

# SAFE EXECUTION OF INFRA PROJECTS



**Engineer's role and responsibility to strengthen EHS (Environment, Health & Safety)....**

## Keynote Address

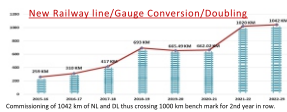
by

**Rajesh Prasad**  
Director Operations, RVNL



### Rail Vikas Nigam Limited (RVNL)

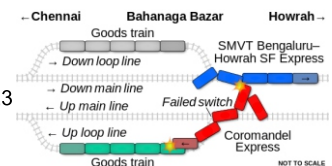
- Incorporated as a PSU on **24-1-2003**.
- Began operations in **2005**.
- Granted 'Navratna' status on 01<sup>st</sup> May, 2023.
- Expertise in "Concept to Planning to Execution to Commissioning".
- 15,534+ kms Railway Infrastructure commissioned
- Many Unique Projects and Many Firsts
- Strategic diversification into Highways/Consultancy/Metro railway projects/Port/marine infra in India/International markets
- Continuous efficiency improvement through training & skill development.
- Developing projects sustainably and in an eco-friendly manner – ISO 45001 Certified.
- Trailblazer in PPP in Rly. - five SPVs/Joint ventures in Public Private Partnership (PPP)
- Order Book – INR 65000 cr. as on 31.03.2023



### Recent disasters....

#### - Worst one....

- One of the biggest
- Balasore, 2<sup>nd</sup> June 2023
- 3 Trains collided
- 294 Died, 1175 injured



### Under construction Railway Bridge collapses near Sairang, Mizoram (N. F. Rly.) – 23.08.2023

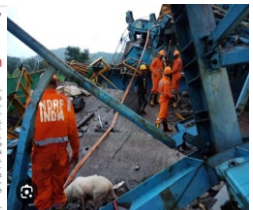


**(17 persons died on the spot)**

### 3<sup>rd</sup> phase of Samruddhi Expressway, Mumbai

#### 4 engineers among 20 killed as 2k-tonne launcher & girder collapse at away project site in Thane

**Labourer falls from 115 ft, survives**  
A 2k-tonne launcher and a 120-tonne girder collapsed from a height of 115 ft during construction work on the 3<sup>rd</sup> phase of the Samruddhi Expressway in Thane on Monday. The accident occurred near Sairang village, approximately 10 km from Mumbai. The launcher was a special equipment used in bridge construction and its installation had been completed in Sairang.



**(20 persons died, launcher collapsed)**

A span of a newly built bridge on Mindhola river in Tapi district, Gujarat collapsed on 14.06.2023



A bridge over the Mindhola river connecting Majpur and Degama villages of Gujarat's Tapi collapsed before its inauguration on Wednesday. No casualties have been reported from the site

(Times of India dated 15.06.2023)

Highway bridge in China collapses due to flash floods. – 02.08.2023

HIGHWAY BRIDGE COLLAPSES IN CHINA FLOODS



A highway bridge in Heilongjiang province collapsed on Thursday due to flash floods triggered by heavy rains as parts of China experience the worst floods in decades. Two cars fell into the Mayi river, but no casualties were reported. A rescue operation was ongoing, and a section of the highway was closed, according to state media. On Wednesday, authorities said Beijing recorded its heaviest rainfall in at least 140 years over the past few days as remnants of typhoon Doksuri deluged the region.

(Times of India dated 03.08.2023)

Ten cars of a passenger train derailed in southern Pakistan on 06.08.2023, killing 30 people and injuring more than 90...

THE TIMES OF INDIA

07 AUG 2023 Delhi

30 dead in Pak train derailment

Islamabad: At least 30 passengers died and more than 90 others were injured after 10 coaches of a train, Hazara Express, travelling from Karachi to Rawalpindi, derailed in the walled district of South Punjab on Sunday afternoon. There were 50 passengers in the train's economy class while 25 were travelling in the AC coach when the accident took place, said a Pakistan Railways spokesman. Sunday's tragedy came just a day after three coaches of Alhamia Express — en route from Karachi to Sukkur — derailed near Paudyal railway station in Sindh's Nawabshah District, though none suffered injuries. The Hazara Express had left Karachi at 8 am, the spokesman said. "The intensity of the accident increased due to a delayed application of the brakes. At least eight to 10 bogies derailed in a row," he said. Pakistan Railways Minister, Kamran Khan, said the train had been running at a normal speed when it crashed at 11 km near Sorhar railway station in Punjab. "We are trying to establish what caused the derailment. There can be two reasons either it was a mechanical fault, or the ball may have been crushed, that is, it might have subsided. We will investigate it," the minister said.

