Draft Functional Requirement Specification

FAILURE REPORTING,ANALYSIS AND CORRECTIVE ACTION SYSTEM (FRACAS) SOFTWARE – Phase I.

1.0 The user requirements for the proposed FRACAS software are laid down. The software should be

1.1 Web based and user configurable.

1.2 Flexible enough to make incremental changes in the presentation of data without recourse to software tools.

1.3 Shall be able to integrate data from other processes in the life cycle process of any specific product. To start with the proposed software shall be used to monitor the Indian Railway Automatic Train Protection System(KAVACH) and the ability to port data from other processes like manufacturers data sheets, design parameters (other than KAVACH) like loco pertaining to the KAVACH product) and integrate with the core data of FRACAS shall be possible.

1.4 Failures will potentially have a variety of causes including component failures, operational errors, maintenance and other errors. It is therefore imperative that the reporting process is clear and logical and that there is a collective forum for all stakeholders to agree the most likely source of failure and hence investigation and corrective actions.

1.5 The failures and defects should be categorized for both safety and reliability for varying levels of severity/criticality.

1.6 The logging of the failures will be done in

1.6.1 Signal Fault Control

1.6.2 Electrical Control

1.6.3 LPs from Crew Management System

1.6.4 Automated receipt of information from Centralized Kavach Monitoring System.

1.7 The format will be developed by the firm in consultation with RDSO. The filled in hazard log shall be forwarded to RDSO who will give a unique tag number to the failure/hazard. RDSO will forward the same with tag number to the manufacturer who will suggest mitigation for each hazard. The same will be reviewed by RDSO who will based on the mitigation suggested may close the tag or refer back to the OEM for review. OEMs, Zonal Railways, RDSO, IRISET and other stake holders (upto maximum of 100) should be able to access with different layers of access. Should be able to take prints of the selective data.

2.0 Detailed FRACAS Requirements:

2.1 The FRACAS process is required to continuously provide feedback regarding any failures and defects (and possible causes) found during operational service to the

- operations safety manager,
- the designer,

- the manufacturer,
- operations manager and
- maintenance manager

2.2 The information shall include:

(a) failure reporting authority
(b) type of system
(c) make of system
(d) location of the failure
(e) time of the failure
(f) detailed description of the failure
    a) safety ranking for the failure.
    b) when and how the failures and defects have been detected (e.g. in operation or during a scheduled maintenance);
    c) the effects of the failures and defects up to the railway system level.
(g) failure decision making authority.
(h) decision of failure
(i) failure analyzing authority.
(j) cause of the failure.
(k) corrective action proposed.
(l) failure resolution authority
(m) implementation of corrective action
(n) Dashboard for above.

2.3 Provide all information necessary to formulate plans/procedures for operation and maintenance.
2.4 Implement operation and maintenance procedures.
2.5 Acquisition and recording of RAM performance data.
2.6 Maintain FRACAS and periodically review FRACAS records.
2.7 Establish records to trace the RAM tasks undertaken.
2.8 Reports of RAM performance analysis and evaluation

3.0 Records shall include:

a) Technical data on system
b) RAM performance
c) Maintenance action
d) Reporting and corrective action
e) Changes in the system configuration

3.1 The FRACAS records shall be periodically reviewed to determine whether any improvement is needed in the following:

Operation and maintenance procedures and manuals
System training documentation
operational Hazard Log
System design

Human factors aspects of operation and maintenance.

3.2 When changes are proposed an impact analysis shall be performed on each change request. The analysis shall include reviewing the impact on:

(a) the system/subsystem or hardware operational/functional safety performance
(b) the system/subsystem/hardware interfaces
(c) adjacent system/subsystem or hardware operational/functional safety performance
(d) the modification installation work, with consideration given to adjacent system/subsystem and hardware that can be affected due to systematic failures.

3.3 The impact analysis shall result in a decision on which parts of the safety life cycle will be repeated for the modification, all relevant documentation for the effected life cycle steps shall be updated, with equal depth and quality as the original documentation that was produced during the development of the system.

3.4 The details and results of the modification, risk analysis and testing shall be included in the safety case. All changes and system/subsystem or hardware identified as being at risk shall be tested for correct operation on completion of the change.

3.5 For each identified recommendation a decision shall be taken whether the recommendation shall be realized or not. These decisions shall be justified and recorded.

