PART 4 OF TENDER DOCUMENT

CONTROL OFFICE APPLICATION

FUNCTIONAL REQUIREMENTS DOCUMENT

Control Room Operations Automation for Indian Railways

1 Introduction

The Divisions, numbering more than 69 are the operational arms of the Indian Railways. They have autonomous functionality in running the day-to-day operations. The divisional control office is the nerve center for all activities related to train running. It has the following major functionaries – A Chief controller controlling the overall train movement and related activities, stock controller for planning wagons / rakes as per demand, train controller for controlling the train movement, punctuality controller for keeping a watch on the punctuality performance, power controller for arranging locomotives and crew and section controller for monitoring and regulating the movement of trains in a section by issuing instructions to the ASMs of the stations lying in his section.

The stations form the lowest tier in the operational hierarchy. These stations may have attached to them goods sheds, sidings, loco repair sheds or marshalling yards. ASMs receive instructions for train movement and related activities from control office and execute the same. In the control center, each event concerning a train move is received and recorded, be it arrival / departure, crew change, track availability / un-availability and any activity which has an effect on train running. The section controller monitors train runs, over a designated number of stations under his control through an omnibus voice circuit, which links all stations under his control. Each train run is monitored and recorded by the controller on a time - distance chart though a line graph. Each line graph represents a train over six hours duration, which is the time frame for each control chart. The control chart marks off on XY axis; the movements of trains over a six hours time frame against the list of stations comprising the section with the requisite inter station distances indicated on the chart, and has stubs to indicate various associated events such as track failures, crew change, signal status, fuel status. Trains are charted on the line graph on a predefined colour scheme with advance plotting done for planning movements of trains from the section controller's viewpoint. Since more than 100 years, IR has a system of manual control charting, where the section controller draws train movements on paper chart provided for the purpose.
The present system involves multitude of paper work, wherein many support staff are utilized to rewrite the information depicted on charts into various registers. This activity takes more time than the real graph-plotting operation. Also, the punctuality monitoring by the Chief Controller is haphazard, and he is unable to take proactive action with respect to traffic monitoring. The management also is unable to receive on-line information about various events and have to rely on tertiary information to take managerial decisions
The most sensitive and critical operation in any transport organization thus takes place from Control Room, and Indian Railways (IR) is no exception.

There is a need for automating these operations. Various prototypes have been implemented for the same in some divisions catering to the specific needs of those divisions. In order to interconnect these prototypes, the need for a standardized system, which enforces structured reporting all over Indian Railways has become a necessity. This document specifies the user

requirements based on the said study and prescribes the solution architecture.

1.1 The Control Office Operations Solution

The prime considerations that shall be kept in mind while visualizing Divisional Control Office Operations Application are :-

1.1.1 Integration with FOIS NTES, CMS and adjoining divisions.

Divisional Control Office Operations Application must be viewed as an application capable of collaborating intricately with FOIS (RMS & TMS), NTES, & Charting front end and other planned sub modules of OIS on an All-India basis. It should aim to prevent duplication of efforts and ensure that investments already made in these applications are fully utilized, thereby leading to best value for money solution.
This would ensure that it become the entry point not only for data required for various analyses of divisional operations, but also the source for real-time/near real-time data for FOIS, NTES and adjoining divisions. Integration across sections / divisions is a must to ensure the growth of the control operations solution in to an overall OIS integrated with FOIS.

2. Functionality in Computerized Environment

Control Office Application (COA) shall provide for better planning and decision-making environment for train movements. The look and feel will be similar like Chennai implementation of COA. The system shall try to overcome the problems currently faced by the existing prototypes and manual system. Various factors that shall be addressed by the system are –

- There shall not be islands of information. The required information shall be shared electronically between various users across the geographical spread of the system.
- Multiplicity of reporting shall be avoided to have consistent data. The information entered on the chart shall be propagated to all controllers implicitly through the system.
- By having a single source of information, conflicting data shall be avoided.
- The processes shall be standardized and structured reporting shall be adopted.
- The development for the functionality shall be modular and shall emphasize on reusable components to be built to avoid duplicity of efforts.
- An integrated approach for IR shall remove the difference in business practices and it will streamline data collection, consolidation and analysis.
- Since the required information shall be readily available, it shall take less time for other functionaries to carry out their duties. This shall help them in better planning for train movement and resource utilization.
- The extent of dependency on control room personnel to get the required data shall be reduced.

- The errors induced by manual compilation shall be reduced since the system shall perform the compilation in the format desired by the user.
- Man Machine Interface shall be user friendly and easy to use.
- The COA shall interface with data-loggers on divisions wherever they are installed.
- The COA shall communicate SMS alerts through mobile phones to Railway management
- The COA shall be capable of interfacing with display devices at stations.
- At the time of sectional/ divisional interchange, the relevant information of a train such as train number, loco number, consist, crew details and BPC details shall be propagated to the adjoining section/ division electronically through the system at a configurable time to the expected time of actual interchange.
- The divisional interchange forecast shall be readily available to the divisions.
- There shall be no need of entering the data manually into NTES. The data shall be sent to NTES through Central application Server (CAS) at CRIS. Similarly data to the extent captured in COA shall be sent to FOIS through Central application Server (CAS) at CRIS. Information regarding asset failures shall be electronically transferred to the concerned departments.

2 Train Controlling

For planning and controlling the train movements, different functionaries perform various tasks in the control office. These tasks aid in the smooth and safe movement of trains. The repository of events recorded in this process is used subsequently for failure analysis and performance monitoring. Considering the factors involved, Control Office Application shall automate the following functions.

Input events in COA:

2.1 Train Ordering

For Passenger Trains

In case of scheduled passenger trains, the train shall be ordered automatically by the system by a configurable time interval in advance, based on the referential static data of train number, scheduled time of departure from originating station, train time table, load composition. Dy Coaching shall be required to put back a scheduled train if so required, for that particular day, in case the train has yet not been ordered by the system or modify the expected departure time. The putting back of the train for a day shall be temporary and shall not affect the train ordering of the same train the next day.

For ordering any unscheduled passenger train, the Dy. Coaching of the originating division shall be required to input a temporary time table for the same along with its period of validity. The train shall be ordered automatically by the system according to a configurable time interval in advance in the same manner as in case of scheduled time tabled train as above.

For Freight Trains

The scheduled and unscheduled freight operations load forecast includes load name, destination station, expected ready time, direction, line number, load summary, loaded/empty status. Prior to the defined configurable time interval decided for train ordering the above information shall be input through Control office Application and shall automatically order the train in case of a scheduled freight train. The system design should be such that this implementation can be pushed from FOIS.

In case of unscheduled freight train however, Dy. Trains shall be required to further specify the train ordering time, train category, train via and train up to station for advising an anticipated train path which will order the train in COA.

For scheduled freight crack trains, he shall also have to specify the train path schedule (from Static Referential) along with the generic name given to such crack trains. The section controller shall have an option of changing the colour hues of lines of such trains to identify them distinctly on the chart.

In case of departure of freight trains from originating yard, the Section Controller shall record both the yard departure time as well as the station departure time.

Control Office Application shall also have the facility of "forecasting a load" before train ordering. The user shall provide load name, destination station, expected ready time, direction, line number, load summary, loaded/empty status for such a load.. There shall be facility of train / load cancellation through the Control Office Application.

For Light Engines

Scheduled and unscheduled Light engines for engines already in traffic use (engines not in shed custody) shall also be ordered in the same manner as in case of trains. Running of track machines, Tower Wagons on a section shall be dealt in the same manner as above.

Power Controller or authorized designatory shall forecast in COA, loco number wise likely shed out time either to link it with a passenger link or to be used in freight on open timings. The time stamp beyond which the loco number is being switched from passenger to goods or goods to passenger and/ or to other specified service (LOCO, Accident Relief Trains etc.) shall also be captured besides the forecast time.

In case of both scheduled and unscheduled passenger and freight trains, the Dy. Train and section controller shall both have a facility to put back/bring forth the originating train by changing expected departure time of the train.

The train ordering shall be depicted on the Controller's chart as a small rectangular box (referred to as a "dot" later) on the time it is expected to depart from the station, which shall appear automatically on his monitor.

In case of both scheduled and unscheduled passenger and freight trains, the Dy. Train and section controller shall both have a facility to put back/bring forth the originating train by changing expected departure time of the train.

Only after train ordering, advance plotting for that train shall be feasible. The first departure from the originating station shall be preceded by a train ready report.

In case of scheduled and unscheduled trains crossing over to adjoining division, on the adjoining Control Office with train ordering information the "dot" shall automatically appear on the section controller's chart (along with expected time of interchange and other relevant information viz. BPC, Consist, Loco, Crew) meant for this division at pre defined configurable time interval decided for train ordering. The Section Controller shall have the facility for entering the details if the dot is not available and link it afterwards.

