

Effects of Heavy Haul Trains on Kottavalasa – Kirandul Railway Line

Waltair Division, East Coast Railway, Indian Railways

Life's Work and Memoirs



Challa Soma Sundaram

2016

Effects of Heavy Haul Trains on Kottavalasa – Kirandul Railway Line

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by

Challa Soma Sundaram

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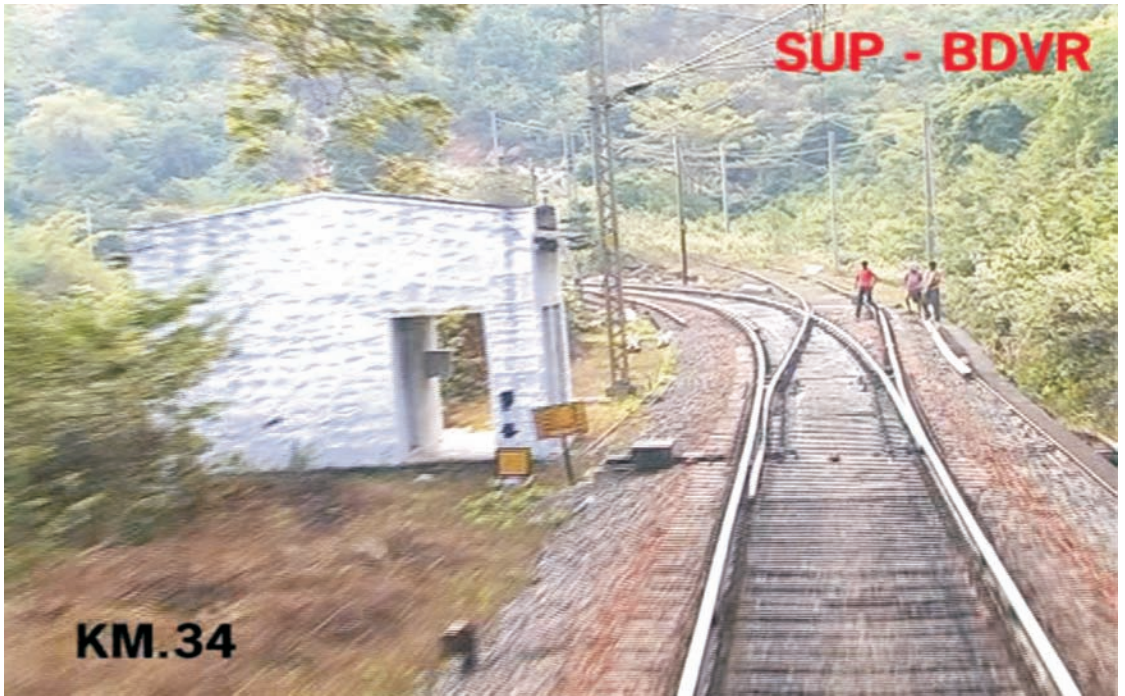
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(a) Catch Siding at km 34/20-26 in Boddavara-Shivalingapuram Section



(b) Kolab Bridge (No. 413; Span $10 \times 45.72\text{m}$) at km 186/4-16 in Suku-Koraput Section



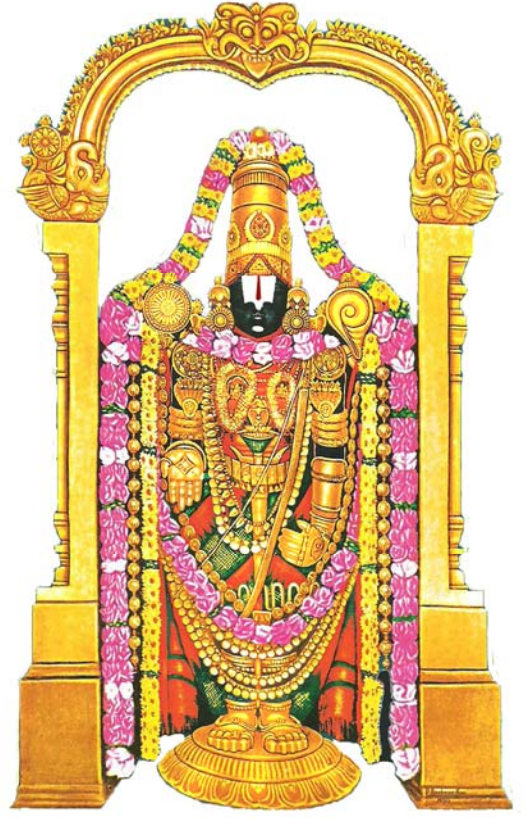
(c) Danteswari River Bridge (No. 1098) at km 403/15-20 in Dantewara-Kamalur Section



(d) Nerli Gorge Bridge (No. 1298; 5×30.48 M under slung girders on 8 curve) at km 432/25-32 in Bhansi – Bacheli Section



|| Om Namo Sri Ganesaya Namaha ||



|| Om Namō Sri Venkatesaya Namaha ||

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Preamble



It is not widely known that *no* major Railway Line crossing any *Ghat* was built by the Indian Railways after the *Western Ghats* (*Bhor* and *Thal Ghats*) were conquered to connect *Mumbai* with *Pune* and *Central India* during the 1950s, when the rail network was being expanded. All the hill railway lines were built to connect towns and hill stations on/along the hills. In 1956, the Government of India signed an agreement captioned *TOP (Transport of Ore Project)* with Japan, for export of 8 million tones of iron ore in 10 years to Japan. And, three railway lines were built as part of this agreement, namely the *Bimlagarh-Kiruburu (B-K) Line*, *Sambalpur-Titlagarh (S-T) Line* and *Kottavalasa-Kirandul (K-K) Line*, from *Kiruburu Mines* in Bihar State and *Bailadilla Mines* in the then Madhya Pradesh State (in Chattisgarh State). All these lines are in the then *South Eastern Railway (S.E.Railway)*.

