Simulation and Potential for Indian Railways

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http://www.anylogic.com/upload/medialibrary/fb5/fb5fed15f60c897b8e5e896a6aeafc0d9.jpg
We will discuss...

- Simulation – Techniques
- Examples of simulation
- Good examples from Industry
- Potential in Railways
- Existing software at IR e.g. RAILSYS at MRVC
- Can we build – Artificial Railway Officer
What is SIMULATION

• Simulation is the imitation of the operation of a real-world process or system over time.

• Simulation can be used to show the eventual real effects of alternative conditions and courses of action.
Types of Simulation

- There are three major methodologies used to build dynamic business simulation models:
  - **System Dynamics** (SD),
  - **Process-centric** (“Discrete Event”, DE) modeling, and
  - **Agent Based modeling** (AB).
- The first two were developed in the 1950s and 1960s and both employ a system-level (top-down) view of things.
- The agent based approach, a more recent development, is a bottom-up approach where the modeller focuses on the behaviour of the individual objects.
System Dynamics (SD), Process-centric ("Discrete Event", DE) modelling Agent Based modeling (AB).
When to use?

• If there is individual data, use an agent-based approach.

• If there is only information about global dependencies, then use system dynamics.

• If your system can be easily be described as a process, then use a discrete-event approach.

• And if your system is complex enough, it probably has all those aspects and you should consider combining the three methods.

  – So IR Must employ all three.
Levels of Decision Making

- **Strategic decisions** are long-term in their impact. They affect and shape the direction of the whole business.
  - RAILWAY BOARD

- **Tactical decisions** help to implement the strategy. They are usually made by middle management.
  - DIVISION

- **Operational decisions** relate to the day-to-day running of the business.
  - ZONE

Simulation can help at all levels

- How many locos to have?
- Coal movement strategy
- Station Layout
- Yard layout
- Increasing line capacity
- Effect of train stoppages on line capacity
- When to move Freight?

Read more: [http://businesscasestudies.co.uk/cima/improving-strategic-decision-making/levels-of-decision-making.html#ixzz48z34G6QB](http://businesscasestudies.co.uk/cima/improving-strategic-decision-making/levels-of-decision-making.html#ixzz48z34G6QB)
List of Simulation Software

• **AnyLogic** is a graphical general purpose simulation tool which supports discrete event, system dynamics and agent-based modeling approaches.

• **Arena** is a simulation and automation software developed by Rockwell Automation. It uses the SIMAN processor and simulation language.

• **Enterprise Dynamics** is a simulation software platform developed by INCONTROL Simulation Solutions.

• PTV Vissim is a microscopic multi-modal traffic flow simulation software package developed by PTV Planung Transport Verkehr AG in Karlsruhe, Germany. The name is derived from "Verkehr In Städten - SIMulationsmodell" (German for "Traffic in cities - simulation model") - [http://vision-traffic.ptvgroup.com/en-uk/home/](http://vision-traffic.ptvgroup.com/en-uk/home/)
Some Examples from one of the most popular software – ANYLOGIC (Russia)

Rail Yard Capacity Modeling
Aurizon is an Australia’s largest rail freight operator, managing more than 700 locomotives and more than 16,000 wagons. Aurizon is widely engaged in coal, iron ore, and mineral transportation. In order to increase operational efficiency the company decided to move one of their rail yards to other town. This rail yard was mainly engaged in wagon and locomotive maintenance and locomotive preparation.
Read more »

CSX Solves Railroad Operation Challenges with and without AnyLogic Rail Library
CSX is a US railroad company that operates about 21,000 route miles (34,000 km). AnyLogic allows the railroad industry users to simulate line-of-road, terminal, and yard problems. The following three projects, completed by CSX in 2014, covered a variety of tasks that were solved using AnyLogic software.
Read more »

Internal Rail Logistics Simulation for the Port of Le Havre
The port of Le Havre, France, needed support for construction of new multimodal terminal. The issue that required simulation was supporting containers transfer between rail trains/river barges and other existing terminals, which transferred these containers to and from sea transport.
Read more »