For an originating train about to start from a yard/station, the basic inputs needed can be described as the "The Ready Report".

2.2 Train Ready Report

The train ready report shall include Consist reporting, Crew reporting, Locomotive attachment, BPC reporting and modified expected departure time (if so). The contents of the ready report for the system shall be different for passenger and goods trains.

2.2.1 Consist Reporting

For Passenger trains, the standard rake consist picked from referential data during train ordering shall be taken as default and may be modified by Dy. Coaching or Section Controller as the case may be, before train departure.

In case of freight trains, The section controller shall confirm the load report to verify the move which was anticipated through the train ordering task with respect to the dot being reacted upon. The Section Controller shall have a facility for entering the consist on the Load.
Consist reporting of other trains like ART is discussed separately.

2.2.2 BPC Reporting

For passenger trains, the BPC reported is from source to destination and only the BPC number and time shall be captured.
For freight trains, the initial BPC shall be entered in COA or receive form the adjoining division in train ready report task through CAS. But any enroute examination resulting in a new BPC needs to be captured in COA.

2.2.3 Crew Sign On/ Off

Provision for entry of Arrangement of crew details shall be made in COA.

2.2.4 Loco Attachment

The section controller is required to confirm (validate) the Loco Number in the Train Ready Report. There shall also be an option available for enroute attachment/detachment of loco, say at traction change points, wherein while detaching loco, the user shall provide the detachment time and reason for detachment along with the details of loco number, type of loco attached.

2.2.5 Running Line Occupation

In case of originating trains coming to the station's running line from the yard / washing line, the section controller shall have an option of specifying the line number and line occupation time. On receipt of this information, the concerned line shall be shown as occupied till the departure of the train. He shall also have an option of vacating a station's running line when a terminating train moves to a yard/ washing line by specifying the time at which that particular line is vacated.

Functionaries:

All this information shall be entered by Dy. Trains, Dy. Coaching or Section Controller (as identified designated personnel for carrying out these tasks in the system for each control office may be different) and shall be available to section controllers and other users.

Integration with adjoining divisions / FOIS /NTES

The requisite information shall be entered once by the originating station after validation and shall be passed electronically through the system to the adjoining section/ division as well as divisions in the train path based on a configurable time period prior to which the interchange with the relevant division is expected.

There shall be data interchange between COA and FOIS / NTES. While passing this information to FOIS, certain validations shall be applied and invalid data shall have to be reconciled.

INTEGRATION WITH ELECTRONIC DEVICES**:**

The system shall receive the arrival/departure and other train operations related information from data loggers. Configurable Operational alert to management through SMS shall be also provided.

Moreover, the COA shall have capability for propagating the information regarding arrivals, departures, ETA's and ETD's to other local systems like display boards, Short Message Service (SMS) for mobile phones, etc.

Reporting of Train Arrival/ Departure/ Run Through in COA

The system shall be configurable to show along side the station the total number of running lines and those that are occupied with the option for inputting data either

a) Through tabular format.

b) Through point and click of a mouse/ any pointing device.
c) data logger wherever installed

It has been further studied and found that the users' comfort to adopt either of the above input mechanisms depends on an individual's dexterity to manipulate the point and click device.

User shall have the facility to erase or modify the LAST plotted movement, in case of wrong plotting.

It shall be possible by the user to modify/add/delete the number of stations depicted on the screen for a section or the number of running lines at a station with ease.

Functionaries:

Arrival, Departure and run through details shall be entered by the section controller and shall be available for further analysis to other users. Designated users shall have an option to view the snapshot of the chart.

In Control Office Application, section controller shall report the train movement details in the above-described way train by train. The system shall draw the train movement on the chart. This information shall be readily available to other functionaries on their respective terminals instantaneously. Various reports required by them shall be generated by the system. These reports are discussed later.

Transfer of data to FOIS/ NTES.

For freight trains, certain events at designated points like reporting stations, sectional interchange point and divisional interchange point (or any other designated criterion) shall be sent to FOIS through Central application Server (CAS) at CRIS. The COA should be able to push and receive this from FOIS.

For time tabled passenger trains, the train arrival and departure events shall be sent to NTES through Central application Server (CAS) at CRIS. The interchange arrival / departure needed by the adjoining division/board shall be automatically transferred.

In case of any link failures or the requisite data being not available in the adjoining division, the Section Controller shall be provided a facility to make the "dot" appear on his screen and perform subsequent events in COA by giving train information as asked for during train ordering (except the FOIS rake link in freight trains). The requisite data shall be transferred to COA from FOIS and shall need to be reconciled once the link comes up.

2.3 Advance Plotting

Planning and depicting the movement of all type of trains in advance is called Advance Charting/ Plotting. Section Controller uses Advance plotting as a tool to control train movements, check that blocks rules are being adhered to and to decide judiciously Precedence and Crossings.

The following procedure shall be adopted in COA:

The system shall automatically generate advance plot for all the trains on a particular board in addition to this the system will also provide a fast point-and-click interface for

the section controller to pick up whichever train(s) he wants to manually change the advance plot. The section controller shall first select a train for which he wants the plot and the system shall plot its movement, considering certain fixed parameters broadly enumerated above. The section controller shall have the option to change the slope of the advance-plotted line. Moreover, a mechanism through mouse operation shall be provided to the section controller for indicating slope of a train in a block section that should be considered for advance plot of that train. Thereafter, the controller can choose the next train for which he desires a plot. The system shall plot the movement of the second train, considering certain fixed parameters so that the Section Controller is able to view the location where a conflict is likely. Considering Crossing and Precedence rules, system shall give various options to Section Controller to resolve the conflict. The time delays likely to be incurred by each train for crossing and precedence's at any of the optional stations shall also be indicated. The Section Controller can choose any of the options provided by the system or give his own plot. The chosen plot, if any shall then be considered as the final advance plot for these trains, if not changed by the Section Controller himself. Once he has done the plotting, the system shall apply validations and give requisite warnings.

Whenever the user for making an advance plot redraws a slope, the system will exercise validation between the two stations, based on maximum slope applicable for that train, calculated using the parameters already mentioned above. It will also exercise validations on conditions, which will result in breach of block rules (including minimum block working time required between two block stations and the time required to travel adequate distance for clearing the block section.). The system shall also give warning prompts if section controller, while deciding crossings and precedence's, tries to bring a train to a station loop line whose length is less than the length of the train (based on the consist available in COA), line is occupied, there is wrong line movement etc.

There shall also be a facility to view the system generated advance plots for a selected range on the chart or for the whole range on user request and make modifications as explained above.

The advance plot for the selected trains shall be visible on the chart along with the actual train path as the train moves on the section. If the Section Controller finds that the movement is not according to the advance plot anticipated by him, he should have a facility to “erase” the earlier advance plot and redraw it afresh.

Projection of Expected Time of Arrival

Advance plotting is also resorted to in order to project expected train arrival at the scheduled halts based mainly on the parameters given below: -

- Type of train, Booked speed (in exceptional cases maximum attainable speed), Maximum Permissible speed
- Type of Block working
- Maintenance Blocks Imposed
- Permanent speed restrictions
- Caution Orders/Temporary Speed restrictions

- Negotiating the station through a loop line
- Run Through time.
- Crossings & Precedence.
- Average speed of the train on the last three block sections with similar terrain, unhindered by any speed restrictions /unusual occurrences

For applying validations and projection of ETA's of trains, the system shall internally calculate ETA's and ETD's for all the trains at a pre defined interval based on the above-mentioned factors and store them as pipeline information without displaying them on the graph.

All Permanent Speed Restrictions shall be advised to the system (which have been put in the database) through an input task to update the referential data of the station and block section. Station specific Permanent Speed Restrictions (e.g. at Turnouts, loop line positions and direction of approach) shall also be built in the referential. Permanent Speed Restrictions due to Maintenance shall be stored department wise.

To calculate the running time over a caution area whether in the block section or in the station yard and also for clearance the following parameters shall be considered: -

- Length of TRACK specified in the Caution Order.
- Speed factor of the train speed imposed at the caution order/ speed while negotiating a loop/ cross over etc.
- Length of the train (based on the vehicle consist available in COA).

Caution Order Imposition detention delay should be built in the advance plotting for calculation of ETA's (Time for deceleration, acceleration). Same is applicable at the time of cancellation of Caution Order.

The concept of maximum attainable speed has been consciously introduced to enable the section controller to restrict the maximum permissible speed prescribed for that train during its run in case of any failure of equipment enroute and at the same time, to take care of any unforeseen conditions that can not be accounted for by imposition of speed restrictions through caution orders. This feature shall be beneficial in the calculation of ETA (Expected Time of Arrival) and for providing more accurate expected time of arrivals and departures to NTES (National Train Enquiry System) and FOIS.

