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NH-12037/170/2025/TUNNEL

Government of India

Ministry of Road Transport & Highways

(Tunnel Zone)

No.1, Parliament Street, Transport Bhawan, New Delhi-110001

Dated: 05th December, 2025

To:

1. The Chief Secretaries of all the State Governments/UTs
2. The Principal Secretaries/ Secretaries of all States/ UTs Public Works Department/ Road Construction Department/ Highways Department (dealing with National Highways and other centrally sponsored schemes)
3. The Director General (Border Roads), Seema Sadak Bhawan, Ring Road, New Delhi-110 010.
4. The Chairman, National Highways Authority of India, G-5 & 6, Sector-10, Dwarka, New Delhi-110 075.
5. The Managing Director, National Highway infrastructure Development Corporation Ltd.,2nd Floor, Tower A, World Trade Centre, Nauroji Nagar, New Delhi - 110029
6. All Engineers-in-Chief and Chief Engineers of Public Works Department of States/ UTs/Road Construction Department/ Highways Departments (dealing with National Highways and other Centrally Sponsored Schemes.
7. The Secretary General, Indian Roads Congress
8. The Director, IAHE, Noida, UP

Subject: Guidelines for Prevention and Mitigation of Road Tunnel Collapses - reg.

Sir,

In recent years, multiple incidents of tunnel collapses have been reported during the construction of tunnels on National Highways. These incidents have been primarily attributed to inadequate attention to detail during the planning and execution phases of tunnel projects. The recurrence of such events highlights the critical need for rigorous oversight and strict adherence to safety protocols.

2. To ensure safety and structural integrity of road tunnel projects, a comprehensive guideline has been evolved following inter-ministerial consultations.The guideline provides a comprehensive framework of preventive and mitigation measures to be implemented at each critical stage of tunnel development. It also includes specific safety protocols for personnel involved in tunnel rescue operations.The guideline is enclosed as **Annexure**.

3. The guideline shall be adopted for all tunnel projects on National Highways.

4. This issues with the approval of Competent Authority.

Yours Sincerely,

05/12/25

(Bharat Kumar Sharma)
Assistant Executive Engineer
For Director General (Road Development) & Special Secretary

Encl: As above

Copy To:

1. All CEs in the Ministry of Road Transport & Highways
2. All ROs of the Ministry of Road Transport & Highways
3. NIC-for uploading on the Ministry's website under 'What's New' and under 'Comprehensive Compendium Circular'

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3. PS to Hon'ble MOS (Corporate Affairs and RT&H)
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5. PSO to DG (RD) & SS
6. Sr. PPS/PPS to ADGs/AS&FA/AS(Highways)

Guidelines for Prevention and Mitigation of Road Tunnel Collapses

The recent occurrences of tunnel collapses during construction have prompted a critical assessment of current implementation methodologies and the necessary improvements to prevent such incidents from recurring. The foremost priority is the engagement of a competent execution team, appropriately sized and highly knowledgeable, with a demonstrated track record of successfully delivering projects under similar geological and logistical conditions. Specific prevention and mitigation strategies to enhance the safety and structural integrity of road tunnel projects are mentioned as under:-

A. Prevention

1. Planning

1.1 It is not uncommon for tunnel projects to face challenges in achieving their objectives, since fundamental flaws in the project concept itself are detected during subsequent reviews. Such shortcomings suggest that the tunnel project was predisposed to encounter difficulties.

1.2 At the stage of project conceptualization, it is standard practice to conduct a comprehensive investigation, resulting in a Detailed Project Report (DPR). Developing a DPR serves as a vital risk mitigation step, as it highlights potential issues through its technical details and establishes a framework for informed risk management. However, recent evidence suggests that many tunnel DPRs lack the necessary technical depth, reducing them to procedural formalities rather than effective risk management tools. The project In- Charge of the Authority shall be responsible for ascertaining the correctness of the Geological and Geotechnical investigation conducted as part of the DPR.

1.3 The contractual framework is equally critical. Risk allocation within contracts, alongside controls for disputes and commercial variations, significantly influences the risk-taking behaviors of all stakeholders involved in tunneling projects. This directly impacts construction risks, as well as the quality, durability and sustainability of the tunnels.