Optimizing French Railways
The operator of the railway network of the country wanted to know if rail cargo transportation could compete with auto truck transportation. They wanted to make truck-rail-truck transportation more effective.
Read more »

http://www.anylogic.com/case-studies/?TAGS=railroads&NUMBER_TAGS=1509
Optimizing French Railway Freight Traffic

https://www.youtube.com/watch?v=kQtxL2RLwv0
Simulation of Railway Station

https://www.youtube.com/watch?v=0W2VAC4Nlf8&list=PL56DB776111FA2592&index=1
Non Lane Traffic Simulation

https://www.youtube.com/watch?v=lF_RoSlofyA
Simulation of Pedestrians, Traffic, and Public Transport at an Airport Curbside

https://www.youtube.com/watch?v=n6LEOehH4bQ
Rail Yard Capacity Modeling

Aurizon is an Australia's largest rail freight operator, managing more than 700 locomotives and more than 16,000 wagons. Aurizon is widely engaged in coal, iron ore, and mineral transportation. In order to increase operational efficiency the company decided to move one of their rail yards to other town. This rail yard was mainly engaged in wagon and locomotive maintenance and locomotive preparation.

http://www.anylogic.com/case-studies/rail-yard-capacity-modeling

Aurizon approached Evans & Peck consulting company with the following task:

To determine the capacity of a rail maintenance yard and if additional roads were required when additional services were moved to the yard.

To develop the model in a relativity short time when compared to current modelling methods used at Aurizon.

To build a model which can be reused in a larger network model if required.
OPENTRACK- Swiss

http://www.opentrack.ch/mobile/opentrack_e/opentrack_e.html
Headway Calculator / Headway Calculation

Based on a number of input parameters, the headway calculator computes the minimum headway between two trains and is able to identify the critical block section. The two trains may vary in type (e.g. intercity, commuter, freight, etc.), route and stopping pattern. The headway calculation works for fixed block (discrete block), moving block and CBTC systems.
Designing an Evacuation System

PTV Viswalk and PTV Visum: HERMES Research Project - Some Results
ARENA Simulation

- https://www.arenasimulation.com/resources/Panama_Port_Simulation.pdf
- https://www.arenasimulation.com/industry-solutions
- http://embed.vidyard.com/share/pS7K6mD2XlzWk-kWkak7Lw - Airport Example
What we already have

UNTAPPED POTENTIAL OF EXISTING APPLICATIONS
RAILSys at MRVC

RM Consultants - Pioneers of Railway Simulation Software – from Germany

Fields of application of RailSys

– Timetable construction, from local traffic operator to state railway
– Rostering
– Ad-hoc planning of additional train runs
– Creation of work-site timetables in case of track blocking
– Infrastructure data management
– Projecting of new plant facilities
– Variant studies in case of infrastructure modifications
– Determination of quality of service
Five different modules starting from right side towards left of the screen described below:

**Railsys timetable Manager**: For development of the trains timetable or modification of timetable and for running the simulation software.

**Railsys Performance Manager**: To get the output after running the simulation model such as Punctuality of the trains, Junction conflicts, critical locations, etc.

**Railsys Infrastructure Manager**: For developing infrastructure necessary for the running of the trains such as track, signaling, EMU/ LOCO characteristics, speed restrictions, junction interlocking plans etc.

**Railsys Database Manager**: For maintaining the data of different models develop for testing various scenarios on the software. Also for management of users and restrict them from using the software for the specific purposes.