Earlier...

(2009)

Zamrudpur Metro worksite accident



'L' pier gave enough warnings....



<https://www.youtube.com/watch?v=CQ117v3avM>

Sequencing in construction is very important Placements of wrong bearings...



Ultadanga flyover (03.03.2013)

Chingrighata Flyover

(TOI 26.07.2023)

26 JUL 2023 Kolkata

Cracks on Chingrighata flyover; may need razing

Experts: Shut It Immediately To Avert Accident

Kolkata: The state's heritage highway corridor has an ominous development as the Chingrighata flyover segment is marred by cracks. The cracks were detected in one of the girders that supports the deck on which vehicles of the 10-lane flyover that carries traffic towards Salt Lake from D-3 Bypass in east-west direction. "Some distress signs have been noticed in the flyover structure. It has been revealed that the bridge should be shut down for a thorough inspection to ascertain whether it is safe to carry heavy traffic on the flyover again. The ongoing strengthening work is not adequate to rectify the distress," said an expert source.

STRUCTURE IN SEVERE DISTRESS

Annual safety review was conducted in 2014

In 2012, experts flagged safety issues in the structure

A 2012 technical analysis found deterioration in the superstructure as well as deterioration of structure

Recently, cracks were detected in one of the girders which have reduced the load-carrying capacity

If the strengthening measures don't work, the flyover will have to be demolished in the last few weeks

Some chairman and former expert committee member said that the flyover should be demolished and replaced by a new one. But that of the minister is not clear.

The cracks in the concrete are concerning the longitudinal girders was first noticed during an inspection last month, sources said the

Some cracks widening, P-3

Restoration work of Vivekananda Flyover by RVNL



Vivekananda Flyover under construction by KMDA, Govt. of West Bengal. Suddenly collapsed on 31.03.2016

IIT KGP REPORT- DEC 2017

- Poor Contract
- Poor Design
- Poor Workmanship
- Poor Supervision



[https://www.youtube.com/watch?v=DdQrA\\_as79Y](https://www.youtube.com/watch?v=DdQrA_as79Y)

**UNDER-CONSTRUCTION FLYOVER COLLAPSES IN VARANASI  
(15.05.2018)**



**(27 Persons died on the Spot)**



Few Critical Examples

<https://www.youtube.com/watch?v=bCuAz0UWyd0>



**Bhagalpur Bridge dismantling leading to a disaster on 02.12.2006**



Dismantling is equally important and to be addressed technically before undertaking



**Derailment of Santiago de Compostela Train Crash - Spain**

Few Critical Examples



<https://www.youtube.com/watch?v=t-90S46P2FA>



**Spain disaster: Train jumps off the tracks on approach to north-western city of Santiago de Compostela Spain killing 80 Passengers**

European Rail Traffic Management System (ERTMS) is normally available for High Speed route to take care of such eventuality. In this case it was about to be provided in next few days. The conventional system AFSA by Dymetronics was discontinued only few days back and the new system ERTMS was not in place. The driver was under pressure to reach destination within the permitted time and Technology was not there to check and control. It seems to be Human Error with System Failure and gives a feeling as if it had happened in India.



**Freak accident 3<sup>rd</sup> Dec. 2022  
(near Gaziabad)**




**CONSTRUCTION ACCIDENTS**

Breakdown of fatalities according to type of accident in construction industry

- 56% falls from height
- 21% trapped by something collapsing or overturning
- 10% struck by a moving vehicle
- 5% contact with electricity or electrical discharge
- 4% struck by a flying/falling object during machine lifting of materials
- 3% contact with moving machinery or material being machined
- 1% exposure to a hot or harmful substance





**IF YOU HAVE A NEAR MISS REPORT IT!**

**Safety Protocol: Near miss is equally important**


Heinrich Model

THE TIMES OF INDIA Jun 15, 2023

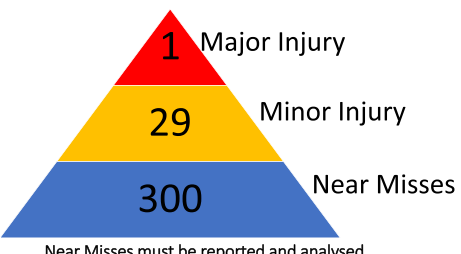
**Delhi: Dwarka Expressway section falls, kills JCB driver**

TNN | Jun 15, 2023, 09:56 AM IST

GURGAON/NEW DELHI: A concrete span of Dwarka Expressway's Delhi stretch, weighing around 800 tonnes, fell on an earthmover at work below on Wednesday morning, crushing its 35-year-old driver to death.