1.4 Tunneling activities are recognized to carry a higher risk than their surface-level or elevated equivalents. The fundamental principle of risk mitigation is *"risk shall be borne by the party best equipped to manage it"* and shall be central to contract design. Both technical and commercial aspects need to be considered in this context. Poorly managed contracts or execution will result in failure of the tunnel project to deliver the intended benefits to the public.

1.5 **Key Considerations for Planning**

1.5.1 Authority's Ownership at Every Stage

The Authority must take responsibility for every stage of the project. Hired agencies viz. DPR consultants, contractors and Authority's Engineers (AE)/Independent Engineers (IE) are distinct entities with specific and time-bound roles. The Authority must

ensure optimal performance from these entities to achieve project goals. The Authority must establish a dedicated focus group or expert team to provide consistent guidance and direction throughout the project lifecycle. Such a team shall ideally comprise members from diverse fields, including contract management, design, execution, safety and geology.

1.5.2. Terms of Reference (ToR) for the DPR Consultant

i. At the time of the alignment survey, the geological maps (1:50,000 scale) and National Landslide Susceptibility Mapping (1:50,000 scale) published by the Geological Survey of India (GSI) must be consulted. It will help in identifying the regional geological and structural setup of the area and also help in avoiding placing the tunnel portals close to a major landslide or on its flanks or even in the areas that are likely to be falling in the run-out trajectory of a major landslide. Furthermore, it will enable the project planners to identify the reaches/sections of tunnel alignment that may be falling below major landslide zones, potentially resulting in inadequate cover above the tunnel or triggering landslide activity due to blasting during construction.

ii. Comprehensive geological investigations are indispensable for identifying the most suitable route, one that minimizes the potential for encountering adverse ground conditions. A key best practice in this regard is optimizing the tunnel's alignment based on a thorough understanding of prevailing ground conditions and their anticipated behavior during and after construction. By strategically selecting a route that avoids known geological hazards, such as active faults or zones of weak rock, the initial planning can significantly mitigate the likelihood of collapse in later stages of the project.

iii. Ministry vide Circular No. NH-12037/3/2025/Tunnel/Zone-I dated 02.09.2025 has issued the Standard Operating Procedure (SoP) for NH Tunnel Alignment Studies and Approval. Authority shall ensure its adherence in letter and spirit.

iv. The ToR for DPR/PMC consultants shall mandate the preparation of a Geotechnical Baseline Report (GBR) and a Risk Register. The Risk Register should include the perceived hazards and associated risks for the project and indicate potential mitigation measures with comprehensive explanations for their basis, based on the DPR studies. The baseline report shall serve as a reference for determining expected efforts and aim for the highest practical accuracy. The primary function of this baseline report is to minimize disputes by clearly defining anticipated conditions; significant deviations beyond permissible limits shall be treated as a change in scope (positive or negative). Geotechnical Baselines shall be based on apt and appropriate geological, geophysical and geotechnical investigations.

v. Similarly, the Risk Register at the DPR stage serves as a preliminary framework. It is the responsibility of the execution team to regularly update and refine it. During the DPR finalization process, the Risk Register shall be reviewed by a larger team to

incorporate diverse perspectives on risk assessment and mitigation strategies. Ultimately, maintaining the Risk Register as a dynamic, continuously updated document is the Authority's responsibility throughout the project lifecycle.

All the construction tenders shall be issued for bidding with the GBR and Risk Register as part of the information provided to bidders.

2. Design

2.1 Detailed design and its proper implementation are critical for any civil engineering project. However, for tunnel projects, it is even more crucial since the ground itself serves as part of the support system. Predicting ground properties based on a limited number of tests and investigations is an oversimplification, particularly in the Himalayas. Inadequate geological and geotechnical investigations lead to great variation between the ground conditions predicted in the DPR and those actually encountered during the construction stage. This, in turn, results in time and cost overruns in the project.

2.2 A thorough understanding of topography, geology, and hydrogeology is essential for designers. It is beneficial to consider as many different conditions as possible to ensure robust design solutions. It is important to note that during the DPR phase, thorough geological and hydrogeological investigations—both surface and subsurface—shall be conducted to account for all anticipated variations in ground conditions along the tunnel alignment in the excavation methodology and the design of appropriate support systems. Tunnel design must account for varying ground conditions and anticipated behavior

2.3 The tunnel shape shall be evaluated not only in terms of space requirements but also for structural stability. In weak ground conditions, the provision of an arched invert is essential, and achieving ring closure as early as possible shall be a priority.