The *Railway Board* directed *S.E.Railway* to undertake surveys of these three lines. And, for construction purpose, a new *Zonal Railway* (named *D.B.K. Railway Project*) was created in 1960 by the *Railway Board* with its headquarters in *Visakhapatnam*. The importance of the *K-K Line* is that it was the first construction undertaken after *India's Independence* to cross the *Eastern Ghats*. It was a major engineering feat, and was recognized by the media then. All other constructions came much later – the line to connect *Hassan to Mangalore* by *Indian Railways*, and *Roha to Mangalore* was constructed by *Konkan Railway Corporation Limited*, and to connect *Jammu to Baramulla* by *Indian Railway Construction Company Limited*, etc. The *D.B.K.Railway* opened the *K-B* and *S-T Lines* in 1967, and the *K-K Line* in 1968 for movement of heavy iron ore traffic, and started exporting the iron ore to Japan from *Visakhapatnam Port*. The *Operating Department* was not only coordinating with *Railway's* internal departments, but also with other Government of India Undertakings, such as *National Mineral Development Corporation (NMDC)*; *Visakhapatnam Port Trust (VPT)*; and *Metals and Minerals Trading Corporation (MMTC)*, for export of 8 million metric tonnes of iron ore in 10 years from 1967.

During 1955-2006, the Author had a 51-year career as a *Civil Engineer*. The experiences spanned over construction of *Multi-storey Buildings*, of *Railway Lines* and of *roads for Highway Projects*. The Author served the *Central Public Works Department* during 1955-60, *S.E.Railway* during 1960-83, the *Indian Railway Construction Company Limited (IRCON)* during 1983-91, and private companies during 1991-2006. The Author had gained experiences in many

Preamble

projects, but the experience on the *K-K Line* maintenance (1974-82) was unique and stands foremost as *Government of India* was honoring the *Trade Agreement* with Japan at that time. This book primarily brings out the Author's experiences in maintaining the *Kottavalasa-Kirandul Railway Line* during 1974-82, when it was under the control of *S.E.Railway*. There were problems on all fronts, including engineering, operations, mechanical loco and wagon, and signaling departments; all these are presented in this book. Also, the modifications made to the track structure and rolling stock up to 1974, are presented in this book.



Preface



The *Kottavalasa–Kirandul Railway Line* (called the *K-K Line* in short form) built by DBK Railway was the first major new railway line constructed by Indian Railways after Independence of India from the British Colonial Rule. Financial support was received from Japan, even though limited. It took 4 years to complete the survey of 446 km during 1956–60. Two more lines were built along with the *K-K Line* connecting the *Iron Ore Mineral Complex* at *Kiruburu* in the State of Orissa; these were

- (a) 182 km line from *Titlagarh* to *Sambalpur*, and
- (b) 34 km line from *Bimlagarh* to *Kiruburu*.

The *K-K Line* was meant for transport of Iron Ore for export to Japan, from *Bailadilla* mines near *Kirandul* in *Madhya Pradesh* (now called *Chattisgarh State*) to *Visakhapatnam Port* in *Andhra Pradesh*. *Sambalpur* to *Titlagarh* line reduces the lead of Iron Ore movement from *Kiruburu Mines* to *Visakhapatnam Port*, avoiding the extra distance involved in carrying the iron ore *via* either *Kharagpur* or *Raipur*.

Many *special* features were adopted in the construction of the *K-K Line*, which were never employed before in Indian Railways. The salient features amongst them are:

- (1) Curves were not compensated for gradients, as braking was perceived as a more important consideration in operations. In down gradients, a *1 in 60* grade effectively becomes *1 in 70*.
- (2) It is the first Railway Line to have designed and built a *Catch Siding*.
- (3) 8° curves were used in a continuous basis in the railway line meant to carry large volumes of freight traffic. The reverse curves had no straight lengths in between, but the transitions on either side were an ideal solution from considerations of stability.
- (4) Curved tracks were laid on girder bridges on a massive scale for the first time, necessitating for the first time design of girders on curves and their strengthening. Another first was providing cant on the bed blocks.

- (5) RC piers were built on the siding at *Sunabeda* (near *Koraput*) to connect the MIG Aircraft Factory of Hindustan Aeronautics Laboratory to permit raising of track for a future submergence anticipated due to construction of a dam planned nearby.
- (6) Large scale diversion was given to an existing highway to avoid level crossings across the same highway; and
- (7) The project was completed *on time and without cost escalation*.

The *K-K Line* was constructed during 1961-1968, and opened for goods traffic in 1968 and passenger traffic in 1978. The line passes through *Anantagiri Mountain Range* in *Andhra Pradesh* State, *Koraput-Jeypore Section* in *Orissa* State, and *Dantewara-Kirandul Section* in *Madhya Pradesh* State; all these three lines are *Ghat Sections* laid at a gradient of *1 in 60* and *1 in 80* against empty train direction, and at *1 in 100* against loaded train direction. It has curves 5° and sharper, up to 8° , interspersed with small straights without transitions. *Anantagiri Ghat* and *Koraput-Jeypore Section* have 46 tunnels and 14 cut & covers, with reverse curves in Tunnels. The maximum permissible speed is 45 kmph in the *Ghat Sections* and 75 kmph in others.

Initially, the track structure was 90R rail with 75 lbs check rails held by distance blocks and bolts with a clearance of 48 mm. The inner bearing plate is designed as a *special bearing plate* to hold together both the running rail and the check rail. In *ghat* sections covering a length of 120 km in 4 stretches, *wooden sleepers* were laid with a sleeper density of $N+5$ over the 5° - 8° curves. At other locations, *CST9* or *IRS Trough Sleepers* were laid with density $N+3$. No wooden sleepers were laid at joints in the track with metal sleepers, and same type of sleepers was used as provided in the rail length. The ballast cushion varied from 3" to 8", except on *Anantagiri Ghat*.