4.0 **Report Generation**: This section describes the various reports that are required to be generated from the FRACAS software.

a. It should be possible to generate the display as defined by user for colour, style of presentation, background, highlighting, to bring out data of concern to the management.

b. The proposed package shall be flexible for user configuration and it shall be possible for the user to modify the display/system.

c. Password security and scalable permission for different levels should be possible. It should comply with the standard data security requirements.

d. The collected data should be accessible as required. Voice enabled reporting should be made available.

e. It should be possible to trace the serial number, system.

f. Corrective actions should also be logged and traceable.

4.1 Application shall have a generate button to generate Performance Report. On Clicking this button, Application shall take From "From month/year" to "To month/year"and also for monthly basis.

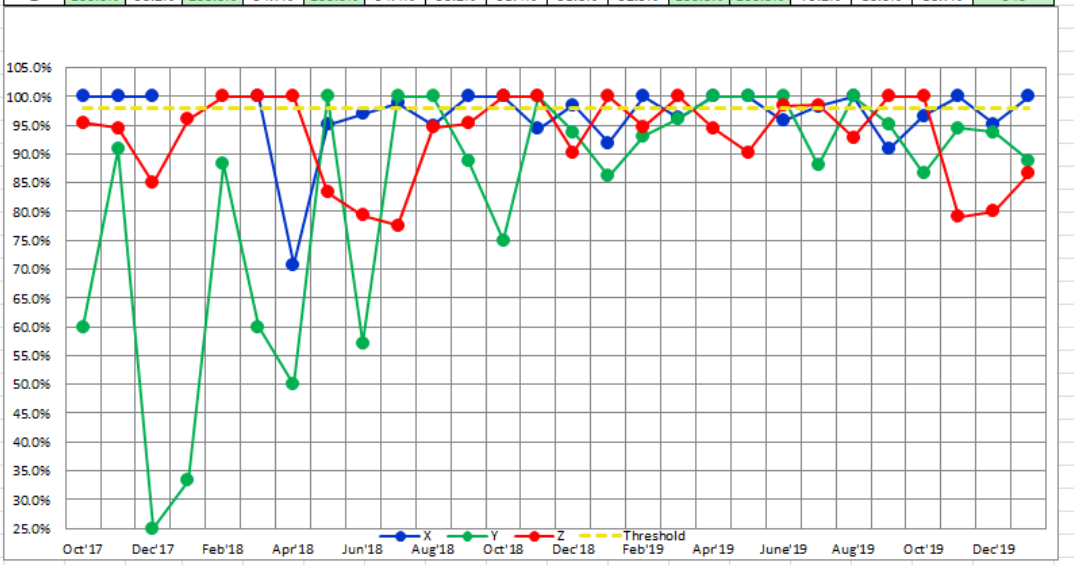
4.2 Application shall display the trial performance in the agreed formats.

4.3 Application shall display the trial performance report of each make of loco in their section or all other sections on "From month/year" to "To month/year" basis in the agreed formats for display. One suggested format is as below. The data shall be generated division

wise and Zonal wise. It should be possible to use different colours as shown below to highlight various conditions.

IRATP Performance (Operational Availability) from XXX-YY to XXX-YY in _____ Division

Make	Nov'18	Dec'18	Jan'19	Feb'19	Mar'19	Apr'19	May'19	June'19	July'19	Aug'19	Sept'19	Oct'19	Nov'19	Dec'19	Jan'20	Total trips
X	94.4%	98.5%	91.9%	100.0%	96.3%	100.0%	100.0%	95.7%	98.2%	100.0%	90.8%	96.7%	100.0%	95.2%	100.0%	1343
Y	100.0%	93.8%	86.2%	93.1%	96.2%	100.0%	100.0%	100.0%	88.0%	100.0%	95.2%	86.7%	94.4%	93.8%	88.9%	497
Z	100.0%	90.2%	100.0%	94.7%	100.0%	94.4%	90.2%	98.4%	98.6%	92.9%	100.0%	100.0%	79.2%	80.0%	86.7%	940