The timings indicated, as per the advance plot of the train shall be used for projection of ETAs for those trains for which advance plotting has been done by the section controller. The end time on the line graph drawn as advance plot for a train (or current position for a train for which advance plot is not given) would be used for projecting expected arrivals beyond that point and would be passed on to NTES/FOIS.

ETA shall be revised at each arrival and departure of the train or when user makes

changes in the advance plot. The difference between advance plot resorted to by the user and ETA's calculated by the system should result in an alert to the Section Controller about the validity of the advance plot through a configurable periodic alert mechanism.

Advice of ETA to NTES and FOIS by COA:
In both cases, the time stamps given by the plotted portion would take precedence over other considerations including time table for estimation beyond the advance plot. In case of a time tabled train, its late or early arrival compared with the time tabled arrival would be advised.

At a pre decided interval (recommended 15 minutes) of time, ETA information for all time tabled trains should be refreshed and maintained for each sectional board in a division. The interface software layer for NTES/FOIS will pick up data from COA for scheduled halts and interchange points. Actual arrival/departure from the scheduled halts will be advised separately. The train running queries shall be answered through the system and the controller shall be spared from this task. A facility to change ETA/ETD of a train shall also be provided to Dy. Punctuality so that any change in ETA/ETD at scheduled halts of a scheduled train can be addressed and made available to allied systems.

2.4 Recording of Unusual Occurrences

An event constitutes any unusual occurrence reported by the stations to the control that may or may not result in detentions to trains.
Certain events which would necessarily have affected train operations, had a train been present at the point of occurrence or would have infringed the safe running of goods and passenger trains shall necessarily be captured by the system including the details regarding their place and time of occurrence, time of removal/rectification. A representative list of events is given in glossary.

Certain events cause impediment to train movements owing to deficiencies/ failures/obstruction over an area be it a block section, station, or a line at a station. These events may be planned or unplanned. The events can thus be broadly classified as follows:

a. **Events that cause total blockade of train movement at a station /on a block section or a line and would therefore affect all trains in the rear that are scheduled to traverse this region**:
   Events falling in this category would comprise of planned events related to granting of maintenance blocks, which would already have been fed into the system. This has been discussed later.

   Block bursting, accidents, Train parting, agitations are examples of unplanned events. Since these events affect all trains in rear, the following details would need

to be apprised by the user to enable the system to calculate ETA's and advance plot: -

- Nature of Event
- Event id
- Location (Station or Block Section)
- Start Time
- Expected End Time
- End Time
- Remarks

The events shall be coded department wise and the user shall fill in the above details. For the sake of further analysis more data may be required by the system in some case e.g. in case of Train parting, user may need to get information regarding the train parted, how many coaches in front/ rear portion, When Authority to proceed without line clear given, time when engine sent to retrieve the left over portion, etc. Thus separate screens shall be designed to cater to these requirements.

b. **Events that cause a speed restriction to be imposed on all trains over a block section/station/line traversing the region till rectification/removal of obstruction.**

Certain speed restrictions have already been conveyed to the system in the form of caution orders and thus fall in the nature of known/preplanned restrictions. These are dealt with later in the chapter.

When certain speed restrictions are first imposed, may be on account of rail fracture, screening works in progress etc., they may cause a train to be stopped out of course at the station in rear for issue of necessary instructions. Once these instructions get incorporated in the caution order being issued by the nominated station, the trains would not require to be stopped but the speed restriction would continue to be in force till reporting of cancellation and shall be duly applied to all trains for calculation of ETA. In this case as well the following input shall be taken:

- Nature of Event
- Event id
- Location (Station or Block Section)
- Start Time
- Expected End Time
- End Time
- Max Permissible Restricted Speed
- Remarks

Event id shall also be linked to the caution order once it is incorporated in the system.

c. Events that cause speed restrictions to be imposed on a particular train.

Such events would affect a particular train. Owing to delay to this train, other trains may however get delayed, but the event is train specific e.g. Brake block binding. The planned restriction, say on account of derated/defective loco may already have

been conveyed through a caution order but in the unplanned case, an event id shall automatically be generated by the system once detention is reported to a particular train. In case the speed restriction is to be imposed for a train before its run on the designated section, then the following information would be required:

- Nature of Event
- Event id
- Train number
- Location (Station or Block Section)- May also pertain to entire journey
- Max Permissible Restricted Speed
- Remarks

This information shall then be used for calculating the slope of this train on the graph as it traverses the section.

d. **Events that cause regulation/stabling of a particular train at a station or a block section**

Certain trains may need to be regulated at a station/ on the section. The system should be able to capture:
Train to be so regulated,
Place or location
Start time
End time
Event id.
Then while charting the train shall not be moved till lifting time is advised or train departure time is advised to the system.

e. **Other failures causing detention to a train**.

This category includes events that may have repercussion on calculation of ETA and thus the time of removal of the cause of impediment would need to be provided by the user. Events like signal failures, provision of meal halt, Issue of paper line clear, introduction of single line working, total failure of Communications, OHE tripping fall in this category. Wherever the delays are known for any such events through referential data, they shall be picked up in case the user gives no information.

For example, if an event id relates to **signal failure**, the system shall navigate to the next table for reporting.
Place of occurrence- Station/ Block section
Start Time of failure
Which signal failed- Outer, Home, Advanced Starter, starter
Signal Number
Asset ID
Time of rectification
Time by which each train likely to be delayed
Then the system shall pick up the time by which each train is likely to be delayed and delay all trains passing through this region by the specified time, for calculation

of ETA., till the reporting of rectification.
Similarly in case the event id pertains to introduction of **Single line Working/Paper line clearance, the system would prompt for the following information:**
Station
Direction
Likely Detention to a train in Up direction-
Likely Detention to a train in Dn direction
Time of start of Single Line Working
Expected end time
Actual end time

After reporting of a failure, the concerned department shall be notified by flashing a message about the failures so that the concerned department can take prompt action. System shall have the facility to report the corrective action taken.
The user shall map these asset failures to the detentions caused by these failures at the time of detention reporting.

Events like maintenance blocks, introduction of single line working, paper line clearance, power block etc. should be depicted clearly on the charts along with a caption describing the type of block.

Functionary –
Section Controller shall report the failure details. Dy. Punctuality and concerned departments shall get this information through the system.

Change in Procedure –
In the manual system, the concerned departments receive the asset failure information on paper; hence there is a delay in receiving information and in taking corrective action.

In computerized environment, there shall be instant flashing of messages regarding the asset failures to the concerned departments so that immediate corrective action may be taken.

2.5 Detention to trains

Detention to trains comprises of those delays that are suffered by a train on its run. These required to be reported for assessment of punctuality performance of scheduled trains and asset performance for goods trains. While events capture the end time and start time of any failure/ obstruction the detention reporting takes into account the actual delays suffered by a train on account of various events.
These would be reported train wise by the section controller. A separate task for reporting detentions shall be included. This will cover detentions at stations, in section to be reported separately.

Mandatory data for detention reporting at a station is –

- Train Number
- Start Time
- Expected End Time
- End Time
- Primary Reason (in terms of event)
- Event id
- Station

If the detention is **In Section**, either of the two stations can report the detention – the station from where the train has departed or the station where next arrival is to be reported.

Mandatory data for detention reporting is –

- Train Number
- Position in Block Section (KM)
- Start Time
- Expected End Time
- End Time
- Reason (in terms of event)
- Event id

Section Controller shall enter the train number, KM where the train has been detained, Start Time, End Time and primary reason from the dropdown list.
Section Controller shall enter the train number for giving detention details and the station at which the train is detained. Arrival Time of that train at that station shall be treated as start time of the detention and shall be populated automatically.
In both the cases, if the detention has taken place due to already reported asset failures/ events, the user shall map the detention to the asset failure/ event through the event id. In other cases, the user shall specify the detention reasons, which shall automatically create an event (described earlier). This event may be applicable to subsequent detentions also.

A horizontal straight line shall appear during that period of time on the chart for which the train had to stop with the color of the train specified. The section controller shall report only primary reason of detention. Some other functionary shall fill in the secondary reasons, if any.

Dy. Coaching gets full details of the detentions suffered by a passenger train from the guard's troll (CTR) also at the end of the journey. The COA should also be capable of capturing this data on line for the purpose of analysis. Such details are also available for goods trains and can be reported as a backend activity. Dy. Coaching, thus shall have an option of modifying the detention reasons. Thus the system should permit modifications in the event file till the time CTR is made available for punctuality analysis.

If a train is moving on a wrong line and another train is delayed because of this move, the reason for loss of time for the second train shall be deemed same as the reason for the movement of first train on wrong line.