**Dispo**: For developing rake links
Railsys timetable Manager
Evaluation Manager
Evaluation Manager..2
Railsys Infrastructure Manager
Fig. 19-20
Path compression
Fig. 22-5
Section of a simulation run
NETWORK VIEW (Only representative)
PLATFORM OCCUPATION (Only representative)
New AC Suburban Trains on WR Simulation Study by RAILSYS

There are many aspects of study – suggested paths

<table>
<thead>
<tr>
<th>Line</th>
<th>Train No.</th>
<th>From</th>
<th>Dep.</th>
<th>To</th>
<th>Arr.</th>
<th>Run Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up Local</td>
<td>AC1012</td>
<td>BVI PF-3</td>
<td>07.30</td>
<td>CCG PF-2</td>
<td>08.32</td>
<td>1’02”</td>
</tr>
<tr>
<td></td>
<td>AC1014</td>
<td>BVI PF-3</td>
<td>09.18</td>
<td>CCG PF-2</td>
<td>10.20</td>
<td>1’02”</td>
</tr>
<tr>
<td></td>
<td>AC1016</td>
<td>BVI PF-3</td>
<td>12.18</td>
<td>CCG PF-2</td>
<td>13.20</td>
<td>1’02”</td>
</tr>
<tr>
<td>UP TH.</td>
<td>AC112</td>
<td>BVI PF-6</td>
<td>07.20</td>
<td>CCG PF-3</td>
<td>08.09</td>
<td>49”</td>
</tr>
<tr>
<td></td>
<td>AC114</td>
<td>BVI PF-6</td>
<td>09.32</td>
<td>CCG PF-3</td>
<td>10.21</td>
<td>49”</td>
</tr>
<tr>
<td></td>
<td>AC116</td>
<td>BVI PF-6A</td>
<td>12.42</td>
<td>CCG PF-3</td>
<td>13.31</td>
<td>49”</td>
</tr>
<tr>
<td>Down Local</td>
<td>AC1011</td>
<td>CCG PF-2</td>
<td>17.13</td>
<td>BVI PF-1</td>
<td>18.15</td>
<td>1’02”</td>
</tr>
<tr>
<td></td>
<td>AC1013</td>
<td>CCG PF-1</td>
<td>19.05</td>
<td>BVI PF-2</td>
<td>20.07</td>
<td>1’02”</td>
</tr>
<tr>
<td></td>
<td>AC1015</td>
<td>CCG PF-1</td>
<td>20.48</td>
<td>BVI PF-7</td>
<td>21.50</td>
<td>1’02”</td>
</tr>
<tr>
<td>Down TH</td>
<td>AC111</td>
<td>CCG PF-3</td>
<td>16.58</td>
<td>BVI PF-2</td>
<td>17.47</td>
<td>49”</td>
</tr>
<tr>
<td></td>
<td>AC113</td>
<td>CCG PF-3</td>
<td>18.58</td>
<td>BVI PF-7</td>
<td>19.47</td>
<td>49”</td>
</tr>
<tr>
<td></td>
<td>AC115</td>
<td>CCG PF-3</td>
<td>20.34</td>
<td>BVI PF-6</td>
<td>21.23</td>
<td>49”</td>
</tr>
</tbody>
</table>
### DETENTION PARTICULARS OF UP LOCAL LINE:

<table>
<thead>
<tr>
<th>Train No.</th>
<th>Sub. Trains affected</th>
<th>Mail/Exp. Trains affected</th>
<th>Delay range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC1012</td>
<td>90166, 90160, 90170, 90158</td>
<td>Nil</td>
<td>3'19” to 1'25”</td>
</tr>
<tr>
<td>AC1014</td>
<td>90310, 90308, 90304, 90302</td>
<td>Nil</td>
<td>3'59” to 1'34”</td>
</tr>
<tr>
<td>AC1016</td>
<td>90498, 90492</td>
<td>Nil</td>
<td>3'24” to 1'35”</td>
</tr>
</tbody>
</table>

