covering different aspects of our famed railway system. We dedicate **Rail Canvaz** to the 74th Independence Day of our nation and devote it to all the rail enthusiasts across the nation, who shares the same fervour….

Our inaugural issue rolls out with a trip down the memory lane from none other than **Samit Roychoudhury**– a luminary and a doyen among ferroequinologists, as he recalls his school days in 'Legend Speaks'. Rail Canvaz carries a bunch of Trip Reports from rail enthusiasts like **Anish Banerjee**, **Purusottam Basu** and **Sambit Chatterjee** - travel along with them as they take you to the different corners of the nation. The issue also explores the world of 3-Phase locomotives with an illustration on the 3-Phase Propulsion System by **Anamitra Bose** in Technical Insight.

After a decade of dilemma, delays, hindrances and hazards, the East West Metro corridor of Kolkata finally saw the light of the day. Our **Cover Story** reflects on the struggle, perseverance and roadblocks that defines the successful launch of EW Metro. **Rudranil Roy Chowdhury** brings to life all the episodes of developments and paying painstaking attention to intricate details.

15thAugust holds an immense ground and significance amongst the citizens of our country, but this date always had a "Tryst with Destiny" and has peerless importance as far the History of Rail Transport in India is concerned. The first ever passenger train in eastern India operated by the then East Indian Railway chugged off from Howrah to Hooghly on this eventful date in 1854. Eastern Railway (ER) commemorates this occasion every year by decorating an EMU followed by its heritage run – **Souroshankha Maji** (trAnspOrt hObO) unravels the script behind the celebrations by ER over the past 3 years with active participation from rail enthusiasts. Relive those moments with the first installment from the diary of trAnspOrt hObO.

This issue of Rail Canvaz embarks on the illustrious 25 years journey of the MEMUs with **Arkopal Sarkar**. Two more articles *"Treasures of the Aravallis"* on the Marwar-Mavli Meter Gauge and *"The Lost Legend"* on the Indara-Dohrighat Meter Gauge sections weave together tales evoking nostalgia and rediscovering the magic of the good old days….

The magazine also features News Station featuring significant happenings from Indian Railways and a Photo Junction section adorned with defining pictures from rail enthusiasts to round off.

We sign off on a positive note that this primary attempt will bring cheers and joy to the 'captive life' we are subjected to lead in these unprecedented times and hope to wade over this crisis with flying colours. Heartfelt thanks for the support of the contributors and well-wishers who made this issue possible. We look forward to attain greater heights and meet higher expectations with your relentless and unconditional support in the times to come.

Somsubhra Das

Subhadyouti Bose

15th August 2020

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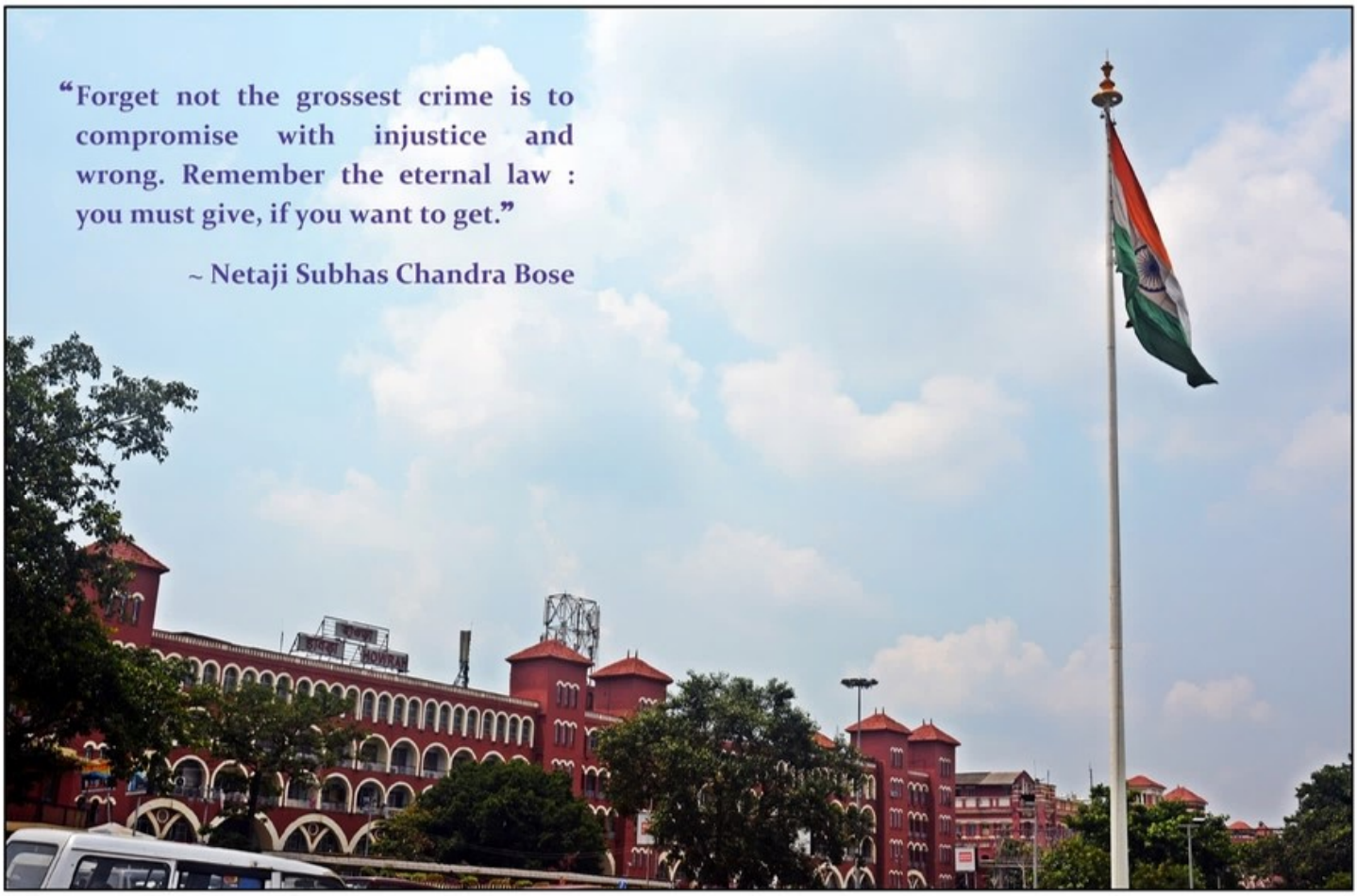
HAPPY INDEPENDENCE DAY



*Photographed by - **Somsubhra Das***

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Legend Speaks

Cover Story

Unveiling all the aspects that came to light while turning the East-West corridor dream into a reality....**Rudranil Roy Chowdhury**

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Photo Story

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Exploring the Unexplored

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inside stories

And Those were the Days....

- Samit Roychoudhury

I went to school in Ajmer, staying at a hostel from 1979 to 1988. The very large school campus was bordered on two sides by railway tracks.

Now these were glory days for metre gauge. Ajmer was situated halfway on the important Delhi – Ahmedabad section.

I recall our cross country run route would cross the railway tracks, and there was a steam loco graveyard situated adjacent. Those were still heady days for steam, and we would, in our childhood innocence, consider them lesser mortals, and were glad to see them go. The school organised our journey to and from our places of residence for the summer and winter breaks. There were teachers accompanying student parties to Delhi and then to Calcutta and Guwahati, as well as to Ahmedabad and then on to Bombay.

On our journey home, for the first few years the Delhi and onward bound students would all be accommodated on a "Mayo Special" of about 8 coaches, steam-hauled much to our consternation while we noticed many lowly freights with diesels up front. The very elegant YP or YG class locomotives would do the honours. We travelled in wooden seated 2 tier coaches, with about 20 of us occupying a space meant for eight. We would likely stay awake most of the night, sleeping in bits and pieces, bidding adieu to a friend who would deboard at Nim-ka-Thana, before pulling in to (very freezing in winter) Delhi Jn. very early in the morning. Most students would take the overbridge while some of us accompanied the baggage hauled by coolies in very large trolleys. These were taken down by the ancient electric lifts placed at every platform. We crossed platforms using strange rat infested tunnels and take the lifts back unto the correct platforms. Quite an adventure in itself. We would then get onboard the Kalka Mail for the latter part of the journey, happy to have individual reserved berths. In the later years, the special was taken off and we all would get on the Aravalli Express, which would in those days originate at Ajmer.

The return trip was definitely better. Kalka Mail would get us to Delhi, and we would change platforms over to the metre gauge side to get on to the Ahmedabad Mail. It was a lovely train in those days. Well maintained like every other 1 Up / 2 Down pair would be. I would relish the journey, getting a feeling it was soon to end when the familiar sounding stations like Gegal Akhri, Ladpura and Tiloniya would go by.

We had strict instructions to keep doors locked so no outsiders could enter the coaches. I recall once aboard the Mayo Special, a very determined person clung on to the door as the train started, and in the freezing weather hung on for dear life as the train picked up speed. The teacher accompanying us finally told us to let him in!

We would get a bit of money to spend on the journey. At times some packed puris and sabzi was organized on the Mayo Special. The rest we had to fend for. The variety on the Ajmer – Delhi section was very limited. There were vendors with 'kakdi', sliced and spiced, and sellers of very colourful bhel-puri like mixtures with a medley of fruits, fried stuff and spices, which would of course be as much a riot to our stomachs as they were of hues. Phulera Jn would serve rather tasty bread-omelettes in those days.

I also distinctly remember getting a chance to get on board the footplate of the steam loco that hauled us, most probably at Phulera. Unfortunately, I had to head back to my coach before the journey resumed.

The stars of the Delhi – Ajmer route were the earlier-mentioned 1 Up / 2 Down Delhi – Ahmedabad Mails. And of course the Pink City Express with its special liveried coaches, which would travel only till Jaipur. A portion of it was later extended to Ajmer as the Gharib Nawaz Express. There was also a Delhi – Ahmedabad Express apart from the Aravalli.

But the train which we spoke of in hushed tones was the one that passed through in the middle of the night – about 0135 hours on either direction. It was simply known as the Superfast. Never seen, just spoken of. So a few of us intrepid explorers broke bounds (during our board exams), and walked the three miles to the station. In the brightly lit surroundings we got a glimpse of the Ashram Express. My curiosity was piqued and I decided my final trip from school back home would be on board this. And so tickets were booked accordingly and after my class 12 board examinations, I spent the day at a friend's house and had him drop me to the station after dinner. The Rajdhani-liveried train with a matching loco swooshed in, rather majestically if I may add. I found my coach and entered and almost got off, thinking I was in the wrong coach. You see, on those days only some air-conditioned coaches had fluorescent lighting. This very special train had such lights even in sleepers. Its sister train, the Mandore Express, would run from Delhi to Jodhpur. In the earlier days, the two would be amalgamated or separated, as the case may be, at Phulera. They would run combined, double-headed, on the Phulera-Delhi section.

The awe was justified.

The author, an alumnus of the National Institute of Design, is a graphic designer and cartographer. A ferroequinologist, he is a long term member of IRFCA (Indian Railway Fan Club) and the man behind The Great Indian Railway Atlas.

treasures of aravalli

- Somsubhra Das

"There's a grief that can't be spoken,
There's a pain goes on and on.
Empty chairs at empty tables,
Now my friends are dead and gone.
Here they talked of revolution,
Here it was they lit the flame,
Here they sang about tomorrow and tomorrow never came."

– Eddie Redmayne

The above lines bear a striking resemblance with the present state of affairs that depicts relegation of smaller gauges of the nation to mere desolate segments ultimately paving way for complete obliteration from the nation.

The Princely State of Rajputana was once home to a network of Meter Gauge which often used to hog the limelight of being among the greatest in the nation – not only by the route length kilometres but also by dint of its extensive expanse that had iconic cities like Jaipur, Phulera, Ringus, Ajmer, Jodhpur, Jaisalmer, Bikaner under its ambit. But with the mantra of modernisation, the erstwhile Meter Gauge (MG) network got overwhelmed by the Unigauge drive – almost the entire smaller gauges network fell prey to the broad gauges with the gauge conversion as the alibi resulting in conversion of the unconverted MG segments into island networks. The Marwar-Mavli MG is one such last surviving MG of Rajasthan which was opened to public in 1936 during the British era encompassing parts of the Todgarh Raoli Wildlife Sanctuary. The route spanning 150 Kms. is still holding fort since inception & has invariably failed to embody the importance and significance of a regular route. The MG days of Rajasthan certainly look numbered.

While on a holiday at my relative's place at Vadodara, I pondered at the prospect of visiting this treasure of the Aravallis before it got down to the pages to history just like the MG sections of easternmost fringes of the nation and the ones in the southern and western parts of the country. Desperation got the better of me as I wanted to make most of what was on offer – thus packed my bags and off I went. Boarded the Pune-Bhagat Ki Kothi Express from Vadodara for Marwar. After change of traction to Diesel from Ahmedabad, the onward journey was consequential with the spotting of two MG passengers crossing each other at Kalol Jn. (Ranuj MG service was operational back then) where my train was incidentally looped to make way for the scheduled crossing of Swarna Jayanti Rajdhani. My wait was extended further for the Mahesana-Sabarmati DEMU to pass by in the single line section. But the best kept surprise came later as I suddenly discovered the Vijapur-Ambliyasan MG Railbus crossing our path at Ambliyasan. Never expected of the encounter with that unique conveyance that day!

As I approached Marwar, the MG train appeared stranded at the

The Ambliyasan - Vijapur Railbus

An early morning start @ Marwar

vicinity with a whole lot of people crowding the track. I was pulverised! Just could not wait anymore for my train to pull in. Deboarding, I made a quick progress towards the MG train to learn what the commotion was all about…. To my utter dismay, I found the train could not proceed due to a broken track. The Railway men were sweating their day out to put things in order but uncertainty loomed large about resumption of service putting my next day's plan in serious doubts. Heart-breaking, isn't it?

A bit shaken, I proceeded towards the BG platforms to witness the Double Stacks. Meanwhile, the ISO certified train aka the Ranikhet Express had arrived for a reversal among many other arrivals. But struggle to restore the MG service was still on and the sun quickly began to lose powers. Suddenly, the MG locomotive was put on with a puff of smoke on the verge of a golden dusk…. Once again my hopes reached horizon and the men had done it! The train had begun to move at no pace and entered the station. The loco detached itself and went up further to get attached again for the Mavli bound heavily-delayed service. No words of appreciation were enough for those soldiers who made it possible. Darkness had already taken charge by then as the MG train crawled it way back to Mavli…. Delighted at the development of things, I decided to hang my boots for the day as I left the station for spending the night elsewhere. Excitement had overwhelmed me but I kept my fingers crossed.

It was around 5.45 am and morning lights were far from invading the sky; artificial lights continued to guide my headway towards the station to make tickets. Soon I discovered that Edmondson tickets were things of past for this otherwise primitive train. Silence was still enjoying supreme authoritative powers all around when a sudden brisk announcement of departure of the Mavli bound train shattered the early morning calm. As the voice began to die down, seconds later, a sudden burst of crank up noise of the erupting YDM4 which would take charge of my train, reverberated every corner of the station drubbing the noise made by the crickets. I trudged my way to the train as temperatures still hovered around 10-12 degrees. The chilled winds began to get enthralled with the resonance of Alco chugging and EMD humming as the towering double stacks arrived from either ends of Marwar for a brief halt and change of guard.

The twinkling lights from the Mavli train parked at the far end of the station drew my attention. As I began to turn all my thoughts towards the MG train, I realized that my moment to realize my dream had arrived!!!

A near empty train with a very meagre patronage was waiting to start off. Soon the station timekeeper struck 6.10 am and the LP and Guard exchanged vows to embark on the journey ahead which looked a regular stuff for them but for me it was historical. The whistle blew and we started….

Darkness gripped in no time as we left the station behind but the company of a full moon kept me illuminated and interested. A sense of eeriness and uncanniness began to crowd my mind as I was travelling with no co-passengers in my dimly lit, shadowy compartment in those wee hours of the day. Clattering track sounds with creepy noises were enough to create a spooky ambience. After a nearly 25 Km. uninterrupted run for an hour amidst thorny bushes and hazy hillocks shrouded with deciduous forests, we chugged our way into Phulad– the station amidst the thickets. Dingy lights and a clumsy setup were all the station had got. It was time for reversal and I still keep wondering as to how the railway staffers managed to get things done with such obscure lights – surely experience is your best teacher. With all done and sorted we started again as the roar of the YDM4 echoed and the rattling sound of our train rattled the tranquillity of the dawn.

The horizon had begun to exhibit early morning hues but day was yet to breakout and the birds were yet to leave their nests. We were raking up altitude as the Aravallis were suddenly all around us. Gradual increment of light and height ensured spectacular and stunning views as we continued with our uphill task through the oldest fold mountains of the nation. The captivating charm of the mountains enchanted my soul with a bewildered rapture and eternal bliss!

Hills floating in the early morning mists presented frames that got etched to my memories forever. Lofty viaducts, Semaphores and Tunnels (dating back to 1934) now became the mainstays as we reached Goram Ghat right in the lap of the Aravallis. The mesmerising Aravallis had already hypnotised me with its riveting charisma and Goram Ghat seemed to be just the right place to be…. not a single boarding or deboarding was witnessed. The only species present were the railway personnel who were up to their task - be it for the cold mornings or the tired evenings.

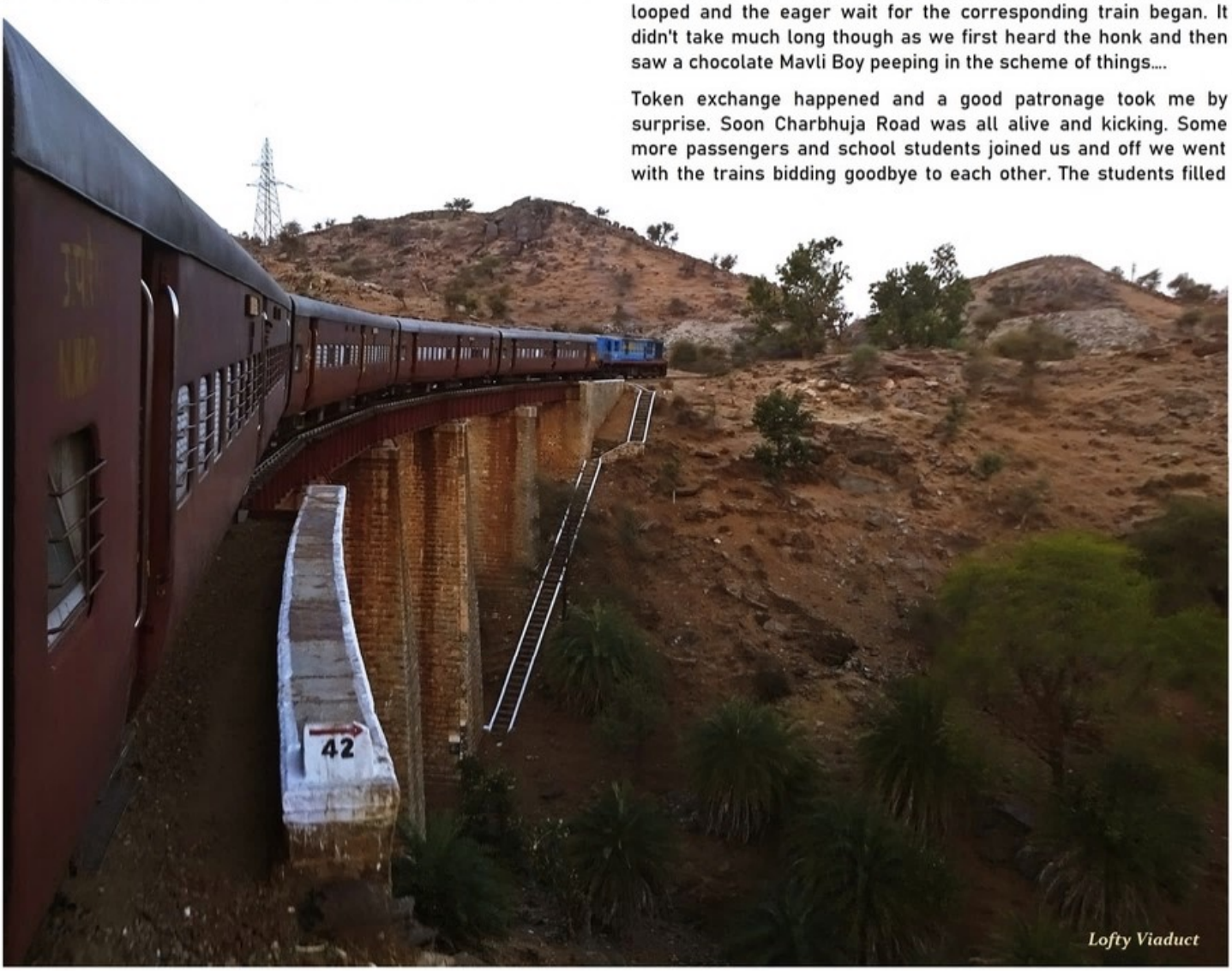
Tunnel dates back to 1934

Moving out we were continued to be treated with a heavy dose of the humongous mountains rising above the sky as our train powered by a blue liveried Phulera YDM4 #6629 (instead of the brown ones from Mavli), negotiated curves and channelled through the rocks and bushes. Some almost dried up river beds, empty streams and worn out trees whispered the story of the extreme conditions that dominate this part of the state. Nature has always been harsh for better part of the year in these sectors.