The clearance of 48mm was found to be inadequate leading to wear of running rails, uprooting of spikes, rail fractures and gauge widening, which, in turn, resulted in derailments. The period 1968-1980 posed challenging problems, which had to be tackled by all Engineers maintaining *track, bridges, wagons and diesel locomotives*. *Rail-wheel* wear was considerable. In sections of the *track with wooden sleepers* along curves which were 5° and sharper, gauge widening beyond 18 mm was predominant, and in sections of the *track with metal sleepers*, the rail wear was excessive on both rails. Due to thin wheel flanges of BOY wagons, accidents occurred in the *Points and Crossing Region*, as wheels were taking two paths. The wheel was dropping inside the track due to excessive widening. At locations where the outer rail was worn out on *1 in 60* and *1 in 80* gradients, wheel mounting added to inadequate check rail clearance, causing frequent derailments during 1974 -1975. Over a period of 12 years, the track structure underwent changes in strengthening from 90R to 52kg, and from 52kg to 60kg rails with *rail renewals* or *complete track renewals*, alongside increasing density of sleepers from $N+3$ to $N+6$, ballast cushion from 3" to 8", and check rail clearance from 48mm to 65mm, and from 65mm to 74mm.

It has been more than 33 years, since I left the Waltair Division (of S.E.Railway) in 1982, and I could pen down the details of my experiences on the *K-K Line* from memory. I hope this report will benefit the present day *Permanent Way Engineers* working on *K-K Line* and similar other railway lines. Also, it is expected that the book will be a useful reference book in the libraries of *National Academy of Indian Railways (NAIR)* at *Vadodara*; *Indian Railway Institute of Civil Engineering (IRICEN)* at *Pune*; *Indian Railway Institute of Signal & Telecommunication Engineering (IRISET)* at *Secunderabad*; *Indian Railway Institute of Mechanical & Electrical Engineering (IRIME)* at *Jamalpur*; *Indian Railway Institute of Electrification and Communication Engineering (IRECE)* at *Nasik*; *Railway Research, Design & Standards Organisation (RDSO)* at *Lucknow*; and *Headquarters of all Divisions, Zonal Railways and Railway Board*.

Lastly, but not the least, the services rendered by *Mates, Keymen* and *Gangmen* cannot be expressed in words. In fact, they are the *backbone of Indian Railways* for safe passage of trains at all times. The alphabets in the word **GANGMEN** are linked to their duties entrusted, and their *relentless, efficient* and *effective* performance of their work, as an acronym:

G	Gauging
A	Aligning and Leveling
N	Night duties
G	Guarding
M	Mobile always
E	Effective
N	In tune with Nature's furies at all times

I sincerely applaud all the *GANGMEN* on the *K-K Line*, without whose help, it would not have been possible to deliver services in time; they spared no pains in overcoming all obstructions that came in their way, and to the best of their abilities. They did yeomen service to the public at large and to the Nation ultimately...

Three cheers to all Gangmen across the Indian Railways!!

May the Almighty bless them good health, prosperity and long life...

Challa Somasundaram

विजय कुमार गुप्ता
V.K. GUPTA



सदस्य इंजीनियरिंग, रेलवे बोर्ड
और पदेन सचिव,
भारत सरकार
रेल मंत्रालय
रेल भवन, नई दिल्ली - 110001
MEMBER ENGINEERING, RAILWAY BOARD
&
EX-OFFICIO SECRETARY,
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
RAIL BHAVAN, NEW DELHI-110001

BLESSINGS

Sri Challa Somasundharam has encapsulated in this book, his life time experience both as Construction and Maintenance Engineer, not only on the Indian Railways but also elsewhere.

This book not only covers technical detail of intricate Railway Engineering but also covers experience of other persons involved in this endeavour. The Kottavalasa to Kirandul Railway Construction stretched every parameter of Railway Engineering to its maximum limits. It had longest tunnels, tallest bridges, sharpest curves, steepest gradients, high axle loads and carried heaviest freight tonnages. It has most powerful train consists with highly specialized braking systems.

I convey my special appreciation and congratulations to Shri Challa Somusundaram for writing a very informative book. It will be of immense interest and use for railway men. It is remarkable that it provides detailed description of difficulties encountered in the construction, operation and maintenance of this very difficult railway line of 446 Kms, and the experiments carried out and solutions applied to maintain the flow of iron ore traffic.

Inclusions of problems encountered and solutions applied in respect of track, bridges, freight wagons, diesel locomotives and operations has helped in providing a complete picture of the KK line. Information on importance of braking systems in controlling the loaded trains on steep gradients and sharp curves is very informative and interesting.

The chapter on accidents is excellent as it provides, important lessons for railway men as to the manner in handling difficult railway accidents.

It will also serve as a valuable reference document for many a researcher and student of railway technology.

I wish him all success.


(V. K. Gupta)

Foreword



Sri M. Seshagiri Rao

Former Chairman & Managing Director
Rail India Techno-Economic Services (RITES) Limited
New Delhi



The *K-K Line* to the *Bailadilla Mines* was an effort ambitious in the extreme. The country was so remote that it was a complete blank on the maps till 1960. Its early Surveyors cut off from the Work, had literally to live off the bush in those remote places during days of little or no communication. The construction stretched *every parameter* of *Railway Engineering* to its limits and demonstrated to the Railway world, what could be achieved with technology, determination and sheer courage. It had the *longest* tunnels, *tallest* bridges, *sharpest* curves, *steepest* gradients, and *highest* axle loads, and carried the *heaviest* freight tonnages. It was made possible by specially designed track work, and most complicated extra-heavy overhead electrification works, with the heaviest ever train loads, the Country's most powerful train consists, highly specialized braking systems and the most dedicated staff braving the harshest of environments in the remotest of places.

Sri S. S. Challa deserves our special *thanks* and *congratulations* for this painstaking efforts to record the achievements of those pioneers among whom, he was himself one. The book is very well written and very thoroughly researched, yet a model of brevity and lucidity. It is very timely and should serve as a great motivator for the new *21st Century*

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generation of Railway building adventurers from snow bound *Kashmir* to the evergreen *North East*. Also, it will serve as a valuable reference document for many a researcher and student of *Railway Technology*, and should find the pride of place in the library of every *Railway Academy* and every *Railway Construction Office* in the country.