### DETENTION PARTICULARS OF UP THROUGH LINE:

<table>
<thead>
<tr>
<th>Train No.</th>
<th>Sub. Trains affected</th>
<th>Mail/Exp. Trains affected</th>
<th>Delay range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC112</td>
<td>90140, 90148</td>
<td>Nil</td>
<td>1'59” to 1”</td>
</tr>
<tr>
<td>AC114</td>
<td>90316</td>
<td>59045 BDTS-VAPI PASS.</td>
<td>4'32” to 1'32”</td>
</tr>
<tr>
<td>AC116</td>
<td>90553</td>
<td>Nil</td>
<td>2'01” to 28”</td>
</tr>
</tbody>
</table>

### DETENTION PARTICULARS OF DN LOCAL LINE:

<table>
<thead>
<tr>
<th>Train No.</th>
<th>Sub. Trains affected</th>
<th>Mail/Exp. Trains affected</th>
<th>Delay range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC1011</td>
<td>90801</td>
<td>Nil</td>
<td>2'44” to 46”</td>
</tr>
<tr>
<td>AC1013</td>
<td>90929, 90927, 90933</td>
<td>Nil</td>
<td>2'57” to 1'34”</td>
</tr>
<tr>
<td>AC1015</td>
<td>91491, 91063, 90950</td>
<td>Nil</td>
<td>2'48” to 46”</td>
</tr>
</tbody>
</table>

### DETENTION PARTICULARS OF DN THROUGH LINE:

<table>
<thead>
<tr>
<th>Train No.</th>
<th>Sub. Trains affected</th>
<th>Mail/Exp. Trains affected</th>
<th>Delay range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC111</td>
<td>90779, 90812</td>
<td>Nil</td>
<td>2'07” to 9”</td>
</tr>
<tr>
<td>AC113</td>
<td>90923</td>
<td>12961 BCT-IND Avantika Exp.</td>
<td>2'38” to 1'01”</td>
</tr>
<tr>
<td>AC115</td>
<td>91043, 90952</td>
<td>19005 BCT-OKHA Saurashtra Exp.</td>
<td>2'46” to 58”</td>
</tr>
</tbody>
</table>
# Existing WR Suburban network
## Simulation for resolving bottlenecks

### Punctuality Position

CCG-ADH Section

<table>
<thead>
<tr>
<th>SUMMARY OF CONSTRAINTS from RAILSYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>Andheri</td>
</tr>
<tr>
<td>Borivali</td>
</tr>
<tr>
<td>Marine Lines</td>
</tr>
<tr>
<td>Mumbai</td>
</tr>
<tr>
<td>Central</td>
</tr>
<tr>
<td>Goregaon</td>
</tr>
<tr>
<td>Churchgate</td>
</tr>
<tr>
<td>Bandra</td>
</tr>
<tr>
<td>Ville Parle</td>
</tr>
<tr>
<td>Dadar</td>
</tr>
<tr>
<td>Mahim</td>
</tr>
</tbody>
</table>
Summary of Constraints (only for representation)

**Borivali:**
Borivali Down Local Home signal at a distance of 1420 mtrs.
Provision of island platform between Down and UP local.
Removal of 15 Kmph crossovers.
Excessive diversions of Virar bound locals from Down Through to Down Local & CCG bound fast locals from UP local to UP through.
Cross overs for diversion are situated in mid-section.
Non availability of simultaneous reception of UP local to UP through line trains to PF No. 5&6, respectively.

**Andheri:**
Removal of 15 Kmph speed crossovers.
Excessive diversion of Borivali bound semi fast locals from Down through to Down local & Churchgate bound semi fast trains from UP local to UP through.
Summary of Constraints

**DADAR:**
SR 30 Kmph till last vehicle clears Pf 4.
The distance between approach signal and starter on Up Through line 824 mtrs. and Up Local line 898 mtrs.

**Mumbai Central:**
Removal of 30 kmph speed restriction on up local line from 5/6 to 4/6 Kms.
Down through line starter signal two aspect.

**Bandra:**
No isolation provided for Common loop line between UP Local line and Down local line.
The distance between approach to starter is 695 mtrs. for UP/T trains.
UP local line starter signal- two aspect.