2.4 It is essential to clearly define the support class associated with each ground type and expected behavior. This ensures that the execution team can apply the appropriate measures and make necessary modifications based on monitoring results. Furthermore, leaving excavated sections of the tunnel unsupported or inadequately supported beyond the stand-up time poses serious risks to worker safety and can lead to significant project delays in the event of a major collapse.

2.5 Effective management of groundwater is essential for ensuring the long-term stability of the tunnel, and the design must include appropriate measures for waterproofing and drainage. The ingress of groundwater into the tunnel can weaken the tunnel linings and the surrounding ground, posing significant safety risks to both construction workers and future users. To mitigate these risks, the design often incorporates a system for proper drainage of groundwater, typically using drainage pipes installed around the tunnel perimeter. For tunnels constructed below the water table or in areas with high groundwater pressure, a systematic drainage system design is crucial to protect the tunnel invert (floor) and to maintain a stable and dry environment inside the tunnel.

2.6 Special ground conditions such as squeezing, swelling, rock bursts, shallow cover zones, sections beneath perennial streams/nalas, hot water ingress, and the presence of toxic or flammable gases (particularly in the case of long tunnels) require specific design and execution measures. Identifying these conditions early in the design phase is crucial.

2.7 In regions known for seismic activity, the design of the tunnel must account for the potential stresses and strains caused by earthquakes. This may involve the use of specific design criteria that consider seismic loading, as well as the selection of materials and support systems that can withstand these dynamic forces.

2.8 The primary design principle for tunnel support must be flexible, allowing for real-time adjustments based on actual ground conditions encountered. Designers must be prepared to revise their designs if significant deviations from the initial assumptions arise. However, understanding the limitations of field and monitoring data is equally important. A well-conceived design strikes a responsible and safe balance between anticipated and actual ground conditions.

3. Tendering

3.1 Comprehensive Coverage of Contract Aspects

All critical aspects of the contract, viz., scope, milestones, scheduling, provisions for variations, risk-sharing mechanisms, and force majeure, must be addressed unambiguously. This ensures clarity and minimizes the potential for disputes during project execution.

3.2 The tender document shall provide comprehensive information based on Geotechnical Baselines to enable bidders to make well-informed decisions. It shall include DPR-stage designs, investigation data, initial survey points, details on local resources, and the status of necessary clearances. It is important to recognize that bidders have their own commercial objectives, and the Authority shall not overlook this fact. A well-structured tender document that acknowledges these considerations can significantly enhance project outcomes.

4. Execution

4.1 The execution phase is the most complex stage, as the physical delivery of the project occurs incrementally. To prevent major construction failures, every team member must fulfill their role precisely. Selecting an AE/IE to oversee technical construction reviews is critical, and they shall be on board with all required resources from the project's outset.

4.2 The Authority must deploy a suitably sized team to monitor execution in coordination with the AE/IE and contractor. A designated Project In-Charge of Authority shall be accountable for project delivery and quality assurance.

4.3 The Project In-Charge must attend weekly risk management meetings with key project stakeholders. The risk register shall remain a live document, regularly updated to ensure

top risks are discussed and mitigation measures are implemented. Each identified risk shall have a designated person responsible for mitigation.

4.4 Common execution risks include tunnel face collapses, support system failures, and unexpected deformations. Implementing NATM principles has proven successful in tunnel projects across India and internationally. The observational method is key to verifying ground behavior and optimizing support measures.

4.5 Establishing a clear procedure for incorporating NATM principles and observational techniques is essential. The process shall define how site observations will be used to optimize excavation sequences and support implementation. RESS (Required Excavation and Support Sheet) shall be maintained for each round, with the AE/IE responsible for their adherence and regular monitoring.

4.6 NATM emphasizes a "design-as-you-go" approach, meaning support systems must be adapted based on observed behavior. Additional support measures shall be determined based on mapping and monitoring data. A similar level of alertness shall be there in case of Tunnel Boring Machine (TBM) tunnels also, particularly to ensure safety in scenarios involving roof collapses, water ingress, or a combination of both.