Vigilant gangman at every viaduct exchanged pleasantries with the LP and ALP. The YDM smoked and puffed as we battled cold winds to our next stop - Khambli Ghat. The conspicuous board yelling "Photography Prohibited" caught everyone's eyes but failed to decipher its relevance and looked extremely ironic.

The Ghat Section had concluded and the sun was shining with its full glory. We proceeded our way forward through the flatter terrains marked with xerophytic vegetations which are idiosyncratic in their own rights. Surfing through the deserted stations enroute, viz. Devgarh Madriya, Dolaji Ka Khera and Khara Kameri, we traversed across a completely dry Chandra Bhaga river whose bed was now being used for camping, playing and commuting – a terrible sight depicting the paucity and scarcity of water in the drought prone region. After this reality bite I gorged into some local samosas sold onboard as we had pulled into Charbhuja Road. It is the station where the solo crossing of the day with the Marwar bound service was about to be scripted. We got looped and the eager wait for the corresponding train began. It didn't take much long though as we first heard the honk and then saw a chocolate Mavli Boy peeping in the scheme of things....

Token exchange happened and a good patronage took me by surprise. Soon Charbhuja Road was all alive and kicking. Some more passengers and school students joined us and off we went with the trains bidding goodbye to each other. The students filled



Lofty Viaduct

Carving into the Khambli Ghat

Climbing gradient @ Aravallis

The Token Exchange

every moment with joy with their screams and loud bantering on their way to school – they merrily enjoyed every bit of their train journey which seemed to be their everyday commute.

Travelling through the rough and stony topography, the torrid weather was slowly but surely making its presence felt – the mercury had begun soaring as we sailed past Lawa Sardargarh, Kuanriya, Kankroli and Bejnal. The Guard had doubled up as the TTE as well with passengers buying travel authorities from Guard at many stations with no facilities of counters. It seemed like modern civilization was yet to make its impact on the lives of the people there.

The Aravallis keep company

Meanwhile, I had picked up a conversation with Gurcharan Singh, a small-time trader, onboard with his trading materials and belongings – I realized how life of people here had changed after Jodhpur, Jaisalmer and other important cities got isolated from this MG stretch following their conversion to Broad Gauge (BG). People no longer intend to take this train for long distance – neither they get connecting trains nor they can spare such longer travelling time. I could feel that how the bus services have eaten into the patronage of this otherwise secluded MG Service which is in stark contrast with the Gwalior-Sheopur Kalan (Narrow Gauge) Services which still get flooded with passengers. The guy also

Making Tickets

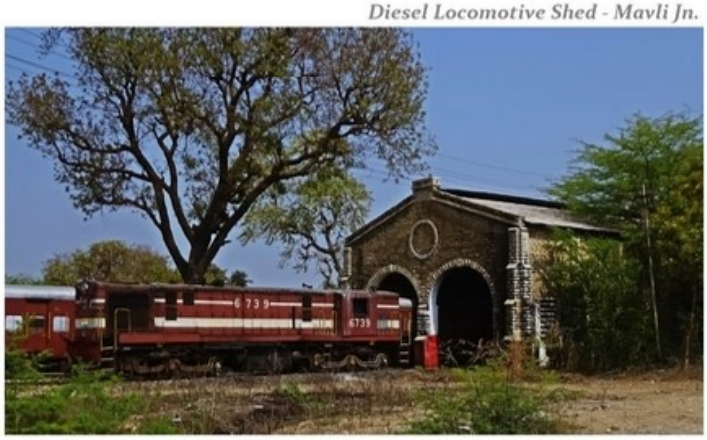
shared that how life could take a U-turn for people here once this stretch gets converted to BG.

I was left with no option but to digest this bitter pill as to how this 'Chota Gadi' which once used to be the lifeline of the people here has lost its relevance and is struggling to find favour with the locals here. It's was heart-breaking and disappointing but time doesn't spare anyone as it's none other than time itself which has stood the test of time.

Our train had made its way to Nathdwara. The BG counterpart had showed up and was running parallel with us. With one more common station in the guise Thamla Mogana, Mavli was almost there. Soon we crawled into Mavli Jn. I was like woken and shaken up from a dream which I wished I could have been engrossed in for a few more hours....but like all good things comes to an end so was this delightful sojourn. The culture and lifestyle of the people reflected the same ethnic ethos that binds them together and sets them apart from the hustle and bustle of a fast life.

After deboarding, I headed straight to the Diesel Locomotive Shed (DLS), basically an outbase of the famous erstwhile Phulera DLS, that had come up here for maintenance of the MG locos. The DLS presented the classic precedence of an ancient steam locomotive trip shed being reutilized into satellite diesel shed. Mavli DLS throws up a wonderful stone-built structure of 1930 with history in its every nook and corner depicting the glorious past.

Diesel Locomotive Shed - Mavli Jn.



Three Mavli boys were crowding the DLS while some luxury tourist MG coaches with Goram Ghat inscribed on them in the livery of the famous Palace on Wheels were also keeping company. The MG lines continued upto Bari Sadri but services had already been suspended for Gauge Conversion. The BG-MG crossing just metres ahead of Mavli still exists which testified the fact that not much progress had been made for the proposed Gauge Conversion of Bari Sadri.

The station board of Mavli Jn. reminded the importance of the place – a true junction for change to Marwar Jn., Chittaurgarh, Udaipur City and Bari Sadri. While waiting for my train to Udaipur City – only 42 Kms. apart, I was still in a trance rewinding and reliving those moments of the journey that beguiled me.

In just about time, the Abu Road WDM3A had rolled in with the Jaipur-Udaipur City Superfast Intercity Special in tow reminding me that it's time to leave. I left Mavli for the City of Lakes with memories of a lifetime....

The Mavli-Marwar MG is perhaps the only route left to explore the Aravallis by train from such close quarters. I can still feel the melancholy of desolation and emptiness that haunts this last surviving MG of Rajasthan. The Railway Ministry has already given its nod to get rid of this MG stretch as well and sooner or later, this MG will also get lost in oblivion with the sands of time and with closure of this stretch, which looks imminent, "The Land of Rajputs" will only be left with the memoirs of 'Chota Gari' which once used to be an inseparable part of life.

Power head of my 'Sawari Gadi'

I still cherish those savoured moments that drives the emotions of a ferroequinologist and catches the imagination of a rail enthusiast with a belief to go back there once again and witness those red little coaches trundling past the colossal Aravallis....

Photos : Courtesy the Author and subject to exclusive copyright of the Author.

Postcard from Mavli

Abu Road memoirs

- Anish Banerjee

Prologue :

Rajasthan is a place of nostalgia, a place where history speaks, a place whose every corner is mystical. Thanks to Ray and his Golden Fortress, we Bengalis reckon Rajasthan a place of our own! So, the summer of 2014 was a memorable one – like all school passing out kids, I too went for one of my dream tours – a tour which was special in more than one way.

Abu Road – the home of my aunt and the NWR Diesels laced by the humongous Aravallis was earlier known as Khardi. The city earned its name from the Mt. Abu – the highest point of the Aravallis. My aunt's father-in-law was a Retired Loco Pilot for the North Western Railways. My trip to this place was not just for the Aravallis– it never can be without the trains for any rail enthusiast, I suppose.

The Trip Commences :

We took the Jodhpur Express from Howrah upto Jaipur and then the all famous Haridwar-Ahmedabad Mail from Jaipur to Abu Road (a train which will carve its name into my heart, forever, very soon, little did I know then). It was all very gorgeous and magical. The vacation was going as planned. Aunt's place signifies you get a special privilege and treatment, your unique desires are always fulfilled. The house overlooked the historic Abu Road station – built by the then Rajputana Malwa Railway in the 1880s, the DLS and in the background were the mighty and beautiful Aravallis with Mount Abu sticking its neck out. We have all once or in future will, once at least, visit Rajasthan for sure, so my take on the desert state involves a narrative canvassing a different kind of experience – one to savour and get fascinated with, if you happen to be a ferroequinologist.

The Fascinating Part :

The last two days of the tour were reserved for my "Railway Wishes" – Dadu there (the retired LP), promised me that he will take me to the Abu Road Diesel Locomotive Shed. I had never been to any shed before, so I didn't know what exactly to expect. It was a Tuesday morning, and Dadu took me out for a small walk to one of India's premium Locomotive Sheds.

As we were approaching the shed, the board was there in front of my eyes – "Welcome to DLS, ABR, NWR" – a welcome it was for sure as I was greeted by the absolutely delightful Abu Road ALCOs in their beautiful liveries. The cherry on the cake was the Baldie

sitting amidst them.

Dadu had a special command there – as if an old warrior had returned to a battlefield he left long time back – "Salaam Dada", "Namaste Dadaji" – echoed throughout as he received a plethora of such greetings. I felt as if I was with the President for a day!

He took me to the Senior Engineer's room. We had a nice little conversation and he was amazed to know that there are guys out there like us who love to run after trains just for a special hobby – ferroequinology. He had gifted me with a set of 10 special handkerchiefs with I.R. sketched on them – which the crew/staff use when they go for duties or locomotive servicing. But my heart was outside of that room, with those rugged monsters making various noises and puffing out smoke. As soon as we finished talking, I knew I had to take a tour and some pictures, of course. Dadu said to a staff – "Mere pota hai ye, isko sab ghumke dikha de zara…. " (Here is my grandson, please make him go around the shed) and out came the reply "Ji Sir, kyun nahi!" (Yes Sir, why not!).

And then I went with him as he guided me along the passages and the pit lines where stood the WDM3As and the WDM2As – the huge ABR fleet of blue-white ALCOs. A Jumbo was packed in between while the Baldie was infront. Vatva and Ratlam ALCOs were guests that afternoon – but the show-stealer was the EMD. Just the day before, Abu Road DLS had received their 1st ever EMD locomotive – a brand new WDG4 from DLW. That sparkling new machine was right up there staring at me with the Factory Fresh feel. The most amazing fact back then was that most of the rail enthusiasts across NWR was not aware about ABR DLS holding its first EMD! I was elated, not just because I was the first one to witness ABR DLS starting to hold EMDs but also it was a tick on my bucket list of spotting an EMD from a shed, so far away from my home. It was 12955 and it's no wonder as to why 12955 continues to remain one of my favourite spottings ever….

The story gets better from here actually. It was time for return, and Dadu didn't want to walk the whole way back again, so what would a retired loco pilot do? He would drive an ALCO himself to home! Yes, you read that right! As we were ready to leave, he casually

First EMD of Abu Road DLS

The Abu Road DLS - Inside View

asked someone – "Isme se kaunsa station jayega?" (Which one will go towards station?) "16794 jayega Sir…. shunting duty!" (Sir 16794 will go with for shunting) – came the reply from staffer. Before I could manage a grisp over what was happening, Dadu instructed me to get into the cab of 16794. I couldn't believe what was I about to experience. I never had the fortune of footplating inside any Diesel Locomotive until then. Would it be my first time then? You bet it would. We went inside the cab, it was 40 degrees outside. Rajasthan was burning in April as usual and it was hotter inside. A shunter LP got in and Dadu said to him - "Ghar tak chhor dena" (Leave us home). I didn't know whether to laugh or be amazed at the fantastic audacity of taking an ALCO to return home, instead of a rickshaw. I was bewildered and what followed bewildered me more.

As the shunter LP went to operate the locomotive, Dadu said - "Rehne de tu, mein dekhlunga!" (Let it be like that, I shall see things off). I couldn't believe what that man was saying – and there was he, an octogenarian of 83, notching the ALCO forward in LHF through the shunting lines.

Albeit the restricted speed, his courage and guts coupled with his long history as an LP, even years after his superannuation, made me realize that what a warrior he was in his heydays. I could discern the authority he exercised while taking charge of the mails and superfasts during his prime. It was like history repeating itself right in front of my dumbfounded eyes. The WDM2A smoked and puffed and chugged as we left the DLS behind with the Aravallis keeping company on our left.

Still looked like a dream as we had a full locomotive for our ride back home! Few minutes, it took. But few minutes of eternal bliss. When we could see the house from the cab windows, Dadu stopped the train, got down and helped me along. A firm handshake with the shunter LP, and the WDM2A was on its way towards ABR station. Me and Dadu walked towards home, and I felt like I had the world under my feet for most of the morning that day. It was just a prelude of what would follow the next day.

Endings Are Beautiful :

As every good thing ends, that was the day of return but it ended in the best possible way. We had the same journey plans – the Ahmedabad Haridwar Mail to Jaipur and then on to Jodhpur Express to Howrah. While we were packing our stuff, Dadu said to me - "Dekchi tomake aj engine e chorano jay naki!" (Let's see if I can get you to be in the loco today). I was again in that same spot

of wonderful ecstasy, there were butterflies in my stomach which just waited for that moment.

We left for the station earlier than we could have and Dadu took me straight to the crew lobby. He, with his usual command at such places, asked who would take the charge of Mail that day – as he got to know the name, he also received a bothering news that there would be a Loco Inspector in the loco for today's trip from Abu Road. He was worried that whether the LI would allow a stranger to be in the cab.

Anyway, we waited to meet the LI, and suddenly a man in a red T-shirt came running in and hugged Dadu in excitement - "Arey Sirji aap yahan? Aapko yaad hai, mein aapke under training liya tha!" (Sir can you recall me…. I got trained by you….). That was a moment of emotional heights. And yes, if you're wondering, that was the Loco Inspector we were talking about. As destiny would have it, my cab ride was a settled issue already. The gentleman was more than eager, happy and joyous to take me along with him. He promised Dadu - "Aap chinta mat kijiye, hum isko ekdum ek trip mein Loco Pilot bana dunga" (Don't you worry Sir; I shall make him an LP in one trip only….)

If you were there at that moment as a railfan, you can perhaps imagine what kind of euphoria was flowing through my veins then. It was decided that I would travel in the loco of ADI HW Mail from Abu Road to Marwar Jn. as my parents would be in the same train we had reservations in. Post Marwar, I would join them.

As we waited for the Mail to enter there came # 20078 Bhagat Ki Kothi WDP-4, in all its beastly splendour in LHF, with the mail. The crew change happened and the LI said to me "Chalo upar char jao!" (Let's climb up!).

It was those few special hours of my life, a special journey enamoured with precious moments where I was inside an EMD which was hauling a grand mail train with my parents behind me in a coach. The Loco Pilot too had a special day – it was his maiden Mail/Express duty after getting promoted.

It was time, the starter was given and the all mighty honk shattered my ears. Waved a goodbye to Aunt and Dadu there, little knowing that it was the last time I would be seeing Dadu. The EMD started moving and immediately the LI started to make me understand the things inside. As we left Abu Road behind, there was a huge curve and peeping through the window I could see the whole train curving behind me, as we notched up and up and up.

Soon, we were cruising around 100kph. And to break all the myths about speed, it is really very difficult to go to 100 with that kind of a load behind and more difficult to stay there constantly. It was a single line diesel section back then and we halted every now and then for the crossings. The LP asked me "Tumko ye signal dikh raha hai? Iska kya matlab pata hai?" (Can you see the signal and what does it imply?). "Yes" I said. It was the turnout for a loop, and there was a crossing we were expecting. The LP was fascinated. We all chatted our way along and I gathered up courage to ask them - "Can I blow the horns once?" and since then I was playing with the EMD horns as if.

EMD Speedometer

The LI said, "Look beta, there is a station coming named Keshavganj – you have to shout out to the ALP – "Home Distant Green" and the ALP will double check and confirm Home Distant Green.

And there came Keshavganj and on the top of my voice I shouted "HOME DISTANT GREEN", the ALP replied "HOME DISTANT GREEN OKAY"…. and I pressed the horns as hard as I could as we blasted past Keshavganj at 105+ kmph. What a feeling, what a feeling that was – perhaps the best I can ever imagine.

The only dull moment came when there was runover – a small calf lost its life under our wheels. Unperturbed, we moved on – perhaps a lesson learnt about maintaining nerves of steel while on duty when emotions take backseat…. Apart from that it was one journey to cherish for the rest of my life. I knew I had experienced something that I would remember everyday and smile, and there would be goosebumps for sure.

As Marwar approached the LP said to me "Mein jab Rajdhani chalaunga taab ana phirse, tab hum logo ko koi loop mein nahi dalega!" (When I shall be incharge of Rajdhani, do come then, none will loop us then..) How nice of him. They asked me to continue till Ajmer, but it was a sweltering 42°C in Rajasthan and the EMD was more like a boiler! Lights were going down too and I decided to return to our coach in Marwar. As I went to my coach, I waved my handkerchief and the LI waved his hand and we were ready to go to our destination with a baggage full of stories to tell, with a bag full of memories to share.

At Ajmer, the LP caught glance of me while going to the retiring room, and I promised I would return someday. Thanking him, we were off to Jaipur with the new crew taking charge and I knew my trip to Rajasthan could not have been any better, I knew I accomplished something which I had only dreamt of till then and will dream about every night…. always and forever. That humming, those honking, that aggression – a whole experience of a lifetime.

Epilogue :

Wherever Dadu is at this moment, up there somewhere, he should know that he fulfilled some of the strangest longings of a boy which he would carry all along his life….

Thank You Dadu, you gave the best present of my life…. Wish we could reunite for many more fabulous experiences….

Thank you, North Western Railways.

Thank You Memories!

A Pat on the Back...

west bengal land & land reforms officers' association

পশ্চিমবঙ্গ ভূমি ও ভূমি সংস্কার আধিকারিক সমিতি

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SOUTH 24 PARGANAS DISTRICT COMMITTEE

Ref. No. 15/WBLLRODA/2020-21 Date 22nd July, 2020.

To,
The Admins,
Railfans United WhatsApp Group

Sub. :Letter of Appreciation

Dear Admins,

I would personally like to congratulate you on behalf of our beloved Association for coming up voluntarily and joining hands with us by donating to our noble causeof distribution of relief amongst the people hit by the onslaught of the devastating cyclonic storm – Amphan at the remote K-plot islandof the Sundarban area under Patharpratima block. A heartfelt thanks to the contributing members of your group who has shown their obligations towards our society in these trying times.

We put forward the names of the contributing members for their commendable commitment of standing by the distressed :
ANAMITRA BOSE, SHREYA CHAKRABORTY, ANIKET PAUL, PURNAVA CHAKRABORTY, AVISEKH ROY, SUBHADYOUTI BOSE, RUDRANIL ROYCHOWDHURY, ANISH BANERJEE, HRISHIK MUKHERJEE, SAMBIT CHATTERJEE, ARGHA BASU, DEBARATHI MONDAL, ANJAN ROYCHOWDHURY, SUMAN MUKHERJEE, ARKOPAL SARKAR, SOMSUBHRA DAS, SOUROSHANKHA MAJI, SHIVAM GHOSH, SOURAV DUTTA, AISHIK CHANDA, SANDIP PAL, DIYA MUKHERJEE and KALYAN SARKAR.

We look forward for future collaborations with your group for any such noble endeavour.

Warm regards,
(Somsubhra Das)
District Secretary

Certificate of appreciation from West Bengal Land & Land Reforms Officer's Association for taking part in their 'Amphan Relief Project' by Team TrainTrainckers & Railfans United Group members...

East-West Metro

Story Behind India's First Underwater Railway

- Rudranil Roy Chowdhury

Circa 1919 – a plan of an underground cross-river railway system connecting the twin cities of Calcutta & Howrah was floated at the Indian Imperial Legislative Council's session in Shimla, following which, a committee was appointed. That committee had failed to propose any concrete planning after several sittings. Later in 1921, a Bengal-born British engineer, Sir Harley Hugh Dalrymple-Hay, was appointed to conduct a feasibility study for an East-West urban rail link for Calcutta – a project reminiscent of the tube rail tunnel under the Thames River in London. The idea was to connect the two emerging railway stations Howrah & Sealdah on either banks of the Hooghly River via underwater tube rail. Sir Dalrymple-Hay, busy restoring the London underground, which had suffered major damages during the First World War, deputed his chief assistant to carry out the study. Report was submitted in the following year. However, the idea could not see the light of the day because of paucity of funds as the soil test revealed the project cost as six times higher than the London project. For five decades, the plan of an underground mass transit system was kept buried under the files until revived by the West Bengal State Government in 1969. But, instead of the East-West corridor, the North-South corridor was brought to the fore to give India's first metro rail in collaboration with the Indian Railways. In 1972, the foundation stone was laid and in 1984, thirty-six years ago, Calcutta got the nation's maiden Metro rail system when Phase-I of the North-South corridor between Esplanade and Bhowanipur (present-day Netaji Bhavan) opened up. While that iconic corridor continued to be extended, the East-West Metro project remained in cold storage, only to be revived in 2008 after the report of a feasibility study conducted in January 2004 by Pacific Consultant International Group was accepted. It proposed the route on standard-gauge, unlike the broad-gauge link of the existing North-South Corridor, with tunnels under the Hooghly River. It was also mulled to acquire about 56 acres of land for the project, of which 53 acres was government-owned khas land while the rest was private.