**Heinrich 300-29-1 Model**



1 Major Injury  
29 Minor Injury  
300 Near Misses

Near Misses must be reported and analysed...

**Effectiveness Of Safety Measures**



**EHS INITIATIVES AT SITE BY RVNL**

1. Safety Committee Meeting
2. Electrical Audit
3. EHS Audit
4. Safety Leadership Tour
5. Heavy Vehicle Inspection
6. External Trainings



**Personal Protective Equipment (PPE) on-site**

- Safety Helmet
- Safety Glasses
- Safety Boots
- Gloves
- Hi-viz jacket



**SAFETY MEASURES TAKEN AT RVNL WORK SITE**



**Proper barricading at site to protect Motorists, Pedestrians, Workmen, Plant & Equipment from accident.**

**SAFETY MEASURES TAKEN AT RVNL WORK SITE**



Height gauge and safety fish net provided for safety of pedestrian and vehicular traffic

**SAFETY MEASURES TAKEN AT RVNL WORK SITE**



**Protection of worksite... (Pile Cap work)**

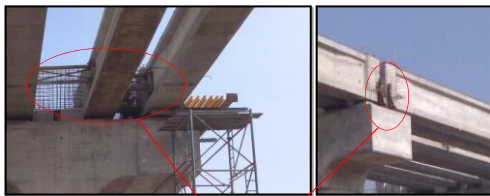


**Safe Access on Site**

- ❖ Everyone can get to their place of work safely
- ❖ Edges from which people could fall are provided with double guard rails or other suitable edge protection
- ❖ Holes are protected with clearly marked and fixed covers to prevent falls
- ❖ Site is tidy
- ❖ Good Lighting
- ❖ Fenced off from public



**I-GIRDER STEEL FRAME LOCKING ARRANGEMENT**



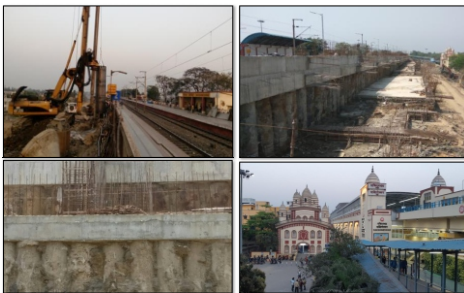
STEEL FRAME LOCKING ARRANGEMENT



**Safe work practices adopted during erection at cable stayed bridge site by RVNL**



**DAKSHINESWAR STATION**



How the PFs were protected with contiguous piles....



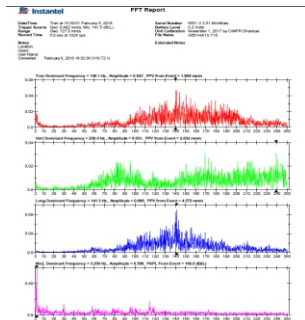
**Monitoring System at tunnel site**

The summary of blast vibration and Fast Fourier Transform Analysis (FFT)



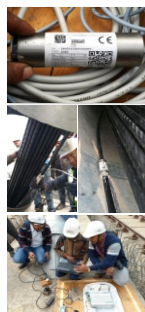
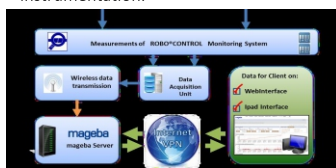
PPV = 4.572 mm/s < 10mm/sec.

Noise = 106.0 dB < 146 dB

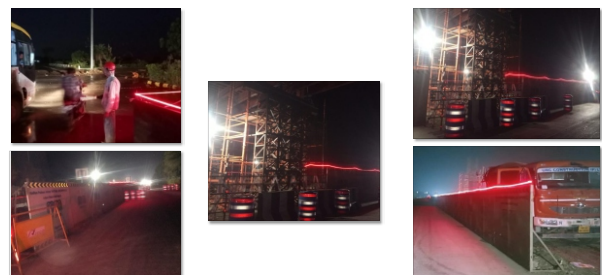


**MONITORING SYSTEM, CABLE STAYED BRIDGE SITE**

- 6 nos. sensors have been installed on the stay cables subjected to maximum loads.
- The structural monitoring system issues alarm notification based on measurements by the on-structure instrumentation.