4.7 In projects with pre-agreed pricing for different ground support systems, an engineering review mechanism must be in place to decide on the required support system based on site observations. This review shall be finalized before the support installation. Instrumentation shall be done side by side with the tunnel excavation, leaving a buffer from the face.

4.8 Monitoring data is crucial for tunnel safety. Proper documentation shall be maintained, covering key parameters such as displacement magnitude, direction, trend, convergence, pore water pressure, liner stress, and rock bolt forces. Standard spreadsheets may limit visibility, and purpose-built software solutions with remote access for 24/7 monitoring shall be used.

4.9 Daily Review Meetings (DRM) are essential to ensure continuous data analysis. Any significant deviations must be reported and discussed for corrective action.

4.10 Deformation allowances and excavation tolerances shall be established based on ground behavior and construction quality. Underestimating these factors can result in under-profiling, which poses challenges for placing permanent structures. In areas suspected of squeezing, the excavation profile shall be sufficiently enlarged. Provisions shall also be made for polyurethane (PU) grouting in the event of excessive water ingress, as well as for flexible lining where the tunnel alignment intersects major thrust zones or fault planes.

4.11 Preparations must be made for worst-case scenarios, including additional support measures such as pre-support systems, face bolting, forepoling and pipe roofing. Pre-support in poor ground is critical to maintaining ground confinement. If excessive relaxation occurs, installed support systems may become ineffective, necessitating re-profiling.

4.12 As part of risk management, the construction team shall be equipped with the necessary tools and resources for immediate deployment. Any variations in support classes must be agreed upon in advance, with decisions based solely on sound engineering judgment.

4.13 Once excavation is completed, the timely installation of support is essential. Monitoring data must confirm the effectiveness of the support system. If trends suggest additional support is needed, it shall be promptly installed. As a rule, when in doubt, reinforcing support measures is preferable.

4.14 Specialist agencies for grouting and dewatering shall be engaged periodically for expert consultations. Additionally, a design-support contract shall be in place to facilitate immediate technical revisions when needed.

4.15 Tunnels shall be categorized into collapse-risk zones based on the potential for structural failure, even after primary support systems are installed. In high-risk zones, a NP-4 escape pipe of minimum 0.9-meter-diameter shall be placed in the invert area and extended into lower-risk zones to provide emergency access. The pipe shall be positioned near the tunnel sidewalls to minimize loads in case of collapse.

4.16 The AE/IE must ensure that all excavation, support installations, monitoring, and re-profiling adhere to approved methodologies. No work shall proceed without AE/IE authorization.

4.17 Competent geologists from both the contractor and the AE/IE shall regularly inspect the tunnel face, roof, and walls—especially at the start of each shift and after every blast—to check for any signs of instability and ensure tunnel safety.

4.18 High-risk zones typically move with the tunnel face, while areas where displacement has stabilized are considered safe. At least one mobile rescue container (capacity: 12 workers) shall be positioned 150–300 meters behind the tunnel face, with a fixed container (capacity: 24 workers) every 2 kilometers. These containers must provide at least 24 hours of survival capability.

