COLOMBO SUBURBAN RAILWAY PROJECT (CSRP); PART III
- Focus on KV-Line and Balana-Incline;
Concept with Meter-Gauge and Y Steel-Sleepers

By Dr. Frank Wingler, September 2018

Meter Gauge Rail-Track on elevated Structure with Thyssen/Krupp Y Steel-Sleepers and Long Welded Rails (LWR) in Spain
COLOMBO SUBURBAN RAILWAY PROJECT (CSRP); PART III - Focus on KV-Line and Balana-Incline; Concept with Meter-Gauge and Y Steel-Sleepers

Current Affairs on converted Broad-Gauge, former Narrow Gauge, KV-Line Track

Although it will become a long and tedious way to reengineer and transform the KV-Trace to become sound and healthy matching a state-of-the art high capacity Mass Rapid Transit Suburban Commuter Rail-System, the CSRP should first of all concentrate on and focus towards the implementation of the KV-Project target.

It will become not easy to resettle all the encroachers, to reclaim the railway land, to acquire new land for line doubling (at grade or on elevated structure) and for easing the tight curvatures to not tighter than 6-7 Degree.

With the hub for multi-modal operations under construction at Kottawa/Malapalla, a first step has been taken.

It will make it easier, that, for the upcoming engineering works, the KV-line can be fully closed down over a lengthy period, and since presently there is not much rail-traffic on this trace.

In contrast, the other lines, envisaged to be up-graded within the CSRP, cannot be closed down, and reengineering has to be executed under traffic or under short traffic blocks. To make matters worse, on Sri Lanka there are no heavy duty and high performance on-track rehabilitating and reengineering machinery trains as in other advanced countries. On the section Panadura - Slave-Island - Fort there is not enough space for an envisaged third
track; see image page 8. The current poor bearing and yielding formation/embankment of the third track between Demategoda and Ragama is unfit for the envisaged project. The yielding substructure components have to be removed, and a new broader and well bearing embankment/formation has to be engineered. For the envisaged track quadrupling on the troublesome marshy subsoil of the Demategoda-Veyangoda section **Ground Reinforcement** with geogrids will be essential. Line quadrupling on this marshy land will need additional technological foundation and stabilizing measurements; see image page 8.

![CSRP Animation of Multi Modal Operation Hub on KV-Line Kottawa/Malapalla](image)

**Rail-Track Rehabilitation On-Track Machinery Train**

I strongly advocate to upgrade the KV-Track on **Meter-Gauge** with **Y-shaped Steel-Sleepers, with Long Welded Rails (LWR) and Pandrol Fast-Clip Rail Fastening**, providing several advantages over a Broad-Gauge track with concrete sleepers and **Short Welded Rails (SWR)**:
Less space is needed. Y steel-sleepers tolerate shallow ballast cushion and allow a tighter top-of-formation width. They make the track-grid resistant to the so-called “curve breathing” in curves without the need to heap up ballast shoulder as needed for concrete sleepers, and they retain the curve geometry parameters in an excellent way.; see: J. Franz, CURVE BREATHING AND TRACK STABILITY OF Y STEEL-SLEEPER TRACK WITH TIGHT CURVES in EI, DER EISENBAHNGENIEUR, 55, December, 2004; Eurailpress Fachartikelarchiv, www.eurailpress.de/archiv ; see also THE Y-STEEL-SLEEPERS IN SWITZERLAND (DIE Y-STAHLSCHWELLE IN DER SCHWEIZ), PDF, www.os.cd.cz/.../09_Strolz-a86acb4f5feb06b3cae87daea0611d08.

Y steel-sleepers are nowadays widely used especially on mountain railways and by railways with tight curvatures and narrow traces in Switzerland, Austria, Italy, Spain and Germany. The live-span is longer than of concrete sleepers with less maintenance expenditures as demonstrated on a 160 kmph standard gauge test-track between Cologne and Düsseldorf in Germany.

On elevated structure, as envisaged for the KV-line, Meter-Gauge and Y steel-sleepers demand less space, and with less ballast-cushion there is less weight. Modern Light Weight Rail-Cars have higher acceleration and deceleration rates than conventional Power-Sets like the Class S8, S9, S11 and S12 with heavy Diesel-engines in power cars, and they can faster negotiate tight curves.
Y Steel-Sleepers on Meter Gauge Track on elevated Structure of rehabilitated Montserrat Railway Spain

Meter-Gauge Stadler Diesel-electric Module Light Weight Rail-Car for Urban/Suburban Commuter Rail-Service in Greece on Test-Run in Switzerland; Pict. by Peter Walter
Modern high Capacity Suburban Rail Transport System on Meter-Gauge with Y-shaped Steel Sleepers and Long Welded Rails (LWR) on winding Trace, making Use of Ballast retaining Walls, with Stadler Light Weight Rail-Cars; Canton Aargau Switzerland


Micro Cars Limited in Sri Lanka has made efforts to develop Rail Mass Transport Systems in Sri Lanka using Light Weight Rail Car Concepts in order to design and manufacture in Sri Lanka Diesel engine powered Rail Cars under the “LANKA ECONO RAIL” Project. Dr. F. Wingler designed a Rail Car based on the technology of the Swizz Rail Car Manufacturer Stadler with conventional “Diesel Power-Packs” in middle Traction Unit. For Crash-Worthiness, Dr. F. Wingler suggested for the Driver’s Cabins the Stadler Concepts fulfilling European Crash Norms. Two 1 in 87 scale train-set models have been displayed in October 2014 at a Technical Railway Exhibition held at the Richmond College, Galle, Sri Lanka:

1 in 87 Scale Design Study for “Lanka Econo Rail” Light Weight Rail-Car with a B0’B0’Middle Traction Van with inside free Passage for Travelers
Stadler Module Light Weight Rail-Cars for Suburban Rail-Service in Austria

Stadler in Switzerland is renowned for customer tailored solutions. The module rail-cars can be coupled to longer units according the demand of the hour of day. The arrangement of the traction power-packs with up to 2 x 800 kW in a traction-module or traction container makes maintenance easy. For the Lithuanian Railway Stadler has built a special B0B0 four axle Broad-Gauge traction module for rougher rail-tracks.

For the rehabilitation of the ailing Balana-Incline Broad-Gauge rail-track with Y steel-sleepers, one can learn from the complete re-engineering of the Montserrat Railway in Spain, which underwent in 1991 renovation under trace broadening using concrete retaining walls:

Track Re-engineering in Spain on narrow and winding Trace of Montserrat Mountain Rack-Railway with Y Steel-Sleeper, Long Welded Rails and Formation/Ballast Retaining Walls – a shining Sample for Re-engineering the ailing BG Balana-Incline Track in Sri Lanka with Y Steel-Sleepers
Shining Sample for Main-Line Rehabilitation and Upgrading Demategoda-Veyangoda: Ground/Embankment Reinforcement with TENSAR Geogrid on troublesome Subsoil of a Line Quadrupling Project in England; Pict. by TENSAR International GmbH, Germany

Not enough Space for third Track on Coast Line; Pict. by Google
A Target Track-Quality Standard for the CSRP: State-of-the Art Standard-Gauge double Line Rail-Track matching a modern high Capacity Suburban Rail Transport System with 140 kmph Diesel powered Light Weight Rail-Car, Regional Hessenbahn Railway RB 92, Germany

The power point presentation on CSRP “Project to enhance SUTI in Colombo Metropolitan Region (CMR)" presents an animation of the Kottawa/Malapalla Hub. It is suggested to get also an animation designed on the VISION OF A SOUND AND HEALTHY RAIL-TRACK FOR A HIGH CAPACITY MASS RAPID TRANSIT RAIL-TRANSPORT SYSTEM ON THE TRACE OF THE KELANI VALLEY LINE.


Indian Railway`s Designs and Standards should be followed and used when implementing the Colombo Suburban Railway Project (CSRP) in Sri Lanka!

For the implementation of the KV-Line project the management-unit of the CSRP should lay down design parameters and specifications for:

- Ruling Design-Speed of 80 kmph, resp. of 60 kmph on tight curvatures.
- Max. Tightness of curvatures (not tighter than 6-7 Degree).
♦ Width of Land-to-be-taken for Double- and Single-Track incl. the Land needed for Drainage System.
♦ Width of the top-of-Formation for Double- and Single Track.
♦ Bearing Capacity of Formation in [MN/m²]; \(E_v1\) and \(E_v2\) Parameters for Soil-Formation-Materials in [MN/m²].
♦ Max. Axle-Load in [t].
♦ Specifications and Design-Parameters for Track Constituents/Components (Meter- or Broad-Gauge).
♦ Measurements for Headways of < 8 Min. for Shuttle Service between Fort and Kottawa/Malapalla Hub, ~15 Min. up to Padukka and ~20 Min. up to Avissawella.
♦ Acceleration- and Deceleration-Rates of Rolling Stocks in [m/sec²].
♦ Minimum dispatchable Traction-Effort for Rolling Stock per Weight of Train-Set in [kN/kg].

The author suggests for the KV Mass Rapid Transit System the deployment of Communication Based Train Control System (CBTC) or European Train Control System (ETCS) Level 1.

It will be highly appreciated, when the content and message of this letter can be forwarded to the relevant clients involved with the project works.

References:


and the Technical Railway Papers published free for download on http://www.drwingler.com; especially the papers on: WITHOUT WELL BEARING FORMATION AND CLEAN BALLAST-BED NO STABLE RAILROAD, Poor Quality Rail-Tracks in Sri Lanka, published on August 13, 2018 August 25, 2018; and

COLOMBO SUBURBAN RAILWAY PROJECT (CSRP) - an ambitious Project with a long Way between actual and Target Quality of Rail Track, published September 07, 2018;

Fundamentals of Railway-Track Engineering and Technology; Quotations for achieving sound and healthy Railway-Tracks of high Quality fit for modern “World-Class” Railway-Service, published on April 1, 2018 April;

OPTIMISING THE ALL-IMPORTANT WHEEL-RAIL SYSTEM, ASSURING NEARLY ZERO DERAILMENTS, published on: October 8, 2017;

BALLAST, FORMATION AND DRAINAGE; Part I & II; published on: September 18, 2016, January 1, 2017;

F. A. Wingler, DESIGNING A LIGHT WEIGHT MODEL RAIL CAR FOR THE “LANKA ECONO RAIL” PROJECT; published on: July 15, 2016 August 23, 2016 free to download from http://www.drwingler.com ;