**Safety arrangement for Night work by RVNL**



### SAFE EXECUTION BY THE SIDE OF TRACK



### HEALTH & SAFETY MANAGEMENT

#### Systems adopted

- Health & Safety Management System (H&SMS)
- Environmental Management System (EMS)
- Integrated Management System (IMS)
- Aspect Impact & Risk Assessment (AIRA)
- Hazard Identification and Risk Assessment / Method Statement (HIRA/MS)
- Personal Protective Equipment system (PPE)
- Emergency Control Room (ECR)
- Emergency Response Team (ERT)



### Hazard Identification and Risk Assessment (HIRA)

#### Purpose

To assess the risk of the activities to be executed, rate the risk levels as per the risk assessment matrix, and identify the control measures so as to bring the risk level to ALARP.

#### Matrix for Risk Assessment

Risk Level	Probability				
	1	2	3	4	5
Likelihood	1	2	3	4	5
	2	3	4	5	6
	3	4	5	6	7
	4	5	6	7	8
	5	6	7	8	9

#### Likelihood of occurrence (Probability)

Probability Descriptions (The highest category will always be used)	Frequency
5. Frequent	Occurs regularly on this site
4. Most Likely	Known to have occurred on this site in the past
3. Likely	Known to occur on other sites
2. Unlikely	Known to occur in the industry
1. Most Unlikely	Never known before

#### Severity of hazard (Consequence)

Severity is the degree or extent of injury or harm caused by the hazards, or as a result of an accident. Severity of hazard is classified as per the table given below.

VALUE	Result of Hazard to Personnel	Result of Hazard to Assets / Progress
5	Single or multiple Fatality	Catastrophic Damages, Critical Delay
4	Serious Injury requiring hospitalisation	Major Damages, Serious Delay
3	Lost Time Accident	Serious Damage, Moderate Delay
2	Injury requiring Medical Treatment but not Lost Time	Moderate Damage, Minor Delay
1	First Aid treatment only	Minor Damage, No Delay

### Aspect Impact & Risk Assessment (AIRA)

These procedures address routine and non-routine activities, including contractors and visitors, having access to the workplace.

#### Evaluation of Risk:

- ♦ The risk evaluation process is to be carried out by competent personnel
- ♦ The risk evaluation methodology is assessed using the scoring tables shown below. The intention is to reduce impacts to "as low as reasonably practicable" (ALARP)

Risk Level	Probability				
	1	2	3	4	5
Likelihood	1	2	3	4	5
	2	3	4	5	6
	3	4	5	6	7
	4	5	6	7	8
	5	6	7	8	9

Having assigned a priority score for each environmental aspect and impact the following table suggests timeframes for managing different priority environmental aspects and impacts (actual timeframes should be agreed with process owners).

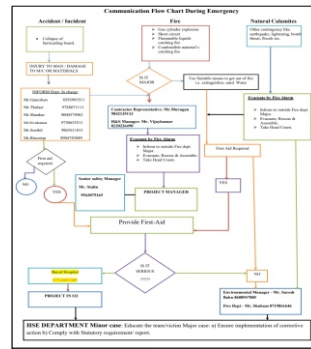
Rating	severity	Rating	Probability
1	insignificant	1	Short-term
2	Minor impact	2	Medium-term
3	Moderate impact	3	Long-term
4	High impact	4	Multiyear
5	significant	5	Permanent

### H&S Submission details

Sl. No	Description
01	Health and safety plan
02	Monthly safety Report
03	Traffic Management Plan
04	Weather protection plan
05	Emergency Response Plan
06	Health & safety KPI
07	Health & safety dashboard
08	Risk Register
09	Security plan
10	Pandemic plan
11	Workmen welfare plan

### Environmental Submission details

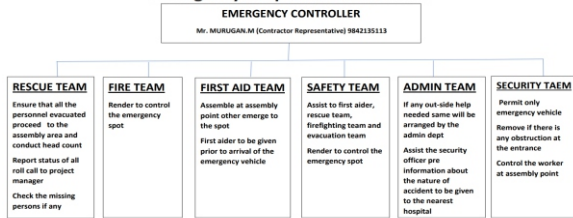
Sl. No	Description
01	Environmental plan
02	Bentonite slurry & soil disposal plan
03	Excavated contaminated materials disposal plan
04	Environmental Risk Assessment
05	Monthly Environmental report
06	Environmental Sustainability plan