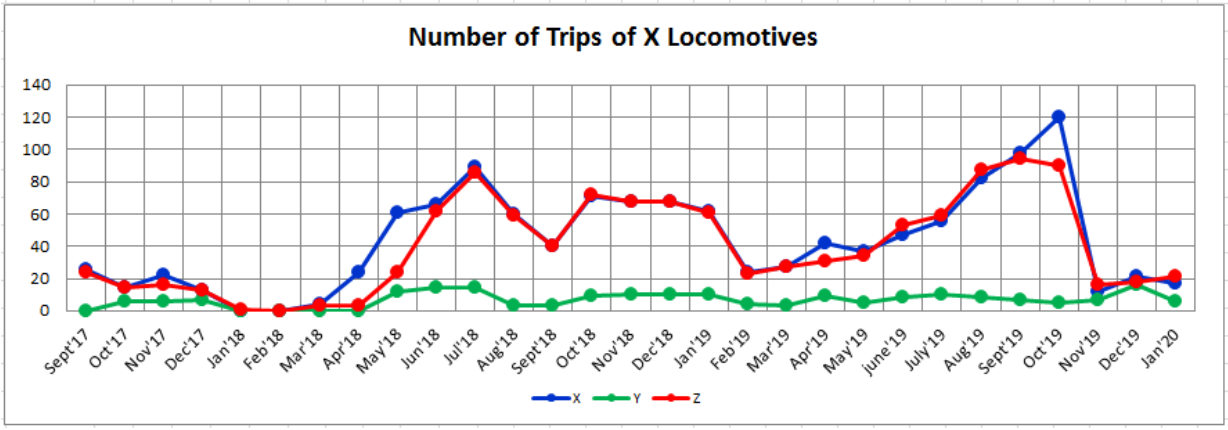


4.4 It should be possible to display the division wise "Inter-operability trial performance report on "From month/year" to "To month/year" basis in the agreed format.

4.5 It should be possible to display division wise "number of trips report on "From month/year" to "To month/year" basis in the following format (XXX being month and YY is the Year).

Number of Trips of X Locomotives

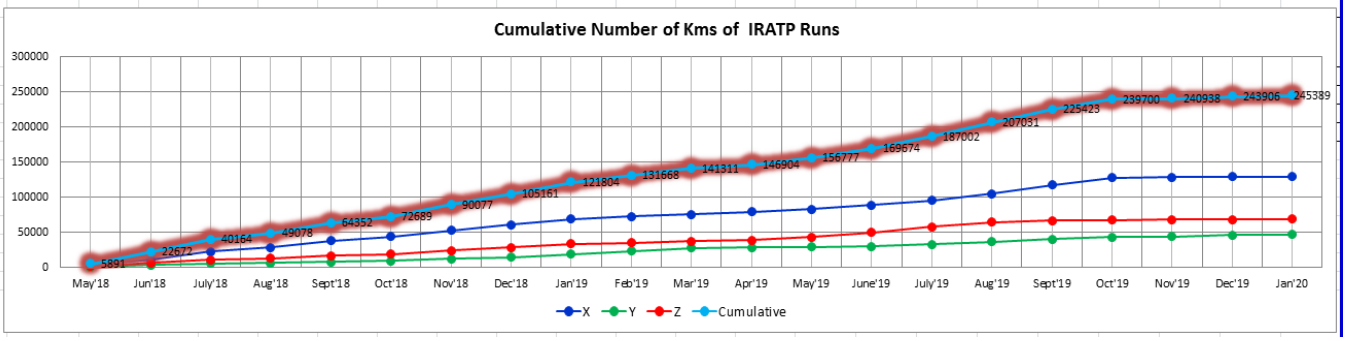
Section	Aug'17	Sept'17	Oct'17	Nov'17	Dec'17	Jan'18	Feb'18	Mar'18	Apr'18	May'18	Jun'18	Jul'18	Aug'18	Sept'18	Oct'18	Nov'18	Dec'18	Jan'19	Feb'19	Mar'19	Apr'19	May'19	june'19	July'19	Aug'19	Sept'19	Oct'19	Nov'19	Dec'19	Jan'20	Total
X	72	26	14	22	13	0	0	4	24	61	66	89	60	40	71	68	68	62	24	27	42	37	47	56	82	98	120	12	21	17	1343
Y	2	0	6	6	7	0	0	0	0	12	14	14	3	3	9	10	10	10	4	3	9	5	8	10	8	7	5	7	16	6	194
Z	72	24	14	16	13	1	0	3	3	24	62	86	59	40	72	68	68	61	23	27	31	34	53	59	87	94	90	16	18	21	1239



4.6 Application shall display the number of kilometres of IRATP runs report on "From month/year" to "To month/year" basis in the

following format (XXX being month and YY is the Year). The division name shall get appended.