M. Seshagiri Rao

Abstract

This book *Effects of Heavy Haul Trains on the K-K Line* brings out the problems faced by the Author, during his tenure of maintaining the line for 8 years (during 1974-82). The subject matter is covered in six relatively independent Chapters. *Chapter 1* gives a brief of the K-K Line in Waltair Division of *East Coast Railway* under *Ministry of Railways*. It describes the salient organizations in around *Visakhapatnam* (headquarters of *Waltair Division*, and popularly known as *Vizag*), a brief on the Indian Railway system, jurisdictions of erstwhile *South Eastern Railway (S.E.Railway)* and of the current *East Coast Railway*, structure of the Railway Board and its service oriented organizations, and break-up of electrified lines.

The Kottavalasa-Kirandul Railway Line Project of 446 km (called as Dandakaranya Line) together with 2 more Railway Line Projects (namely Sambalpur-Titlagarh Railway Line Project of 182 km and Bimlagarh-Kiruburu Railway Line Project of 34 km) were conceived by the Railway Board in 1955 for purpose of export of iron ore to Japan from the richest mines of Bailadilla (located in erstwhile Madhya Pradesh) and Kiruburu (located in Orissa). The projects were together captioned in as the D.B.K.Railway (D stands for Dandakaranya, B for Bimlagarh (a district headquarter in Orissa), and K for Kiruburu). The Government of India entrusted (a) National Mineral Development Corporation (NMDC) prospecting of iron ore, (b) S.E.Railway transporting 8 million Tonnes for export of Iron Ore in 10 years, (c) Visakhapatnam Port Trust (VPT) handling and loading into Japanese ships of 100,000T capacity, and (d) Minerals & Mines Trading Corporation (MMTC) for compliance of trading commitments with Japan. Chapter 2 presents arrangements made by MMTC at Kirandul and Bacheli, transportation facilities created by S.E.Railway, construction of Outer Harbor by VPT, and coordination arrangements done by MMTC.

Chapter 3 recalls accounts of (a) survey of the 3 new railway lines by *S.E.Railway*, (b) formation of a *separate zonal railway* called as *D.B.K.Railway* with headquarters at *Visakhapatnam*, (c) organization and construction of the railway lines by adopting laid down specifications of engineering, (d) details of *Tunnels* and *Gorge Bridges*, and (e) opening the K-K Line for traffic in 1968. A special feature of the K-K Line is that *three WDM₂ Diesel Engines* hauled 50 BOY wagons at a time, with a trailing load of 4,500 million Tonnes, with *Special Air Brake* mechanisms, and provision of *Catch Sidings* and *Slip Sidings* on *Ghat Sections* with steep gradients of 1 in 60 and 1 in 80, favorable to load to hold run-away of uncontrolled Engines with wagons. Details of the above are provided along with:

- (1) Longitudinal section of Kottavalasa-Kirandul Railway Line,
- (2) Stations and chainages, gradients, degrees of curves, jurisdiction of states, altitude above Mean Sea Level, maximum permissible speeds, and Tunnels and Cut and Covers, and

- (3) Track structure (90R, 52 kg and 60 kg), Rail Sections with arrangement showing Check-Rail and Check Rail clearances, which were adopted from time to time.

The *K-K Line* was opened for traffic in 1968. Chapter 4 deals with track problems faced while moving iron ore trains from *Kirandul* to *Visakhapatnam Port* for export to *Japan*. The works sanctioned by the *Railway Board* for strengthening the track system. Also, it brings out the solutions adopted locally. Further, the problems are recalled that were faced by *Mechanical Engineers* in maintaining the *WDM₂ Locomotives* and *BOY wagons*.

Chapter 5 describes in detail a few serious accidents that occurred on the *K-K Line*. Damages were caused to track during monsoons every year in the *Ghat sections*, owing to sliding of side slopes of mountains, and heaving-up of formation vertically. A special report from *Sri A. Bhima Rao, Chief Administrative Officer (Construction), S.E.Railway, Waltair*, is presented on the restoration operations conducted in 1983 and 1990. Also, important events are described that had happened during 1978-82, such as a *Mega Block* was organized to lift released and unserviceable *Permanent Way Materials* from the *K-K Line*, the Opening of the *K-K Line* in 1978 for passenger traffic by *General Manager, S.E.Railway*, Emergency working in *Waltair Division* for 18 days due to flood waters overflowing the Bridge on *River Vamsadhara* in December 1980, and Laying the foundation stone at *Koraput* for a new Railway Line in 1981 of 175 km between *Koraput* and *Rayagada* by the Hon'ble *Chief Minister of Orissa*.

Chapter 6 presents the closing comments. The Annexures at the end of the book give details of:

- (a) Notable experiences of the Author from June 1955 to December 2006;
- (b) Salute to Seniors and Homage to Colleagues;
- (c) Bio-data of the Author;
- (d) Blessings; and
- (e) Bibliography.

Dedication

This book is dedicated to

*Late Sri Thomas M. Verghese, Principal Chief Engineer, S. E. Railway, and
Late Sri M. N. Prasad, Engineer in-Chief (Track), S. E. Railway*



Sri Thomas M. Verghese was the Principal Chief Engineer, S.E.Railway, from 1974 to 1979. It was during his tenure that the K-K Line was strengthened in its track structure to carry 22.5 mTonnes axle loads, when BOY wagons were introduced. The problems were galore and there was tremendous pressure on Civil Engineers in keeping the wheels moving against the odds. He had two Engineer in-Chief (Track) under his control, namely Sri M. N. Prasad and Sri M. Seshagiri Rao, at Garden Reach, Kolkata, the headquarters of S.E.Railway. Both these officers were constantly moving on line for Inspections, as per the wishes of the then General Manager, Sri M. S. Gujral.