### Emergency Preparedness at site

### Emergency Preparedness at site

#### Emergency Response Control Plan



Note:  
INCIDENT SPOT CONTROLLER: Give the correct information about location & nature of emergency to project manager (Emergency controller)  
EMERGENCY CONTROLLER: Approve the evacuation procedure & location of assembly area determine whether there is need for evacuation. Order to activate alarm ALL PERSONEL Stop the work & evacuate safely to assembly point. Assemble according to work area wait for the instruction from supervisor or Engineer

### Monthly EHS Calendar

RVNL, Indore Metro Rail Project				FLR-EHS-018 Rev	
EHS - Matrix for Inspection & Meeting				For the Month : Aug-2023	
Sunday	Monday	Tuesday	Wednesday	Thursday	Saturday
		1 Electrical Inspection (RCCB, Earth pit, Cable layout, DG)	2 Scaffolding Inspection, Drinking water tank cleaning by Env. & Safety	3 Work at Height Inspection, Fire Point Inspection, First Aid kit, Office area by Env. & Safety	4 Power Tools & Hand Tools Inspection
	6 WEEKLY OFF	7 Lifting Tools & Twines Inspection, Training on Hoist Identification & Mitigation	8 Electrical Inspection (RCCB, Earth pit, Cable layout, DG)	9 Scaffolding Inspection, Waste disposal from site by Env. & Safety	10 Fire Point Inspection, First Aid kit, Office area by Env. & Safety
	13 WEEKLY OFF	14 Full body Harness Inspection, Training on Slip Trip & Fall	15 Generator Crane & Vehicle Inspection, RO Plant Inspection by Env.	16 Electrical Inspection (RCCB, Earth pit, Cable layout, DG)	17 Scaffolding Inspection, Waste disposal from site by Env. & Safety
	20 WEEKLY OFF	21 Internal Electrical Audit, Drinking water tank cleaning by Env. & Safety	22 Lifting Tools & Twines Inspection, First Aid kit, Office area by Env.	23 Scaffolding Inspection, RO Plant Inspection by Env.	24 Work at Height Inspection, Training on Height Rigging Practice
	27 WEEKLY OFF	28 Resilient Plant Inspection by Env. & Safety	29 Power Tools & Hand Tools Inspection	30 Electrical Inspection (RCCB, Earth pit, Cable layout, DG)	31 Scaffolding Inspection, Waste disposal from site by Env. & Safety

### EHS Statistics

S.N.	Accident Statistics Summary	Aug'23	Cumulative
1	Number of Man hours Worked	881310	11120020
2	Number of Man days Worked	88131	1112002
3	Number of Reportable Fatal Accidents	0	0
4	Number of Reportable Non-Fatal Accidents	0	0
5	Number of Dangerous Occurrences	1	25
6	Number of Near Miss	0	15
7	Number of First Aid Cases	12	131
8	Number of Man-Hours Lost	0	0
9	Number of Man days Lost	0	0
10	Number of Reportable Accidents per 100,000 Man-hours Worked	0	0
	Accident Frequency Rate		
	$\frac{3+4}{1000000}$		
11	Average Number of Staff & Worker Daily	2937	47714

### Tool Box Talk & Induction Statistics

For the month : Aug' 2023	Nos. of meeting/training conducted	Nos. of person attended
Tool box Meeting	505	7972
Induction Training	999	16,490

### Work Permit Statistics

Sl. No.	Type of Permit	INDORE METRO	
		Aug-23	Cumulative since inception
1	Work at height Permit	145	3897
2	Hot work Permit	142	3276
3	Lifting work Permit	146	2518
4	Excavation Permit	61	2207
5	Night work Permit	105	2891
6	General work Permit	155	5003
	<b>TOTAL</b>	<b>755</b>	<b>19792</b>