**Churchgate:**
Removal SR 20 Kmph while entering and leaving Pf.1 & 2.
Ease PSR of 40 Kmph on DN local, UP local and DN T/L.
In the same study (full report is in the folder)

HEADWAY WHICH WAS GIVING CONFLICTS – 3’20”
IDEAL HEADWAY AS PER SOFTWARE – 3’48”
Datalogger

Specification -
http://www.rdso.indianrailways.gov.in/works/uploads/File/IRS_S_992006%20%20Amendment%204%20mod%2016th%20Nov.pdf

Manual by CAMTECH-

It can simulate Train movement with yard and station layout. COA data discrepancies can easily be found by this.
Sample Station from datalogger
Sample Station Video from datalogger

JUMPA NWR
RailSYS and Datalogger can together

- Simulate entire Railway Network
- Build timetable – Pan India
- Detect all bottlenecks
- Real time updates on the TRUTH !!!
- Plan for the future
- After DFC, can be used for auctioning the EMPTY PATHS to private players.
Discussion

HOW IR CAN BENEFIT
Lucknow Railway Station

https://goo.gl/maps/9p6nNdEBudS2

The Vehicle movement and parking area simulation
Vadodara Platform No 7 connecting to Main line
VADODARA AREA

PROVISION FOR CONNECTIVITY
FROM LINE NO1 TO LINE NO8
(PLATFORM NO7) AT BRCP
Connecting group of three lines including PF 7 in to Line No. 1 of BRCP towards ADI end.

Advantages of work:

– Availability of alternate platform for UP trains.
– Avg. of 40 passenger train and 78% of total UP Goods train passed via line 1 (platform 1)
– Three additional lines become available in UP dir. for Goods trains, if through path is not available.
– Detention of Goods trains in UP direction will be saved.
– Line boxes of Goods crew & Guard of UP Goods train to be changed on these line and train passed from Line No. 1.
...Connecting group of three lines including PF 7 in to Line No. 1 of BRCP towards ADI end.

- Advantages of work:
  - At present after one Passenger/M-Exp train is received on PF-1 in Up direction, second train is required to be taken on PF-2/Line No. 2, affecting down movement. The connectivity will provide facility to handle ST bound up train in platform No. 7.

- Action:
  - Work to be sanctioned in Law Book
  - Estimated cost of Rs. 95 lacs
Station Capacity Assessment

There are some published guidelines, for example by Network Rail here:

Capacity assessment guide Network Rail

The formulae can be used for simulation:

The formula for the total number of gates in each gateline is as follows:

\[
\text{roundup}\left(\frac{5 \times \text{EntryFlow}}{25 \times 5}\right) + \text{roundup}\left(\frac{\text{TotalNumberofExitingPassengers}}{25 \times 2}\right) + X
\]

The formula for the total number of gates in each gateline is as follows:

\[
\text{roundup}\left(\frac{\text{TotalNumberofEnteringPassengers}}{25 \times 5}\right) + \text{roundup}\left(\frac{\text{TotalNumberofExitingPassengers}}{25 \times 4}\right) + X
\]

\[
\text{Clear width} = \left[\frac{\text{PeakMinuteEntryFlow} + \text{PeakMinuteExitFlow}}{40}\right] m
\]
Financial viability and Revenue model
Some items identified by RB

1. New line between Biyavra Rajgarh-Bhopal (104 km)
2. Gauge Conversion between Miyagam-Dabhoi-Samlaya (96 km)
3. Doubling between Surendra Nagar-Rajkot (115.7 km)
New line between Biyavra Rajgarh-Bhopal (104 km)
Gauge Conversion between Miyagam-Dabhoi-Samlaya (96 km)
Doubling between Surendra Nagar-Rajkot (115.7 km)
Following are the major challenges being faced in coal transportation:

- Lack of availability of proper transportation mode for produced coal
- Mismatch between the demand and supply of railway wagons
- Lack of infrastructure to support a coal movement at full capacities