In 1977, Sri Verghese was at Malligura Diversion Site for 4 days, when the side slopes of a huge mountain slipped into the cutting, resulting in suspension of traffic. It was when he was at the site that this diversion was planned. Later on, a masonry retaining wall was built at the same location under the directions of Late Sri M. N. Prasad, Engineer-in-Chief (Track II), who was later Chairman, Railway Board. This retaining wall also gave way in 1977 monsoon and the Diversion laid was re-restored for traffic movement. Later, in 1978, Late Sri M. N. Prasad also was at an accident site between Chimidipalli and Borraguhalu in Waltair Division, when a big boulder had fallen on the 2nd Engine of a 3 Loco WDM₂ consist, hauling 50 loaded BOY wagons to Visakhapatnam Port. As a result, the middle engine had gone down the gorge. The 1st Engine had hit the tunnel face and got perched on the bank slope. The 3rd Engine jumped the gap of span 2 and also got perched by the side of 1st Engine on the slope. The middle 80 feet span girder was thrown out of its bearing on Pier 1 and was precariously hanging with inadequate support on Pier 2. Seven BOY wagons went down the gorge. Sri Prasad stayed at the accident site for 4 days and conducted the restoration operations; technical details of these operations are given in the body of this report. There were many other instances when these two officers gave direct instructions, guidance and advice on

Dedication

track matters during their tenure, for which we the staff of the *K-K Line of Waltair Division* remain grateful.

Sri Prasad expired on 24 November 2013 at *Trivandrum* and *Sri Verghese* on 11 March 2014 at *Bangalore*. It is a great loss to the Railways and to the nation at large, as experience of such dedicated officers was available always to junior officers, whenever approached, even after their retirement. We deeply mourn the sad demise of these two outstanding officers of Indian Railways. I express my deep sympathies to the two bereaved families.

I humbly dedicate this book to *Late Sri Thomas M. Verghese* and *Late Sri M. N. Prasad*; my heartfelt condolences to their bereaved families on the tragic loss. May the Almighty bless their souls to rest in peace in heaven...

Somasundaram Challa



Sri T.M. Verghese being garlanded by the Author in November 1979 at Waltair Railway Station on the eve of his departure on promotion as General Manager (Construction), North Frontier Railway



Sri T.M. Verghese giving his message to the Author at 3 UP Howrah–Madras Mail at Waltair Station on way to Bangalore

Sri Thomas M. Verghese

04 October 1922 - 11 March 2014

Date of Appointment : 16 October 1944

Retired as : General Manager (Construction), N. F. Railway
October 1980



Service Profile

Sri Thomas M. Verghese joined the Indian Railways in 1944 after completing his *Bachelor of Engineering* degree from the *College of Engineering, Guindy, Tamil Nadu*. His long and committed career took him all over the country through numerous postings and a variety of assignments. These ranged from arduous surveys for railway tracks in jungle terrain in the deep south; managing the railway workshops in *Arkonam*; designing and testing standards with the *RDSO*, the research wing of the railways in *Shimla* and *Lucknow*; representing *ITES* in the *Philippines* and *Iran*, to planning the bridge over the *Brahmaputra* in the *North East*. In 1966 he was deputed to the *Bureau of Public Enterprises* of the *Ministry of Finance, Government of India, New Delhi*, for five years. He returned to the railways in 1971 as *Engineer-in-Chief* with the *South Eastern Railway* in *Garden Reach, Calcutta*, became *Principal Chief Engineer* in 1974, and finally retired as *General Manager (Construction), N.F.Railway*, in 1980. He settled down in *Bangalore* where he was a faithful and regular member of the *Retired Railway Officers Association (RROA)* till the very end.

Post-Retirement

After retirement, *Sri Verghese* spent a brief period in *Iraq* with *M/s Bhageerathi Engineering*, heading a team responsible for survey of a proposed railway track. He was an *enthusiastic member* of two senior citizen associations, and was associated as *Honorary Advisor* to educational and social organisations.

Sri M. N. Prasad

08 May 1932 - 24 November 2013

Date of Appointment : 05 February 1954

Retired as : Chairman, Railway Board, New Delhi
July 1990



Service Profile

Sri M. N. Prasad, in 1952, immediately on graduation in Civil Engineering with Distinction from the College of Engineering, Trivandrum, joined the then Travancore, Cochin State Public Works Department and served for 1½ years in the Design Section, newly formed in the Chief Engineer's Office to design bridges and structures for the First Five-Year Plan of India. In February 1954, on being selected by UPSC, joined the Indian Railway Service of Engineers and served on various Zonal Railways, the RDSO for railways and finally the Railway Board, for a total of 36½ years of which the last 5½ years were in the capacity of General Manager and above, before retiring as Chairman cum Ex-Officio Principal Secretary to Government of India, in July 1990. As General Manager on North East Frontier Railway, he was responsible for the successful completion of certain crucial stages of construction on the Second Brahmaputra Bridge, a 3 km long road bridge at Tezpur, a prestigious project specially entrusted to the Railway by the North Eastern Council.

Post-Retirement

After retirement, he settled down back home in *Trivandrum*. Since then he **pursued** various matters of public interest, like: (i) *Road Safety*; (ii) *Rational Development of Kerala's Transport Infrastructure*; and (iii) *Animal Welfare*. Besides, he continued to maintain an abiding concern for *Indian Railways* and sounded notes of caution whenever the situation warranted.

Respects to Senior Officers who the Author worked with on the K-K Line



The Author worked with many *Senior Officers* of distinction, who rendered exceptional service on the *K-K Line*. Details are given below of some of them, whose details could be collected. The Author pays respects to each of them for their support and guidance during the association and beyond.

Sri M. Menezes

15 February 1922 – 27 January 1982

Appointment : Assistant Engineer
01 September 1945
Retirement : Chairman, Railway Board, New Delhi
28 February 1980



Sri V. C. A. Padmanabhan

06 March 1922

Appointment : Assistant Engineer
07 February 1946
Retirement : Member (Engineering), Railway Board, New Delhi
31 March 1990



