

Development of Transport Emergency Response Plan in the Cement Manufacturing Industry

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Abstract – The main purpose of this manuscript is to help the responders to effectively tackle the incidents related to transport systems by setting proper procedures under the response phase in the TERP to save lives, limit the impact severity and to respond the condition with a minimum of expense. By this method, a proactive approach to a transport emergency is developed to control the impact of an incident with minimum time delay. Further, this manuscript contains the guidelines for safe recovering of the vehicle either by towing or lifting. The data for each vehicle used within the cement manufacturing industry concerning type, dimension and weight is measured and the identification chart has been prepared. This paper also contains specific procedures for lifting both rigid and articulated vehicles.

Key Words: TERP, MBS, WLL, AFR, fire Zone, VR.

1. INTRODUCTION

A well-defined Workplace Transport Emergency Preparedness Plan takes us one step ahead by anticipating the actions and initiatives that need to be drafted and developed before any such incident thus helping us to contain the loss of human life, property and provide speedy and effective remedial measures. An effective transport emergency response plan requires a well-defined emergency policy and Guidelines which is a combined extract of several factors such as,

- The People involved (Responders),
- Knowledge (Regarding the Emergency Condition),
- Vehicle,
- Proper equipment

Responders: The key personnel involved in the Emergency response situation shall be able to carry out the following things,

- Should be able to implement the TERP Plan effectively.
- They shall know the Hazards and risks associated with any activity regarding the rescue.
- Should have a clear knowledge regarding the emergencies and be able to anticipate the consequences developing from the particular emergency condition.
- Should have the practical knowledge to address the condition by using the engineering controls,

Hazardous material handling procedures and sometimes by the use of new techniques to counter the situations.

- They shall be responsible for providing the emergency medical response to the responders on the scene.
- They should have the capability on when to decide the termination procedure.

Vehicle: A Rescue vehicle covers figuring out and choosing the most appropriate automobile to respond to the emergencies. It is also Dependent on the vehicle by which the emergency is being caused and hence it is highly required for the transport emergency plan (TERP) to hold all possible information's related to the type of the vehicle, the purpose for what it is being used, weight and dimension of the vehicle. **Knowledge:** This portion gives complete guidance on the possible emergency condition to the responders having relevant knowledge and experience or can benefit those through training.

General duties of the employer in developing the Transport emergency response are:

- Establishing the written policy on Transport Emergency service.
- Assessing the risk to the safety and health of any individuals affected by the activities carried out during the course of responding to an accident.
- Ensuring the sound arrangements in the TERP for making effective planning, managing, Mitigating and reviewing the Control measures identified by the risk assessment.
- Ensuring the employees are instructed, trained and supervised on the associated health and safety issues during the Transport Emergency response Phase.

A transport Emergency response is a safety issue which requires proper and quick response to contain the further adverse effect. It is highly needed to develop a Transport Emergency response plan in the Cement manufacturing industry. Since the industrial environment consists of various transport vehicles ranging from Light to Heavy vehicles. Although the TERP is an essential characteristic of the transportation infrastructure, Its Procedures are not still well defined. The guidance has been produced by this report is to help the management to effectively deal with the emergencies regarding the transport

systems by Providing the responders with maximum knowledge on the emergency conditions, hence it would help them to make quick and correct decisions on the Field. As far now the transport emergency handling is a confusing state with no clear Responsibilities, guidelines, and other required information.

2. LITERATURE REVIEW

This Study addresses various Common components required for creating a well-defined transport emergency Response plan. The components include following: the key responsibilities of the responders, Risk assessment in two main ways general and the on-scene risk assessment, Written procedures describing the steps and the protective measures that are required to be carried out, Education and training to the responders, situation appraisal and investigation techniques, Emergency medical response and first aid, The inspection of tools, equipment's and the Vehicles (as a proactive approach) [1]. The Standard from the Cement industry defines the need and requirement of emergency preparedness and response plan in the clause twelve, this standard state that a TERP (Transport emergency response plan) shall be developed additionally under the existing Workplace Emergency preparedness and response plan (EPRP). I.e. this plan shall address the procedures for remedial actions to be followed during an emergency which would also include whom to report and whom to call for help [2]. Guidance from the Advisory Committee on the Transport of Dangerous Goods (Australia) and Regulation 14.5 road transport Reform-1997, addresses that a TERP shall have a plan activation mechanism that has grouped into three major sections such as the internal and external alerting mechanisms, the Situation appraisal for collecting the required information for easy decision making, the authority and the resources available [3, 4].

The guidance on the Common issues in the TERP developed by the U.S Department of transportation federal highway Administration reports that a responder attending a transport emergency scene should be able to focus on two important issues, the first thing is minimizing the time of initial response and the second thing is maximizing the mass of the population moved from the vicinity without being affected by the other dangers.