4.19 The AE/IE must maintain updated records of all support installations throughout the tunnel.

B Mitigation

1. While systematic preventive measures can significantly reduce the likelihood of tunnel collapse, it is crucial to acknowledge that tunnel safety margins can drop drastically in poor geological conditions. Tunnel failures often occur unexpectedly.
2. Since tunnel collapses tend to be sudden and unpredictable, it is imperative to have a well-defined response plan and ensure that construction teams are thoroughly trained in emergency protocols before any incident occurs. Pre-planning and regular evacuation drills help mitigate panic and improve reaction times during an actual collapse.
3. All shift managers must be trained to implement the Emergency Response Plan (ERP), which shall be prepared in advance to address all possible scenarios identified in the project's risk assessment. The plan must be reviewed and formally approved by the designated safety officer of the Authority.
4. Safety drills shall be conducted regularly to enhance awareness and refine the emergency response plan.
5. At each construction site or tunnel face, updated contact details of key local authorities, including DDMA, Police, Fire Services, Health Facilities, and nearest NDRF/SDRF stations, must be prominently displayed and included in the Emergency Response Plan (ERP). These must be reviewed bi-weekly and verified by the Safety Officer.
6. The ERP shall be directly correlated with the contractor's construction schedule and updated weekly based on actual site progress. Weekly submissions to the AE/IE shall include revised ERP sections reflecting tunnel advancement and associated risk transitions.
7. The Ministry of Road Transport & Highways vide Circular No. 15017/37/2019-P&M(Mon)-DMP dated19.08.2025 has issued the Disaster Management Plan (DMP) of the Ministry. The DMP provides a comprehensive framework for managing disasters on roads and highways. This plan outlines a comprehensive framework for managing disasters related to roads and highways. Provisions concerning tunnel collapse mitigation specified in this document shall be interpreted in conjunction with the DMP.
8. All actions taken during and after the collapse must be meticulously recorded for future evaluation. The Project In-Charge of Authority must be informed immediately and shall convene an urgent meeting involving key personnel from safety, contracts, risk management, construction, surveying, monitoring, geology, geotechnical engineering and insurance. The meeting must not be delayed unnecessarily to wait for unavailable personnel.
9. In the event of a collapse, the immediate priority must be to evacuate all personnel from the affected tunnel section to a safer location. The construction manager of Contractor is responsible for ensuring swift and efficient evacuation without unnecessary delays. All workers must be assembled for an accurate situational assessment, and clear instructions shall be communicated to prevent misinformation or panic.
10. The Project In-Charge, with assistance from the safety and geology teams, must rapidly assess the extent of the incident and determine whether the collapse has the potential to

propagate into adjacent areas. A decision regarding tunnel re-entry and access to the collapse zone must be based on this critical assessment.

11. Based on the available data, the project's geological and geotechnical key personnel shall prepare a concise summary detailing critical aspects of the collapse. This summary must include geological conditions, water ingress recorded during face mapping, monitoring data trends, support systems implemented, and any unusual conditions observed. Details of the actual blast design and blast cycle and the time lapse between excavation and providing support shall also be clearly mentioned for analysis. Additionally, it shall be accompanied by a face mapping sheet of the affected zone, a timeline of photographs, support drawings, monitoring data interpretation and a record of non-compliance reports related to the affected stretch and their resolutions.

12. The Project In-Charge must review the report with key stakeholders and formulate a course of action. Specific tasks shall be assigned to individual team members, and a structured list of action items must be recorded.

13. Depending on the severity of the collapse, the Project In-Charge shall consult the focus team and if necessary, arrange for the immediate deployment of experts from similar projects to support mitigation efforts.

14. The response strategy to be implemented in the event of a tunnel collapse is detailed in **Annexure-A.**

C. Safety of Responders in Tunnel Rescue Operations

In the recent past, there have been incidents of tunnel collapses during construction, stranding the workers —and in some cases—losing their lives. In such emergencies, rescue operations are carried out in coordination with agencies like the NDRF, SDRF, and the Armed Forces. Although the rescue agencies conduct visits to the tunnels for familiarization in coordination with the tunnel authorities, the varying designs and construction types—shaped by terrain and topography—mean that each tunnel presents unique features and vulnerabilities. As a result, agencies deployed for rescue operations are often not equipped to operate independently and require close supervision and support from technical experts to ensure their own safety. Without such guidance, there is a serious risk of accidents and potential loss of life.

2. In light of the above, it is essential to establish clear guidelines for response agencies involved in tunnel rescue operations to ensure coordinated action and uphold safety standards throughout the mission. The guidelines are outlined below to provide clarity and direction for agencies engaged in such operations.

a) Role and task of the Incident Commander:

All rescue agencies will work under close supervision of the Incident Commander designated by the concerned Dy. Commissioner (DC) / District Magistrate (DM) of the District or any other Superior Authority in the State / Centre. The Incident Commander will undertake the following tasks:

i) Engage the main agency involved in tunnel construction and other tunnel experts in understanding the various nuances of tunnel construction and safety for proper appreciation and identification of probable threats.

ii) Form a Rescue Team comprising of all important elements involved in tunnel rescue operation, including experts if available, to conduct a survey inside the tunnel to ascertain the situation and work out a plan for the rescue operation. The team shall be equipped with safety gear, oxygen, and equipment.