Respect to Senior Officers who the Author worked with on the K-K Line

Sri V. K. J. Rane

24 March 1930

Appointment : Assistant Engineer

10 February 1955

Retirement : Managing Director, IRCON, New Delhi

31 March 1990



Sri M. S. Gujral

11 June 1933

Appointment : Assistant Engineer

01 February 1947

Retirement : Chairman, Railway Board, New Delhi

30 June 1991



Sri A. K. Raman

30 July 1928 – 24 November 2013

Appointment : Assistant Engineer

14 February 1956

Retirement : Group General Manager, IRCON, New Delhi

31 March 1991



Sri P. S. Prasad

15 September 1929 – 16 January 2013

Appointment : Assistant Engineer

26 October 1959

Retirement : Senior Divisional Engineer, S.E.Railway, Waltair

30 September 1987



Sri M. Jagannadha Rao

10 February 1931 – 27 January 1982

Appointment : Assistant Engineer

20 April 1967

Retirement : Divisional Engineer, S.E.Railway, Waltair

27 January 1982



Sri R. Krishna Murthy

22 November 1932 – 20 July 2001

Appointment : Assistant Engineer

31 December 1962

Retirement : Additional Chief Engineer, S.E.Railway, Waltair

30 November 1990



Sri K. Govindan

09 November 1932 – 30 October 1996

Appointment : Assistant Engineer

20 April 1967

Retirement : Divisional Engineer (Construction), S.E.Railway, Bachel

30 November 1990



Sri S. Narayana Rao

05 March 1933 – 31 July 1985

Appointment : Assistant Engineer

16 August 1971

Retirement : Deputy Chief Engineer (Construction),

S.E.Railway, Waltair

31 July 1985



Sri S. R. K. Rao

21 April 1922 – 12 August 2010

Appointment : Senior Permanent Way Inspector
05 May 1945

Retirement : Divisional Engineer, S.E.Railway, Bilaspur
30 April 1980



Sri J. Ankaiah

01 June 1940– 09 April 2012

Appointment : Assistant Permanent Way Inspector
05 May 1945

Retirement : Senior Project Manager (Construction), S.E.Railway,
Waltair
31 January 1991



Sri M. G. K. Swamy

04 June 1932– 11 April 2014

Appointment : Assistant Engineer
24 December 1971

Retirement : Assistant Engineer (Construction), S.E.Railway, Bachel
30 June 1990



Special Respects to Reviewers



The Author sought assistance of three *Senior Colleagues* of distinction, in the review of the manuscript of this book. They provided critical comments and valuable constructive suggestions for improving the quality of document. The Author is grateful to them.

Sri Jitendra Sondhi

Management and Engineering Consultant
New Delhi



Education

B.Sc. (Engineering), Banaras Hindu University, 1957

M.Sc. (Diesel Engine Design), CNNA, England, 1971

Work

Was employed in

Indian Railways Service of Mechanical Engineers during 1959-76

Zimbabwe Railways during 1976-87

Since 2005, working on development and implementation of several high speed railway projects in *China*, having maximum speed of 350 km

Currently

Management & Engineering Consultant in Railway sector to *World Bank* and other international agencies on implementation and supervision of railway projects in *China, India, Europe and Africa*.

Professional Recognitions

Member, Institute of Rail Transport, India

Member, Chartered Institute of Transport, India



Dr. K. R. Rao

Licensed Professional Engineer

Brandon, MS, USA

K. R. Rao's professional experience, spread over five decades, includes architecture and urban design, urban and regional planning, design engineering in automobile, locomotive, aluminum and steel, manufacturing industry experience, civil and structural engineering, mechanical and nuclear engineering fields. He has publications in several disciplines covering a wide range of topics, including operational research, quantitative techniques, urban and regional planning and design, public policy issues, and mechanical and structural engineering.

K. R. Rao retired as a *Senior Staff Engineer* with *Entergy Operations Inc.*, and was previously with *Westinghouse Electric Corporation* at Pittsburg, PA, and *Pulman Swindel Inc.*, Pittsburg, PA. He got *Bachelor's in Engineering* from *Benaras Hindu University*, India, with a *Masters Diploma in Planning* from *School of Planning & Architecture*, New Delhi, India. He completed post-graduate engineering courses in *Seismic Engineering*, *Finite Element and Stress Analysis*, and other engineering subjects at *Carnegie Mellon University*, Pittsburg, PA. He earned *Ph.D.* from *University of Pittsburg*, PA. He is a *Licensed Registered Professional Engineer* in Pennsylvania and Texas. He is past *Member of Operations Research Society of America*.

K. R. Rao was *Vice President (Southeastern Region)*, *American Society of Mechanical Engineers (ASME) International*. He is a *Fellow* of ASME, and active in National, Regional, Sectional and Technical Divisions of ASME. He has been the *Chair, Director and Founder* of *ASME EXPO(s)* of Mississippi Section. He was a *Member of General Awards Committee* of ASME International. He was *Chair of Codes & Standards Technical Committee*, ASME (PV&PD). He developed an *ASME Tutorial* for PVP Division covering select aspects of Code. He is a *Member of Special Working Group* on Editing and Review (ASME B&PV Code Section XI) since September 2007.

K. R. Rao is recipient of several cash recognitions and service awards from *Entergy Operations Inc.*, and *Westinghouse Electric Corporation*. Also, he is recipient of several awards, certificates and plaques from ASME PV&P Division, including *Outstanding Service Award* (2001) and certificate for *Vision and Leadership in Mississippi* and *Dick Duncan Award*,

Southeastern Region, ASME. He is recipient of the prestigious *ASME Society Level Dedicated Service Award*.

He has been Editor since the initial edition of ASME Boiler & Pressure Vessel Code & Standards published by ASME in 1968. The mammoth 3-volume 2,400 page *Comparison Guide* publication of 3rd Edition is now in the 5th Edition, in addition to the 2-volume *Comparison Guide*, a standalone *Continuing and Changing Priorities of ASME Pressure Vessels Piping Codes and Standards* Editor was published in 2014, and *Global Priorities of ASME B&PV Codes and Standards* is due for publication in January 2016. This monumental publication is considered as a *classic* and used in nuclear facilities around the world. He is Editor of 800 page *Energy and Power Generation Handbook – Established and Emerging Technologies* volume published by ASME Press in 2011.

He founded the annual *Early Career Technical Conference (ECTC)* that had the 15th ECTC at *University of Birmingham, Alabama*, during 2-3 November 2015. With his efforts, over 800 persons from Asia, Australia, Europe, Canada and USA attended the ECTC and received honorariums of over \$100,000. He is a *Fellow* of ASME, *Institution of Engineers (India)* and *Chartered Engineers, India*. He was recognized as a Lifetime Member for inclusion in *Cambridge's Who's Who* registry of executives and professionals, and listed in *Marquis 25th Silver Anniversary Edition of Who's Who in the World* as one of the leading achievers from around the globe.