This guidance also addresses the importance of a policy in the transport emergency and response system and the need for the Safety Data Sheet containing the information on the hazardous materials that are listed under sixteen different sections. The policy should cover the funding, evacuation planning, mutual coordination, periodicity of review and the procedure for forecasting the abnormalities in the scene [5, 6]. The Indian standard: IS 9435:2004 defines the various possible dimensions of the vehicle such as vehicle length, Vehicle Width, front overhang, rear overhang, minimum ground clearance, the overhang of the attachment [7].

The guidance developed by the AIGA in house members clearly defines the implementation of recovery operation after announcing the end to an emergency response to bring back the situation to normal condition. This guideline has segregated the after-math recovery system into two categories such as Area Recovery and Vehicle Recovery. The area recovery plan shall be focusing on nullifying the environmental degradation effects which sustain even after the emergency. While the vehicle recovery plan shall be concerned on the remedial measures that are to be taken for bringing the vehicle back to normal operating condition, this also includes the proper use of tools and equipment [8].

The guideline from the Canadian Fuels Association reports specific procedures in handling the Petroleum spills. This Guideline proposes the various detailed on-scene response Considerations such as the event control and mitigation, product removal operations and the truck salvage procedures [9].

The Standard from the Cement Industry: The standard for Material lifting and operations (Cranes and Hoists) Provides the Information and guidance on Lifting the materials using the mobile crane. This guidance includes the information related to the main boom length, the Working Radius, load weight and its dimensions and also the weight of the hook block and rigging weight [10]. The publication from the glove box edition gives the information which is very much likely to be considered while towing the vehicle. They collectively include many factors such as the minimum breaking strength of the toe straps and chains used, the fire of the strap, angle of towing [11].

Studies report that many of the accidents involving commercial trucks in and out of the workplace evolve as an uncontrollable emergency only because of the poor responding systems. This is mainly caused by Responders who breach their duty of care such as Lack of knowledge, undefined responsibilities, inadequate knowledge over the tools and equipment's [12][13]. A study by Randy H, Shih, Oregon institute of technology on AutoCAD 2007 reveals the basic information about the usage of AutoCAD 2007 software to aid the guidance on the Two-dimensional Drawings over the fields such as The determination of the units, drawing limits, dimension lines, curves, fillet options, line colouring, Circle options [14].

2. METHODOLOGY

A Transport emergency response framework in the workplace is a safety issue because of the extensive emergencies. It is an undeniable fact that all the top organizations are much focusing on the plan for and responding to the emergencies in a systemized way considering the challenging risk environments, policies and the available emergency technologies. Therefore, a well-defined, applicable and efficient emergency preparedness plan can be drafted by following and considering the methodologies and information as given in the fig.1.



Figure.1. TERP Framework

3. RESPONSE PHASE

3.1. TOWING THE VEHICLE.

Towing is always preferred only when the tow truck is available. But in case if the tow truck is not available and it is a necessary condition that a vehicle is towed or pulled, consider the following guidelines.

- Check the gross vehicle weight (Refer figure.4.Vehicle identification chart or Vehicle identification and information plate on the driver's door as shown in Figure.2) and the additional load weight on the vehicle.
- Never use the lighter vehicle to tow/ pull the heavier vehicle Always use only the recovery straps for towing/pulling the vehicle. The recovery straps should necessarily contain the loops.
- Never attach the loops into the vehicle's weak portions such as the bumpers, or other protrusions like ball hitches, bull bars.
- The Recovery straps should only be attached to the load rated components such as tow hooks, shackles which are connected with the vehicle frame.
- The recovery straps and the attachments into which it is being fitted should be checked for its Minimum breaking strength and Working load limit (as shown in figure.3)
- While choosing the recovery strap, always consider MBS so that the chosen recovery strap shall be rated at least 2-3 times higher than the total weight of the truck. i.e. if the rating of the strap is less- there is a high chance for the strap to snap and if the rating is high then the elasticity would reduce the pulling effort.
- In case if the strap is not labelled with MBS then assume that the width of the strap adds 4500 kgs (Approx.) of MBS (i.e. the 5-inch-wide strap would have an MBS of $5 \times 4500 = 22500$ kgs.)
- The tow hooks or shackles should always have a higher rating than the straps.

- While hooking the straps to the vehicle align the vehicles in a straight line (Maximum of 10-degree deviation from the straight line may be permissible).
- Clear the sand, mud or other obstruction in the direction of pull and ensure the swing zones of the tires are free.
- Once after setting the above things, ensure that the middle of the straps is draped by a blanket to resist any backlash
- Deploy a traffic marshal on the scene to assist and communicate instructions between two drivers. Such traffic marshal should be subjected to training on how to hand signal.
- The fire zone/ the backlash zone of the strap used is 2 times the length of the strap perpendicular to the line of pulling.
- Ensure that the pulling/ towing is done only after complying with the above guidelines.
- While pulling/ towing the vehicle, ensure that the vehicle which is pulling the other accelerates slowly to create a tension in the straps. High acceleration of the pulling vehicle would create an impact pull which would have the potential to snap the straps.