For a scheduled train, recovery time on different accounts – traffic, engineering is provided to the train on its run and a train running late on account of imposition of caution orders can minimize the late running by the time provided for engineering recovery. Similarly, if halt at any station is curtailed, that can also be attributed to traffic recovery. Thus not only delays suffered by a scheduled train in the block section/station need to be reported, but also time made up on the run accounted for by the system.
Main reasons for detention to a train shall be visible on the chart. This detention is event specific and time lost on this account say ACP, C&W failure, Loco Failure shall be logged as major detentions. To view further details, user shall select the train and shall choose the detention menu. Train wise detention report shall be prepared through the system, which shall be beneficial in Punctuality Analysis by Dy. Punctuality.

Functionary –
Section controllers shall report detention details with the primary reasons. Dy. Punctuality/ Coaching shall report the details of the detention as well as secondary reasons. The data required for punctuality and various other analysis shall be readily available through the system to other users.

Change in Procedure –
In the manual system, section controller reports the detention with primary reasons. Dy. Punctuality gathers all the detention details from the ASMs at the stations and prepares the punctuality reports.

In computerized environment, the detention details reported by section controller shall be passed implicitly through the system to the other users. Dy. Punctuality shall report secondary reasons for the detention. Punctuality reports generated by the system shall aid in punctuality analysis.

2.6 Capturing Speed Restrictions and Caution Orders in COA

Caution Orders are Speed Restrictions imposed on the traffic due to various reasons. Section Controller needs to see the list of Caution Orders all the time for better planning of the train movements. These Caution orders can be Temporary or Permanent order, Day order and Engineering orders. An Engineering Order is applicable to all trains. These Caution orders are given at the Train originating station for all scheduled and non-scheduled train runs. These caution orders specify the speed restrictions to be followed in various sections during a train run. The Permanent Speed Restrictions are built in for the scheduled ETA's of timetabled trains.

Temporary Speed Restrictions (TSR) or Caution Orders are imposed and lifted from

time to time due to various reasons. These Caution Orders affect the train running because the trains have to follow a strict speed reduction operation for the length of track specified. Since various departments initiate Caution Orders for different works, the controller is intimated in advance of such work. Normally, different departments are allotted a fixed time for the work being done.

Speed Restrictions imposed on locomotives, rolling stock, station and block section running lines (e.g. gate inoperative, cattle over-run, etc.) shall be captured by the system through either the Section Controller, Dy. Trains or any other authorized designatory, wherein he specifies the restriction over a station/block section/line or on a train (i.e. the restriction to maximum attainable speed of a particular train in case of malfunction). Caution Orders shall be codified department wise.

Caution orders are notified to the drivers and guards of the trains regarding the caution orders in force at certain nominated stations. Whenever a fresh caution order is imposed, the station in rear immediately advises both the control and the nominated station regarding the imposition of the caution order. The station in rear stops all the trains due to enter the section, and hands them the caution order till the time the nominated station confirms that the caution order has been included in the list being handed over to the crew. The nominated station also indicates the first train to which the caution order is being given by the nominated station. This shall also be fed into the system.

Station Masters shall be advised by the section controllers of the recently imposed speed restrictions through a prompt by the system. The information shall also be sent to CMS. Similarly, the cancellations shall also be advised.

A separate list shall also be maintained to see whether the delay caused by Caution Orders exceeds the allotted time (Recovery time).

It shall be possible to show the caution orders in force on the full section, in a tabular format on the screen at all times.

Details required for Caution orders:

S.No.	Speed Restriction	Message No	Station Between	KM Between	Reason	By	Date Time	Private No.

There shall be a provision for mapping an event already recorded to be converted to caution order.

Functionary –
Chief Controller approves the caution orders to be imposed and shall authorize the concerned functionary to enter the details of caution orders and cancellation of the same.

Change in Procedure –
In the manual system, chief controller informs the section controllers regarding caution orders on paper. Section Controllers, in turn, write these caution orders on the chart.

In Control Office Application, section controller shall enter the details of caution orders as informed by the Chief Controller. This information shall be implicitly propagated to section controller and other users. Caution Orders shall be displayed on the second monitor for section controller so as to facilitate him in planning and decision-making.

2.6.1 Cancellation of Caution Orders

During cancellation of Caution Order, a Private Number is exchanged with the station. The cancellation details which shall require to be entered are:
--

Private Number	By	Date Time

2.7 Reporting of Blocks in the system

This refers to a situation in which a line or all the lines at a station or in a block section are blocked due to engineering reasons, any accidents in the section or a power trip. Maintenance blocks are scheduled while breakdown blocks are unscheduled. Section controller takes into consideration, various blocks in his section, while planning train movements.

The chief controller shall plan the scheduled blocks activities for a period of time and pass the information to sectional controller. Once entered by Chief Controller, list of scheduled blocks can be seen by section controller, which shall be applied for the day. The sectional controller shall discuss the details of scheduled and any unscheduled blocks with the concerned department and enter all the permitted blocks with their duration, reason and department in the system.

System should in addition have the facility of indicating start of block after passing of a certain train.

Case 1: If one line is blocked at a station

Following set of details shall be entered by section controller for giving single line block:

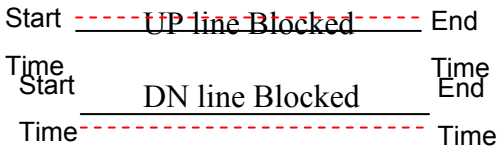
- Station
- Start Time
- End Time
- Direction (UP and/or DOWN)
- Block Type
- Line numbers that are blocked

It shall be possible to give information from the referential data regarding simultaneous reception /dispatch facilities from various lines (Depending on cross overs provided/ signaling etc.) in order to plan movement at times of blockage.

On saving, a Red Dotted Line shall appear on either Up or Down of the station for that time period depending upon which line is blocked. If UP line is blocked at that station, the Red Dotted Line shall appear on Upper side of that station. If DOWN line is blocked at that station, the Red Dotted Line shall appear on Lower side of that station.

In this case, the train may move on wrong line. For example, if the UP line is blocked at a station and the user reports the arrival/ departure/ run through of UP train at that station, the system shall give a warning message and shall treat this as wrong line movement. Wrong Line Movements shall be depicted on the chart by writing 'WL' alongside the train line at that station so that the section controller can plan the trains moving on that line accordingly.

Introduction of single line working involving wrong line movement, paper line clear working, power blocks etc. shall be indicated by mentioning the reason for the block/ Type of block as well.



Case 2: Representation of Full Block on the Chart

Whenever there is some block on both UP and DOWN line as well as loop lines, it shall be treated as Full Block on the Track. Red Rectangle in the chart shall represent the Full Block.

The section controller shall give the following inputs to draw the Full Block:

- Station

- Start Time
- End Time
- Direction (BOTH)
- Block Type

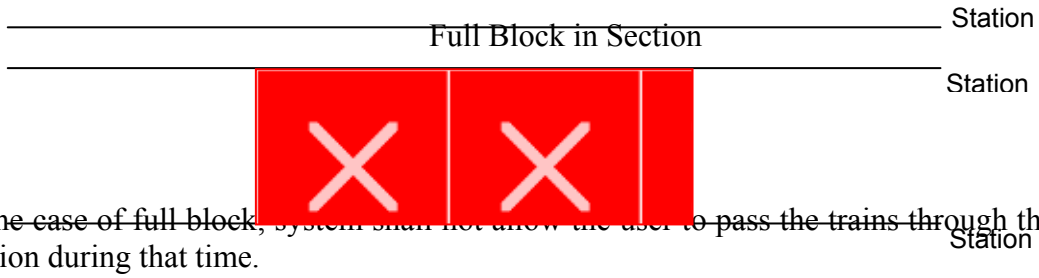
Full Block at Station

In the case of full block, system shall not allow the user to pass the trains through that station during that time.

Case 3: if the block is in section

If the block is in section then the section controller shall note down the following information:

- Start Time
- End Time
- Direction (UP or DOWN)
- Station From
- Station To
- Block Type



Full Block in Section

In the case of full block, system shall not allow the user to pass the trains through that section during that time.
Movement shall however be permitted by the system only in exceptional cases like accidents, train parting where light engines, ART may need to be sent in the blocked region. This is dealt with later.
In automatic block sections, if a train enters the section during block period, it shall be shown as standing in mid-section on the chart.
The depiction of block on the chart shall include a progress bar showing elapsed time and time remaining. The user will have to specifically indicate the time at which the block has ended.

In case the duration of a block extends to the next shift as well, the block shall be automatically indicated in the graphical chart for that shift and the time of start of the

block will also be mentioned therein.

2.7.1 Block burst/Extension

When the time period granted for a block is extended with permission, it is known as Block Extension. When it is extended without permission, it is called burst. Both the cases need to be depicted on the chart so as to plan for safe movement of trains.