HISTORICAL BACKDROP

The East-West Metro Corridor was a response to Kolkata's ever-increasing importance as a business and cultural center and offered a solution to the widespread traffic congestion & population explosion the 300-year-old city is suffering from. An efficient connection between Howrah and Salt Lake Sector-V via Esplanade & Sealdah is now a dire necessity. Citizens desperately seeking a respite from the inefficient traffic management contributing to never ending traffic

snarls especially between Esplanade-Howrah & Sealdah-Howrah sections, over-crowded & inadequate public transport; passenger refusal & over charging by cabs is now an everyday routine. Average travel time to cover a distance of 5 km between Howrah & Sealdah station is more than 30 minutes in normal traffic conditions, which easily escalates to even 1 hour during heavy rains or political rallies (something quite common in Kolkata). Under normal traffic, it takes at least 20 minutes to reach Howrah from Esplanade, a distance of approximately 4.5 km, which may also take an hour or more, in the event of any disruption. Likewise, it usually takes an hour to reach Salt Lake Sector-V from Esplanade under normal circumstances. Thus, in a city where the average speed of public transport is around 15 kmph, Metro can be termed as the only viable solution. While the North-South corridor has already been termed as the 'Lifeline' of the city, the East-West metro also aims to live up to its expectations with an estimated patronage of around 1 million passengers per day by 2035.

After all the initial hurdles, in February 2009 - the foundation stone of East-West Metro Project was laid.

- A new entity named Kolkata Metro Rail Corporation (KMRC) came into being to construct & operate the line dedicatedly.
- Initially, it was a joint venture between State-Centre-JICA (Japan International Cooperation Agency), but the State backed out later.
- A consortium was appointed to carry out the preliminary design of the line, which included the Lee Harris Pomeroy Architects (LHPA), for designing the six underground stations.
- In 2009, Gammon India and Simplex were roped in for building the elevated stations and viaducts. Gammon carried out the designing and construction of 4.725 km of viaduct whereas Simplex built the elevated station complexes.
- In 2009, a consortium of ITD-ITD Cementation – a part of Italian-Thai Development Public Company & their Indian counterpart was awarded the contract to build the underground portion between Subhash Sarobar & Central (later to Esplanade).
- In 2010, Afcons Infrastructure, in a joint venture with Transtonnelstroy (a Russian infrastructure major), were appointed for the final design and construction work of the underground portion between Howrah Maidan & Esplanade, which includes two 520 metres underwater tunnels.
- In 2012, Kalindee-Rahee JV group was brought in the thick of things for supplying & installing regular tracks of UIC 60/60E1, IRS-T-12-2009, 880 grade for the depot/yard lines.
- In 2014, Austria's VoestalpineSchienen GmbH- a specialist in steel rail making, was drafted in for 2700 tonnes of head-hardened UIC 60E1 IRS-T-12-2009, 1080 HH grade rails, manufactured through a special heat treatment process to provide additional strength, lower residual stress, elongate track-life and minimize maintenance for Phase-I (Sealdah – Sector V) section. Similar tracks of 1,710 tonnes are to be used in Phase-II for the underground section between Howrah Maidan & Mahakaran, including the underwater section. The hi-tech 'mobile flashbutt welding' technology is being used for soldering the tracks.
- For procurement of the rolling stocks, KMRC floated several rounds of tenders over a span of 6 years and finally the contract went to Bharat Earth Movers Ltd (BEML), being the sole bidder in September 2015. As per the contract valued at ₹ 900 crores, BEML will supply 14 train-sets of 6 coaches each. With a Transfer of Technology (TOT) agreement in place with South Korea's Hyundai Rotem, BEML has emerged as a key player in indigenous

Kolkata Metro Rail Corporation (KMRC) Logo. *Photo by: Arkopal Sarkar*

CHRONOLOGICAL FRAMEWORK

A BEML-built Rake of East-West Metro *Photo by : Arkopal Sarkar*

manufacturing of metro coaches.

- In 2017, a consortium of Zhuzhou CRRC Times Electric and Panasonic Manufacturing (Beijing) was awarded the contract to design, install, test and commission Platform Screen Doors (PSDs) at all the 12 stations along the East West corridor.

ALIGNMENT DILEMMA

The initial East-West Metro plan was to build 15 km Metro railway system connecting Salt Lake Sector-V with Howrah Maidan via Sealdah, Central & Howrah stations en route – with 9 km of underground section between Howrah Maidan & Phoolbagan (including a 520 m section of underwater tunnel) and around 6 km of elevated viaducts from the Phoolbagan ramp to Sector-V. Post re-alignment (via Sealdah, Esplanade, Howrah), the total length of the EW metro corridor stands at 16.6 km, as of now, between Howrah Maidan & Salt Lake Sector-V with 10.8 km of underground twin Metro tunnels, one east-bound and one west-bound. A total of 12 stations were planned as part of the project – six underground stations (Howrah Maidan, Howrah Station, Mahakaran, Esplanade, Sealdah & Phoolbagan) and another six elevated stations (Salt Lake Stadium, Bengal Chemicals, City Centre, Central Park, Karunamoyee & Salt Lake Sector-V). Extension up to Santragachi Railway Station (a fast-evolving alternate terminal for South East Railway to decongest Howrah Station) on the Howrah side and up to Teghoria over the Salt Lake side are also on the cards.

List of Stations in East-West Metro Corridor *Photo by : Arkopal Sarkar*

The Engineering Excellence:

ENGINEERING EXCELLENCE

The East-West Metro project, in reality, is an engineering marvel and once completed it will be a metro system boasting of numerous state-of-art technologies ever used in India. The story behind its making is equally interesting & fascinating. Phase-I of the project includes construction of the elevated section between Sector-V & Phoolbagan ramp, which was initiated by Gammon & Simplex. The elevated viaducts consist of a pre-stressed concrete, U-shaped or box girder on a single pier with pile or open foundations. These pillars are mostly located on the median verge of the road. The locations of the piling were already recognized by the survey team. The first piling work commenced on Bengali New Year's Day – 14th April 2009. Augers were used for excavating the hard-bituminous layer on the road surface. As the layer beyond was silty in nature, soil buckets were used at desired depth to excavate. Then the piling was done by Bentonite, which is used to maintain soil stability. A casting cage was then inserted into the hole and concreting was done. Like other Metro projects, the elevated stretch of EW Metro was also constructed following the Segmental Bridge construction method, which is a more industrialised, economical method with low maintenance costs. A Segmental Bridge is a viaduct built span-by-span, in short sections or segments which are erected to the piers and then joined to make a continuous pathway. These segments are either precast or cast-in-site. Here the Precast Segmental Method was used. This method is generally opted for long bridges with a large number of spans. The process started by casting the segments in the casting yard, which required the factory-built custom-made reinforcement cages to be delivered to the site. These cages were placed in moulds with bulkheads and concreting was done with Portland cement, water, aggregate & chemical admixtures. Generally admixtures are added to prepare a durable, high performance concrete which is high range water reducing, superplasticising with improved surface appearance, reduced shrinkage and low permeability. After completion of concreting, the segments were placed for 24 hours curing. Following which, the moulds & bulkheads were removed

Elevated viaduct of EW Metro *Photo by : Arkopal Sarkar*

and segments were cleaned by sand blasting method to get a better surface. The ready segments were numbered & stacked and transported to the location site where the erections of these segments were done by standard scaffolding (span-by-span erection) method with the help of ground support system. The positioning of the segments was fixed, so that they must be at required level, with the help of hydraulic machines. To prevent the leakage of grout during grouting, Epoxy gluing was used in between the segments. After the segments were placed, temporary pre-stressing was done to maintain correct alignment and also to balance the weight, following which final pre-stressing started. The cables were inserted in the ducts using bearing plates. Master wedges were used to prevent slipping of the cables. Pre-stressing pressure was then applied on the cables by hydraulic jacks and after reaching the measured elongation length, the cables were left undisturbed for 24 hours to avoid slippage failure. Extended portion of the cables were cut and cementing covers were applied. Following this, grouting was done and the process continued till the entire viaduct length from Sector-V to the Phoolbagan ramp was achieved in a phased manner and was completed by 2015, except for a small portion in Duttabad (near Bengal Chemical station), which was left out due to political disturbances and could only be completed by October 2017.

EW Metro station construction site @ B.B.D. Bag *Photo by Anindya Biswas*

Phase-I also includes underground tunnelling between the Phoolbagan Ramp and Sealdah stations. The construction was carried out using state-of-the-art tunnel boring method, which led to minimal disruptions on the surface, with the help of German made Herrenknecht Tunnel Boring Machines or TBMs. Each of these industrial monsters are suitable for projects on unstable terrain or under structures that are sensitive to ground disturbances, as the machines are equipped with 'earth pressure balancing' capabilities & can withstand three times more atmospheric pressure during the boring process. Each TBM is 8.5 m (nearly 28 feet) long and more than 6 m (approximately 20 feet) tall with back-up gantries extending up to 100 m (~ 328 feet). Each of these gigantic boring machines are equipped with five motors with a combined output of 650 HP along with more than thirty-five other auxiliary motors. Six generator sets of 1,010 kVA supplies power to the boring machines which can dig up to 15 m (or 50 feet) a day, excavating up to 500 cubic metres of earth. A rotating cutter-head dug out earth which was transported back behind the machine by a moving conveyor belt. As the TBM burrows, an industrial robot places segments of a 1.2 m wide precast concrete ring. Thus, 12 m (nearly 40 feet) length of tunnel gets created every day without perturbing and unsettling anything up and above the ground level. And all these are in striking contrast to the mayhem the city had to live through in the 1980s due to the construction of the North-South Metro. Choked arterial city roads, mountains of debris, tilted or cracked residential buildings and monumental pile drivers hammering concrete pillars day and night are all now things of a dreadful past – thanks to the advancement of technology and skills.

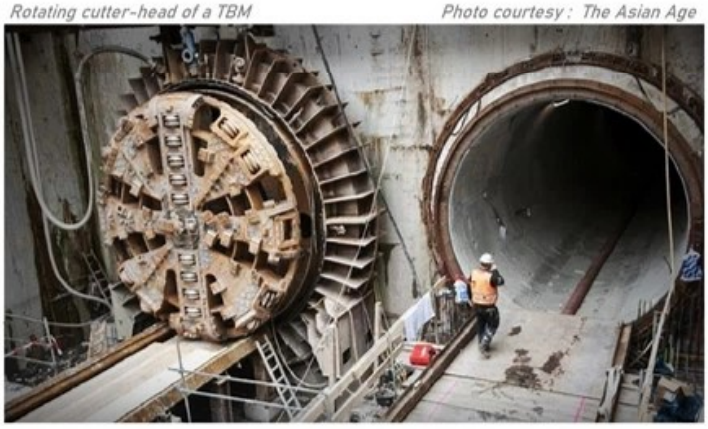
TBMs used for East-West Metro *Photo Courtesy: tunneltalk.com*

The first two Tunnel Boring Machines - TBM S616 named as 'Urvi' & TBM S615 named as 'Chandi' were commissioned by ITD-ITD Cementation in 2011 to construct the tunnels between Subhas Sarobar & Sealdah and work was completed by 2013. The realignment of the line forced the firm to halt further tunnelling for over 5 years during which both TBMs were retrieved, sent to work on Delhi Metro's Magenta Line tunnels. Otherwise, ITD carried on with the construction work of the underground stations - Phoolbagan & Sealdah. Work on the Phoolbagan station actually started in 2011 and was supposed to be completed by mid-2014, but a delay on the part of the State government in handing over land led to cost and time overruns. All the underground stations of the East-West corridor were built by cut & cover method. A typical station involved construction of a two-storied rectangular building below ground. Constructing these underground structures required excavation up to the required depth and in order to support the soil temporarily, diaphragm walls were first constructed along the periphery of the station and while excavating the soil between them, the diaphragm walls were strutted. A number of layers of strata were placed as the excavation proceeded to the final level. The base slab of this rectangular station box was constructed first and then side walls, concourse slab, and roof slab were constructed progressively from

bottom to top. The struts are also removed in sequence. The same procedure was performed during all the other underground station constructions of the EW corridor but at strikingly more depths than any other metro stations in India.

Meanwhile, the construction work of Phase-II also began between Howrah Maidan & Esplanade. Afcons-Transtonnelstroy commissioned their first TBM S640, nicknamed as 'Prerna', from Howrah Maidan in April 2016, shortly followed by the second one, TBM S639, nicknamed as 'Rachna'. This marked the beginning of the most difficult part of the entire project – construction of India's first underwater transportation tunnels. But before that could be undertaken, the TBMs were confronted with a different challenge – negotiating a curve with a radius of 228 m between Howrah Maidan & Bankim Setu, which is actually one of the steepest curves of the project; whereas the usual standard radii for underground tunneling is kept around 200 m. But thanks to the expertise of the Afcons-Transtonnelstroy JV, both the TBMs negotiated this tricky part with flying colours. Having done that, now, it was all about the biggest challenge ahead – the underwater tunneling. Boring the underwater tunnels in a terrain that predominantly consists of soft and stiff clay has been one of the stiffest challenges of the project. And hence came the masterstroke from KMRC, as the underwater tunnel construction is technologically comparable to the Eurostar high-speed railway service that traverses through the tunnel underneath the mighty English Channel connecting UK & France. Here also, two underground tunnels were constructed with approximately 520 m of underwater section under the Hooghly River at a depth of 13 m (43 feet) below the water-level, which is equivalent to a ten storied building. Each of the two tunnels has an inner diameter of 5.55 m (18 feet) and an external diameter of 6.1 m (20 feet). The inner walls of the tunnel are being made with M50 grade reinforced concrete segments with a thickness of 275 mm each. Six of these segments complete a circular lining of the tunnel's diameter. These segments are then being pre-cast in specialized moulds imported from South Korea. Several protective measures have been taken to prevent water inflow and leakages in the tunnel. Concrete mixes composed of fly ash and micro silica have been used in order to minimize water permeability. The segments are being sealed using a complex grouting process that filled the space between the segments and the shield of the TBMs. A two-component grout mix, including a slurry mix made of water, cement, bentonite and sodium silicate is being used to fill the gaps. The liner segments are fitted with a German-made neoprene and hydrophilic auxiliary gaskets, which expands when it comes in contact with water to prevent inflow through segmental joints. The two TBMs bored the east and west-bound underwater tunnels in record time by June 2017.

Rotating cutter-head of a TBM *Photo courtesy : The Asian Age*



Howrah end of underwater twin tunnels *Photo courtesy : e-architect.co.uk*

ENGINEERING EXCELLENCE

State-of-the-art tunnel ventilation systems are also being installed in order to ensure adequate ventilation during emergencies. Tunnel ventilation fans, which can circulate fresh air at the rate of 85 cubic metres per second (m^3/s), were installed in a three-storey building over the emergency evacuation-cum-ventilation shaft at Strand Road on Kolkata side. Over-tract exhaust fans, platform supply fans, as well as booster fans were installed in Howrah station side and other appropriate locations. Continuous walkways are being provided for sidewise evacuation during emergencies. Emergency evacuation walkways up to 760 m in length are being provided inside the underwater tunnel to adhere with the National Fire Protection Association (NFPA) guidelines. The deepest ventilation-cum-evacuation shaft of the country was constructed at Strand Road, for the 2.9 km section between Howrah & Mahakaran stations. Passengers will have to climb up 300 stairs to safety through this 13 storey tall shaft in the event of an emergency evacuation. This 44 m deep shaft will have 10 landings in between stairs for passengers to catch their breath during evacuation. The shaft is also designed to act as a drainage pumping station. In case there is a leakage in the underwater tunnel walls, the design ensures that the water accumulates in a pit below. A 1.8 m high pump, placed 42 m below ground level, will suck out the water. A similar type of shaft of around 25 m depth was built at Wellington Square for the 2.25 km corridor between Sealdah & Esplanade to improve passenger safety. When the planned intersection with North-South link at Central Metro station was scrapped owing to re-alignment issues, RITES chose Wellington Square as the site for a station between Sealdah and Esplanade in the Detailed Project Report (DPR). But, during a technical survey, it was found that the site required a large-scale demolition, in order to construct a station at that

location. So, the idea was dropped and an evacuation-cum-ventilation shaft was planned instead. The School of Physical Culture at Wellington Square, a 90 year old Boxing Club, had to be relocated elsewhere for this purpose. History beckons as the renowned boxer Jagat Kanta Seal, after being inspired by Netaji Subhash Chandra Bose, set up this iconic club in 1927 once Netaji had helped him to acquire a 22-cottah plot of land in Kolkata.

After completion of the underwater section by June 2017, both the TBMs 'Prerna' & 'Rachna' started continuing their journey in the same month towards Esplanade with similar precision & extra caution. From this juncture, the tunnels went under the pile foundation of Brabourne road fly-over as well as within the vicinity of some critically dilapidated buildings around the fly-over. It passed within 100 m of a cluster of heritage monuments like the Writers' Building, Magen David Synagogue, Beth-El Synagogue, St. Andrew's Church and Currency Building, which required 24×7 monitoring of soil settlement and grouting injections to strengthen their weak foundations. Prior to proceeding with this, permission was acquired from the Archaeological Survey of India (ASI). The work continued following evacuation in a phased and staggered manner from the several old buildings in Brabourne Road as the TBMs passed below them. Not only for the susceptible buildings, but also for the busiest & the most congested locality of the city, i.e., Burrabazar, both the TBMs reached BBD Bag (Mahakaran station) in December 2017, without a single mishap. Both machines were temporarily halted in dynamic stability mode at BBD Bag until the diaphragm wall further south got constructed. The machines undertook further excavation & finally reached Esplanade safely to carve out the second deepest metro station in the country at 29 m (or 95 feet) (Hauz Khas of DMRC in Yellow Line/Magenta Line jointly holds this distinction), thus completing the entire tunnelling works from Howrah Maidan by April 2018.

By this time, under Phase-I, a superior, environment friendly 'Green Depot' with modern train maintenance facilities was constructed on a 16.5 hectare land at Central Park in Salt Lake. Depot layout has been kept in such a way to make optimum use of natural lights, minimizing the carbon footprints. Apart from that, roof-top solar panels were installed to generate energy for internal consumption. With the completion of this maintenance depot by the end of 2017, KMRC started procuring the rolling stocks from BEML. In April 2018, the first rake of the East-West Metro reached the Central Park Depot followed by the second one in May 2018.

The Central Park Depot *Photo by : Arkopal Sarkar*

With the regular inflow of rakes, construction of the entire elevated stretch from Sector-V to the Phoolbagan ramp finished by May 2018, with resounding precision and without any major impediments, while the underground stretch between Subhash Sarobar & Sealdah stations was still undergoing last minute detailing. The construction & furnishing of all the six elevated stations with infrastructure matching international standards also got completed. Hence, from July 2018, KMRC started conducting trial runs from Central Park to Sector-V, in addition to the already undertaken test rides inside the Salt Lake Depot from June 2018 onwards. Buoyed by the positive outcome, trial runs began for the entire elevated stretch between Sector-V & Salt Lake Stadium from October 2018. Initially, the trial runs were restricted to the west-bound line with gradual extension to the east-bound line as well.

Implementation of Advanced Technologies:

The entire East-West corridor features some state-of-the-art technologies matching international standards which are set to change the way one is used to travel in a Metro.

The Swanky Rakes

- The state-of-the-art air-conditioned trainsets run on 1435 mm standard gauge, drawing 750V DC current from the third rail with 'Single-arm Bottom Current Collector' mounted on motorized bogies.

A BEML-built Rake of East-West Metro *Photo by : Arkopal Sarkar*

- Acceleration and deceleration of these trainsets are controlled by Variable Voltage Variable Frequency (VVVF) Inverter blended with Regenerative Braking. Regenerative braking is blended with pneumatic braking by electrical and back-up brake by driver's brake valve. Wheel mounted disc brakes have been provided on all of these rakes.

Inside a DMC of EW Metro Rake *Photographed by author*

The Door-way view *Photographed by author*

STATE-OF-ART TECHNOLOGIES

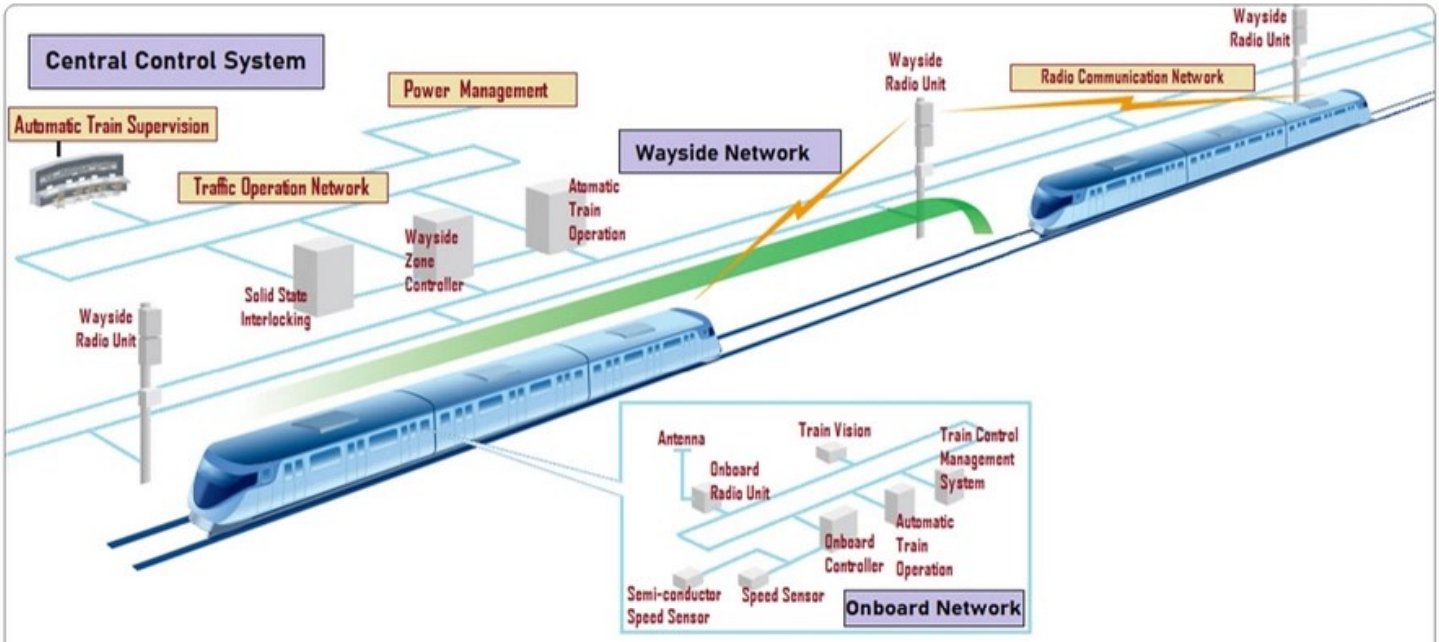
- Train composition is standardized to six car rakes with DMC-TC-MC-MC-TC-DMC compositions. Each coach is 2.88 m wide, with stainless steel body having longitudinal seating arrangement. Length of a Driving Motor Coach (DMC) is 21.05 m & that of a Trailer Coach (TC)/Motor Coach (MC) is 20.8 m. Passenger carrying capacity of a DMC is 316 persons while for an MC/TC, it is 348 persons.
- Bolster-less type bogies are fitted with Conical Bonded Rubber Spring as primary & Air Spring as secondary suspension.
- These trains are also equipped with 'Squirrel Cage'-type 3-phase Induction Motor with IGBT converter and roof-mounted, self-contained type air-conditioner with 45 kW cooling capacity.
- These trains also have electrically driven external sliding-type Aluminium doors and double glazed, toughened, laminated glasses for doors & windows and wider sealed gangways.
- The sliding doors of the rakes are equipped with obstruction detection system so that no passenger gets hurt,even if he gets stuck between the doors.
- Each coach has two pairs of CCTV cameras, a public address system and a radio for communication between the driver and passengers. An LED display board flashes the name of the next station and the terminal station.
- Most importantly, all these trainsets are equipped with Communication-based Train Control System (CBTC) with Automatic Train Protection (ATP) – software installed by Mitsubishi Electric Co. Ltd, Japan.