iii) Take needful action in coordination with NDMA/SDMA/DDMA and tunnel construction agencies/experts to activate the basic requirements in the tunnel to conduct operations safely by the rescue agencies.

iv) Ensure a comprehensive initial briefing is conducted for rescue agencies by the construction company and relevant experts prior to the commencement of rescue operations.

v) Ensure to conduct daily briefing and de-briefing of the rescue agencies involved in the operations and share important inputs with all concerned.

vi) Ensure availability of required logistics backup and support for smooth conduct of rescue operations.

vii) Enforce a system for proper check and control on entry of unauthorized personnel / other stakeholders in the tunnel without proper justification and approval.

viii) In view of the associated risks and hazards, determine—through coordination with rescue agencies—the minimum personnel strength required for operations inside the tunnel, and implement an effective rotation plan to ensure safety and operational efficiency.

ix) Ensure placement of a self-contained and properly equipped team outside the tunnel in readiness for quick response in the event of an emergency during rescue operations.

x) Establish coordination with the local administration and agency involved in tunnel construction, a system for real-time monitoring of the rescue operations in the Command & Control Centre.

xi) Engage with experts for consultation on various aspects of the operations, safety protocols, and workable options to achieve the tasks.

xii) Conduct a joint media briefing with representatives from all the important agencies involved in the operation.

xiii) Establish a unified Incident Response System (IRS) involving all stakeholders for joint meetings, a common action plan, and safety standards for the conduct of a smooth rescue operation.

xiv) If at any time, it is revealed or comes to the knowledge of the Incident Commander that there is a threat to the rescuers inside the tunnel, he/she will without delay discuss the matter with the tunnel agency, experts and supervising officer / Team Commander of the Rescue Team and take a conscious decision to halt the on-going operation and further resume it only after conditions are favourable/safe for the same.

b) Role and task of the main agency engaged in tunnel construction:

The agency engaged in tunnel construction by virtue of its technical and professional knowledge and expertise shall play key supportive role during rescue operation led by the specialized agencies such as NDRF, SDRF, and DDMA. Considering sensitive ground conditions that typically accompany such contingencies, the construction agency must ensure the following actions are carried out in a timely and coordinated manner:

i) Conduct a thorough check of the ground situation before commencement of operations to appreciate the prevailing problems inside the tunnel and likely threats, i.e. fire hazards, flooding, possibility of roof collapse, presence of hazardous gases, etc.

ii) Ensure the functionality of various systems like air ventilation, conveyor belt, de-watering systems, clearance of entry & exit routes and placement of signages, identification of safe zones in the tunnel, restoration of communication system, high

intensity lighting inside the tunnel, installation of cameras for visual monitoring and ready availability of important specialized equipment to support operations, besides availability of trained & skilled manpower. A list of such important equipment and experts shall be maintained by the agency.

iii) The In-charge of the agency assigned with the construction of the tunnel will take needful action to identify the trained staff under a supervisor who will accompany the response agencies. For this, a proper roster shall be prepared. The detailed element shall have a well-acquainted staff designated as the Safety Officer, who will be responsible for 24x7 safety inside the tunnel.

iv) The agency, in coordination with the Incident Commander and local administration, will ensure to keep all logistics required for support during operations along with trained staff in readiness to move inside the tunnel in an organized manner as and when required.

v) The In-Charge of the agency will remain in close coordination with the Incident Commander, tunnel experts, and local administration and organize daily briefing / de-briefing of the rescue team moving inside / coming out of the tunnel.

vi) Based on the inputs available from the rescue team, the agency will prepare an Action Plan for operations and review such actions on a daily basis based on regular inputs and other developments occurring from time to time.

vii) The agency will ensure to regularly assess the structural stability of the tunnel and brief the Incident Commander on any new development crucial to safety in the rescue operations.

c) Role and task of Local Administration:

The local administration under DC / DM plays an important role in rescue operations by providing all logistics support and back-up and preparing the ground for the smooth launching of the operations. The administration will take necessary actions to ensure the following:

i) Enforce restrictions in the area for the public from getting close to the tunnel site to prevent interference with rescue operations by deploying adequate security, police, and traffic personnel, and maintaining continuous monitoring and surveillance of the area.