Sri G. V. Mohan

Managing Director

Sundarbagh Design Center, Hyderabad



Education

B.Sc. (Engineering), Mechanical Engineering, Benaras Hindu University, 1956

D.L.C (Honors), Mechanical Engineering, Loughborough University, UK, 1958

D.I.C. (Hydro Power), Imperial College, London, 1961

Work

Bell Maschinenfabrik, Switzerland, 1958-59

AP State Electricity Board

: Tungabhadra Hydro-Electric Pumped Storage Scheme, 1960

: Upper Sileru Hydro Electric Scheme, 2×60MW, Turbines & Valves, 1967

: 4×110 MW Lower Sileru Hydro-Electric Scheme, 1970

: 1×110 MW Nagarjuna Sagar, Hydro-Electric Scheme, 1978

: 4×100 MW Reversible Pump, Turbines and Valves, Srisaïlam, 1982

: Field Support & Operation, All Hydroelectric Stations at Kottagudem, including 2×110 MW Thermal Station, 1985

Aradhana Colony, New Delhi, prepared completion drawings, 1987

Sunderbagh Design Centre, Delhi & Hyderabad, Managing Director, 1988

CAD Assistance for Layout Drawings for Nature Cure Hospital, Hyderabad, 1989

IMECHE Conference on Power Development & Environment, Birmingham, 1990, as part of Eurotech Direct 91, presented a paper

Development Consultant for Voith Hydro Kraftwerk Technik, Delhi, 1996

Educational toys and publishing

Acknowledgements



Sri M. Ravindra (Former Chairman, Railway Board) was Divisional Engineer (Araku) on D.B.K.Railway Project during construction stage. He was kind enough to share his thoughts on this major railway line built by Indian Railways after independence and recognized as an Engineering Feat by the then media. His suggestions are reflected in the Preamble and Preface.

An overview is presented in brief in Chapter 3 of Survey and Construction scenario of D.B.K.Railway. The overview is based on reports given by six retired officers who worked on D.B.K.Railway Projects, namely:

- (1) Sri M. R. S. Murthy, Former Senior Divisional Engineer, S.E.Railway,
- (2) Sri J. Rajulu Reddy, Former Chief Engineer, S.E.Railway,
- (3) Sri P. R. Sivasankara, Former General Manager, IRCON,
- (4) Sri G. V. Subrahmanyam, Former Additional Member (Finance), Railway Board,
- (5) Sri M. D. Khattar, Former Managing Director, IRCON, and
- (6) Sri. M. Ravindra, Former Chairman, Railway Board.

I am highly grateful and thankful to these Officers for sharing construction stage information.

Major problems were noticed in the track structure of the Anantagiri Ghat immediately after opening the line for traffic in 1968. Sri U. V. N. Raju (Retired as Chief Engineer (Construction), East Coast Railway, Waltair) was Assistant Engineer (Araku) during 1969-75. He faced the brunt of the effects of the problem that caused derailments, leading to execution of large scale track renewals works on the entire K-K Line. His report (of 5 March 2015) is given in Chapter 4. Similarly, Sri M. G. Sripathi (Retired as Chief Rolling Stock Engineer, Southern Railway) was Senior Divisional Mechanical Engineer (Diesel), Waltair, during 1977-81. He witnessed problems faced in maintaining the WDM2 locomotives. His report (of 9 March 2015) is given in Chapter 4. Again, Sri J. S. Gupta (Retired as Chief Safety Officer, South East Central Railway) was Assistant Mechanical Engineer (Carriage & Wagon) at Waltair when BOY wagons were introduced newly in 1974 on the K-K Line. He recalled problems faced by him in maintaining BOY wagons; his report (of 19 March 2015) is given in Chapter 4. The reports of these three Officers reveal a great deal of information not known to me, and I am grateful

Acknowledgements

and thankful to them for giving their reports readily within a short period of approaching them. Further, we were closely associated with the *K-K Line Electrification Project*, as we had realigned all curves before the foundations were laid for the masts. Sri M. T. Prabhakar retired as *General Manager, Southern Railway*, in January 1992. He was *Engineer-in-Chief (Railway Electrification)*, Waltair. He was kind enough to give a report on the *K-K Line Electrification Project*, and the same is included in this book; I am highly grateful and thankful to him for the same.

The *Boddavara–Karakavalasa Section* used to get blocked during monsoons every year, sometimes even extending for a period of one month. The hill slopes of *Anantagiri Ghat* are not yet stabile, even after passage of 47 years since opening of the line for traffic in 1968. There were major damages during the cyclonic weather conditions in the years 1983, 1990 and 2014. Sri E. Sreedharan, the then *Member (Engineering)*, Railway Board, inspected the site in 1990, when there was total suspension of traffic on the *East Coast Main Line* and *K-K Line*, and guided and directed quick restoration of the lines. Sri A. Bhima Rao, was *Chief Administrative Officer (Construction)*, Waltair, and in-charge of restoration operations. He recalled the emergency works of 1983 and 1990; his detailed report (of 18 December 2015) is given in *Chapter 5*. I am extremely grateful and thankful to him for readily giving the report and photographs of his experiences.

The *Railway Board* had considered Doubling of the *Araku–Shrungavarapukota Section* in 1966. Sri M. Ravindra (Retired Chairman, Railway Board) was *Divisional Engineer, D.B.K.Railway*, who had handled the matter at that time. The proposal was found technically infeasible; he recalled it in his report. Sri M. Seshagiri Rao (Retired Chairman & Managing Director, RITES) was *Chief Track Engineer, S.E.Railway*, during 1975-82; he suggested that it would be more advantageous to construct a new line from *Dantewara* to *Bhadrachalam–Kovvur* (on *Vijayawada–Visakhapatnam* railway line) following the contour of *River Godavari*, as it will be economical to move the iron ore to *Visakhapatnam Steel Plant* on this alignment. In fact, the Survey was done of *Dantewara–Bhadrachalam* and connection to *Kovvur*, by Sri S. Narayana Rao, the then *Divisional Engineer, D.B.K.Railway*. Now, the *Railway Board* has sanctioned the third line from *Vijayawada* to *Visakhapatnam*; the other alternative routes were to be examined by conducting Surveys, like

- (a) *Araku–Paderu–Lothugedda–Chintapalli–Narasipatnam–Kasimkota* route, and
- (b) *Araku–Paderu–Jalampalli–Chodavaram–Kasimkota* route.