The Signaling Aspect

- KMRC had initially planned to adopt the Distance-To-Go (DTG) signaling system - a bidirectional communication system using the GSM-R radio & track-side circuits. Though DTG is quite an advanced technology, it can still allow a two-and-half-minute gap between two trains. But the idea was later scrapped and a more advanced technology was implemented - Communication Based Train Control (CBTC) which is leading a new era of rail transit control, enhancing flexibility, reducing maintenance costs and improving inter-operability. CBTC is an advanced

Sliding Doors of BEML Metro Rake *Photo by : Arkopal Sarkar*

Driving Panel of a BEMI-built EW Metro Rake *Photographed by author*



Schematic Representation of Communication-based Train Control (CBTC) System

(Images courtesy - Mitsubishi Electric Corporation)

railway signaling system, with continuous Automatic Train Control (ATC) system utilizing high-resolution train location determination from bidirectional train-to-wayside radio data communications, which is independent from track circuits; and trainborne to wayside processors capable of implementing Automatic Train Protection (ATP) functions, as well as optional Automatic Train Operation (ATO) and Automatic Train Supervision (ATS) functions.

- Installation of this technology requires both trainborne as well as wayside/trackside equipment along with software integration. There are two players who are working together to implement the CBTC at the East-West corridor – a consortium of KMRC & Ansaldo STS (Hitachi) of Italy – responsible for wayside equipment & trainborne components and the BEML-Hyundai Rotem-Mitsubishi Electric (Tokyo) consortium – responsible for the trainborne software & related components.
- Wayside equipment includes a Control Unit (CU), a Solid State Interlocking (SSI), Wayside Zone Controller & the trackside radio units. Encrypted wireless technology enables position data and control data for each train to be exchanged, and control to be applied to the distance between trains, speed, route, etc. The use of a failsafe processor ensures a high level of safety.
- The Control Center functions as an advanced software-aided Dispatch and Centralized Traffic Control by regulating traffic to schedule or headway, even when unexpected events occur. Allowing central or local operating modes with different levels of automation, the system instantly adapts to failures or anomalies within the network, protecting transit lines against outages and service disruptions. Each zonal center unit is integrated with adjacent ones and communicates with interlocking and trainborne controllers to guarantee that all aspects of operation and controls are safely managed.
- Trainborne equipment include an onboard radio unit tailored to train control using the train radio bandwidth, which ensures stable communication quality; and a trainborne controller & software-based ATO unit which obtains control data related to the interval between trains while transmitting position data for the subject train to wayside zone controller via radio communications, enabling ATO to be applied within a restricted speed.
- CBTC allows trains to run at less than 90-second intervals. Riding on this technology, KMRC aims to operate driver-less trains once the full line becomes functional in the near future.
- The other signaling equipment includes an integrated system featuring Fiber Optic cable, Supervisory Control and Data Acquisition (SCADA), Radios and a Public Address system. And also to add, the train information system, control telephones and a centralized clock system.

Platform Screen Doors

One of the most commendable features adopted by the KMRC is the introduction of Platform Screen Doors (PSDs). All PSD installations in EW corridor are entrusted to a consortium of CRRC Times Electric (Zhuzhou) & Panasonic Manufacturing (Beijing). The PSDs offer a gamut of advantages including increased safety & comfort for passengers with added aesthetic appeal. But most importantly, PSDs act as a physical barrier preventing passengers from accidental or intentional falling onto the tracks & trespassing into the tunnels in the

Platform Screen Doors (PSDs) Photographed by author

A KMRC Smartcard Photo by : Prabal Bhattacharya

North-South link. It also prevents littering onto the tracks thus preventing the rails from early corrosion. Two types of PSDs are being installed - Half-heighted PSDs for the six elevated stations and Full-heighted PSDs for all the six underground stations. Full-heighted PSDs also improve temperature control within the station premises allowing economic and judicious use of air-conditioning system in the platform. PSDs operate in synchronization with the train doors. Each PSD unit consists of a sliding door, a fixed door, an emergency door and an end door unit. The power system and central control panel are usually located in the platform equipment room. The platform control unit is located at the end door unit. There is a door status indicator provided for each sliding door, emergency door and end door. For Full-heighted PSDs, the header of the door body is provided with a rear cover and a front cover which completely isolates the platform area from the driving area and is dustproof and waterproof. They protect electrical devices and are used to indicate passenger information. For any operator, the installation of platform door systems results in better schedule adherence and optimized operating efficiency. With this development, Kolkata became the third city after Chennai and Delhi to commission PSDs in the country.

Contactless Ticketing System

Another advanced feature implemented by KMRC is 'Contactless Ticketing' by adopting the state-of-the-art Near-Field Communication (NFC) technology. In the north-south link, passengers have to place their RFID Token or smartcard on the smart gate panels in order to enter or exit. But, NFC technology leads to a complete change in this practice, as from now on, smart gates can be accessed without even touching the panels but just by swiping over them. NFC works on a set of short-range wireless communication protocols for communication between two electronic devices within a distance of one and half inches. NFC protocols typically work when one of the devices has internet connectivity, while the other device can exchange data with online services. NFC-enabled portable devices (e.g., smart cards, smartphones, etc.) can be provided with an application software to read electronic tags when connected to an NFC-compliant apparatus (smart gates, Manual Token counters, ATVMs etc). NFC tags contain read-only as well as writable data which are custom-encoded by their developers. The communication takes place between an active 'initiator' device (the smart gates) and a target device. This target device can be a passive one such as RFID (Radio Frequency Identification) Tokens, Smartcards or an active one like smartphones enabled with NFC software. NFC standards cover communications protocols and data exchange formats, which are based on existing standards set by ISO/IEC 14443 1-4. The entire implementation & installation of NFC and integration of the same with Automated Fair Collection (AFC) system was entrusted to a Spanish company Indra Sistemas of Madrid. After successful testing & implementation, this system has now been integrated with the north-south metro link as well which ensures a seamless travel by commuters at both corridors.

Smartgates

KMRC has installed NFC-enabled Smart Gates or 'Automated Validator Machines' or 'Traveler Access Control Equipments' provided by Indra Sistemas. These terminals are specially designed to facilitate the fast and efficient access of travelers upon presenting their tokens, cards, smartphones etc. Access areas with special widths are available for Divyang (handicapped) passengers and for passengers carrying large baggage or objects. These gates are made of polished, stainless steel with rounded contours and include pictograms with information on their status or availability, and informational modules on the result of the ticket validation process through TFT/LCD displays. They are fitted with photoelectric anti-fraud systems. They are designed to be used through a real time connection to the local station concentrator and the ticketing control and management center, communicating via ethernet network to send information on completed validations, alarms and events. These are equipped with a powerful industrial PC

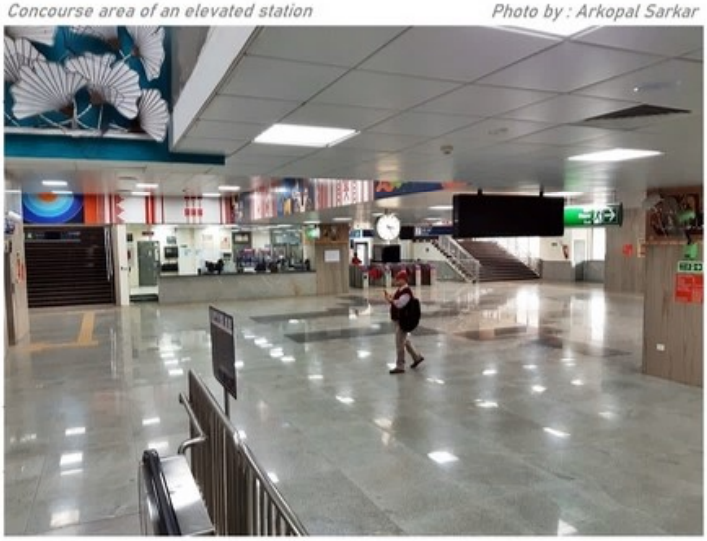
The EW Corridor Smartgates *Photo by : Arkopal Sarkar*

for managing the devices and communications with the management and control center.

Other Amenities

Apart from the normal ticket counters, Ticket Vending Machines (TVMs) are deployed at the unpaid areas of all the functioning stations for purchasing RFID Tokens, recharging of Smartcards etc. These touch screen terminals are Divyang & Child friendly, and accept both Cash and Debit/Credit cards. Similarly, Add Value Machines (AVMs) are also installed at unpaid areas for Top-up/Reloading the Smartcards & supports online recharge facility. Concave mirrors at two ends of the platforms, CCTV camera and communication system installed at the stations for contacting the control room during emergency, improved air conditioning system at underground sections are among the many passenger-friendly initiatives taken by KMRC. Other features like lifts, escalators, concept of barrier free movement, designated parking for Divyang passengers are also provided. State-of-the-art Noise Absorptive Barriers are provided near hospitals/schools to reduce the train generated noise.

Concourse area of an elevated station *Photo by : Arkopal Sarkar*



Morphing Through Time:

With all these innovations & amenities in place along the elevated stretch and after months of testing and performing trial runs, KMRC was gearing up for commencement of service which involved announcing several deadlines. But, the CBTC software development issue ensured failure to match certain deadlines. A murky blame game soon followed between KMRC-Ansaldo STS and BEML-Mitsubishi upon delivering the vital inputs which are pre-requisites for developing the CBTC software. After several months of delay, the vital inputs were ultimately delivered by Ansaldo STS and the software developed by Mitsubishi bore fruit, paving the way for integration into the system by the end of August, 2018. Thus, the stage was set for stringent trials for the next quarter.

Meanwhile, under Phase-II, the last leg of construction work was initiated on April 2018 between Esplanade and Sealdah stations. But, a major road-block had already raised its head – the H-piles. The geo-sensing survey by ITD-ITD Cementation had already revealed the presence of these H-piles in late 2017 – as many as five 12 m long steel beams under the existing Esplanade Metro station were discovered, however, no measures were taken at that point of time. The situation got complicated as the two TBMs S615 & S616 'Chandi' and 'Urvi' had been brought back from Delhi Metro and were re-commissioned to work by ITD-Cementation at Esplanade station site which is 29 m (95 feet) below the surface & around 15 m (50 feet) below the existing north-south alignment. A sheer case of negligence on the part of ITD-Cementation; despite being aware of the impediment ahead, and yet, choosing to be ignorant and going ahead with the lowering of TBMs for tunneling of the 2.4 km stretch before chalking out any backup plans to by-pass the H-piles. The H-piles are usually square structural beams usually made of timber, steel or concrete, that are driven under the ground for foundation applications. These were left alone by the then construction agency of the North-South Metro, some 30 m underground, which were built to support a temporary iron road over the Esplanade crossing that was dug for construction work at that time. It was an absolutely necessity to remove the H-piles in order to clear the path for TBMs, as these machines can drill through rock, sand, mud and concrete but not steel. After months of consultations with various IITs across India and experts abroad, KMRC yet again came up with a workaround by adopting the method of using the hi-tech New-Austrian-Tunneling-Method (NATM), which works on the principle of excavating micro-tunnels in tight spaces, to create a passage in between the slots designated for the TBMs, reach the H-piles or joists and remove them. This process is also referred to as the Sequential Excavation Method (SEM). This technology is best suited for short-range tunnels in regions with variable soil conditions and the same technology helped KMRC to overcome the hindrances by removing all five major & four minor H-piles and continue with the tunneling work towards Sealdah via S. N. Banerjee Road from January 2019.

'Smooth Sailing' and 'East-West Metro Corridor constructions' have always been antithetical to each other and it was no sooner that the Phase-I ride had become jittery. Things looked jinxed as the

the KMRC kept extending the deadlines due to various issues.

- In November 2018, Research Designs & Standards Organisation (RDSO) conducted the oscillation trials on four different trainsets.
- During one of the trial runs in December 2018, CBTC software integration glitches were detected while negotiating curves along the route. Ansaldo STS started to fix the software integration on an urgent basis.
- In January 2019, KMRC got the crucial clearance from RDSO regarding the rolling stocks. On receiving the same, without wasting time, KMRC moved an application for the Railway Board's inspection of the rolling stocks, which is a must before starting any commercial service. The Commissioner of Railway Safety (CRS), on behalf of the Railway Board, conducted the preliminary safety inspection of the BEML-built trainsets on February 2019, checking various issues like emergency brakes & signaling system of the train etc.
- Following this inspection, on May 2019, KMRC got the speed safety approval from Railway Board for all its rolling stocks with a speed limit restricted to 80 kmph. By this time, Ansaldo STS also completed fixing the software glitch and recommended a 1000 hours trial before commencement of service. While trial runs were going-on at the elevated stretch, the third rail got energized for the first time on the underground section between Salt Lake Stadium & Phoolbagan. Trial runs began on 31st May 2019, which got extended later upto the Sealdah cross-over gradually.
- In the thick of the things, KMRC was denied a Fire Safety No Objection Certificate (NOC) from the West Bengal Fire & Emergency Services (WBFES) Department due to issues at Bengal Chemical & Salt Lake Stadium stations.
- On the other hand, KMRC achieved a major success over getting an international safety nod from an independent third-party evaluator. The French multinational transportation company Keolis – a subsidiary of the state-owned SNCF, was the evaluator appointed by the Ministry of Urban Development, which provided safety certificate for train operations on June 2019.
- The train operations were officially handed over to Metro Railway, Kolkata from KMRC on July 2019.
- On the same month, CRS conducted a safety audit for the initial run but WBFES still delayed the NOC.
- On August 2019, KMRC received a provisional NOC from WBFES and more importantly, a conditional safety clearance from CRS with certain issues still to be rectified before the first run, mentioned as follows:
  - Immediate upgrade of the outdated software of Train Control and Management System (TCMS) pertaining to the crucial microprocessor-based Communication-based Train Control System (CBTC) installed by the Mitsubishi Electric Corporation was the need of the hour.

East-West Metro - Kolkata Photo by : Arkopal Sarkar

  - The defective bearings on the piers that hold the viaducts on which the rail tracks have been laid had to be immediately replaced by the KMRC. The bearings were fitted on the entire stretch on 2012, and with the occasional push back of commissioning, coupled with limited maintenance, had weakened them. The CRS instructed both KMRC and Kolkata Metro to conduct joint inspections and to find out the health status of the viaducts along with some 600 bearings and replace them accordingly before commencement of the service.
  - Around 80 Kolkata Metro Staffs had already undergone rigorous CBTC Training at BEML and also at Hyderabad Metro. But, the CRS still wanted those staff to undertake a Refresher Training for seamless train operations.

MORPHING THROUGH TIME

Meanwhile in Phase-II, the TBMs have encountered a repeat of an earlier trammel. Just like the steep underground curve between Howrah Maidan and Bankim Setu in the past, these set of TBMs were subjected to a similar challenge, in fact, twin challenges this time with two sharp-turns, both having a curve radius of around 280 m spanning around 450 m each. The TBMs – Chandi and Urvi, following a near-linear path after leaving Esplanade, had left S. N. Banerjee road by taking a sharp left-turn towards Nirmal Chandra Street – a left-bend corridor passed under heavily congested locality with several ramshackle structures of over 100 years or more at Goaltuli Lane, Moti Lane etc. with the span ending at Wellington square where the ventilation shaft was being built. During this entire process, the TBMs thrived with elan and overwhelmed one of the two challenges as of now.

But very shortly, the TBMs were about to take another sharp-turn to leave Nirmal Chandra Street and move towards Sealdah – this time a right-bend corridor spanning through another highly populated residential area like Gour Dey Lane, Syakra Para Lane, Durga Pithuri Lane upto B. B. Ganguly Street, only to follow a linear-path then onwards to Sealdah beneath the Sealdah flyover.

Another important breakthrough occurred in Phase-II as the structural construction of the Howrah Metro station – India's deepest Metro station at 30 m depth, got completed in August 2019.

Initially, there were four platforms of Howrah Railway station above the planned Howrah Metro station. Platform number 16, used only for goods trains, was abandoned and platform 15 was shifted. Excavation work started between platforms 14 & 17. It took 13 months to dig upto 34 m (112 feet) of depth, given that the width of the base slab was supposed to be around 4 m. The station's ground level starts at 30 m or 98 feet, where the tracks would be laid and the platforms are 100 feet below the surface. The station has four levels — the upper concourse, the mechanical level, the lower concourse and the base or platform level — all spread across a good 40,000 sq. m. The multi-level sprawl will have interconnected facilities spread over five lakh square feet of interior space. There are three platforms, so that doors of the trains can open on both sides. The roof is waterproofed and the premise is greener and eco-friendly.

But who knew that another twist in the tale was waiting around the corner! Things soon turned out to be murky as the TBM S615 'Chandi' breached a shallow aquifer and triggered the subsidence and collapse of 11 residential buildings at Bowbazar area (worst affected zones are northern ends of Gour Dey Lane, Syakra Para Lane & Durga Pithuri Lane), while carving out space for the west bound tunnel between Esplanade & Sealdah stations on the last day of August, 2019. Tunneling was immediately stopped as a precautionary measure in the heavily congested locality as several other buildings developed cracks and were on the verge of collapsing. It became evident that the entire zone needed to be stabilized before carrying out any more construction works.

BIGGEST IMPEDIMENT

As a precautionary measure, two steel barriers have been erected at 3 m from each other in the flooded tunnel to prevent the accumulated water from spreading and causing further damage to buildings. A mixture of concrete, fiber and sodium silicate (shotcrete) was being placed into the gaps in the barriers following the process of pneumatically projecting the mixture at a high velocity through a nozzle. The force of spraying in shotcrete leads to compaction of the concrete, which then forms layers of solid blocks of required thickness. From the surface, a mixture of water, cement and sand, known as grout, was then injected into the tunnel. Grouting was done in the roof of the tunnel between the two steel barriers, above the accumulated water. The grout was being used to block the portions through which water was seeping out. It was essential to protect the tunnel and also arrest the subsidence. Water was drained out using suction pumps as the level rose following the installation of the steel barriers. This exercise was continued for at least 48 hours till subsidence relented. Following that, ITD-ITD Cementation started strengthening a massive area, measuring nearly 75 acres with the house collapse site as the epicenter, through compaction grouting – an advanced ground improvement technique done to stabilize the soil. Thousands of tonnes of concrete were pumped into the earth through holes drilled on the surface, both from within the houses and outside by staged injection of low-mobility aggregate grout. This concrete filled up the gaps and sealed the perforations. Cement and chemical grouting filled the cracks and voids in the soil by permeating coarse and granular soils to create a cemented mass.

The whole incident created three major setbacks to the project. First of all, TBM 'Chandi' got damaged beyond repair due to water inflow. So, the onus now solely rested upon the other TBM. Secondly, an unplanned 15m × 8m shaft had to be dug to take out Chandi – the challenge did not end with the extraction, but for transporting the mammoth machine out of the heavily congested locality with narrow lanes was next to impossible, thus leaving the engineers with no other option but to dismantle the TBM into smaller parts before removing it from the site. The third and prime factor had its roots to the first two debacles – the prospect of the entire project getting delayed indefinitely with an unprecedented cost escalation.