ii) Allow only approved/recognized agencies/persons to enter the tunnel for undertaking rescue work who have been specifically tasked for the purpose.

iii) Deploy sufficient police personnel to maintain law & order if any, that may arise at the tunnel site.

iv) Check the India Disaster Resource Network (IDRN) website with respect to the availability of any important equipment/tools which may be required during operations and plan its movement at the incident site as & when required.

v) Establish Incident Command Post (ICP) at the tunnel site along with the Command & Control Centre for important functionaries of various agencies involved in operations in consultation with the Incident Commander.

vi) Establish medical post at locations along with ambulances to provide first-aid in case of any requirement.

vii) Co-ordinate with nearby hospitals for emergency evacuation in case of retrieval of live victims or dead bodies during Operations.

viii) Ensure sufficient lighting in the area of operations and availability of food & water for rescue agencies as per requirement.

ix) Ensure multi-agency coordination to prioritize operations requirements and smooth conduct of operations.

x) Plan for efficient handling of press & media and arrange for Joint Press Conferences under the designated Incident Commander or Senior Officers present at the site.

d) Role and task of NDRF / SDRF Commander:

i) NDRF / SDRF Team Commander / Supervising Officer on the ground will conduct operations under overall supervision of the Incident Commander and with the assistance of the local administration, police, agency in-charge of tunnel construction, and other experts involved in the operations.

ii) NDRF / SDRF Team Commander / Supervising Officer will ensure proper briefing of the team members by the Incident Commander/agency involved in tunnel construction and experts available at the site before commencement of work, and further brief the rescuers at their level.

iii) The Team Commander / Supervising Officer will ensure that all rescuers have proper safety gear, helmets with headlights, gloves, self-contained breathing apparatus (SCBA), gas detectors, hydration pack, and required equipment for rescue work. During operations, any additional/specific requirements for equipment/gear may be placed before the Incident Commander/agency / local administration.

iv) The Team Commander / Supervisory Officer will not brief the media separately but can participate in the joint media briefing by the Incident Commander / senior-most administrative officials present on the ground.

v) The Team Commander will provide the update on all deployments inside the tunnel and urgent issues that can pose a threat to the safety of the rescuers shall be flagged without delay.

vi) Supervisory Officer and Team Commanders must adhere to all protocols/guidelines on tunnel safety as briefed by the Incident Commander / In-charge of the agency

operating in the tunnel and also enforce the internal SOP of the Force for specific tasks, if any. An Internal Safety Officer shall be designated by the Rescue Teams besides that from the agency, who will enforce the LCES system – Lookout, Communication, Escape Routes & Safety measures.

vii) A proper shift rotation of the rescuers will be ensured by the Team Commander / Supervising Officer of the rescue team to prevent fatigue and stress.

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Annexure 'A'

RESPONSE STRATEGY TO BE IMPLEMENTED IN THE EVENT OF A TUNNEL COLLAPSE

a) First Information / Perceive the Threat / Assess the Hazard

- **Immediate Detection:**
  - Trigger emergency alarm systems upon detection of collapse or cave-in.
  - Use loudspeakers to alert all personnel across the tunnel site.
  - Use two-way radios to communicate with all personnel and initiate the emergency response protocol.
- **Reporting & Initial Response:**
  - Utilize emergency numbers like **1033** (24x7 highway helpline) to report the incident.
  - Dispatch first responders (route patrolling officers, ambulance, crane, etc.) to the site.
  - Assess the number of personnel affected and severity of injuries.
  - Mobilize trained experts to evaluate the extent of the damage. Determine the potential impact on nearby infrastructure, traffic, and communities. Use drone / satellite imagery and ground surveys to assess the damage.
- **Initial Hazard Assessment**
  - Assess the location, size, and potential hazards of the collapse.
  - Prioritize locating trapped workers using Sound detection, Thermal imaging, Exploratory drilling etc.
  - Gather information on the number and condition of trapped individuals.