To give the details for block burst, user shall double click the rectangle block and shall give the extended time only. Existing details of the blocks shall be visible to the user. After giving the time, rectangle/ line shall be extended till the extended time period. In case of extension, user shall have the option to give the reason for extension.

Functionary –

Chief controller shall enter the details of blocks permitted for the day. The section controller shall report further details of the block required to draw the block on the chart. This information shall be available to other functionaries for further analysis.

Change in Procedure –

In existing manual system, chief controller sanctions the blocks to be implemented for the day. This information is passed to the section controller who, in turn, decides the timings for the block and draws it on the chart. In order to do analysis like block allocation versus utilization, other functionaries take the data from the chart.

In Control Office Application, chief controller shall enter the details of the permitted blocks for the day. The section controller shall get this information readily through the system. He shall report the timings and other required details to draw the block on the chart. Section controller shall enter the details of block burst/ extension. The data required for the analysis shall be passed implicitly through the system. The lines where block is operative shall be shown in red on the line diagrams.

2.8 Stabling/Regulation

The user shall also have an option of reporting stabling of trains. If expected Lifting Time is known at the time of stabling, option to report the same shall also be there. The stabling information related to freight trains shall be transferred to FOIS.

For stabling a train, the user shall report following details:

- Train Number/ Load Name
- Stabling/Regulation Station
- Stabling/Regulation Start Time
- Expected Lifting Time
- Stabling/Regulation Reason

The train line shall be extended horizontally till the expected Lifting Time and shall be

shown in Red color. To report the lifting of the train, the user shall report the following:

- Lifting Time

The lifting time shall be treated as the departure time of the train. After reporting the lifting of the train, the train shall be displayed in its original color. Stabling details shall be fed in by running a special stabling task provided for the purpose. The Section Controller, who then clicks on the time at which the train is stabled/lifted, shall select the train for which stabling/lifting information is being entered.

Functionary –
Section Controller shall report the stabling and lifting of the trains with reasons. This information shall be available to other functionaries for further analysis.

Change in Procedure –
In manual system, section controller reports the stabling details.

In Control Office Application, section controller shall report the stabling and lifting details. This information shall be used for generating reports on stabling.

2.9 Enroute Wagon attachment /detachment

In case of freight trains, Wagon attachment/detachment reported by the Section Controller shall be communicated to FOIS electronically, where this shall be validated against the consist/yard balance. Any discrepancy shall be reconciled and reported back to Control Office.
In case of passenger trains, Coach attachment/detachment reported by the Section Controller.
Section Controller shall invoke the Wagon Attachment/detachment task after choosing the desired train.

Functionary –
Section Controller shall report the enroute wagon attachment/ detachment details. Dy. Goods shall get this information through the system.

.

2.10 Diversion / Rerouting/ Termination

In case of scheduled and unscheduled passenger trains being diverted or rerouted, the Dy. Coaching shall update the train's path (only for that day) along with scheduled ETA's and ETD's. This information shall be uploaded to NTES at a defined configurable time interval. This information shall also be used to calculate revised ETA's and ETD's in context of advance plotting.

In case of freight trains, the Dy. Trains/Section Controller shall update the train path by specifying load via and load destination. Diversions/rerouting shall also be communicated to affected divisions/sections electronically at a defined configurable time interval, which shall accordingly change the appearance of the train "dot" in subsequent divisions.

For reporting diversion, user shall choose the diversion option and shall enter the following details:

- Direction
- Via
- Load Name/ Train Number
- Reporting Station
- New Destination Station(in case of diversion only)
- Change Time
- Authority By
- Authority Date
- Authority Number
- Commercial / Operational Diversion (In case of goods Train)

Functionary –
Section Controller shall report the diversion/ rerouting details. Dy. Goods, Dy. Punctuality and other users shall get this information through the system.

2.11 Accident Management

In case of accidents, the controller shall immediately give the inputs regarding the accident so that the line(s) can be marked as blocked. The user shall plan for Accident Relief Trains (ARTs). Referential data for all ARTs and medical vans with current location and equipment shall be maintained in the system. The system shall also maintain the information regarding the nearest hospitals (with phone numbers) in the referential data. This shall help the user to plan for accident relief in an efficient way. Movement of ART and its composition, starting from the time when it is called for to the time when it reaches the accident site shall be reported in the system. The return journey(s) of the ARTs shall also be reported in the system. ARTs proceeding to the accident site shall be given highest precedence.

If a derailment takes place, part of the train may be carried by the already attached loco and other part may remain in the section thereby resulting in blockage of the lines. This is known as train parting. To remove the remaining wagons, light engine is moved to derailment point and the remaining consist is removed either backwards or forward.

The line shall be shown as blocked till the last wagon/ bogie is removed from the line and details shall be entered through Section detention task. The system should allow movement of Accident relief train, light engine meant for clearing the tracks, medical vans, cranes during such a block.

Movement on an obstructed line by a train shall be verified by the system before being accepted as input. Moreover, before permitting movement on wrong line, an event of obstruction to the adjoining line should have been reported. Movement on wrong line/ Blocked line will then be a subsequent event reported to the system.

Following inputs shall be required from the user while reporting ARTs movement –

- Time at which ART is called for
- Time when engine in/ out line
- EOL time
- Staff on ART
- Departure time from base
- Time of Arrival at the accident site
- Time of reaching mid section
- Complete details of ART Movement
- Departure time from the accident site
- Composition of ART

The system shall also be able to depict the movement of cranes; light engines used during accident management, for which inputs similar to those mentioned above shall be captured.

2.12 Shift Start/ End

2.12.1 Shift Start

At the time of start of the shift, the system shall show a summary of tasks performed during the previous shift. This shall help the section controller to plan the tasks during his shift. In general, the user shall not be allowed to do the reporting for the previous shift. In exceptional cases where the an event is spanning over the two shifts in time, the user shall be allowed to report on that e.g. for a block/ detention which spans over the two shifts, the user for the next shift shall be allowed to report on the same.

2.12.2 Shift End

When the shift ends, the section controller shall have an option of viewing the summary of tasks performed by him during his task. This shall facilitate him to take actions on pending tasks. This summary shall consist of –

- Caution Orders Imposed
- Blocks
- Detentions suffered
- Overdue Locos
- Special Features/ Events

At the time shift end, the user shall have an option to list the pending tasks and hand over to the section controller for next shift.

After the shift changes, the chart of the previous shift shall be treated as frozen. No changes shall be allowed on this chart with the above mentioned exceptions. User shall be allowed to view the old charts. Any further reporting of detention shall be allowed to be performed by Dy. Punctuality.

2.13 Creation and maintenance of Referential Data.

Referential base data needed for train running and other events reporting shall be created and maintained on each division. In order to drive the Control Office Application the vendor shall create referential databases for the Madurai and Trivandrum divisions of IR on which the COA software is to be implemented. Some of the components of the referential database are enumerated below:

1. Station Master
2. Station Lines
3. Train Schedule
4. Load Route
5. Codified Detention Reasons
6. Gauge Codes
7. Station Directions
8. Track Gradient
9. Track Curvature
10. Asset Types
11. Rake Types
12. Train Types
13. Load Category
14. Stock Types
15. Wagon Types
16. Locomotive Masters
17. Wagon Masters
18. Commodity Codes
19. Divisional Interchange Master
20. Sectional Interchange Master
21. Station Distances
22. Section Profile
23. Division Profile
24. Crew Master

The vendor will also provide maintenance application for the referential data.

2.14 Master Charting Module

Along with the charting application for day to day running of trains and advance plotting to assist the section controller, software has to be developed for Master charting, While developing a robust simulation model for master charting for assessing the capacity of a section is not in the present scope a facility should be available to generate master charts based on scheduled trains and manually inserting unscheduled good or passenger movements which should then get plotted automatically using the logic and constraints already built for advance plotting. A suitable interface should be built to facilitate easy and quick insertion of unscheduled trains or new scheduled train planned for the section with suitable validations and alerts to ensure compliance of operational constraints like block working rules, availability of lines, berthing, loops etc. The controller should also have the facility to manually plot the path of unscheduled trains inserted by him with alerts for any logical conflicts with block working, availability of berths, scheduled trains etc. the advance plot should have a 24 hour scrollable window with facility to introduce unscheduled trains at configurable time (6-8 hrs) in advance of the start time for master chart. Different scenarios built by simulation of the master charts as above should be saved in the database for future reference and building fresh scenarios. Referential databases as required for the master chart utility shall also be created in addition those already created for control charting and advance plotting.

2.15 Security and Functions of various functionaries in computerized environment Roles.

The relevant Chart shall be updated only by designated Control Room Personnel in the corresponding shifts between shift start and shift end. Once the shift of one Section Controller ends, the next controller shall not be allowed to make changes on that chart. The chart shall be frozen at the end of the shift of the section controller. This frozen "picture" of chart should be available later for analysis. Any changes, which need to be incorporated for that shift (from guards troll), shall not temper the "original frozen" shift end chart available. The next controller can only view the chart of the previous shift.