It was later learnt that, ITD-ITD Cementation were very much aware of the presence of the mammoth aquifer - a giant water-bearing stratum, which has been estimated to be 19 m deep and about 600 m long, before the Tunnel Boring Machine ran through it. It started at 5 m under the surface and extended till 24 m. It was extremely risky to take the Tunnel Boring Machine through this huge water pocket without taking proper precautions. But, still the construction firm continued the tunneling process and after punching in 200 m through the aquifer, the water pressure rose so much that the machine gave in. Those managing the operations were aware of the risk and tried twice to inject grout from above, hoping that it would fortify the stretch and prevent leakage of water into the tunnel, but, both attempts failed miserably. Engineers with decades of experience in burrowing tunnels suggested later that work should have been stopped at that point. The residents of the buildings at risk should have been evacuated before the TBM hit the aquifer. That mayhem caused hundreds of residents to be evacuated within a few hours on that morning after water started flooding the tunnel and buildings started developing cracks. Most residents had to leave in a hurry, leaving essentials and valuables behind. The evacuation, had it started earlier, could have been done in a planned manner and the inconveniences could have been minimized. Had those measures been taken before, the TBM could have been saved.

This incident led to a complete hold up of the construction work that could only be resumed after six months, following the Hon'ble Calcutta High Court's directive on February, 2020. As per the new tunneling plan, TBM S616 'Urvi' continued tunnelling eastwards and is supposed to make a breakthrough at Sealdah Station which is another 900 m away from the Bowbazar mishap site. It would then turn backward as per the west-bound tunnel alignment up to the mid-shaft, in order to complete the pending tunneling works before being lifted out finally.

On the other hand, service trials were initiated at Phase-I and several more deadlines were set & reset by KMRC before its inaugural run. Eventually, the initial three months' CRS deadline also expired and a new 3-month window in the form of 'grace period' was granted till 29th February, 2020, following which, a truncated part of Phase-I of the famed & much awaited East-West

Two beautifully decorated rakes on the Inaugural day

Metro Corridor of Kolkata got the final nod. However, the underground stretch, between Salt Lake Stadium & Phoolbagan, did not find favour with CRS for operations and further modifications were advised in order to meet the requisite criteria for a commercial run to take place.

The Inaugural Run:

Finally, the D-Day had arrived after a long and meandering wait. 13th February, 2020 - history was created as the 'City of Joy' got its second Metro connectivity, after a gap of nearly 36 years! Amidst much fanfare, a beautifully decorated BEML-built Metro rake rolled out from the Salt Lake Sector-V station towards the future. It was only the beginning of a special journey, commencement of a new era which would span across the city's IT Hub, then Sealdah – one of the busiest suburban terminal, followed by the downtown area at Esplanade and would finally take the plunge under the Ganges to reach Howrah. The inaugural run covered a distance of 4.88 km up to Yuva Bharati Krirangan (Salt Lake Stadium). This paved the way for the commencement of commercial services of the world's cheapest Metro service from 14th February 2020, with an operational distance of six stations that includes Karunamoyee, Central Park, City Center, and Bengal Chemical.

Of Delays & Deferrals

Despite being one of the finest urban infrastructure projects of the country, criticism & controversies have had their fair share in this project of immense magnitude. The East-West Metro Project is often touted as one of the slowest metro projects in the world. It is one such Metro project which has badly suffered from the ire of political interference. It has been a 'no love lost' scenario between the central and state governments, which has had a detrimental effect on fund allocations and project cost sharing.

- Initially, the state government had agreed to bear 30 % of the total cost of the project, the Union Urban Development Ministry was to contribute 25 %, while the other 45 % would come from JICA. However, the state pulled out of the project in 2013 citing political differences, resulting in a complete change in the funding arrangement. Now, JICA agreed to sanction a loan amounting to 48 % of the project cost while Indian Railways is contributing 40 %, while the Union Urban Development Ministry is providing 12 %. It took around two years to arrive at this new agreement.
- The project also got entangled in land acquisition and slum relocation issues. Station construction in Phoolbagan was started in 2011, but land required for the ramp area and other facilities, were not handed over by the State government in time and was delayed indefinitely for years. Finally, the station work was completed in 2019, five years behind the schedule.
- The work of the elevated section between Salt Lake Sector-V & Stadium was completed by 2015, except for a small (365 m) stretch in Duttabad near the Bengal Chemical station due to political disturbances regarding resettlement of slum dwellers in that area. The work could only be completed in 2017 after the relocation of those slum dwellers, succumbing to pressure both from the locals and political goons. This delay pushed back the prestigious project, incurring huge cost escalations & a time delay of two years.
- If all these encumbrances were not enough, the realignment mess delayed work by another three years. A politically motivated forceful realignment in 2016, which was beyond the bounds of any technical or engineering impediment, ensured shifting of the already planned intersection at the Central station of the North-South corridor to Esplanade. After this, RITES chose Wellington Square as the site for a station between Sealdah and Esplanade in the Detailed Project Report (DPR). Thanks to another political vendetta, the 2.4 km Sealdah-Esplanade underground stretch remains without any halt.

The EW Metro project has often been labeled as the 'planning disaster' as well. According to experts, meticulous planning and adequate studies were needed to implement such a massive project in an old city like Kolkata, but the implementing authorities failed to dig deep into the architectural history of the city and had not done enough studies which resulted in a series of unprecedented mishaps costing property, time & money.

The incident of water gushing in from the river during the construction of emergency evacuation-cum-ventilation shaft at Strand Road in 2017 drew the attention of all and sundry, but KMRC proved its worth here to find a way to tackle this disaster by the process of compaction grouting technology. This incident disrupted the adjacent circular railway service as there were chances of subsidence in the line. Also, the construction work of the shaft got delayed for more than a year and eventually was completed by July 2020.

Next in line was hitting the abandoned H-piles below the Esplanade Metro station on April 2018, which cost the project a good 9 months delay as the TBMs were supposed to start boring

from May 2018, but could only start working from January 2019 instead. After overcoming the H-piles episode, in came the incident of the TBM 'Chandi' hitting a gigantic aquifer at Bowbazar area which caused severe subsidence and resulted in indefinite delay.

On 19th March 2020, ITD-ITD Cementation had stopped tunneling work for a scheduled maintenance of the machine and from then on, the project again came to a grinding halt following the nationwide lockdown inflicted by the COVID-19 epidemic. From 1st July 2020, work resumed, although at a much slower pace. All of these delays contributed to a monumental cost escalation of the project. In 2009, the estimated project cost was ₹ 4,874 crore but the project now faces a more than seventy percent surge to a staggering ₹ 8,574 crore. So far, the project has missed a record six deadlines — 2012, 2015, 2016, 2017, 2019, and 2020 and it is very likely to miss the 2022 deadline as well.

The Path Ahead:

Notwithstanding the several setbacks and delays, this project was neither shelved nor derailed – the present operational stretch is a testimony to the fact. Another feather that was recently added to the cap of KMRC amidst the nationwide saga of lockdown, followed by unlock, was the receipt of CRS clearance of Phoolbagan station on the 17th of June, 2020. Meanwhile, another encouraging development that came to the fore included the resumption of tunneling by the stranded TBM towards Sealdah from the 19th of June, observing all social distancing norms along with other regulations in force due to the outbreak of the COVID-19 pandemic. The construction of Howrah Maidan, Howrah & Sealdah stations also got completed in the meantime. Construction of Mahakaran & Esplanade stations are going-on at war footing. Once the entire route comes to life, this engineering marvel will be showcased forever in the hall of fame, abounding with admiration and glory. All the sacrifices, blood and sweat that went into its making will ultimately give a much-needed respite to the commuters. Life will be transformed and city limits will shrink as more and more people are set to touch the horizon marked with lesser travelling time and immensely comfortable transportation. Eagerly looking forward to the golden days ahead....

Acknowledgements:

1. Kolkata Metro Rail Corporation (KMRC)
2. Metro Railway, Kolkata
3. Hitachi Rail STS
4. Mitsubishi Electric Corporation
5. IRICEN
6. Afcons Infrastructure Ltd.
7. Zhuzhou CRRC Times Electric
8. Railway-technology.com

The Central Park Station *Photo by : Arkopal Sarkar*

Close Encounters of a Rail Kind

First ContACT : 2017 - Diary of a trAnspOrt hObO

A band of rail enthusiasts had been discreetly executing a rather diametrical plan of love for the railways for the last three years minus any publicity or gimmick. This is their story...

ContACT I: Scene I: Days of the Past

As most of us are already aware, the beginning of the railway system in the eastern part of the country has a very interesting twist. E.I.R. (East India Railway) was all set to introduce Railways in India much before G.I.P.R. (Great Indian Peninsula Railway), but the ship carrying the locomotives from England had a mind of its own and veered off towards Australia, instead of coming to Calcutta. As if that delay was not enough, the ship which was carrying the coaches sank at the sandheads near the mouth of river 'Hooghly' at a time when E.I.R.'s venture with railways was already complicated by land issues between Shrirampur and present day Baidyabati along with the area around the French settlement of "Chandernagore". The above three incidents were the chief reasons behind the delay that E.I.R.'s railway business suffered and its projects got delayed by a year and a half as compared to that of G.I.P.R.

However, after much dilly-dallying, the inaugural commercial run happened on 15th August 1854, a date, which, 93 years later, became enormously significant for the whole country owing to a completely different occurrence - the Independence Day. Naturally, for rail enthusiasts from the eastern part of the country, 15th August is an auspicious date not just because it's the day on which India gained her freedom, but also for it being the day on which the first commercial service chugged out of Howrah for Hooghly, which was, for the ensuing fortnight, back in 1854, the northernmost terminal point out of Howrah.

ContACT I: Scene II: The New Millennia

Of late, in the early 2000s, on 15th August(s), E.R. organized steam specials to commemorate the first run from Howrah to Hooghly. However, after 2009, owing to changes in administration as well as

priority, the scheme fell through, although the very existence of railways in the eastern part was all a gradual build up on what had happened on that very day, some 155+ years back.

ContACT I: Scene III: The First Contact

Cut to early July of 2017 when this absenteeism from the railways on 15th August of every year since 2010 became too much of an aberration for a group of infatuated rail fans, who decided to try their luck with the railway authorities to do something about it. Pat came the idea to decorate an E.M.U. rake; and in they went with that and out they came, all victorious. The first contact was established; a tradition was set and it continued for the next few years.

The group was comprised of rail fans from all walks of life. Care was taken to include more of the industrious folks as heaps of work was to be done and as evident in some later editions, work was to be done within a very quick time. The team was made extremely flexible with an open door for anyone who was willing but with a stern unwritten rule that non-performers or trouble makers will not be entertained again and will be shown the same door through which they came in. The group had its fair share of ups and downs while rolling with such open policy, but eventually made it to the summit every year through sheer zeal and love for railways.

There was also a fair share of hurdles as a cocktail of appeasements, personal greed and egos often laid bare their claws on their path; but the longing to do something meaningful always won over lustful and envious hankering! We might indulge in detail about it in our later chapters.

ContACT I: Scene IV: The Anamiks

The interesting thing about this band of rail fans was that that they never had a name; never thought of giving one. Teamwork was paramount and everyone chipped in as and when needed. Naturally, the unity never needed to be named with anything specific. However, for our convenience, let's just call them the "Anamiks" for our benefit!

So, when the "Anamiks" decided to approach the railway authorities back in 2017, they were not sure about the process. The easiest way out was to approach someone they knew and that turned out to be the Station Superintendent of Bandel who was known to them for a beautification project at the station that they had done earlier. The advantage while choosing Bandel was, it has an E.M.U. carshed and historically speaking, is the very next station to Hooghly where the first train's northernmost journey ended in 1854.

Mr. Halder, the Station Superintendent of Bandel was an amicable person - due to retire in about an year's time, and yet, still had an overflowing love towards the railways and was always energetic about doing something new. He introduced the team to the person who was in charge of the E.M.U. carshed at Bandel - the D.E.E. of E.M.U. CS, Bandel, Mr. Das - another wonderfully friendly chap who wholeheartedly supported the cause.

Ideas poured out, plans chalked up, print outs taken and the "Anamiks" were ready to roll.

ContACT I: Scene V: The Schemes

The plan was to divide the 12 coaches according to themes and decorate them at each end wall of the inside of coaches with historical pictures as per the thematic ideas. There were minimal plans for the exterior with only 2 designs of vinyl plates adorning each of the last two coaches of the rake.

After a little discussion, the rake chosen turned out to be a fairly new B.E.M.L. one which arrived in E.R. in 2015 and was one of their mild steel made E.M.U. It had the following composition of coaches (from Howrah end to Bandel end)-

50053, 58036, 53084, 53085, 50052, 58035, 53087, 53088, 50054, 53086, 53083, 50051.

Each of the coaches were then taken up, to be decorated with historical pictures and the varied themes ranged from old pictures of railway stations, locomotives of yesteryears, carriages and wagons of the past era, important historical bridges, pictures of old time tables and tickets, electrification milestones and past signalling systems, narrow gauge of Eastern Railways, various route opening information with specific dates and several other subjects clubbed as miscellaneous.

ContACT I: Scene VI: Volté Face

It was decided that the "Anamiks" would work on the rake from 14th afternoon till as late as possible and then if required, will chip in next morning too. However, an emergency requirement pushed that rake out of the carshed on 14th of August and the team was informed that it will only be back late at night.

It was a rather damp day - more owing to humidity than rain and the "Anamiks" were not really sure what to do. The situation made them sweat even more as the circumstances just threw a complete volté face which required all of their plans - A, B and C to be completely re-written. They gathered in a quick huddle and after a meeting with the D.E.E. of Bandel E.M.U. CS, decided to sweat it out throughout the night to complete the decoration. It was also decided that only the interior work will be taken up at night as the train will be parked outside the shed on tracks which had maintenance platforms.

However, this made the number of members dwindle as most of them were not in a position to stay back among the lonely metal structure homing the MUs. There were few who decided to stay back while the rest decided to be back early next morning. To their comfort, Mr. Das, the D.E.E. of Bandel E.M.U. CS, arranged for sleeping areas for the "night owls" of the team "Anamiks" where they can take a nap if they want to.

ContACT I: Scene VII: Ground Zero - Nowhere - Ground Zero

With the rake pushed out in service, the band of rail fans had nothing to do at the carshed and scampered off to the station building in the evening where Mr. Halder, again offered all possible help by providing them with a room to work and refreshments to zing the energy level up.

The team finished their preliminary work and left to have dinners etc. only to be back at Bandel at around 12 midnight. With the rakes done with the day's work, they were greeted by a plethora of E.M.U.s on all the six platforms barring no. 5 (Bandel has seven platforms but the first two are numbered as 1A and 1B).

The next job was to find a rake which would be the first to go towards the carshed. It turned out to be standing at the opposite track of the same platform on which the "night owls" got down and in no time, the "Anamiks" were at ground zero once again.

ContACT I: Scene VIII: Hoots of the Night Owls

A quick break and a short discussion later, the "night owls" were back at work selecting and segregating pictures as per theme and coach numbers. Although 8 pictures per coach seemed an easy job, with limited hands and no previous expertise, it turned out to be tedious and with a day's sweat behind them, it quickly drained their remaining energy out. A long night later, as the first few rakes were already heading back to another day of grinding on the rails, the work was mostly done with all the posters up in all the coaches. No one knew how much of sweat got unintentionally mixed with the adhesive while putting those posters up, but boy,

they looked impressive!!! The hoots of the "night owls" were almost silent as by daybreak, they were almost running on reserve power. Hunger and thirst were slowly getting the best of them.

ContACT I: Scene IX: D-Day

The rest of the team soon joined the "night owls" and in no time, flowers and vinyls were all ready to be put up on the face and sides of the rake. However, the arrival of the fresh hands brought another important succour for the "night owls" - the much needed breakfast.

Again, putting up flowers on the face of the E.M.U. appeared to be an easy looking job, but soon turned out to be extremely cruel in the hands of the inexperienced. However, toil of a few more hours later, the "Anamiks" were informed of the scheduled departure of the rake from the carshed at around 11:30 for a 12:15 departure. The last bit of the work involved pasting the vinyls on the sides of the end power cars and the team just made it in time for an 11:30 departure.

ContACT I: Scene X: Departure

The rake, rather unusually, pulled in onto platform no. 1 which generally caters to Burdwan and Katwa bound up trains. There was another set of activities on the platform as the officials, including the Station Superintendent Mr. Halder, were present to receive and inspect the work done by the rail nuts. A celebratory cake was cut and after a few photo ops and pleasantries with the Motorman and the Guard among others, the train was ready for departure.

Few of the "Anamiks" were slightly shaken while looking at the screen of their phone which predicted a slightly delayed arrival of the Memari local which was to precede the decorated Bandel Howrah service. However, a little slack before Bandel resulted in its early arrival and bang on time departure; relieving most of the now exhausted rail fans.

Soon the honk announced the official departure and the rake rolled off for its journey to Howrah as 37244 down Bandel Howrah local arriving Howrah at around 13:20 hours after calling at all stations.

The Lost Legend

Indara - Dohrighat MG Route

- Subhadyouti Bose

This story is about the search and journey onboard of one of the last vestiges of Meter Gauge railway in Uttar Pradesh, whose large network once spanned the entire length and breadth of that state. The states of Uttar Pradesh and Bihar used to be connected by a vast network of several MG routes, with MG sheds at various places like Izzatnagar (near Bareilly) in UP, Chapra Kacheri and Narkatiaganj in Bihar, to name just a few. At one point of time, a passenger starting from say, Mathura, in western Uttar Pradesh, could travel all the way to Siliguri in West Bengal, via Lucknow, Gorakhpur and, Muzaffarpur, and even all the way to Assam and the far eastern states. Recent and rapid conversion of Meter Gauge (MG) routes into Broad Gauge (BG) ones have led to a decline and neglect of the MG routes. This created small pockets of standalone, isolated MG routes where the surviving lines were barely clinging on to life, somehow. One of these pockets was in eastern UP, on the Varanasi Gorakhpur BG route that runs via Aunrihar, Mau and Bhatni, which was itself an MG route till the nineties. The MG route in question here starts from Indara Junction and ran upto Dohrighat, situated on the banks of the Ghaghara river. Services first began on this route decades ago while the last train ran on this route on the 1st February, 2018. Thus, this is one of those routes that started more or less at the same time as that of the main line from Varanasi to Gorakhpur. Some trip reports, published online, indicate the presence of steam traction on this route that ran till the late nineties, which was then replaced by a railbus, something that continued till the closure of the line for gauge conversion.

The planning for this trip began about a month prior to the actual date of the trip. It was decided to spend a day at Varanasi for rail fanning with my two railfan friends, Somsubhra Das and Anjan Roy Chowdhury, who joined me at Varanasi from Kolkata. Since it was the month of February, we spent a comfortable day at Varanasi, spotting trains and engaging in other train-related discussions, something that we do quite often. Unfortunately, Somsubhra da and Anjan da had to return back to Kolkata due to some urgent work whereas I decided to continue my journey towards Indara and from there towards Dohrighat on the MG rail bus. From Varanasi, I took the Manduadih Gorakhpur Intercity Express, which reached Indara at around 0830 hours. Back then, Indara was a picturesque station, bereft of the cluttering associated with the catenary jungle that electrification brings with it. After grabbing a quick breakfast, I made my way to the MG platform, situated adjacent to the main BG platform. From here, began my journey onboard the MG railbus till Dohrighat, retracing the route that was traversed by steam engines during better days. The MG platform was empty, awaiting passengers who would arrive by the morning return service from Dohrighat. I utilized this time to explore the surroundings. Parked

Defunct MG Railbus @ Indara Junction

Defunct MG DEMU DMCs coupled together. The Trailer Cars can be seen behind.

under a tin shed was an Ashok Leyland built railbus, YRB 10010, which used to serve this line along with its counterpart, YRB 10009. I was not sure if this particular railbus was awaiting repairs or if it was waiting for eventual condemnation. However, it did not appear the railbus was in need of repairs of any kind. Therefore, a safe assumption can be made regarding its fate. Parked slightly away from the YRB was a MG DEMU rake that also used to run on this route. This rake was manufactured in 2003 by Rail Coach Factory, Kapurthala (RCF), while the traction motor was built by Bharat Heavy Electrical Limited (BHEL). It appeared as if the rake was lying abandoned and waiting to be scrapped. External electrical fitments like engine lights and other equipment looked to have been salvaged, although the headlamp looked intact.

After spending a good amount of time photographing the railbus and DEMU rake, I realized it was almost time for the service from Dohrighat to reach Indara. Consequently, I positioned myself at such a location from where I could capture the existing rake as well as the defunct rakes together. By now, it was 0930 hours and I was able to spot something bluish approaching the MG platform from a distance. Within a few moments, I was able to identify what was coming towards me, the Dohrighat Indara MG DEMU service. Judging by the large crowd that got down at Indara, one could make a fairly educated guess regarding its high demand in this short route of 35 kilometers. I boarded the train and deposited my luggage in the luggage rack above the seats and got down to check on a train that had stopped in the BG platform. The train that had arrived on the BG platform was the Varanasi City bound Krishak Express from Lucknow, headed by a Gonda shed based ALCo locomotive. A large number of passengers who got down from Krishak boarded the DEMU. Now, the DEMU appeared to have a good number of passengers and the scheduled time of its departure was minutes away. At around 1020 hours, a loud honk was sounded and the DEMU lurched forward and began its 35-kilometer journey towards Dohrighat, something that is covered in around 90 minutes. I managed to pick a window seat for me which allowed me to take some interesting snaps along the way and also observe the local people who were boarding and deboarding at the intermediate stations along the way.