Restructuring and/or reallocation of railway networks to connect with the coal bearing areas

- Doubling of railway routes at places where coal movement is higher
- Enhancing port capacities as well as evacuation efficiency and augmenting the existing capacities from existing ports

This is the modelling part: Restructuring and/or reallocation of railway networks to connect with the coal bearing areas

The Indian coal sector: Challenges and future outlook - PwC Report 2012
https://www.pwc.in/assets/pdfs/industries/power-mining/icc-coal-report.pdf
SCENARIO: Sagar Mala

The Grand Coastal Shipping Programme of GoI

[Map of Sagar Mala Programme]
Inland Waterways

http://iwai.nic.in/map.php?lang=1

These will be the biggest challenges to IR
• Coastal shipping
• Inland waterways
ROAD-LINKING SCHEME

TOTAL LENGTH
5,000 km
(Approx)

INVESTMENT
₹50,000 cr

STATES TO BE COVERED
Entire northeast,
Odisha, West Bengal,
Punjab, Rajasthan,
UP, Tamil Nadu, J&K,
Himachal Pradesh

FOCUS | Provide road connectivity all along the borders and to ports on the coast

MAJOR STRETCHES
Rajasthan (1000 km),
TN (600 km), WB (300 km), Odisha, (400 km), Uttarakhand (300 km)
Western Corridor (1499 km)
Rewari-Vadodara (920 km)
Vadodara-JNPT & Rewari-Dadri (579 km)

Eastern Corridor (1839 km)
Bhaupur-Khurja (343 km)
Bhaupur-Mughalsarai (402 km)
Khurja-Ludhiana (442 km)
Mughalsarai-Sonnagar (122 km)
Sonnagar-Dankuni (534 km)

And of course, DFC
Latest Technique- Agent Based Modelling (some literature)

- [http://www2.econ.iastate.edu/tesfatsi/acomplab.htm](http://www2.econ.iastate.edu/tesfatsi/acomplab.htm)
- [http://jasss.soc.surrey.ac.uk/12/4/4.html](http://jasss.soc.surrey.ac.uk/12/4/4.html)
- [http://www.mcs.anl.gov/~leyffer/listn.slides-06/MacalNorth.pdf](http://www.mcs.anl.gov/~leyffer/listn.slides-06/MacalNorth.pdf)
- Survey of Tools - [http://jasss.soc.surrey.ac.uk/12/2/2.html](http://jasss.soc.surrey.ac.uk/12/2/2.html)
Can we do this?

ARTIFICIAL RAILWAY MANAGER/OFFICER
Automated Decision Making

- Decision once taken by human, should not be repeated.
- It will be learnt by the Computer- Machine learning.
- Artificial Intelligence today has gained momentum again
  - Data Analytics
  - Tremendous computing power
Is it possible?

YES

Atleast Tactical and Operational decisions can be automated as here human discretion can be minimised.

Strategic level are Politico-socio decisions—difficult to model.
Lawyers ask ROSS research questions in natural language, just like they were talking to a colleague, and the AI 'reads' through the law, gathers evidence, draws inferences and returns with a 'highly relevant', evidence-based answer.

The program will continue to improve the more it is used.

It also keep track of developments in the legal system and especially if anything pertains to a lawyer's specific case.
Project CROCODILE was launched in 2013 to establish a transnational framework to collect and exchange data for putting into place concrete improvements for road users – such as dynamic traffic safety information or information on parking space availability for truck drivers. It is co-financed by the European Union’s TEN-T programme.

CROCODILE addresses congestion and traffic gridlocks in border areas of Central and Eastern Europe that are caused by coordination gaps among road operators.

It involves national ministries and their agencies, road operators and service providers from 13 countries (Austria, Bulgaria, Cyprus, Croatia, the Czech Republic, Germany, Greece, Hungary, Italy, Poland, Romania, Slovakia and Slovenia).