Sri M. Seshagiri Rao had recalled that the situation in 1960 was that (a) a single line bridge across *River Godavari* of 9,096 feet length between *Kovvur* and *Godavari Stations* was struggling to carry even the traffic then prevailing, and (b) it was not possible to add to that load, as the Goods and Passenger Trains were moving at a crawling speed due to speed restriction imposed, as the Girders were made of early Steel. But, two new bridges were constructed, a Road-cum-Rail Bridge (with road on top) on downstream side and a rail bridge on the upstream side (the substructure of which designed and built to carry 2 railway lines, even though only one line was girdered to begin with). Today, in 2015, there needs to

be absolutely no hesitation for the *Jagdulpur* or *Kirandul* traffic to cross and re-cross *River Godavari*, to avail of the very easy plain country with almost no curves and gradients. It was even claimed in one of the surveys, that on the south bank of *River Godavari*, it would be possible to have absolutely straight stretches of 50-60 km setting an Indian record. I submitted this proposal on 31 July 2015 to Member (Engineering), Railway Board, for his consideration.

I am highly grateful and thankful to Sri M. Seshagiri Rao, Former Chairman & Managing Director, RITES, for writing the *Foreword* for this book, and also for his valuable suggestion of an alternate alignment along *Dantewara-Bhadrachalam-Kovvur* for movement of iron ore to *Visakhapatnam Steel Plant* from *Bailadilla Mines*. While in service as *Chief Track Engineer*, S.E.Railway, he was a *beckon of light*, and under his able guidance, a new track design was adopted, for improvement of the track structure, by use of 60kg IRS Steel Trough Sleepers with provision for variation in gauge from -10mm to +18mm using 4 adjustable clips & bolts, to overcome the excessive side wear of outer rails along the 8° curved sections of the *K-K Line*. The trial was conducted in the section between *Boddavara* to *Shivalingapuram* for about 3.5km, and it was successful.

I took charge of maintenance of the *K-K Line* only in 1974 and worked as *Divisional Engineer IV and III*. I found it necessary to include reports collected from colleagues, so that the book gives a *complete* picture of the situation prevailing from the beginning during 1960-68, when the line was opened for traffic, and recalls a fair account of the problems faced during construction stage and the conditions of *Track*, *Locos* and *Wagons* with which the goods traffic was allowed to move. I am grateful to each of these colleagues for taking pains to pen their thoughts from memory and sharing the same with some photographs and sketches.

Sri C. S. Munireddy (Retired *Divisional Engineer*, S.E.Railway) was *Permanent Way Inspector (Shrungavarapukota)* and Sri A. T. Brooks (Retired Assistant Engineer, S.E.Railway) was *Permanent Way Inspector (Kirandul)* during my tenure, and their detailed reports were very useful and incorporated in this book. I am grateful and thankful to them for sharing their knowledge. Also, I am hopeful their details presented in this book will benefit the *Permanent Way Engineers* of the present day and of posterity, and specially those working on the *K-K Line*.

Members and Senior Administrative Officers of *Railway Board* and *RDSO*, sought to upgrade the track structure as and when necessary. Senior Administrative Officers at the Zonal Railway headquarter constantly kept a watch on the date-to-day problems, and encouraged in giving full support and offered help, whenever necessary. Procuring and fixing *P&M lubricators* in 1976 was a critical move. This was possible as Sri M. N. Prasad (Retired *Chairman, Railway Board*), the then *Chief Track Engineer (Track)*, took quick action in procurement of these Lubricators. *Divisional Railway Manager* and *Senior Officers* of the *Waltair Division* (of South Eastern Railway, now East Coast Railway) took stock of the situation and took bold decisions in the interest of running the trains with *Iron Ore*, in spite

Acknowledgements

of the wheel wear on the wagons. The *Assistant Engineers, Permanent Way Inspectors (PWIs), Sub-PWIs and Inspectors of Works (IOWs)* were on foot by foot inspections to prevent any derailment. *Mates, Keymen and Gangmen* had put-in maximum effort throughout the day and night, irrespective of weather conditions. I pay my respects and regards to all my *Senior Officers* for their valuable and timely guidance and help, and to my *Officer Colleagues* for their immediate assistance and co operation at all times, on all occasions (See *Annexure B*). My heartfelt appreciation and thanks are due to all *Assistant Engineers, Senior PWIs, Senior IOWs, Sub-PWIs and Sub-IOWs, and Permanent Way workmen* for their quick response at all times, for their dedicated services, especially in all emergencies.

Sri Thomas M. Verghese was the *Principal Chief Engineer, S.E.Railway*, during 1974–80, and *Sri M. N. Prasad* the *Chief Track Engineer (Track), S.E.Railway* during 1975–78; both were stationed at *Kolkata*. I had the privilege of working with them during my tenure of service at the *K-K Line*. *Sri Verghese* was at *Malligura Diversion Site* for 4 days in 1977 and *Sri M. N. Prasad* at the accident site for 4 days during the accident in 1978 (in the *Chimidipalli-Borrughalu Section*); they piloted the restoration operations. The accident occurred due to fall of a big boulder on the *2nd Engine* of a *3 Engine-consist* of a loaded train, while negotiating *3×80 feet Girder Bridge* in an *8° curve*, on *1 in 60 down gradient* close to a tunnel approach. I had the benefit of working in close association with these high officials. I deeply mourn the sad demise of these Officers; they left us on *11 March 2014* and *21 November 2013* respectively. I humbly dedicate this book to *Late Thomas M. Verghese* and *Late M. N. Prasad*. I pray to the Almighty, that their departed souls rest in heaven...

A number of persons assisted in preparing this book. Some gave extracts of their memoirs for inclusion in the book, and others assisted by giving material (photos, drawings, sketches, ...) to prepare the book. They are gratefully acknowledged below:

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