Between Indara and Dohrighat, there are four stations, including a

Perfect Framing

Indara-Dohrighat MG DEMU

The mid-morning service from Indara to Dohrighat is ready for departure

Lonely, derelict and possibly abandoned, MG railbus rakes parked at Indara junction

Kopaganj Station

small passenger halt. The first stoppage after Indara is Kopaganj, 6 kilometers from Indara. The DEMU took a leisurely 25 minutes to cover this distance, following which many passengers boarded the train. At the time of traveling on this route, this was a four coach DEMU rake, which was sufficient given the passenger load on this route. Nearly everybody was seated comfortably, although some chose to stand by the door, enjoying the crisp winter air outside. Moreover, since multiple services used to run between Indara and Dohrighat, the coaches never used to get too crowded, as we are used to seeing on mainline sections. Apart from the 1010 service, which I took, three other services operated, starting at 0615 in the morning from Indara.

After leaving Kopaganj, rural scenes were quite abundant now. Agricultural fields, houses built of mud, and normal village folk going about their normal daily businesses were visible from the window now. For a city dweller like me, these scenes are quite hard to come by, which makes me travel more and more into the great Indian heartland and explore the countryside through my own eyes. The next stop was Ghosi, 11 kilometers from Kopaganj. A local vendor had boarded from Kopaganj, selling some delicious boiled chickpeas, an all-time favourite snack people consume in trains, buses and roadsides throughout the country. Unable to resist, I bought a pack for me and started munching on them as we trundled towards Ghosi. Numerous thoughts were drifting around my mind at this point of time. The foremost being the loss of novelty of this route after gauge conversion. It is highly unlikely the railways will allot another railbus on this route and it is very likely that services may soon resume with conventional coaches as soon as the gauge is converted. With my head getting clouded with these thoughts, I suddenly realized that the tiny DEMU had now picked up some speed after leaving Kopaganj. Once Ghosi arrived, the same situation, as seen at Kopaganj, prevailed here. Quite a few people got down and a considerable number of fresh people boarded the train from here to travel the short distance to Dohrighat. In the meanwhile, I spotted a tea seller at the station and asked him to give me a cup of tea. As soon as I handed him a ten rupee note, the train started moving forward. I gulped the sugary tea quickly before it got cold.

The next stoppage after Ghosi was Amila, 7 kilometers further down the line. The final destination was much closer now. Just a small halt after Amila and Dohrighat was within reach. By now, we were delayed by around 40 minutes, although none onboard seemed to mind this fact. Most were concerned about reaching their destinations and therefore most people are used to delays like these! Once Amila arrived, a majority of the people got down and only a fraction of people got onboard from here. The remaining people were busy preparing to get down at Dohrighat, rearranging their entire luggage, while some woke up from their almost noon-time siesta. While I was busy observing all this activity inside the compartment, I saw a small boy was looking at me. I engaged in a small discussion with him and asked where he was headed. His reply, "*aakhri* station", which meant the terminal halt for this route.

Just one tiny passenger halt now remained between Amila and Dohrighat. Muradpur halt, located just 3 kilometers from Amila, was a very small, blink-and-you-miss-it sort of station. The 'platform' at Muradpur halt, if it can be called a platform, was a

Ghosi Station

The Childhood dreams....

ground level grassy patch where a handful of people got down. As the train departed from Muradpur, I began preparing myself mentally about the end of a journey that was just minutes away now. I kept wondering how many days would this small section be kept alive before all the MG tracks are uprooted to make way for new BG tracks, along with a proposed extension of this line from Dohrighat to Sahjanwa, located near Gorakhpur. Unfortunately, my fears were not unfounded, as I soon realized that the small MG tracks closed down for conversion to BG, exactly a year after I travelled on this route. I had asked a few railway officials if they had any news regarding the impending gauge conversion and the closure of this line at Indara before the train departed. They could not tell me anything for sure, but they did tell me that the line won't last more than 12 months, at most. Not surprisingly, their prophecy did come true on 1st February, 2018, when the line closed down for good. It is anybody's guess regarding the fate of the rolling stock that was used on this route. Either they have been scrapped by now or they are waiting to be cut open after being sold in a scrap auction, not a very happy thought for a rail fan like me!

By now Dohrighat was not out of bounds and most of the passengers had already left their seats and were waiting at the doors to disembark from the train. I could now see the platform at Dohrighat was buzzing with a crowd, waiting to board the service back to Indara, scheduled to leave at 1150. However, by the time the train came to a halt at Dohrighat, it was around 1210, which meant a delayed arrival of nearly 30 minutes. Consequently, the return service was also delayed by a similar quantum of time. As soon as all the passengers got down from the train, there was a scramble for seats by the new set of passengers. However, most of the new passengers quickly settled down and almost everybody had found a place for them to sit. The solitary platform at Dohrighat really comes alive when the service from Indara pulls in at the station. Sometimes, some vendors come and sell some snack items to the waiting passengers. But as soon as a train leaves for Indara, the station premises become desolate, awaiting passengers and the associated commotion, once more. I, too, got down and took some final pictures before the train left. The train did not wait for more than 5 minutes at the platform. At 1215, a customary honk was sounded and the train started its journey towards Indara. However, I saw a lady running on the platform, in an apparent bid to catch the train. The guard saw the woman running towards the train and asked the loco pilot via walkie talkie to stop the train. The train departed only after the woman got onboard.

Nobody is left behind

I made my way out of the small station and enquired around a bit to find out where the bus stand was. From here, my plan was to travel by road to Gorakhpur and take the Maurya Express the next day to Ranchi. During my walk to the bus stand, I understood the importance of these small, short distance routes for the local people and how much they depend on these. Many poor labourers are unable to afford the bus fare to big cities from small towns like Dohrighat and are therefore completely dependent on the MG DEMU service that shuttles four times a day between Indara and Dohrighat. It was also apparent to me that this train is the lifeline of the villagers who live in and around the route and travel on a daily basis to make a living.

Dohrighat

MG DEMU @ Dohrighat

NORTH-EAST CALLING...

Here is a Photo-Story of three friends embarking on a journey full of hues and shades to the easternmost corner of the country on a colourful train passing over towering viaducts and thrilling tunnels negotiating huge curves. Mesmerizing views are sure to tantalise your senses as the train cruises through an abundance of magnificent splendour and dramatic grandeur that nature offers here.... Some breath-taking snaps depicting the virgin beauty of the North-East, coupled with an eloquent narrative are sure to enthral you and take you to the lap of mother nature – far away from the hustle and bustle of a monotonous city life....

Well, I really don't know where to start from! After going through a number of coverages on the beauty of the Lumding – Badarpur Hill section of the Northeast Frontier Railway in Assam, Sohan had been discussing possibilities with me to get the tour done. After a lot of adjustments and delays, we three (Sohan, Shivam and myself) managed to finalise it in late October, 2019.

A rained-out onward journey

From the evening of 23rd October, it was raining incessantly all-over Eastern India, as a result of which our journey in 13173 Sealdah – Agartala Kanchanjungha Express was mostly ruined. Given the dynamics of extension and further extension of this train, they should consider renaming it as 'Extension Express' – initially till New Jalpaiguri, then to Guwahati and now running up to Silchar (tri-weekly) and Agartala (the four remaining days). The Agartala counterpart is further getting extended to Sabroom (Myanmar border) while we are looking forward to the Silchar counterpart for getting farther extended to Imphal once the section gets completed.

For the better part of the 1550 km journey, we were under a blanket of rains (for over 1,000 km) – mostly in Southern Bengal and again after crossing Bongaigaon – all the way until Karimganj. Therefore, the entire scenic stretch was completely marred due to relentless precipitation – but for some engaging snaps of the crossing with 12504 Agartala – Bangalore Humsafar Express at New Haflong headed by a Tri-coloured NGC WDP4D....

Thus, the return journey gave us the only option to accomplish the desire of some satisfying lens works.

A thrilling ride back

In Agartala, we stayed near the Tripura Medical College, in the Southern fringes of the state capital of Tripura. Honestly speaking, Agartala didn't seem like a state capital. We didn't want to risk ourselves by hiring an auto in advance since the station was barely 2 km away from our hotel. On the dawn of 29th at around 4:15, we started walking towards the station. Three young men with rucksacks, walking along a dimly lit road, was an interesting scene! After covering a few hundred metres, we found a thin and a very bleak looking man standing with his mobile torch on – seemingly waiting for something. The moment we passed him, that suspicious figure started following us. We were a bit sceptical and escalated our steps. He trailed us for nearly 500 metres until we reached the three-point crossing in front of the ONGC quarters. He simply vanished as we looked back. It was around 4:30 am and we already had covered a kilometre in about 10 minutes, thanks to him!

Now there were two ways to the station – the illuminated main road for vehicles, around 2 kilometres. The other one was a semi dark walkway through residential areas near the ONGC quarters, which was less than a kilometre. We chose the risky option. Walking though courtyards and gardens, we were in front of the station within 4:45 am.

Our 12504 Humsafar Express was already shunted on platform 2, the locomotive in-charge was palindrome numbered New Guwahati (NGC) WDP4D 40604. We got into our coach B5 with almost no co-passengers from the source station. At 05:17 am, we heard a loud honk and felt a jolt – the journey to home had begun.

As soon as it left Agartala, the train picked up speed while cruising past a fog engulfed northern Tripura.

Ambassa and Dharmanagar were crossed almost at their scheduled time slots. Food from the train's pantry car was decent. We reached New Karimganj Junction well ahead of scheduled time. Our co-passengers boarded there. We sneaked into Badarpur Junction well ahead of time. A WDG4D of New Guwahati was attached as a banker here. We departed on schedule, sharp at 10:20 am.

Moments after that, we took our positions at doors of two different coaches. Sohan took the rear doors of our B5 and I took the front doors of B7, while Shivam remained seated in the coach to keep an eye on the luggage, though he could enjoy the mesmerising scenes outside from the window. The quaint rail track passes through some of the most picturesque spots as it winds it way through the foothills of the Himalayas.

The next two hours were like moments in heaven - the rivers, viaducts, bridges and what not as this route takes you through delightful Purvanchal hills...

The green valleys and hills presented a pleasing spectacle of exquisite charm !!!

Moving along, we were halted for a crossing with the 55615 Guwahati – Silchar Fast Passenger at Bandarkhal for about 20-25 minutes, which resulted in a slightly delayed arrival at the next halt, New Haflong.

It was 12:18 pm when we sneaked into New Haflong, delayed by 8 minutes. We had to wait for the Silchar bound 13175 Kanchanjungha Express from Sealdah which arrived with a NGC WDP4D in lead and a Malda WDM3A as a banker. I and Sohan got off and climbed the foot over bridge to get some satisfying clicks of that beautiful setup. I was still on the bridge and Sohan went down the other platform.

To our bewildering surprise, the starter for our train flashed and the train started lurching forward at 12:22 pm – far ahead of our assumptions. I was confused whether to rush and board the running train or wait for Sohan! Then I could see him scampering back madly to catch up, hence I too did the same. We managed to board the crawling train just after it departed.

After that, I kept mostly confined to my seat while Sohan was still busy clicking the grandeurs outside. Flanked by hills on both sides, the rail line, like twin threads of silver, clings on to the steep cliffs and ventures boldly over bridges, built over streams or ridges, while the sun plays hide and seek. The captivating charm and the pervasive beauty of the floras and the forests enroute cast a spell that spins a web of eternal bliss which yarns a treasure trove of fond memories to rejoice forever.....

Meanwhile, our train was getting detained for trailing behind the 55616 Silchar – Guwahati Fast Passenger which was acting like a hurdle to our clear passage. We finally manged to get rid of it at Mupa - 44 km ahead of New Haflong. As we joined the mainline, our railfan friend Subhadeep Das from Lumding waved at us....

I dozed off a bit as we arrived at Guwahati sometime around 6:30 pm, almost an hour ahead of schedule. Shivam and Sohan went outside looking for sustenance and bought some delicious Chinese food to devour on. With nothing to fathom about as darkness had already descended in these parts of the nation, we decided to switch over to the slumber mode.

We crossed almost all halts in scheduled timings at night. We woke up next morning to find ourselves arriving at Malda Town, half an hour ahead of schedule. After that we had a superb run till Howrah, arriving almost on time. Our ways fell apart as headed for our home sweet home....

NFR has always had a special bond with me and it was no surprise that this journey was one of my finest, and most satisfying till date!

- Sambit Chatterjee

Silver Jubilee of MEMU Service

- Arkopal Sarkar

Railways have been a facet of many told and untold stories. It has fascinated filmmakers, authors and children over ages. Most of us always visualize a locomotive while discussing trains and tend to get oblivious about the concept of Self-Propelled Multiple Unit trains. While the introduction of EMU services over 95 years ago had changed the face of urban rail transit across the nation, the other avatar of the Self-Propelled Multiple Unit trains – MEMU has also grown in stature over years and has already served the country for more than 25 years.

The concept of EMU/MEMU has its roots to the fact that faster transit for short distances would benefit the masses in the long run. The several factors that attributed to the cause include advantages like Higher acceleration, Regenerative braking on multiple axles at once, Faster braking, Reduced axle loads, Lower structure and maintenance costs, Higher seating capacity among others. But the most crucial factor that played part behind its phenomenal success was doing away with the requirement of a dedicated locomotive on permanent basis.

EMU trainsets meant for shorter distance; city based suburban travel with the permissible distance limited to 150 Km. But as the nation grew in numbers with time, new challenges in the form of new demands came up. That's when the Indian Railways tried to invoke the concept Self-Propelled train in Non-Suburban Sectors and the answer was MEMU (Mainline Electric Multiple Unit). It's a kind of trainset which connects urban and suburban areas with the city, breaking the distance barrier. MEMU burst into the scene in 1994 when ICF rolled out a first of its kind.

Rake Specifications and Compositions:

The rakes have 10' 8" wide coaches. MEMU moved out of the shadow the EMU with some very useful modifications like wider coaches with higher roofs, vendor equipped coaches throughout, higher seating capacity with wider passages, vestibule rake with a higher door count for quicker movement. MEMUs have also evolved over time as they are now provided with Toilet facility & Air Suspension Brake in bogies for a smoother, jerk free and comfortable ride.

Formation of MEMU rake usually comes in 8 CAR (2Motor Units + 6 Trailer Coaches) which may be increased in 12 CAR, 15 CAR and 20 CAR formations as well. Presently a 20 CAR MEMU is in service in Virar-Bharauch section of WR.

:: The ER Story ::

On 11thJuly 1994, the first MEMU service was started between Asansol and Bardhaman (105 KM) in Eastern Railway after inauguration by Mr. Ashok Kumar Bhatnagar, the then Chairman of Railway Board. The Asansol MEMU Carshed happens to be the first official MEMU Carshed of India which also holds the distinction of

The Longest Running MEMU (ASN-BSB) *Photo by Somsubhra Das*

A decorated MEMU on the occasion of Silver Jubilee Celebration *Photo by author*

operating the Longest Distance covering MEMU of the nation – the Asansol-Varanasi MEMU which charts nearly 481 Km. with 82 scheduled stoppages.

Earlier, only (TI) trip inspection of MEMUs was done at old coaching complex, Asansol and major inspection (IA) & heavy lifting were done at EMU car shed, Howrah – back then each rake had 8 coaches. The first rake that was manufactured by ICF, Chennai had **21000** and **21001** as Motor Units (MCs) while **22000, 22001, 22002, 22003, 22004** and **22005** were the Trailer Coaches (TCs). It was received by the Howrah TRS on 7th July 1994.

Symphony of Progress:

Gradually, as the MEMU services were beginning to hit the popularity charts in the Bardhaman-Asansol section, the Asansol MEMU Shed got established on the 29th of June, 1999. The journey of TRS Asansol started with 30 number of MCs and 90 number of TCs. Limited maintenance facilities though did not deter it from holding of 79 MCs and 239 TCs against an installed capacity of 45 MCs & 135 TCs at present. With 23 rakes of 12 CAR and 5 rakes of 8 CAR been carved out of the present holding, Asansol MEMU Shed amasses as many as 108 link services catering over the Eastern, East Central, South Eastern & the Northern Railway.

The very first rake **21000-21001** has retired from service in 2019. The first motor coach along with one trailer coach have been converted into a Restaurant at the premises of Asansol Railway station, which is better known as a ***Restaurant On Wheels*** of Indian Railways. The restaurant is named 'Wow Bhojan' (Motor Coach) while the tea boutique developed has been named as 'Chai-Chun'.

On the auspicious occasion of Silver Jubilee of ASN-BWN MEMU Service, a brand new RCF rake "198300-198209-198299" with state-of-the-art hygienic bio-toilet which included Mirrors and Vinyl wrapping on the inside and outside of toilet, Air suspension, and Mobile charging points, was inaugurated by the DRM of Asansol on 11th July 2019. That MEMU ran as the 1610 hours Asansol-Bardhaman service.

With the passage of time, Asansol TRS has also started

Asansol - Dhanbad MEMU service *Photo by Somsubhra Das*

A 16-car MEMU Rake *Photo by Rudranil Roy Chowdhury*

Unique livery !!! An SER based MEMU *Photo by Somsubhra Das*

MEMU in 'Utkrisht' Avatar *Photo by Subhadyouti Bose*

:: Chronological history of introduction of MEMU services in ER ::

- **11.07.1994** :: First MEMU service of the nation was inaugurated by ER between Burdwan and Asansol
- **07.06.1997** :: Purilia-Burdwan MEMU Service introduced (reversal at Adra)
- **29.06.1999** :: Asansol Carshed inaugurated
- **2003** :: Introduction of Asansol Jasidih MEMU service
- **03.10.2011** :: Asansol-Ranchi MEMU service introduced
- **15.12.2011** :: Ranaghat MEMU Carshed inaugurated
- **16.01.2012** :: First MEMU Rake arrived at Ranaghat carshed
- **19.02.2012** :: First ever MEMU service over Sealdah and Lalgola commissioned
- **16.05.2016** :: ER inaugurates the longest distance covering MEMU service of the nation between Asansol and Varanasi – a distance of 481 km with 82 scheduled stops.
- **21.09.2018** :: Introduction of Bardhaman-Hatia MEMU service
- **11.07.2019** :: Conversion of Sealdah/Ranaghat - Lalgola EMU into MEMU service

:: Chronological history of introduction of MEMU services in SER ::

- **15.07.1995** :: First MEMU service of South-eastern Railway between Asansol and Adra was inaugurated.
- **22.07.1995** :: MEMU service over Kharagpur and Tata introduced
- **01.10.1996** :: Howrah-Kharagpur-Tata-Adra MEMU Service introduced
- **18.10.1998** :: Adra-Bankura MEMU Service introduced
- **30.06.2000** :: MEMU service over Bankura and Howrah introduced
- **02.10.2000** :: Bankura-Howrah MEMU extended to Adra
- **15.03.2001** :: Adra-Purulia service introduced
- **26.01.2003** :: Extention of Asansol-Adra-Purulia MEMU service to Bokaro Steel City via Muri junction
- **10.02.2003** :: Tata-Chandil-Muri-Hatia MEMU Passenger introduced
- **01.01.2004** :: Adra-Vishnupur, Adra-Bhojudih, Adra-Purulia, Adra-Midnapur MEMU passenger introduced
- **31.03.2004** :: Adra-Bhaga, Bhojudih-Chandrapura, Bhojudih-Bhaga MEMU passenger introduced
- **22.10.2005** :: Inauguration of Kharagpur MEMU Carshed
- **15.05.2006** :: Howrah-Kharagpur-Bhadrak MEMU introduced
- **14.02.2009** :: MEMU service over Bankura & Bhojudih started
- **01.03.2009** :: Santragachi-Jhargram MEMU introduced
- **13.02.2010** :: Midnapur-Jhargram 'Jangal Mahal' MEMU service inaugurated
- **13.04.2009** :: Kharagpur-Baleswar MEMU introduced
- **14.06.2010** :: Gokulpur-Joychandipahar MEMU service started
- **31.03.2011** :: MEMU service over Howrah and Ghatshila introduced
- **17.05.2011** :: New MEMU service between Kharagpur-Tatanagar-Dhanbad via Jhargram-Purulia-Bokaro-Chandrapura started
- **20.02.2012** :: Kharagpur-Midnapur-Jhargram-Purulia MEMU introduced
- **16.09.2012** :: Extension of Gokulnagar MEMU upto Moynapur (ER Section)
- **19.11.2018** :: Introduction of the first 12-CAR MEMU service between Kharagpur & Ranchi under KGP Carshed
- **06.06.2019** :: Conversion of Kharagpur-Asansol & Adra-Barkakana Passenger into MEMU
- **13.08.2019** :: Resumption of MEMU service in Tata-Ranchi section with the introduction of a MEMU service in Hatia-Rourkela section
- **11.09.2019** :: Conversion of Kharagpur-Adra-Gomoh passenger into MEMU service
- **25.10.2019** :: Introduction of MEMU service in Ranchi-Lohardaga-Tori section

Old SER Livery of MEMU *Photo by Somsubhra Das*

Howrah - Midnapur MEMU *Photo by Somsubhra Das*

refurbishment of its old MEMU rakes. An old 12 CAR ICF MEMU Rake "21019-21014-25008" was remodelled with modern facilities and 2 toilet-fitted coaches which was later inaugurated by the DRM in 2019. 80% MEMU rakes of Asansol has now been equipped and upgraded with cushion seats and modified interiors along with toilet facilities in every coach.

:: The SER Saga ::

If Eastern Railway showed the way, then how can South Eastern Railway (SER) be left far behind! SER followed suit the following year and established itself as the second corridor of MEMU service.

