# NEW SIMULATION SOFTWARE FOR TRAIN RUNNING

***Correct determination of Train Running Parameters (TRP, running time, fuel consumption, haulage capacity, etc.) used for route planning, resource allocation, etc. play a crucial role in efficient service operation. Service providers need a robust simulation tool to estimate these accurately. IR's Research Design and Standards Organisation has used software called Runtrain, developed in the 1990s to estimate these TRPs. The results from Runtrain, used since then, have been used for scheduling trains in various sections.***

Recent developments in IR focus on significant improvements like higher operational speeds, longer block sections, automatic signalling etc., generating a need for TRP estimates that are remarkably close to field runs. The *Runtrain* results have not shown close correspondence with the field experience. *Runtrain* needed an update. Besides, *Runtrain* has a considerably basic difficult-to-operate User Interface (UI). This lead to the need for developing new software with advanced capabilities and better UI. RDSO and the Indian Institute of Technology Delhi have now developed software that outputs results that can be incorporated into timetabling methods. The outcome of this collaborative project is a software *Runtrain#*.

Validation of the Runtrain was tried on the Secunderabad-Wadi section in 2004, but the output showed low correlation with field trials on a sectional stop and start passenger train. IR has not incorporated Runtrain results in its timetabling efforts and instead relies on the old rule of the thumb guidance for intersection running, stoppage and restricted speed running…Editor.

The team has conducted one running time proving its ready to use results as the outputs from *Runtrain#* on running time have been compared with the actual running time.

Section: Mysore, Bengaluru, Train number 66552, train configuration: 20 MEMUs

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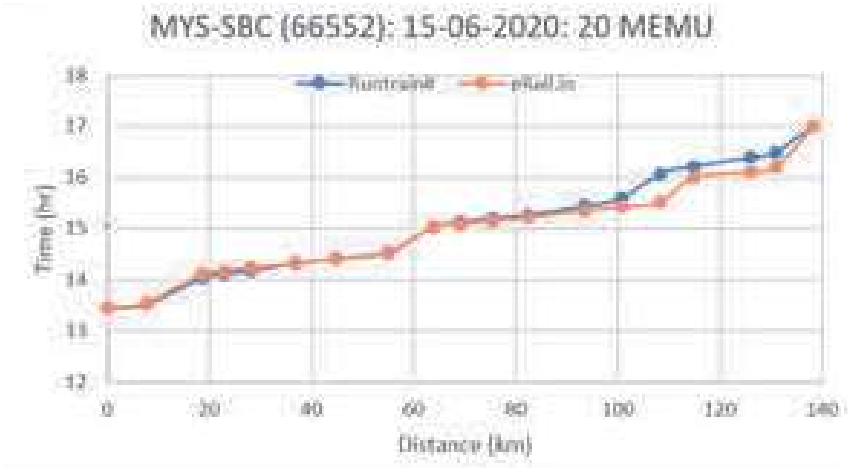
Set 1: Runtrain#

Set 2: Actual time from www.eRail.in

Each dot on the plot represents a halt, the excel file also contains details of the stops in between. On execution, *Runtrain#* window pops up where one builds a train by inputting necessary inputs like the number of locomotives, trailing stock type, maximum permissible speeds etc.




The figure below is the post-processor window to show outputs likely running time estimation, and other parameters of interest. A user can select plot options to show speed profile, energy consumption, etc. The results can be exported for further processing.

RDSO already had a database of section index plans that list the distances, gradients and curvatures for each section, under three files for speed restrictions, station data and gradient and curvature.

In *Runtrain#*, the developers have provided a section data editor window, where the user can create a new section, add/ remove /edit the existing section,or merge/split sections.

## The roads ahead

Porting with digital speedometer results on multiple trains on each zone: IR locos are now provided with digital recording speedometers that capture the speeds for each second. Software to record validation for various classes of trains should be a possibility, permitting a near 100% validation of the outputs of the simulation software Runtrain#. That

would add a new tool to IR repertoire for better train simulation and a much true-to-life timetabling exercise.

- New time tabling rules that incorporate the *Runtrain#* results and experiences: IR methods for train tabling use sectional timings, provisions for trains passing low-speed restrictions on station loops and maintenance works, acceleration and braking times etc. that are fixed without any relation to horsepower upfront and the train types and loads. Clearly, that is a legacy method that can be upended by using such software in all situations. That change needs to be mandated.


- Many companies are now offering onboard driver guidance software that uses stored data and actual runs to guide a driver for better energy efficient or time-saving operations. A parallel development on these lines is now feasible.

*At the time of this report, the IIT method was under study and adoption by RDSO.*

**Features of Runtrain# software**

| Module | Inputs | Outputs |
|---|---|---|
| Running time | Train and section data | Running time, energy consumption (fuel/ power), load factor, braking distance, Distance, and time run on maximum speed |
| Traction | Train data+ | Traction and resistance curves, balancing speed, acceleration profile |
| Time lost due to speed restrictions | Train data, speed, and length of the restriction | Speed profile, fuel and time lost/ gained due to the restriction |
| Dynamic braking | Train data | Braking effort characteristics curve |
| Haulage capacity charts | Train data+, Section data# maximum speed, electrical loads (for electric locos) | Haulage chart for various speeds, maximum haulable stock |
| Acceleration characteristics* | | Acceleration, distance, time charts for various grades and curvatures |
| Optimal assets* | Section data#, maximum no. of locomotives/stock | Minimum no. of loco required to haul, maximum stock for a given number of locos |
| Coupler forces* | Train data+, Section data# | Maximum coupler force of given trainset in a section |

+Train data consist of information like the number of loco and stock, type of loco and stock, loco position, etc.; #Track data contains speed restrictions, gradient and curvature, station data; *New module.

This Simulation Software has been developed under the guidance of Prof. Subir Kumar Saha, Principal Investigator and Prof. Satinder Paul Singh of the Mechanical Engineering Department at IITD; other members of the team: Bhanu Vardhan, Shashwat Jain, S Vishnu, and Rajeevlochana.