After the end of a shift, details of events/ detentions entered by section controller shall be kept separately. A copy of these details shall be provided to Dy. Coaching or any other designated functionary for modifying detentions, till the time CTR is available for analysis and input of further detention details.

The work distribution of different functionaries shall require to be mapped in the computerized Control Office environment. The application design should provide for role-based functionalities for various roles like Chief controller, Dy. Trains/Dy. Goods, Dy. Puncuality/Dy. Coaching, Section Controller, Power Controller etc.

Every user shall have a pre-defined set of roles and functions for which he shall be authorized to operate on. No unauthorized person shall be able to gain access to the system.

Only system administrator shall be allowed to login to the database.

2.16 Man Machine Interface

2.16.1 Graph

A Section controller keeps track of all the trains in his section by plotting all movements on a graph paper, which is drawn as Time V/S Station. In this graph different categories of trains are represented by different colors. Section controllers maintain these graphs for various time periods, generally in blocks of 6 or 8 Hours. Chart should be prepared and saved to coincide with the shift timings so as to facilitate smooth handing over of the chart with facility to show some period like one hour in advance of the shift or post completion of shift. The section controller working in a particular shift shall not normally be allowed to modify the timings of the previous or next shift. Exceptions necessitated by operational considerations shall be logged with administrative and security safeguard.

The system shall have a configurable time span for a chart display window, in order to facilitate accurate and clearer depiction of minute lines on the chart for ease of mouse handling, In Control Office Application, there shall be Time v/s distance graph. The display should be configurable to show actual plotting one hour before The Chart shall be displayed in form of graphs with X coordinate as time and Y coordinate as Stations. The distance between the stations in the chart shall be shown proportional to the actual distances between the stations. Sectional Interchange points shall be shown in the charts of both the sections. It should be possible to add/delete/modify stations, branch lines in a section shown on the chart and the number of running lines at a station with ease. Similarly changes like conversion of a section to double from single or change of gauge should be configurable.

Whenever the user wishes to view the line occupation or the station diagram or any other refrential information for a particular station on his section he shall be able to chose the station through a drop down list on the data entry monitor and On selection of the desired station be able to chose the various option to display the required station. Similarly he should be able to view sectional information. He shall also be able to view caution orders in force, blocks, asset failure, various online reports, special features, alerts, etc. The user shall have an option of choosing the queries/information, which he wants to see constantly on the screen. This shall make the information required by him available at his disposal in order to facilitate smooth and safe train run .

In the graph, different categories of trains shall be represented by different colors. The standard colour scheme is followed on IR to distinguish separately various types of

trains running on the section in order to facilitate the section controller in train identification and arranging of crossing and precedence. Since the Railways are now also running trains with committed transit times and certain time tabled goods trains have also been introduced, their string lines shall be shown in separate colours so that that their running can be watched effectively. On certain divisions, crack trains are run within certain specified time slots on a division. It is essential that these trains are also distinctly seen on the chart. Therefore the endeavour is to retain the standard colour scheme for all types of trains while adding distinct colour codes to incorporate the above mentioned train types.

The colour coding for various trains has been indicated in the table below :
The user can set on the monitor colour hues of the trains to define different crack trains.
There shall be an option available to the section controller to hide the movement of military trains.

A controlled train with loco attached shall be depicted in the colour meant for that train type when on a station.

Entry/ Origin points of trains shall be shown as hollow rectangular boxes of same color as of the train type. For trains entering a chart on the Y-axis (i.e. at intermediate stations on a section), these boxes shall be placed horizontally. For trains entering the chart on the X-axis (ie at the first station on the section in UP/DOWN direction), these boxes shall be vertical. This box shall contain the following information

Train Type	**Content Of Box**
Scheduled Passenger Trains	Train Number
Time Tabled Goods Trains	Schedule Id
Committed Transit time goods trains	Destination for loaded, rake type for empties
Crack Trains	Destination for loaded, rake type for empties
Light Engines	Loco Number

Exit/ Terminating points of trains shall be shown as ovals. In case of passenger trains, the terminating point shall contain the platform line number.

In order to distinguish between a train arrived at a stopping station and a train which is run through, the arrival at the intermediate station in the first instance shall be depicted on the chart as a dot (of the same color as of the train) and in the second instance (for run through train), as a dot along with a sloping extension of the train line in the direction of train movement. For advance plots or trains expected to enter a division, the dots shall be shown in gray colour to avoid any confusion with the arrival/departure of train. As soon as the actual arrival/departure of the train is advised to the system, the colour of such dots shall change from gray to the train's corresponding colour.

The controller should be able to access the relevant details of the any board or trains, stations and other details of his section.

There shall be proper representation of section inoperative due to communication failure on the chart separate from depiction of blockage ..

2.16.2 Scrollable Graphs:

A Section controller keeps track of all the trains in his section by plotting all movements on a graph paper, which is drawn as Time v/s Station graph. The time duration of the chart in computerized environment should be configurable. The scrolling of the chart should be controllable through configurable parameter on manual intervention by the user i.e. the chart shall scroll only when the user advises the system to scroll it by a configurable time interval. Section controllers shall have an option to view the previous charts.
User shall also have the facility to enter/modify the anticipated end times of certain events like detentions, stabling, blocks, etc. that are likely to extend beyond his shift by changing the expected departure times, expected lifting time, expected end time, etc. This shall be beneficial when the section controller is aware of events such as stabling, blocks and shall be relieved from the task of transferring the information to the next section controller and thus handing over a chart at shift change shall not be a cumbersome task.

2.16.3 Dual Monitor:

The system for section controllers, on which Control Office Application software shall be installed, shall require two monitors. On one monitor, chart for a shift pertaining to a particular section shall be shown. Any Train movements shall be captured on second monitor and accordingly this chart on the first monitor will get updated. It is envisaged to depict at all times only the full sectional picture on the first monitor unhindered by any other tasks except the ones reported by him..
.

Point and Click Device and Keyboard

For data entry and reporting in the system, user shall work with mouse and keyboard and touch screen. Mouse shall be preferred for use instead of keyboard (wherever possible). Mouse shall be used maximum to help the user to navigate easily through different controls and facilities provided on the screen. Hot keys shall be provided for faster access to various tasks.

2.17 Station Diagrams

The user shall have an option to view the station rule diagram. This shall facilitate the user to plan in a better way for smooth and safe running of trains. This shall depict the lines at a station, emergency cross over points, loop lines with their respective lengths, platform lines, signals and sidings. The diagrams shall be stored in a referential database.

Facility should also be provided to view information regarding the Type of Block working, interlocking, class of station, gauge, traction, bridges, level crossings etc for each station /section..

2.18 Line Occupancy status

The Control Office Application shall display the line occupancy of stations status on clicking on option after reporting arrival of any train at that station. All the trains berthing at a station shall be listed and the status of line occupancy shall be updated by selecting the appropriate line number.

Functions of various functionaries in computerized environment

Various roles for different control office functionaries shall be defined and access accordingly. The broad framework of functions expected to be carried out by the various functionaries in a computerized Control Office shall be firmed up during the development and implementation stage as per the needs of the divisions.

3 Alerts.

At various instances there shall be a need to give alert messages to section controllers and other functionaries/departments . Some alerts that are required have been mentioned below. However, this list is not exhaustive and other required alerts, which can be generated from the system, may also be added to this list. It should be possible to send these alerts through email, messaging system or mobile phone etc.

- Block Burst – If a maintenance block extends beyond expected end time, the Section Controller should be warned about it. Moreover, any block burst reported to the system should prompt an alert to the concerned department.
- When anticipated running time on a block section is exceeded by a configurable time period (recommended 10 minutes), the Section Controller should be warned about it.
- In case any train moves in block section with speed more that maximum permissible speed, the system should prompt the Section Controller with a warning.
- Diversion/Rerouting/Termination.
- Asset Failure/ Event Recording – Any asset failure/unusual occurrence reported by the Section Controller should result in an alert automatically for the concerned department.
- Accidents.

4 Queries and Reports.

Computerization of Control Office shall facilitate generation of queries and Reports through the system. Apart from the daily reports required for analysis, Cumulative Progressive and comparative reports for certain specified periods of time should also be easily generated, The system should have the facility of restricting access of various queries and reports based on role /IP address/Mac address.

Following is a list of some of these reports that are in the scope of Control Office Application. However the list is only indicative and not exhaustive. The actual requirement will be frozen only at the design/development /implementation stage.

Queries.