15th July, 2020 marked as the Silver Jubilee of MEMU services in SER. The Asansol-Adra section is accredited with the inaugural MEMU service across SER on 15.07.1995. The first ICF MEMU Rake for S.E.R. (20000-20001), commissioned by the Tikiapara EMU CS, had done the honours then. The rake had **20000** and **20001** as Motor Units. Trailer Coaches included **21000, 21001, 21002, 21003, 21004 and 21005.**

In SER also, MEMU rakes are mostly of 8 CAR formations, while a few were made into 12 CAR consists after the extension of MEMU Traffic under "Mission Rafter Project" in 2019. It consists of two units – each comprising of one driving motor coach and three trailer coaches, i.e., 1 unit = 1 MC + 3 TCs.

Kharagpur Carshed specializes in maintaining MEMU rakes and it was proposed to be constructed at an anticipated cost of 11.02 crore INR for 15 rakes in Final Works Programme of 1996-97. The shed was set up to compensate the over-loading of EMU Carshed Tikiapara due to the ever-increasing fleet of suburban services. It started functioning w.e.f. 22.10.2005 with regular maintenance activities commencing from July 2008.

The first generation MEMUs were not equipped with toilet facilities which has now revolutionized MEMU services in the country. Kharagpur MEMU Carshed was pioneer in introducing Toilet facilities in MEMUs as a Pilot Project which was later approved and accepted by the Rail Board which ultimately rubbed off on other zones thereby resulting in gradual retrofitting of toilet facilities in all MEMUs. Now, all RCF manufactured MEMU rakes come with modern Bio-toilet facility.

The success story of MEMUs have changed the vision of the Railway Board as more and more passenger trains with ICF coaches are getting converted to MEMUs. With the crucial aspect of 'no requisito' of a dedicated locomotive and its reversals along with the introduction of Toilet facilities, non-suburban travel has changed forever and changed for good.

And the journey continues.... *Photo by Somsubhra Das*

Moving the Wheels from the Desk

A brief overview of 3 phase propulsion system

- Anamitra Bose

"Your attention please, train number 12301 Howrah-New Delhi Rajdhani Express will depart from platform number 9 at 16:55 hours!" Imagine being onboard the train that day and at the scheduled time, a white WAP7 locomotive honks to announce its departure and gradually the train moves out of Howrah to negotiate the turnouts and accelerate smoothly towards the Howrah-Barddhaman chord section. In the cab of the locomotive, the experienced loco pilot is gradually moving towards the Maximum Permissible Speed (MPS) of the section by a gentle push on the throttle handle.

Cut to scene 2, where you are standing at a scenic station, in the iron-ore rich area of Odisha. A VSKP WAG9 pair is starting to accelerate with a fully loaded BOYEL rake with all its effort. They start effortlessly and gradually accelerate with their heavy load and clear the section.

We often get mesmerized looking at the amazing acceleration and heavy load hauling capacity of these modern three phase beasts. But have you ever wondered what makes these machines such efficient, fast and easy for the crew than their predecessors ? Yes, you have guessed it right - it's the 3 phase AC propulsion system built in their machine rooms.

The 3 phase AC drive system, i.e., the propulsion system is like a human body; it has a brain, heart and limbs. Here, the software acts as the brain, viz. VCU (Vehicle Control Unit), the lungs are the transformer and, the heart is the hardware unit, viz. the traction converter, auxiliary converter and in some cases, the hotel load converter and the limbs are traction motors, bogies and wheelsets.

Let us start with the heart, i.e., the hardware part of the AC drive system, which is the main force driving the wheels on the rails with thousands of tonnes of load. Like many compartments of the heart, it consists of different converters for different purposes. Now, what is a converter? A converter is an electrical equipment which takes the voltage from secondary winding as input and gives voltages as required, as its output. The converter which is directly associated for moving the wheels, i.e., powering the traction motors, as the name suggests, is a traction converter. The converters that run the ancillary and auxiliary equipments in the locomotive like blowers, lights, battery charger is an auxiliary converter. And in locos like WAP7, the converter which powers the hotel load demand by the coaches for lights, AC without using the EOG, is the hotel load converter.

Traction Converter

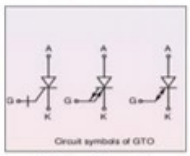
In the modern three phase locomotives, three phase asynchronous motors are used widely for their high efficiency, easy control, low maintenance cost and regenerative capability. Locomotive classes like WAP5, WAP7 and WAG9 use three phase asynchronous squirrel cage induction motors. To control the speed, both traction and braking effort of the traction motors can be controlled by varying the voltage and frequency of three phase AC voltage. To derive this requirement from single phase 50 Hz AC output from the secondary winding of the main transformer, we need traction converters.

The fundamental limitation of three phase induction motors is

Traction Converter *Photographed by author*

their inability to start with a huge load from rest. This is due to the inability of supplying high torque at a fixed frequency. This was solved with the advent of modern power electronics modules like Gate Turn-off Thyristor (GTO) and Insulated Gate Bipolar Transistor (IGBT). The frequency of output voltage to traction motors is lowered in order to maximise the rotor torque at the initial stage, following which, frequency is increased gradually to allow the locomotive to accelerate rapidly. The amplitude is also adjusted simultaneously to maintain constant torque at the rotor. This technology of varying both frequency and voltage of output of the converter to feed the traction motors is known as Variable Voltage Variable Frequency (VVVF) drive.

Before getting to know about the details of a traction converter, we should know a bit about the power electronics devices, i.e., GTO, IGBT, SiC etc. As conventional locomotives had tap changers, chopper controls and thyristors later on, the basic unit of converter units is a power device like GTO/IGBT. GTO is a fully controlled bipolar semiconductor device. A fully controlled GTO means that it can be turned on or off by adjusting the gate current. GTO requires a quite high negative gate current to turn off the device.



GTO Circuit Symbols

IGBT is a modern power device which has an excess minority carrier region, to decrease the ON resistance, thereby reducing transition loss. It has minimum power loss but a little greater switching time during turning off. IGBT is mostly preferred now over GTO in all converter applications for its easy driving and better controllability.

IGBT Circuit Symbols

Now coming back to converter, a traction converter has three main stages: input stage or Line Converter (NSR), intermediate stage or DC link, output stage or Drive Converter (ASR).

Line Converter: It takes input from the secondary winding of the main transformer as constant frequency single phase AC input and converts it into a constant DC link voltage of about 2180V. Since it is a 4 quadrant PWM converter with GTO or IGBT, it has almost a unity power factor and therefore, a snubber circuit is not required.

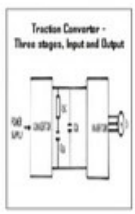
DC link stage: This stage has a filter circuit to remove unwanted second-order harmonics and then a DC link capacitor in the middle for handling the high DC link voltage and also for providing constant DC in case of momentary power failure at the input side. It supplies reactive power to the induction motors. There is also an over-voltage protection unit.

Drive converter: It is a single-source voltage inverter that converts the DC link voltage into three phase voltage with variable frequency and variable amplitude. Hence, it is a VVVF converter that drives the traction motors. The voltage can be varied from 0 to 2180V and the frequency from 0 to 160 Hz. The firing of the GTOs and control of IGBTs is done by control electronics.

During braking effort, the traction motors act as induction generators by controlling output frequency through negative slip value. The 3 phase power generated is converted to single phase AC through the DC link and then fed to the catenary. This is efficiently done by the converter and thereby acting as a voltage stabiliser.

To control the speed of the locomotive, the tractive and braking efforts need to be adjusted accordingly by varying the voltage and frequency of the traction motor, which is efficiently done by the traction converter.

Now all new locomotives are being equipped with IGBT based converters instead of the old GTO technology. The main advantage of IGBT based propulsion is individual control of every traction motor, leading to higher adhesion and reliability. Also, IGBT leads to reduction in space, snubber circuits and switching losses.



Auxiliary Converter

Another compartment of the locomotive's heart is the Auxiliary converter. The main aim of the traction converter is to drive the traction motors, but for the other requirements of the locomotive like air compressor, blowers, lights etc., the purpose is served by the Auxiliary converter. The Auxiliary converter is fed by the Auxiliary winding from the main transformer. It has a configuration similar to that of a converter, uses a DC link capacitor and an inverter to feed the load. There are three Auxiliary converters in three phase locomotives, designated by BUR1, BUR2 and, BUR3.

BUR1 is placed in a separate cubicle and supplies 110V three phase voltages to mainly oil cooler blowers. BUR2 and BUR3 are integrated in a separated cubicle and oil pumps for both converter and traction motor work due to BUR2. The scavenge blowers are connected to BUR3.

HOG Ports of WAP-7 Locomotive *Photo by Somsubhra Das*

HLC (Non-HOG) Ports of WAP-5 Locomotive *Photographed by author*

In addition to this, cab ACs, compressors and battery chargers are also fed by Auxiliary Converters. There is a separate auxiliary winding for supplying 415V/110V AC single phase voltage to machine room blowers, cab heaters, cab lights and fans.

Hotel Load Converter

This part of the locomotive's heart is exclusively for WAP7 locomotives. This special converter supplies power to the coaches for AC, lights, fans and pantry cars for heaters, refrigerator etc. In the initial stages of HOG implementation, a single 750V hotel load winding was provided in the main transformer. It was converted from single phase 750V AC to three phase 750V AC for hotel load requirement by the coaches, by 2 X 500 KVA IGBT converters, called Hotel Load converters. But, it suffered from high voltage spikes, and had a presence of a lot of harmonics. This damaged the transformer in EOG and other accessory elements.

Later, the HOG locos were supplied with modified transformer with two separate windings in the secondary side for two Hotel Load Converters. These Hotel load windings were 2 x 622.5 KVA, 960V and the transformer is known as LOT7775, instead of the previous LOT7500 transformer. The two separate windings fed two Hotel load converters to produce 750V 3-phase AC output for the Hotel load. In this modification, the voltage spikes were greatly reduced and an external filter circuit has been provided to absorb the harmonics. HOG facility has proved to be a major success behind the IGBT based locomotives and also reduced the operating costs due to reduced usage of diesel-run generator sets to power the AC coaches and pantry cars.

Composite Converter

This type of IGBT converter has recently been used in WAP5 type of locomotives, mainly due to lack of availability of space for separate Hotel Load converters. This type of converter has two line converters, two DC link capacitors and, two drive converters, one for each bogie. In addition to that, it had a Hotel Load converter fed by the Hotel Load winding from the transformer. Thus, the traction and Hotel Load, both were derived from a single converter unit, thereby naming it as a composite converter. It was fit into a GTO-type converter cubicle.

The older generation WAP5 engines also had a provision for Hotel Load with Hotel Load Couplers (HLC) in front, but it was only the output from 750V single phase winding of the main transformer, deeming it unfit for use on both ICF and LHB non-self generating coaches.

Now, after going through the heart of the locomotive, let's go for a tour of the brain of the locomotive, i.e., the microprocessor, control electronics and software used for running the locomotive.

The VVVF converter and 4-quadrant converter, if wired by hardware, would be very complicated. Therefore, the engine uses MICAS-S2 (Micro Computer Automation System-Series-2) type of microprocessor to control the converter units, traction motors, monitor the loco and enable fault diagnosis.

MICAS-S2 control electronics control all the essential functions of the locomotives. It is in the form of bus stations and processors. Microprocessors are adapted as hardware optimization tool. The remote arrangement of computers for control electronics means that a limited amount of wiring is required for control signals.

MICAS-S2 control system has three layers - Train Bus, MICAS Vehicle bus and, Drive Control Bus. The Train Control Bus communicates between different Multiple Units (MU) and controls the braking system. The MICAS Vehicle Bus controls the converter units, diagnoses the faults and, monitors the overall condition of the locomotive. The Drive Unit controls the converters and traction motors.

The demand from drivers' cab for speed, i.e., traction and braking, is efficiently calculated by the onboard control electronics and communicated to the traction converter through the vehicle bus. The control electronics and main hardware are connected via optical fibre bus. These are resistant to electromagnetic interference. The control electronics is based on microprocessors

Driver's Display Unit of a 3-phase Locomotive *Photo by Somsubhra Das*

Hardware specs of a WAP-7 locomotive *Photo by Somsubhra Das*

connected to each other by MICAS vehicle bus. Each loco (vehicle) contains a Vehicle Control Unit (FLG) & each converter contains a converter bus station. The converter bus station contains the Converter Control Unit (SLG) and Drive Control Unit (ALG). The ALG contains both line and motor converter control units.

Depending on the speed requirement from the cab, the FLG calculates required braking or tractive effort and sends it to the SLG. The SLG compares this value with the actual torque value from the ALG and thus, the required torque is calculated from a difference of the two. The ALG generates required firing pulses and turn-off pulses for the GTO. These are communicated through bus to the Gate Units. The line converter is also controlled by ALG and maintains a constant DC voltage.

In the newer three phase locos, due to the obsolescence of MICAS based proprietary loco control, an indigenous VCU based on the TCN (Train Control Network) Protocol was developed by CDAC (Centre for Development of Advanced Computing), Ministry of Electronics and IT, GOI under Make In India special scheme called NamPET. It uses international standard communication Protocol

Driving Panel of a 3-phase Locomotive *Photo by Somsubhra Das*

IEC-61375. Here, the Train bus is known as the Wired Train Bus (WTB), while the Vehicle Bus uses the international bus standard called Multifunctional Vehicle Bus (MVB) and Controller Area Network (CAN) between the digital/analog cards. The Driver Display Unit (DDU) communicates with the MVB with the help of a main host called MVB administrator using the RS232 network. The cards, inputs and, outputs to other controllers are controlled by two application-specific processors. The entire control electronics is based on QNX Real-Time Operating System (RTOS). CDAC VCUs can be easily tested on a test bench in an ELS, and simulated using a 3-phase Loco Simulator anywhere. MICAS-based locos are also gradually upgraded to CDAC TCN VCU for greater reliability and control.

The integration of advanced traction drive with microprocessor and software control system is a major breakthrough not only in three phase electric locomotives, but also in three phase EMUs. This 3 phase AC propulsion system has taken Indian Railways traction outlook into a new horizon of higher torque, speed and efficiency, in lieu of low costs, low space requirement and low maintenance.

Acknowledgements

1) Handbook on Three Phase Technology by IR, IRIEE: Nasik.
2) WAG9 driver manual, CLW.
3) Fundamentals of Power Electronics, Springer E-book (Picture courtesy).
4) NPTEL Course on Advanced Power Electronics and Control, IIT Roorkee.

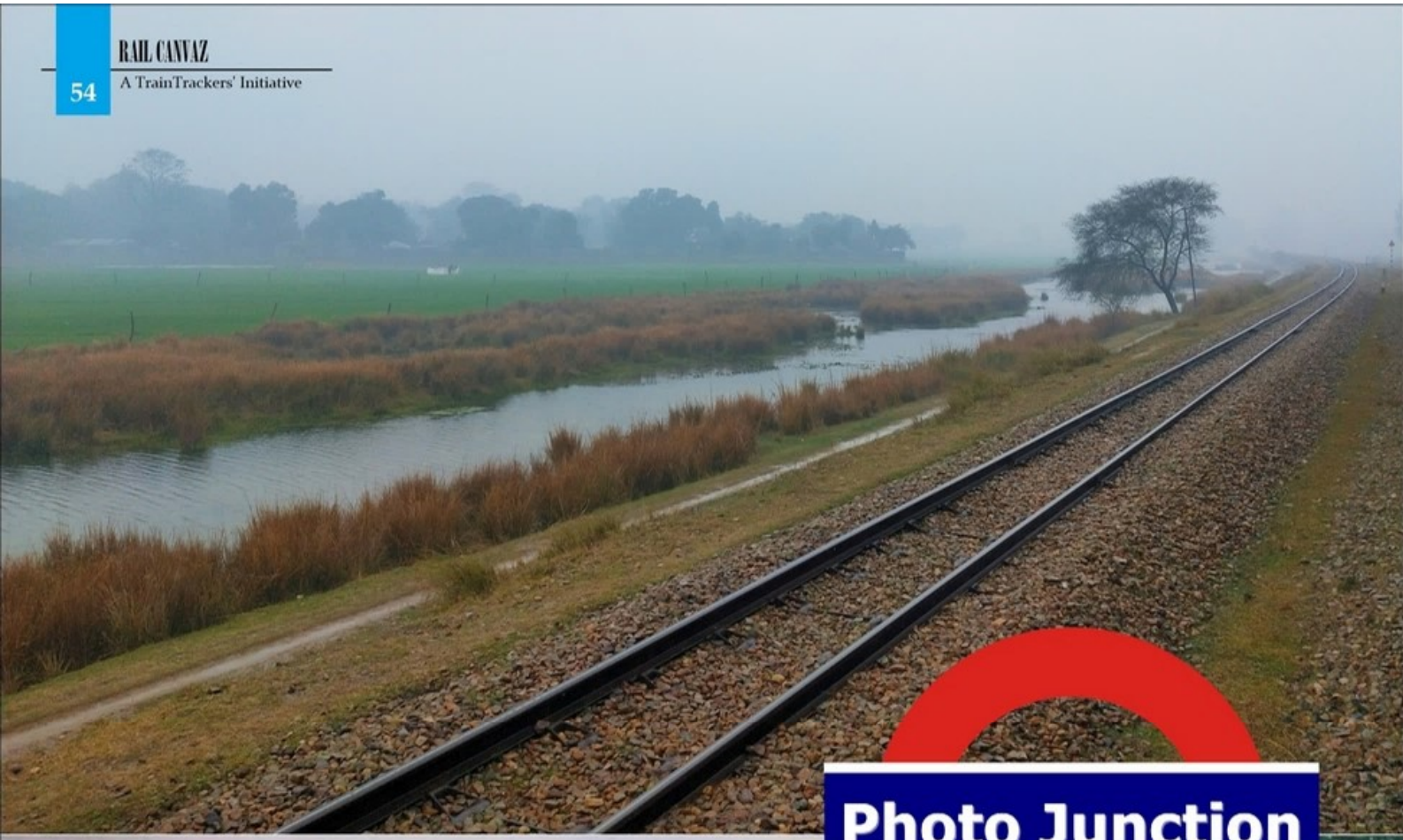


Photo Junction

Circa 2009. Kalyan WCG2 triplets descend from Monkey Hill Yard and pass over the Tata Bridge.

- Apurva Bahadur

Pune bound 51350 Passenger emerges from fog near Uruli.

- Apurva Bahadur

The famous 58501 Visakhapatnam Kirandul Passenger passes over a viaduct, through the thick woods of the Eastern Ghats.

- Avishek Ray

Twin ALCo from Itarsi take a sunbath at Mughalsarai.

- Anjan Roy Chowdhury

A Banihal bound DEMU departs from the picturesque Qazigund on a winter day.

- Ankit Shotra

16274 Ananthapuri Express passes through Nagercoil under a beautiful rainbow hauled by a beast from Royapuram.

- Karthik Abbilash

The 2nd pseudo bullet train, 22439 Vande Bharat Express arrives at Katra with Mata's hill in the backdrop.

- Ankit Shotra

Evening and sea hues; the legendary 16852 Boat Mail crosses the mighty Pamban Bridge over the Bay of Bengal hauled by a Ponmalai digger.

- K Gautham Karthik

Photo Junction

The tiny yet elegant ZDM5 of Pratapnagar enjoys a ride over Broad Gauge hauled by its BG counterpart near Vadodara.

- Mayank Raj Srivastava

17326 Belagavi bound Vishwanamana Express crosses Heggere Grama hauled by the oldest GT46MAC aka Godfather, 12001 Hubballi WDG4.

- Nischay Shetty

Train to Nepal !!! Well, not literally... The Meter Gauge connectivity to Nepalganj Raod on a wet and misty morning.

- Prasenjit Biswas

A Passenger tiffin box of Krishnarajapuram arrives at the beautiful Suravali station with 56964 Vasco-da-Gama Kulem Passenger.

- Praveen Mishra

The mighty 12841 Coromandel Express crosses Cossey river near Khirai and passes by the bloomy fields.

- Purnava Chakraborty

The Kolkata bound 13107 Bangladesh Railways' Maitree Express from Dhaka passes through Khardah hauled by Burdwan deemer.

- Saurav Das

The Roll-on Roll-off service, a speciality of Konkan Railway, crosses the Swarna river before Udupi hauled by twin WDM3A from Itarsi.

- Sumanth Bhatt

18646 Hyderabad Howrah East Coast Express negotiates the famous Raigir curve of SCR.

- Rabiratan Samanta

Photo Junction

Amidst thick foliage, the passenger train from Gorakhpur to Narkatiaganj manoeuvres through the dense forests of Valmiki Nagar Wildlife Sanctuary.

- Protkarsh Kumar

A Naihati bound Electric Multiple Unit leaves behind an amazing light streak while crossing the Sampreeti Setu over Hooghly.

- Soumyajyoti Dey

A silent looking YDM4 from Bareilly's Izzatnagar shed slowly chugs in homeground, the Terai region while receiving commands from a semaphore.

- Mahel Jacob

16578 Harihar Yesvanpur LHB Intercity cruises towards Hirehalli hauled by a KJM WDM3A with EMD headlamps.

- Mahel Jacob

EXPLORING THE UNEXPLORED

- Purusottam Basu

Indian Railways does a fabulous job in connecting each nook and cranny of the country. Not only does this help in providing regional connectivity between state capitals and other smaller towns and villages, it also helps people earn a livelihood when trains, offering one of the cheapest modes of transportation, help the common man to travel from his place of residence to his place of work. But, for ferroequinologists like us, it offers an opportunity to leave the humdrum of modern life and go explore some unexplored routes that dot the Indian railway network, every once in a while.