Machine Learning

Scenario Analysis and Simulation
Current Data Analytics
Old Data Analytics

ARO

COA
FOIS
ICMS
PRS
SLAM/LMS

IoT and other Data

ARCHIVAL DATA BASE

Passenger Feedback
Asset health

ANALYTICS
ARCHIVAL DATA BASE

Old Data

Passenger Feedback
Asset health
Latest Decisions in IR that will help develop ARO

- Data Analytics cell formed
- Integration of Databases
- Common platform envisaged
- IoT (Internet of Things) coming in the system
- Innovation Challenge
- Opening up the sector to ideas from market
DISCUSSION

What can you do?

MISSION MODES OF IR DEFINED IN 2016 BUDGET
## Mission Modes

<table>
<thead>
<tr>
<th>S.No</th>
<th>Mission</th>
<th>Objective</th>
<th>Mission Director</th>
<th>Faculty Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25 TONNE</td>
<td>70% originating loading on 25 Tonne and above axle load wagons by 2020</td>
<td>EDME (Fr)</td>
<td>SPCE/SPME</td>
</tr>
<tr>
<td>2</td>
<td>Zero Accident (Elimination of UMLC)</td>
<td>Zero unmanned level crossings (UMLC) on Broad Gauge in next 3 years</td>
<td>EDCE/B&amp;S-II</td>
<td>SPCE/SPFM</td>
</tr>
<tr>
<td>3</td>
<td>Zero Accident (TCAS on High Density)</td>
<td>Train Collision Avoidance System (TCAS) commissioning on 100% of high density network in next 3 years</td>
<td>AM/Signal</td>
<td>SPST/PNM/PSM</td>
</tr>
<tr>
<td>4</td>
<td>PACE (Procurement and Consumption)</td>
<td>Optimise procurement spending to achieve cost savings in the current financial year</td>
<td>EDRS (G)</td>
<td>SPMM/PFI/PIM/PIT</td>
</tr>
<tr>
<td>5</td>
<td>RAFTAAR</td>
<td>Increase average speed of goods trains to 50Kmph and average speed of passenger/superfast/mail/express trains by 25Kmph in the next 5 years</td>
<td>Adv/Mobility</td>
<td>SPTM/PIT/PEE/SPME</td>
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## Mission Modes

<table>
<thead>
<tr>
<th>S.No</th>
<th>Mission</th>
<th>Objective</th>
<th>Mission Director</th>
<th>Faculty Group</th>
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</thead>
<tbody>
<tr>
<td>6</td>
<td>Hundred</td>
<td>Commission hundred private sidings and freight terminals in next 2 years</td>
<td>EDFM</td>
<td>SPCE/SPFM/PCM</td>
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<td>7</td>
<td>Beyond Book Keeping</td>
<td>Roll out accounting reforms across Indian Railways in next 2-3 years</td>
<td>ED/Accounting Reforms</td>
<td>SPFM/PAM/SPOB</td>
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<td>8</td>
<td>Capacity Utilisation</td>
<td>Plan for utilizing capacity on IR network once the DFC’s are commissioned in 2019.</td>
<td>ED/PP</td>
<td>SPTM/PCM/PFI</td>
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<td>9</td>
<td>SRESTHA</td>
<td>Setting up of SRESTHA</td>
<td>ED/E&amp;R</td>
<td>SPMGT/SPST/PEE/SPCE/PRM</td>
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<td>10</td>
<td>Rail Planning &amp; Investment Organisation</td>
<td></td>
<td>AM/Planning</td>
<td>PIT/PCM/SPCE/SPTM</td>
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<td>11</td>
<td>NAVRACHANA</td>
<td>Innovation Challenge</td>
<td></td>
<td>SPMGT/PAM/PNM/SPOB/PCM</td>
</tr>
</tbody>
</table>
“If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions.”

– Albert Einstein
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Official Website of IR: http://www.indianrailways.gov.in/
Knowledge Portal of IR: http://www.kportal.indianrailways.gov.in/

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