Train Enquiry – There shall be an option to enquire about a train's location and expected time of arrival/ departure at a station. The user shall enter a train number and the station at which he wants to enquire the ETA. The system shall display the expected time of arrival/ departure at the station and train's current location including the time of arrival at/ departure from the current location.

Loco details: There shall bean option to enquire details about Locos on the division.

Punctuality – This shall display the trains arriving late at the terminating station so as to facilitate Dy. Punctuality in planning. Trains, which have been put back/ brought forward at the originating station, shall also be displayed in this query with reasons for the same.

Cautions -- Information relating to current caution orders.

Blocks–Information on block including programmed/planned block online blocks bursts/ extensions shall be displayed in this query. This shall also display the reasons for extensions, department(s), type of block, block start time, scheduled block end time and new block end time.

Equipment Failure – Online details of equipment failed shall be available to the user in this query. Type of equipment, department, equipment id (optional), type of failure, time of failure and time of corrective action taken (if corrected) shall be displayed. This shall also be available to various departments.

Detention Report –Train wise, event wise detention for the day shall be available separately.

Station/Section Details – Asset profile for a station/section like type of signaling, interlocking, level-crossing, block working, section speed, ruling gradient, gauge, traction, adjoining /interchange stations, station civil and rule diagram, etc.

Charts – viewing of current and previous charts for
REPORTS.

a) **Punctuality Performance Related**
   - Hours On Run
   - Trains Lost
   - Punctuality Performance
   - Unusual Occurrence Report

b) **Loco Related**
   - Shed/ Under Repair Loco at Odd Hours
   - Shed Outage
   - Electric/Diesel Engine Failure indicating total hours lost
   - Overdue Inspection Locos
   - Loco Earning Less KM
   - POL Position

c) **Operations Related**
   - Running Line Position at Odd Hours
   - Temporary Speed Restrictions (Day Wise)
   - Executive Summary of Special Features
   - Trains on Road at Odd Hours
   - Block Requirements for a day
   - Loop Blocking
   - Equipment Failure Report
   - Stabled Load
   - Passenger Sick Coach Consist
   - Passenger and Freight Coach Inventory based on Attachments and Detachments at the enroute stations

MORNING POSITION REPORTS

Category: Punctuality

4.1 Hours On Run

Purpose: This report shall show the details of the trains running in a division on a particular date.

Inputs:
1. Division
2. Date

Outputs:
1.Train Name
2. Load
3. Stock Type
4. Loco Number
5. Arrival and Departure Timings at various stations
6. Total Time taken
7. Time taken In a section
8. Time taken at a terminal
9. Train Category

Example:

				HOR												TRML				Ctgr
Train	Load	Stck	Loco	TDL (A)	TDL (D)	GMC (A)	GMC (D)	RRH (PASS)	ALD (A)	ALD (D)	MGS (A)	Total	TDL - GMC	RRH - GMC	GMC - ALD	ALD - MGS	TDL	GMC	ALD	
GYA + WRS	40	BCN	31012								18:25	69:35	0	0	0	0	0	0	0	THRU

4.2 Trains Lost

Purpose: This report shall show the details of the trains lost in a division on a particular date. The details shall be shown train wise, which shall include the time lost, station at which the time is lost, reason for train loss and remarks.

Multiple rows of data for time loss at different stations and reasons/ remarks against a train

shall be shown.

Details of Recovery Time for each train in different sections shall also be shown. These details include the Provided and Actual Recovery Time details.

Inputs: 1. Division
2. Time/Date

Outputs: a) Train Loss Details

1.Train Number
2. Train Name
3. Section Name
4. Station
5. Time Loss (in Mins.)
6. Reason for Train Loss
7. Remarks

b) Recovery Time Details

1. Provided / Actual Time (in Mins.)
2. Section Name
3. Engg Recovery
4. Traffic Recovery
5. Loco Recovery
6. Others

Example:

Train Loss Details

Train No	Train Name	Section	Station	Time Loss	Reason for Time Loss	Remarks
4269	TRIVNI EXP.	SKTN – LKO	RBGJ	20	L/O	RBGJ HEAVY RUSH BSP RALLY AT LKO
			LUSA	04	L/O	LUSA HEAVY RUSH BSP RALLY AT LKO

			CAR	38	REP:- L/R(4270)	CAR 01:10-02:38 FOR LINK POWER 4270 (100 LATE) HEAVY RUSH BSP RALLY AT LKO ANOTHER EP 23453 ARRD:- CAR 01:35 EOL 01:45 V/R 02:15 & PRE:- 2301,02:32
			MZP	03	L/O	MZP BSP RALLY HEAVY RUSH
			MJA	20	L/R	MJA 04:05-04:58 PRE:-2423 – 04:14
				32	L/R	ACP BY RALLY PASS. GS-17148, GS-17451 (FIR-17) & PRE:-2313 – 04:54
			ALD	20	ACP	ALD O/S ACP KM –824/05 GS-6065

Recovery Time

	CPU - CAR				**CAR - ALD**			
	ER	**TR**	**L**	**O**	**ER**	**TR**	**L**	**O**
PR	9	31	14	X	8	2	6	X
ACT	10	15	2	29	7	20	3	55

4.3 Punctuality Performance

Purpose: This report shall show the punctuality performance of the trains as a percentage.

Inputs: 1. Division
2. Time/Date

Outputs: Performance of :
1.Mail Express Trains
2. M.R. Trains
3. Passenger Trains
4. Mixed Trains
5. Over All Performance
6. Progressive Performance

7. Coaching Stock in terms of
   a) Mail/Express Trains
   b) Passenger Trains
   c) Total Trains

Example:

1. Mail Express Trains	:	94.2%
2. M.R. Trains	:	89.7%
3. Passenger Trains	:	100%
4. Mixed	:	100%
5. Over All	:	97.1%
6. Prog.	:	97.0%
7. Coaching Stock		
Mail / Express	:	122=2077=4154
Passenger	:	122==786=1572
Total	:	244=2863=5726

4.4 Unusual Occurrence Report

Purpose: This report shall reflect the details of any untoward incident occurring within the division during a specified time period.

Inputs:
1. Division
2. From Date
3. To Date

Outputs: <u>Loco Details</u>

a) Loco Number
b) Loco Type
c) Shed
d) Last Ins.
e) Train/Direction
f) Loco Shed Out Time/Date

<u>Failure Details</u>

a) Date/Time of Incident
b) Date/Time of FIR
c) Section
d) Driver
e) Headquarter
f) Driver's LI
g) Assistant
h) Person giving FIR

UOR Type

a) Same Failure Occurred (SF)
b) Other Failure Occurred (OF)

SE / OE

Details of Case

a) Shed Report/Joint Report / Repercussion
b) Details of Incident

Example:

Loco							**Failure**			
No.	**Type**	**Shed**	**Last Inst.**	**Train**	**Drtn**	**L Shed Out Date**	**Date/Time Of Incident**	**Date/Time Of FIR**	**Section**	**Driver**
24435	WAG – 5	AJN	05/09/2002 AOH	KKF	UP	21/09/02	27/09/2002 02:25	27/09/02 02:25	GMC	R.N. Singh

Failure				**UOR Type**	**SE/OE**	**Details Of Case**
Driver's LI	**Astt.**	**HQ**	**Person giving FIR**			
Zamid		CNB	Suresh Kr. Gupta	SF: 14:27/09/02 OF:	SE: 1407:27/09/02 OE:	EOL 00:55 A/F 1.00 CALIBRE-A, DRIVER REPORTED EX GMC AT 02:25 THAT TM-4-5 NOSE DEFICIENT, INFORMED JE OUTPIT. GMC SHED REPORT: LOCO ATTENDED BY FITTER SRI SOHAN LAL AND FOUND TM-5 ONE BOLT OF LOAD BEARER PIN DEFICIENT,. REQUIRED JE AT 03:35 LOCO CHECKED BY SSE SRI MAZUMDAR AND ADVISED LOCO TO BE DETACHED AND PUSHED TO OUT PIT. EP WITHDRAWAL AT 03:50 OUT PIT ARRIVAL 16:00 B/L 20:25 LOCO ALLOWED IN SAME CONDITION UPTO HOME SHED.

Category: Loco

4.5 Shed / Under Repair Locos at Odd Hours

Purpose: This report shall show the details of locos that are in shed or under repair at odd hours in a division.

Inputs:
1. Division
2. Shed Name

Outputs:
1. Loco No.
2. Location
3. Since When
4. Reason

Example:

S. No.	Loco Number	Location	Since When	Reason
1.	27090	GMC YD	26.09.02	HQOP 2 OFF
2.	27140	CNB	25.09.02	F/L MODIFICATION
3.	27200	CNB	25.09.02	TRIPPING ON 6TH NOTCH

4.6 Shed Outage

Purpose: This report shall indicate the shed outage details of locos in a division and thus reflects on the performance of a shed.