### Training for the month of Aug-23

S. No.	Date	Topics	Duration	For the Month : Aug 2023
				No of persons attended
1	04.08.2023	Heavy Lifting safety	1 hour	20
2	05.08.2023	Electrical safety	1 hour	20
3	06.08.2023	Bar cutting & Bar Bending safety	1 hour	20
4	07.08.2023	Road safety	1 hour	20
5	10.08.2023	Defensive Driving	1 hour	20
6	12.08.2023	Lifting safety	1 hour	23
7	14.08.2023	Chemical hazards safety	1 hour	20
8	15.08.2023	Work at height	1 hour	25
9	16.08.2023	Material Handling safety	1 hour	15
10	17.08.2023	Lifting Tools & Tackles	1 hour	18
11	19.08.2023	Work at height, Scaffolding	1 hour	30
12	21.08.2023	Fire safety	1 hour	20
13	23.08.2023	Electrical safety	1 hour	23
14	24.08.2023	Hot work welding & gas cutting	1 hour	22
15	25.08.2023	IBS/ gantry crane safety	1 hour	20
16	27.08.2023	Cable stressing safety	1 hour	21
17	29.08.2023	Work at height scaffolding	1 hour	25
18	31.08.2023	Traffic management	1 hour	18
	<b>Total</b>		<b>18 hours</b>	<b>380</b>

### H&S Construction Surveillance Reports (CSR) Statistics

H&S CSR	Issued	Closed	Open
up to July 2023	57	57	0
For August - 23	01	01	0
<b>Cumulative</b>	<b>58</b>	<b>58</b>	<b>0</b>

### Environmental Construction Surveillance Reports (CSR) Statistics

H&S CSR	Issued	Closed	Open
up to July 2023	28	28	0
For August - 23	00	00	0
<b>Cumulative</b>	<b>28</b>	<b>28</b>	<b>0</b>

### Analysis Of Unsafe Act/Conditions For The Month Of Aug 2023



1	Fall Protection	44
2	Electrical Lapses	24
3	Poor Illumination	10
4	Falling Hazards	16
5	PPE Usage	8
6	P&M lapses	7
7	Edge Protection	6
8	Lifting Method	6
09	Housekeeping	5
10	Traffic Management	5
11	Hot Work	5
	<b>Total</b>	<b>136</b>

### Health Initiatives at Site

1. Pre- Employment Medical Examination
2. Frequently Free Medical Check up camp
3. Quarterly Health Checkup
4. Availability of Resident Doctor & Nurse
5. First Aid Room Facility
6. Tie up with Hospital
7. In-house Ambulance



## EHS INITIATIVES AT RVNL WORK SITE



### Electrical Equipment Inspection



### Full Body Harness Inspection



### Work At Height Inspection



### Fire Fighting Training



### On Site Training and Tool Box Talk



### Environmental Initiative



### Barricading Boards Maintenance





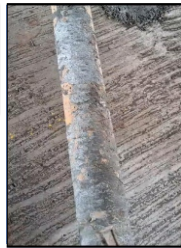
### Safety Inspections



RCCBs were inspected at Gandhinagar station.  
 • 30mA RCCB tripping over rated current.  
 Earthing not provided but earth value is maintained.  
 DBs are not serially numbered for site wise identification.



Rope light not functioning properly at many places.



SC- Station Concrete pump pipe was damaged and leaking.



**SAFETY, HEALTH AND ENVIRONMENT POLICY**

At RVNL, we are committed to continually improve and achieve excellence in construction & infrastructure building complying with Safety, Health and Environmental Standards. RVNL undertakes to:

- Identify and conform to occupational safety, health and environmental related laws, rules and regulations applicable to projects.
- Ensure that all the RVNL employees, agencies and their work force are provided safe and healthy working conditions for the prevention of work related injury and ill health by adopting their areas of ultimate responsibility related to Safety, Health and Environment.
- Lay down responsibilities for achieving safety, health and environmental objectives and allocate resources for meeting and meeting.
- Follow a well defined approach in prevention of pollution, waste management and efficient utilization and conservation of natural resources to protect the environment.
- Take steps to carry out an OH, S & E risk assessment by consultation & worker participation for all site activities to reduce risks and identify hazards and healthy working environment.

Date: November 25, 2022  
 (Version - 2.0)  
 Chairman & Managing Director

### RVNL SAFETY, HEALTHY AND ENVIRONMENT POLICY

- Follow a well defined approach in prevention of pollution, waste management and efficient utilization and conservation of natural resources to protect the environment.
- Take steps to carry out an OH, S & E risk assessment by consultation & worker participation for all site activities to reduce risks and identify hazards and healthy working environment.



Winner for outstanding achievements in ‘Construction Safety’ Award.

Date: 30.05.2023



“हम भारत का स्वर्णिम कल हैं, बात नहीं इतिहास की।  
 राहें दुर्गम पर हम सक्षम, हम हैं गति विकास की।”

**THANK YOU FOR YOUR PRECIOUS TIME**

RVNL Anthem:  
<https://www.youtube.com/watch?v=mG8V8G8-UBc>

धन्यवाद