Number of Kms of IRATP runs of _____ Division																					
Section	May'18	Jun'18	July'18	Aug'18	Sept'18	Oct'18	Nov'18	Dec'18	Jan'19	Feb'19	Mar'19	Apr'19	May'19	June'19	July'19	Aug'19	Spet'19	Oct'19	Nov'19	Dec'19	Jan'20
X	3432	8715	10740	6024	9616	5588	8930	8260	7791	3396	3434	3210	4256	5626	6272	9583	12963	10368	174	646	301
Y	944	2982	2133	752	1722	1078	2937	2256	4256	4617	4054	945	1039	818	2734	3829	3513	3003	478	2068	798
Z	1515	5084	4619	2138	3936	1671	5521	4568	4596	1851	2155	1438	4578	6453	8322	6617	1916	906	586	254	384

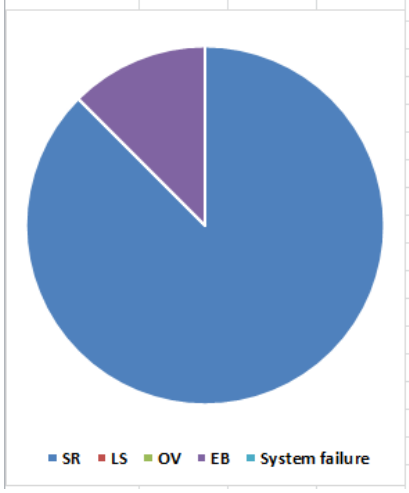


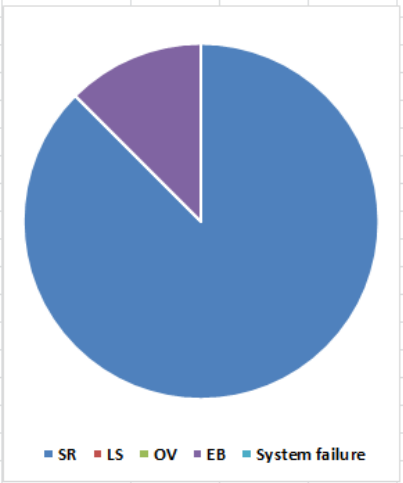
4.7 Application shall display division wise the number of hours of IRATP runs report on "From month/year" to "To month/year" basis in the above format (XXX being month and YY is the Year).

4.8 Application shall display division wise Performance of IRATP report on "From month/year" to "To month/year" basis in the following format (XXX being month and YY is the Year). Similarly, this performance of IRATP report on monthly basis also shall be made available.

Performance of IRATP in _____ division from XXX-YY to XXX-YY			
#Parameter	X	Y	Z
Trips	76	47	50
SR	7	1	2
LS	0	1	4
OV	0	0	0
EB	1	1	0
System failure	0	0	0

Performance of IRATP in _____ division for the month XXX-YY			
#Parameter	X	Y	Z
Trips	2	Total	0
SR	4	Total	0
LS	0	Total	1
OV	0	Total	0
EB	0	0	0
System failure	0	0	0





4.9 The above Presentation formats are suggestive and the Firm should handhold the users (Zonal/division Railways, RDSO, Manufacturers) for ease of use of the formats and any other formats found useful during the run of the software.

5.0 Hazards are submitted by various stake holders…Railways (Zonal, Divisional), RDSO and Manufacturers/firms. The tentative hazard log flow to be used for KAVACH project is enclosed. This will be amplified in consultation with the company supplying software and the stake holders.

5.1 Hazard/failure input is done manually in the agreed format with description like date, location/loco, section/station, time of occurrence and time put right, defect description, probable cause etc.

5.2 The severity of failure can depend on the downtime or the type of system down.

5.3 Upon restoration, the cause is input into system. Similar details as mentioned in para 5.1 are input.

5.4 To reduce the impact of failures, alternative action is contemplated by higher management.

5.5 Based on the cumulative data of the failures, it should be possible plot fault tree analysis.

6.0 The FRACAS software will be linked to software used for carrying out RAMS analysis in Phase II. The FRACAS software supplied shall be open for linking with RAMS related software of Phase II and it should be possible to take inputs from the data that is generated from RAMS analysis or vice versa.