b) Identification of Evacuation Routes

- Develop detailed evacuation plans tailored to the layout of the tunnel. Communicate these plans to residents and commuters through multiple channels, including local authorities and digital platforms.
- Identify and clearly mark alternative routes to divert traffic away from the accident site & spillage area (if any) using road signs and digital boards to guide drivers.
- Follow traffic diversion plans as per IRC: SP 43-2022 (Guidelines on Traffic Management Technique).
- Ensure emergency vehicles have clear and unobstructed access to the site.
- Coordinate with State traffic police to manage the flow of vehicles, set up roadblocks, and ensure smooth diversion of traffic.
- Clear the accident site of debris and damaged vehicles to restore traffic flow.

c) Immediate Evacuation

- Begin evacuation for trapped personnel. Ensures that everyone follows pre-established evacuation plans and exits the area safely. Personnel should stop all activities and proceed to designated safe exits.
- **Assistance to Trapped Individuals**
    - Provide medical supplies, packaged food, drinking water, and sanitation (e.g., portable toilet bags) to trapped individuals until rescue begins.

d) Identification of Human Resources Needs and Their Deployment

- Deploy emergency responders, route patrolling officers, ambulances, and medical personnel for immediate assistance.
- Mobilize specialized search and rescue teams including engineers, medical personnel, and structural experts. Ensure they are equipped with the necessary tools and protective gear.
- Mobilize the Site office & Regional Office officials and respective contractors to assist with evacuation, first aid, and other support activities depending on the severity of the accident.
- Before any rescue attempts, the collapse zone must be stabilized. This may involve using shoring timbers, erecting barricades, or diversion of water.
- Identify and mark accessible points within the tunnel for potential rescue operations. These access points should be easily identifiable.
- Coordinate with State traffic police to manage the flow of vehicles, set up roadblocks, and ensure smooth diversion of traffic.
- Identify & mobilize trained community volunteers if required to assist in managing the situation and providing first aid.
- **Risk Assessment for safe rescue operation:**
    - Conduct thorough risk analysis of the collapsed area to ensure safety of rescue personnel.
- **Search and Extraction:**
    - Utilize specialized equipment such as hydraulic spreaders, concrete cutters, and lifting devices to extricate trapped individuals safely.
    - Implement safe extraction techniques to minimize further collapse or injury.

e) Identification & Deployment of Other Essential Resources

- Ensure a sufficient number of ambulances & route patrolling vehicles are available and equip ambulances and emergency response units with first aid kits, stretchers, and other medical supplies.
- Provide tow trucks or cranes to remove damaged vehicles and clear the road of any debris. Deploy fire trucks equipped with firefighting and rescue equipment in coordination with

the state fire brigade. Ensure fire extinguishers are available at the site to handle small fires.

- Identify backup equipment's in advance, to be mobilized in case of failure of the former.
- Provide support items, viz., packaged food, drinking water, and portable sanitation facilities for trapped individuals until rescue operations commence.
- Identify backup equipment in advance to be mobilized in case of failure of primary resources.

f) Communication Management

- First responders shall inform the Site office & Regional Office officials about the accident as soon as possible & in no case later than 1 hour.
- Use Variable Message Signs (VMS) on highways and urban roads for real-time driver updates. Use television, radio, and social media platforms to inform the public about the accident, its location, and alternative routes.
- Maintain continuous communication between police, fire brigade, medical teams, and traffic management personnel to coordinate efforts effectively.
- Inform the Ministry and the public about the reopening of traffic through newspapers, social media, television, radio, and pamphlets. Use official channels to prevent the spread of misinformation and keep the public informed.

g) Medical Assistance

- **Triage and Treatment**
  - Establish triage near the collapse site to assess and prioritize injured individuals based on the severity of their injuries.
  - Administer necessary first aid and medical treatment on-site to stabilize patients. This step prepares them for safe transportation to medical facilities for more advanced care.
- **Transportation to Medical Facilities**
  - Coordinate with emergency medical services for hospital transfers of injured individuals

h) Post-Emergency Procedures

- **Debriefing and Evaluation**
  - Conduct debrief with Emergency Response Team and stakeholders to review response and lessons learned.
- **Documentation and Reporting**
  - Document all actions taken, resources used, and outcomes.

- Submit incident reports to regulatory authorities and Ministry.

- **Recovery and Rehabilitation**
  - Implement measures to stabilize the tunnel structure and mitigate the risk of further collapse or instability.
  - Provide support and counselling services to affected personnel and their families to address any emotional or psychological trauma.

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