Inputs:
1. Division
2. Shed

Outputs:
1. Railway
2. Holding
3. In effective
4. Net Outage

Example:

Railways	Holding	Ineffective	Net Outage
WAG – 7	108.0	13.7	94.3

WAP –4	28.0	4.7	23.3

4.7 Electric/Diesel Engine Failure

Purpose: This report shall show the details of failure of electric and diesel engines.

Inputs:
1. Division
2. Date

Outputs:
1. P.No
2. Train
3. Loco Number
4. Shed
5. Station
6. Detention Time
7. Remarks

Example:

P. No	Train	EP No	Shed	Station	Det	Remarks
91	KKF	2405	CR	GMC	460”	A/GMC 23:50 OL 00:55 U/F & FAILED 04:15 F/EP 7270 OL 05:50 DEP 07:30

4.8 Over Due Inspection Locos

Purpose: This report shall show the details of locos, which are due for inspection in a shed depending on the schedule type.

Inputs:
1. Division
2. Shed

Outputs:
1. Loco Number
2. Inspection Due Date
3. Inspection Code
4. Location

Example:

IC				IB				IA			
Loco	Due	Cod	Loc	Loco	Due	Cod	Loc	Loco	Due	Cod	Locn

No.	On	e	n	No.	On	e	n	No.	On	e	
27519	25/9	D-3	WR	27619	23/9	D-5	ER	27424	4/9	X	CR

4.9 Loco Earning Less Km.

Purpose: This report shall indicate the details of locos, which run less than the specified kilometers.

Inputs:
1. Division
2. Date

Outputs:
1. Loco Number / Train Number
2. Hours Run
3. Kilometers

Example:

S. No.	Loco No. / Train No.	Hrs	Kms.
1	27513/MLCP – 00:00 RRH – 2:30 GMC LE 6:30 – 15:30 ALD PNP 21:50 – 24:00 GMC	24	193

4.10 POL Position

Purpose: This report shall show the details of POL in a division on a particular date according to O/W Loaded Tank, I /W Loaded Tank, EMT Tank On Run, Tank Loaded for Dispatch.

Inputs:
1. Division
2. Date

Outputs: 1. Details of POL according to O/W Loaded Tank, I/W Loaded Tank, EMT Tank On Run, Tank Loaded for Dispatch

Example:

	S. NO	Train	I/c Pt.	LD	Date/Time	F/C	6 Hrs. On Run	OPRS Valid Up to	Total POL B/UP

O/W LOADED TANK									OB	RECD	TOT	M/O	CB
I/W LOADED TANK	S.NO	Train	I/c Pt.	LD	Date/Time	F/C	6 Hrs. On Run	OPRS Upto Valid	P/M TANK				
TANK LOADING	S.NO	Train	I/c Pt.	LD	Date/Time	ARR		P/M					
						Date	Time	Date	Time				
EMT TANK ON RUN	S.NO	Train	I/c Pt.	LD	Date/Time	F/C	6 Hrs. On Run	OPRS Upto Valid	EMT B/UP				
									OB	RECD	REL	TOT	M/O	UT	C/B
TANK LD FOR DESP	S.NO	Train	From Sttn	LD	ARR		P/M		DESP				
					Date	Time	Date	Time	Date		Time		

Category: Operations

4.11 Running Line Position at Odd Hours

Purpose: This report shall show the line position at stations in a division.

Inputs:
1. Division
2. Date

Outputs: 1. Line Position at different stations

Example:

CAR	COI	ALD	SFG	HGJ
1-936 DN	5-BSB 40 BCN/L		10-2BRN/E	

4.12 Temporary Speed Restrictions (Day wise)

Purpose: This report shall show the speed instructions imposed in UP and DN lines in a division on a particular date.

Inputs:
1. Division
2. Date
3. UP/DN line

Outputs:
1. Date of Imposition
2. Time Consumed
3. SR Km per Hrs.
4. Station From
5. Station To
6. Kilometers From
7. Kilometers To
8. Remarks
9. Expected Date of Cancellation
10. Length in Meters

Example:

Date Of Imposition	Time Consumed	SR Km Per Hrs	Station		Kilometers		Remarks	Expected Date of Cancellation	Length in Meters
05/09/02	4’	20	MIU	DER	1410/10	1415/08	T/OUT Renewal	Will Continue	200

4.13 Executive Summary of Special Feature

Purpose: This report is an executive summary of the total number of trains, trains affected and gross detentions on a specified date or within a specified time period due to items like accident /derailment, E/P failure, crew etc.

Inputs: 1. Division
2. Date

Outputs: 1. Total Number of trains
2. Trains Affected
3. Trains due to Gross Detentions

Example:

S. No	Item (Special Features)	27/09/02			01/09/02 – 27/09/02			01/09/01 – 27/09/01		
		No	Train Affected	Gross Det.	No	Train Affected	Gross Det.	No	Train Affected	Gross Det.
1	ACCT / DERAILMENT	0	0	0	3	3	1660	3	3	1268
2	LOCO FLAT TYRE	0	0	0	3	3	195	1	1	60
3	FOR CREW	7	7	755	179	179	14128	153	153	13372
4	D/P FAILURES	0	0	0	14	14	1914	14	14	4100

4.14 Trains On Road at Odd Hours

Purpose: This report shall show the details of trains running at odd hours at a particular

date between two stations.

Inputs: 1. Date

Outputs: 1. Details Of trains

Example:

Sttn	**COI**	**ALD**	**GMC**	**TDL**	**B.G.**	**A.G.C.**	**GZB**	**WTS**	**KRJ**	**HGJ**	**Dn. Train**
MGS-ALD	BCN/E - GMC						SOG – CAR	DER - KUN			BOX-DAP
ALD											
ALD-GMC											
GMC											
GMC-TDL											
TDL											
TDL-GZB											
TDL-JAB											
Total	**1**						**1**				

4.15 Block Requirements for a day

Purpose: This report shall reflect the details of blocks in a section with reasons for block requirements in UP and DN Lines.

Inputs: 1. Date

Outputs: 1. Details Of Blocks

Example:

UP Line:

S.No	Section	L No	Reasons
1.	MZP-BOL	150X1	PRC DMT Unloading
2	UND-MJA YD	150X1	Hanging OBS rail + welding with S&T

DN Line:

S.No	Section	L No	Reasons
1.	ALJN-DAQ YD	150X1	TTM/8250 pt. 7W with S&T

4.16 Loop Blocking

Purpose: This report shall show the details of blocking of loop lines at a station.

Inputs:
1. Station
2. Date

Outputs:
1. Station
2. Line Number
3. Blocking since date
4. Reasons

Example:

S.No	Station	L No	Blocking Since	Reasons
1	ALD	1	07/12/02	Repair work

4.17 Equipment Failure Report

Purpose: This report shall show the details of failure of equipment at a station or in a section.

Inputs:
1.Division/Station/Section
2. Date

Outputs:
1. Section
2. Station
3. Equipment
4. Failure Type
5. Since when
6. Reasons
7. Remark

\xample:

Section	Station	Equipment	Failure Type	Since when	Reasons	Remarks
	ALD	S&T		08/12/02	Defective	-

4.18 Stabled Loads

Purpose: This report shall show the details of stabled loads in a division.

Inputs:
1. Division
2. Date

Outputs:
1. Date
2. Train Number
3. Station
4. Time
5. Load
6. Remarks

Example:

Date	Train Number	Station	Time	Load	Remarks
7/10/02	DSN	SJP	21:00	35+0	-

4.19 Passenger Sick Coach Consist

Purpose: This report shall show the details of Passenger Coaches reported sick in a division.

Inputs:
1. Division
2. Date

Outputs:
1. Date
2. Wagon Number
3. Station

4. Time
5. Train Number
6. Sick Reason

Example:

Date	Train Number	Station	Time	Wagon Number	Reason
7/10/02	DSN	SJP	21:00	SC	-

Cumulative Reports:

There are certain reports / queries which depict the cumulative totals for a month or performance during previous months / years. These reports are a candidate for being stored directly as MIS data structures for immediate retrieval without any computations. Such MIS data shall be stored as daily records with certain attributes like section, number of occurrences of an event, total time spent/taken, etc. These trends/ MIS data needed for analysis can be stored for a period of 3 to 5 years depending on the duration for which comparative analysis is required. Some of the MIS data stores needed in the system for periodical analysis are illustrated below:

- Progressive Punctuality Analysis,
- Line Capacity Utilization,
- Analysis of detentions to Freight trains having a committed time of transit.
- Communication Failures over a specified period as compared with the same period in previous years.
- Asset Failures by type over a specified period as compared with the same period in previous years.
- Total Maintenance Blocks granted over a period of time, Instances of Block Bursting.
- Caution Orders imposed- reason wise, number of instances and total train hours lost during a specified period of time.