So, when my semesters got over, I contemplated taking a journey to one of the newly opened sections of the East Coast Railway that connects Khurda Road and Balangir. As of now, the new section is operational up to Mahipur, a small town located just beyond Nayagarh. Now, this trip was just perfect since it would take me just a few hours to cover the journey and return home the same day.

One of the highlights that this trip offered me was that I could travel on a train hauled by a diesel locomotive, something which is very rare to see these days, instead of an electric one. So, the prospect of traveling behind smoke belching, chugging locomotives and exploring a virgin route kept me up most of the night. I quickly charted out a schedule and made plans in my head. I was thinking of exploring this route on my own. But then, I thought of my friend Sayan, who lives in Bhubaneswar. Sayan and I have undertaken many trips in the past and explored many places together. So, I gave him a call and asked him if he wanted to travel to Mahipur with me. He replied in the affirmative and I shared my plans with him.

It was the eleventh day of January, earlier this year and winter was at its peak. Morning would break a little beyond 6. I was supposed to board the 15644 Kamakhya Puri Express from Cuttack. At around 0530 hours, a red-hot Howrah WAP4 entered Cuttack with my train in tow. This train had been recently upgraded to modern LHB coaches. As the train rolled into the platform, I could see the general (unreserved) coaches packed to capacity and there was no way I could get a place to stand, let alone find a place to sit! Therefore, I got into one of the sleeper coaches. Within a few minutes, the train pulled out of Cuttack and in no time crossed the popular Howrah bound 12074 Jan Shatabdi Express, hauled by a Visakhapatnam based WAP7 locomotive. I immediately called up my travelling partner for the day, Sayan and informed him about the arrival of my train at Bhubaneswar within the next few minutes. Bhubaneswar came and Sayan hopped onto the train. The early morning sunshine lent a warm glow to the upcoming metropolitan

city as people were milling around and trying to catch trains to their destinations.

After halting for around 5 minutes, the starter was given and our train continued on its journey towards its destination, Puri. We were, however, supposed to get down at Khurda Road Junction from where our dream journey would start. Within minutes, the train was gliding through the first triple line section of this region and we were eagerly waiting to get down at Khurda Road. In another 15 minutes, we reached Khurda Road and quickly got our tickets booked for the Mahipur bound morning passenger service. The Khurda Road - Mahipur section is on the partially completed stretch of the upcoming East-West connector, Khurda-Balangir line. And, the uncompleted section will be passing through the mountainous regions and the undisturbed woods, a part of Odisha's best kept secret. This region is home to virgin forests and undulating mountains that provide the perfect backdrop to a sylvan setting. Most of us ferroequinologists, as well as the common man, are eagerly looking forward to the completion of this stretch of scenic route!

Sewa Express @ Khurda Road

After purchasing our tickets that cost us a mere Rs 20 per person for one way, we decided to take a quick look around the station since we had some time in our hands before the next train was supposed to leave. We saw a similar early morning rush here as well. Two diesel locomotive hauled trains had arrived, the 18424 Nayagarh Town - Bhubaneswar Sewa Express hauled by a Visakhapatnam WDM3D and 12844 Ahmedabad - Puri Express with Raipur WDP4D, undergoing a reversal. Since it was time for breakfast by now, both of us started looking for a place to grab a quick bite before boarding the Mahipur-bound train. So, after taking some snaps, we went to an outsourced food counter of IRCTC which served average tasting patties. I had one of them while Sayan had his freshly made sandwich which he had bought at Bhubaneswar before boarding the train. We also purchased some biscuits from the store. The store keeper was a friendly middle-aged man who also kept a pet puppy tied to his store. Now, that's how unique our stations (and culture) are! You find vendors who keep a dog for security and also to give him company!

By now, it was 0835 hours and we had to run towards our train's platform as we had forgotten to keep a note of time while leisurely enjoying our breakfast. The train was an 8-coacher rake with only 2 coaches having a good number of passengers. We went to the last coach as capturing one's own train on a curve makes not only us, but even a commoner gaze in admiration. The coach was a bit old, looked unwashed and unclean. We wondered when better days would come for local ICF passenger trains.

The clock displayed 0840 and the hoot was sounded by our Loco Pilot. At the helm was a Long Hood Forward operated Visakhapatnam WDM3A. God knows what will ECoR do once Visakhapatnam becomes a part of the newly created zone of South Coast Railway. Odisha relies heavily on Visakhapatnam, which although being a part of ECoR, is situated in Andhra Pradesh, while Odisha's own Bondamunda, belongs to South Eastern Railway (SER).

The guard exchanged the green flag with the Loco crew after a while and the train started rolling out of the platform slowly, twisting on the multiple points and loops to get to the other side of the mainline. We were now entering a non-electrified section, the only virgin one in entire ECoR - the recent spurt in electrification had converted most of the non-electrified routes. The train started chugging, accelerating on the 3rd notch. Just after departing from Khurda, we got our first curve towards the right-hand side. The route now went past IIT Bhubaneswar's campus and a hill of the Eastern Ghats. The weather outside was misty, as in winters, and this mist gets cleared only post noon. The train gathered a speed of approximately 70 kmph, the Maximum Permissible Speed (MPS) of the section. We were passing through the countryside and agricultural fields had started to come into view now. The iron-horse now passed over the Kolkata-Chennai National Highway 16 (erstwhile NH-5) with the busy Bhubaneswar-bound traffic passing underneath.

The train was now headed towards the first of the seven ready-to-cater stations, Khurda Town. I had visualized Khurda Town as a busy station, situated somewhere near Khurda's main market, having all the qualities of a crowded and important station. But the

Khurda Town Station

reality turned out to be quite contrary to my imagination. The station was constructed way outside the town and looked completely nondescript. We got down and took some pictures of the station and the station board. Just a handful of people got up here. Khurda Town is separated from Khurda Road (Jatni town) by a distance of 13 kilometres. All the stations in this route have a loop line for the platforms and a mainline which, for now, seemed to be of little use. It would only come handy once the entire stretch is completed and trust me, freights would be the king of this section, which is so typical of ECoR.

Within minutes, the loco pilot honked and off we went again. The brief stoppage time reminded me of a DEMU service as the ALCo smoked harder this time to attain speed and we were again flying at MPS in no time! As I've mentioned earlier, our coach was near-empty and we were standing at the door. People on board presumed us to be highly enthusiastic cameramen hailing from a media house – a classic case of mistaken identity. A local vendor on board was selling long tubular fried rings, better known as 'nali' locally, the hues of which looked straight out of our VSKP livery. I purchased a couple of packets from him for later consumption. Equipped with a monkey cap to fight the winter chill and consuming food at regular intervals, I, a Bengali as one could be, gazed out of the window onto the moving biosphere which had dissected farmlands and scattered hills. As I went to the washroom, I discovered a dry toilet, devoid of any water. This is nothing but one of the many phenomena which distinguishes ECoR from other zones – poor maintenance!

We were impatiently waiting for the next halt, Begunia, to arrive. This part of the route in Khurda district is a bit monotonous with no significant landscape change but for the plains and paddy fields. We were hoping that post Begunia, the route would get more scenic. The stretch from Khurda Town to Begunia is the longest intermediate distance between two stations on this route – aggregating to a good 18 kilometres. The train kept rumbling at MPS while negotiating the rare speed restrictions at some places. We arrived at Begunia with a delay of just 3 minutes. Begunia station was a mirror image of the Khurda Town station, with the platform to the right this time infested with towering shrubs. The train departed soon after its arrival. It was time to bid adieu to Khurda district for the time being.

Begunia Station

Rajsunakhala

We were now waiting to enter rural Nayagarh district. Nayagarh happens to be the most beautiful district of eastern Odisha with low-lying hills of the Eastern Ghats, interspersed with paddy fields and other small farmlands. Rajsunakhala appeared at the horizon, just 8 kilometres from Begunia. The station had received a fresh coat of paint. The hills were also visible, but were shrouded from us due to the morning mist.

With all the stations passing by, a small fraction of passengers kept alighting every now and then and the train now seemed significantly less occupied. We now reached 7 kilometres further down the line, at Bolagarh Town passenger halt, and were back in Khurda district. The town consists of a tehsil and is one of the important towns of this district. The station seemed, just like the preceding ones, situated on the outskirts of the main town. Just 6 kilometres further down the railroad, Bolagarh Road looked a bit busier than the town station as more people deboarded here and

Bolagarh Road

the platforms seemed much broader than any of the other stations we had encountered till now. The train was more or less, maintaining its schedule and living upto our expectations.

The halt at the Road station was unusually long. Had it been a completed section, one could have expected a crossing with a passenger or freight train. But that wasn't to be, as we found out soon. The reason for the delay was, the LP exchanging pleasantries with an old-time friend of his, a railway staffer at the station. After the departure, the loco pilot made up his mind to make up for the few lost minutes and clocked the loco all the way upto the 6th notch.

As the train was racing towards the penultimate and the last major halt, Nayagarh Town, the passengers of the busy coaches were preparing to disembark. The entrance to Nayagarh greets a person with a royal looking hill in the backdrop that bears an uncanny resemblance to the Aravallis of Rajasthan.

Approaching Nayagarh

The kids and the villagers were now flocking alongside the line, and watching the metal snake, standing in awe! I felt like a celebrity, a VIP and a person who was being welcomed by the entire town. That's the feeling anyone would have got on the train. This left me wondering about the people of the 1853's sojourn, who were a part of a greater history, a revolution, a turnaround point in India's travelling and connectivity, which completely changed the face of the nation.

Almost the entire lot of commuters deboarded there. It was the district headquarters and the people were back to their homes after a hectic week back at the capital city. The journey for them too would have been a joyous one. The loco now honked for the last time in Long Hood mode as we departed for Mahipur. Those last 12 kilometres from Nayagarh to Mahipur went by a lot sooner than expected. This particular stretch gave me some nostalgia from my trip to Katra as the hills were taller and their range continuous here.

We soon pulled into the beautiful Mahipur – a station set on a curve right next to a rising hill. The stretch beyond Nayagarh had opened just a fortnight back, implying excitement at its peak

Mahipur

among the villagers as they had gathered in great numbers to watch the arriving train. The station was far from being ready as it only had its nameboards on both ends with no platforms! One of the two mobile tin sheds served as a ticket counter. We hurriedly purchased return tickets for our journey back to Khurda Road to make some time to appreciate the beauty of the place as the turn-around time was in just another 30 minutes. The crew in the meanwhile was preparing for loco reversal, and while the coupling on the rear end was being done, a few old grandpas came along with their grandchildren to witness the 'show'. We indulged in enough lens-work including a head-on capture of the Short Hood Forward (SHF) operated loco with the entire rake parked on the curve.

After fulfilling our photographic desires, we rushed towards the tail end of the rake. Thankfully, this time, the last coach had no water issues! The train departed empty, only to witness some occupancy post Nayagarh and Bolagarh. The Sun was now shining in its full glory paving the way for a hotter noon. The train merrily reached Khurda Road outer three quarters of an hour before schedule. But, knowing ECoR very well, I knew something unusual was likely to happen! Due to some technical snag in a shunting loco at a corner of the junction, the entire Khurda bound traffic from all four sides had become stranded at the outer signal. The guard was yelling at the station master, who seemed all but helpless. Finally, we got into Khurda Road station where a thousand other passengers were waiting to board this train. No, this won't be going back to Mahipur. It would depart for Puri now with an electric loco and a different set of crew. We somehow managed to deboard as people had already started bulldozing their way in. The only purpose our tickets now served was while exiting the station premises. We soon took a home bound bus. My friend had already reached his place by the afternoon itself while it took me another couple of hours to reach Cuttack.

A prevailing sense of accomplishment had overwhelmed my tiredness and hunger. My friend and I were the first (and till now perhaps the only) rail enthusiasts to have traversed the lesser known route of my home zone. We were the only ones to witness the smile and joy a train could bring to the people across all ages whose dreams of finally seeing a train in their vicinity came true after 25 years of the project getting the Railway Ministry's nod. I promised to myself to come back here again once the entire stretch becomes operational....

Bankura-Sonamukhi Electrification Work

Electrification work of Bankura-Sonamukhi Section in Adra Division of South Eastern Railway has been completed. Bankura-Sonamukhi section is a part of Bankura-Masagram Electrification Project spanning 118 km at an estimated cost is Rs. 106.45 crores.The work of the remaining portion of the project between Sonamukhi and Masagram which is of 77 Km is going on in full swing.

Rourkela-Jharsuguda Third line Construction

The 3rd Line between Dhutra and Bamra (27.9 km) in Chakradharpur Division of South Eastern Railway has been completed. This is a part of the all-important 3rdLine project between Rourkela-Jharsuguda (101 km) on the Howrah-Mumbai main line and was sanctioned in the year 2015-16. The present estimated cost is Rs.1312.93 crores. The 3rd Line between Dhutra-Bamra has been completed at a cost of Rs.362 crores. The existing main line has become fully saturated due to which operation of Passenger and Freight train services have become extremely difficult as well as complicated.

Safety Initiative of South Eastern Railway

South Eastern Railway has been making efforts to improve safety performance in all respect. Several corrective measures have been adopted by South Eastern Railway for safety improvement such as massive renewal of railway tracks, stringent monitoring of safety aspects, use of modern technology for safety works, effective track maintenance, improvement of signalling systems, proper training of railway staff, switching over to modern and safe LHB coaches in place of conventional coaches etc. All unmanned level crossings have been eliminated over South Eastern Railway. 50 Manned level crossings have also been eliminated for safety of road users. 18 Manned level Crossings have been interlocked and provided with gate stop signals to improve the confidence of the Loco Pilots and discipline the Gateman responsible for timely closing of gates against road traffic.

A New Rail Museum at Hubbali Opened by SWR

Indian Railways has dedicated a new Rail Museum at Hubbali to the nation. This new Rail Museum is second in South Western Railway after the Mysore Rail Museum. Railway Minister Sri Piyush Goyal virtually inaugurated the new museum on the 9th of August. It is located next to the second entry to the Hubbali Railway Station. The Museum aims at preserving and portraying the glorious heritage and gradual evolution of railway system in India.

A grand arch at the entrance welcomes one to the bygone era. Two NG locomotives are the prime attraction of the museum. Locomotives, coaches, wagons, tankers and other exhibits provided in the galleries set up amidst soothing greenery of the museum. The Narrow Gauge coaches depicts unity in diversity. Two beautiful cottages of 1907 are converted to two facets of Museum named as Malaprabha and Ghataprabha. Ghataprabha cottage features a model room with running train, signal instruments etc. A colourful children activity room with fun facts is also part of this cottage. In Malaprabha cottage, booking office with ticket counter, printed tickets, iron cash chests reflect reminiscences of the ticketing system a few decades back. The evolution of rails, sleepers, track fitting, telecommunication, electrical items is also illustrated in the museum. Another attraction of the museum is a toy train with colourful carriages steered by steam engine. A food plaza named as Suruchi Cafeteria is provided in the museum.

:: Visitors Information ::

‹Opening Hours›

- 12 noon to 7 pm (Tuesday to Friday)
- 12 noon to 8 pm (Weekends & Public Holidays)
- **Every Monday is a Holiday**

‹Entry Ticket Charges›

- Adult (above 12Years) : INR 20/-
- Child (5-12 Years) : INR 10/-
- Less than 5 Years : Free

‹Toy Train Ticket›

- Each Ticket INR 10/-

ER's NEW Dual Mode Locomotive - 'Ojas'

As a part of ER's endeavour to blend innovation with Green Initiatives, Kanchrapara Workshop of ER has innovated an electric loco into dual mode. This dual mode loco can work under 25000 Volt electric traction and can work also where yard lines are not electrified, by battery voltage for shunting. This loco is given to Howrah yard. Such dual voltage loco, as green energy model, is first of its kind introduced in Eastern part of India. After WCR, ER is the second Railway Zone to introduce such dual mode loco.

BG Diesel Locomotives Handed Over to Bangladesh Railway

Indian Railway handed over 10 Broad Gauge Diesel locomotives to the neighbours Bangladesh. In the handing over ceremony held on 29th July, WDM-3D locomotives were virtually flagged off by External Affairs Minister Sri S. Jaishankar and Minister of Railways Sri Piyush Goyal. The event was also attended by the Minister of Foreign Affairs of Bangladesh Dr. Abul Kalam Abdul Momen along with Minister of Railways of Bangladesh Md. Nurul Islam Sujan from Dhaka.

10 locomotives started their journey from Gede towards Bangladesh. They were received by the Bangladesh Railway officials at Darshana. Of these 10 locomotives, 6 were from East Central Railway's Samastipur DLS, two from Eastern Railway's Howrah DLS and the remaining two from East Coast Railway's Visakhapatnam DLS. Indian Railway has modified these 120 kmph capable, 3300 HPlocos for maximum height restriction in Bangladesh Railways. All locos have codal life of 28 years or more.

Indo Bangladesh rail cooperation is a vital element of bilateral relation. According to Ministry of Railways, India and Bangladesh are jointly working to enhance rail connectivity. In 1996, Railwayhad exported 10 MG locomotives to BR. 40 more BG locos were exported to BRover a period of14 years from 2001 to 2014. 120 LHB coaches were also exported to BR in 2016-'17. To further strengthen rail connectivity, one new rail link between Agartala in India and Akhaura in Bangladesh is being constructed.

Utkrisht 2.0 of Kharagpur Workshop

Kharagpur Workshop has geared itself up for upgrading the Integral Coach Factory (ICF) rakes as Utkrisht Rake. This workshop has turned out first fully refurbished ICF rake and handed over to division. The rake is branded as first Utkrisht-R rake of Indian Railways, where 'R' stands for refurbished. The coaches have completely new floor, roof, panels, berths and all the amenity fittings. All toilets are upgraded with epoxy flooring, health faucet, dustbins etc. All coaches are provided with energy efficient LED lights and Braille Signage to assist the visually challenged.

The workshop has also turned out 2nd generation Utkrisht rake and branded it as Utkrisht 2.0. The Utkrisht 2.0 is having extra features like interior panelling with DGFRP sheets, USB charging ports, Modular toilets, auto janitor, LED lightings, health faucet, stainless steel dustbins, epoxy flooring, vinyl wrapping on the toilet walls, bio-toilet, vinyl wrapped Utkrisht colour scheme on the exterior. Presently 16 rakes have been upgraded as Utkrisht rakes. The rake of Howrah- Yeswantpur Duronto Express, Howrah- Vasco-da-Gama Amravathi Express and Shalimar- Patna Duronto Express have been upgradedto Utkrisht rake.

Reopening of Heritage Transport Museum

The Heritage Transport Museum at Gurgaon (Gurugram) reopens today commemorating the 74th Independence Day of the nation. All the protocols of visitors' safety will be the top priority maintaining the three Ws – Wear Masks, Wash Hands and Watch Physical distancing.

:: Visitors Information ::

<Opening Hours>

- 10 am to 7 pm except Mondays.

<Entry Ticket Charges>

- Adults : INR 400/-
- Child: INR 200/-

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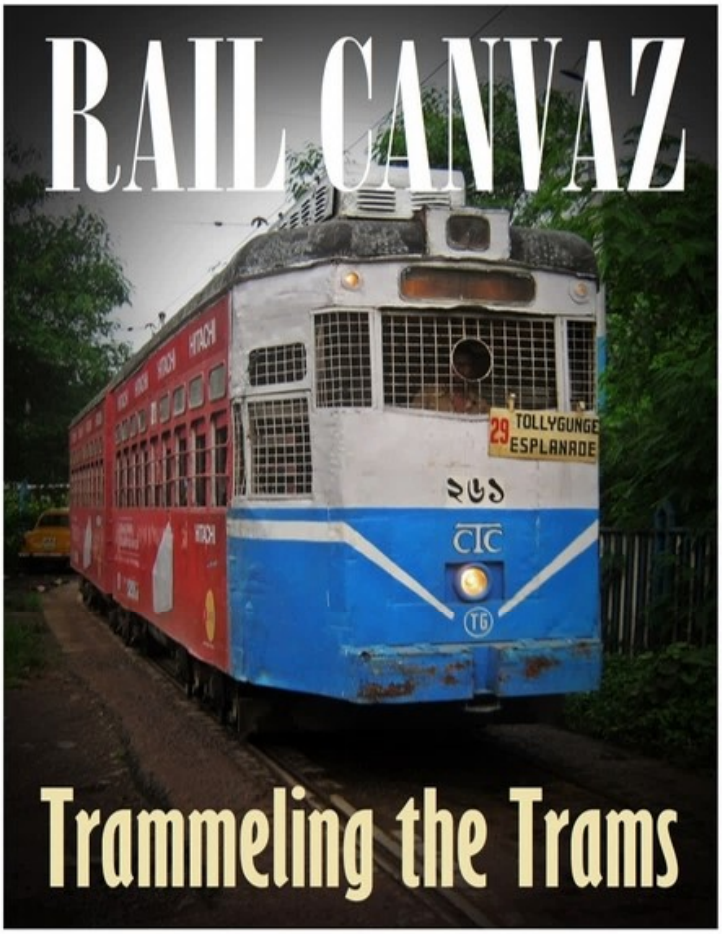

The fast disappearing conveyance from the busy streets of Kolkata needs an urgent shakeup to boost their chances to survive the challenges of everyday life in an ever-changing society…. Let's not push the eco-friendly trams into stupor….

CHECK OUT THE COVER STORY ON KOLKATA TRAMS IN OUR NEXT ISSUE

If you are interested featuring your photos related to Indian Railways in the forthcoming issue of Rail Canvaz e-magazineplease submit those at : *railcanvaz@gmail.com*