Figure.2. Vehicle Identification and information plate



Figure.3. Minimum Breaking Strength of straps and Working load Limit of Shackles

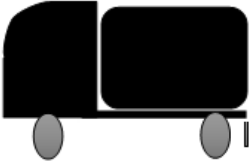
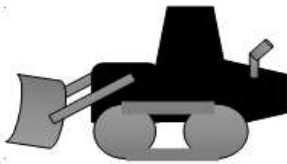
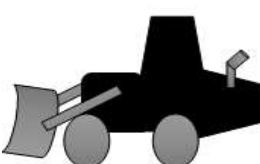
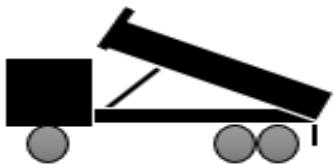
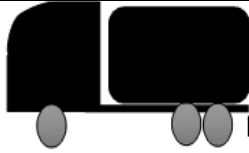

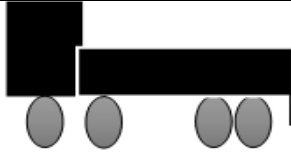
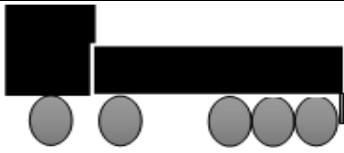

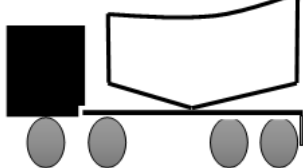
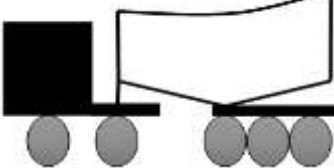
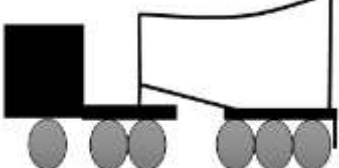

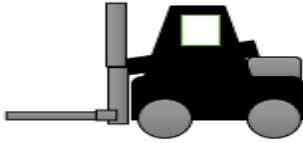

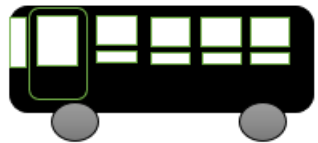



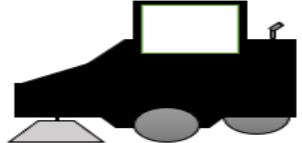
VEHICLE IDENTIFICATION CHART			
CLASS A -HEAVY DUTY			
 <p>Length: 5.50 m Width: 2.50 m No of Axles: 2 Tonnages: 15</p>	 <p>Length: 7.20 m Width: 2.50 m No of Axles: 2 Tonnages: 8.48</p>	 <p>Length: 8.20 m Width: 2.30 m No of Axles: 2 Tonnages: 20.20</p>	 <p>Length: 7.20 m Width: 2.60 m No of Axles: 3 Tonnages: 25</p>
 <p>Length: 5.80 m Width: 2.50 m No of Axles: 3 Tonnages: 25</p>	 <p>Length: 10 m Width: 3 m No of Axles: 3 Tonnages: 19</p>	 <p>Length: 10.5 m Width: 3 m No of Axles: 4 Tonnages: 25</p>	 <p>Length: 12.5 m Width: 3 m No of Axles: 5 Tonnages: 35</p>
 <p>Length: 8 m Width: 3 m No of Axles: 2 Tonnages: 10</p>	 <p>Length: 10 m Width: 3 m No of Axles: 4 Tonnages: 27</p>	 <p>Length: 13.5 m Width: 3 m No of Axles: 5 Tonnages: 35</p>	 <p>Length: 15 m Width: 3 m No of Axles: 6 Tonnages: 40</p>
CLASS B - MEDIUM DUTY			
 <p>Length: 3.40 m Width: 1.70 m No of Axles: 2 Tonnages: 2.90</p>	 <p>Length: 4.50 m Width: 1.50 m No of Axles: 2 Tonnages: 7.30</p>	 <p>Length: 4.40 m Width: 1.60 m No of Axles: 2 Tonnages: 2.25</p>	 <p>Length: 7.10 m Width: 2.10 m No of Axles: 2 Tonnages: 6.05</p>
CLASS C -LIGHT DUTY			
 <p>Length: 4.60 m Width: 1.80 m No of Axles: 2 Tonnages: 2.30</p>	 <p>Length: 4.00 m Width: 1.70 m No of Axles: 2 Tonnages: 1.34</p>	 <p>Length: 5.40 m Width: 1.90 m No of Axles: 2 Tonnages: 5.25</p>	 <p>Length: 2.33 m Width: 1.51 m No of Axles: 2 Tonnages: 1.55</p>

Figure.4. Vehicle Identification chart

3.2 STABILIZING THE TOPPLED VEHICLE AND LIFTING THE VEHICLE

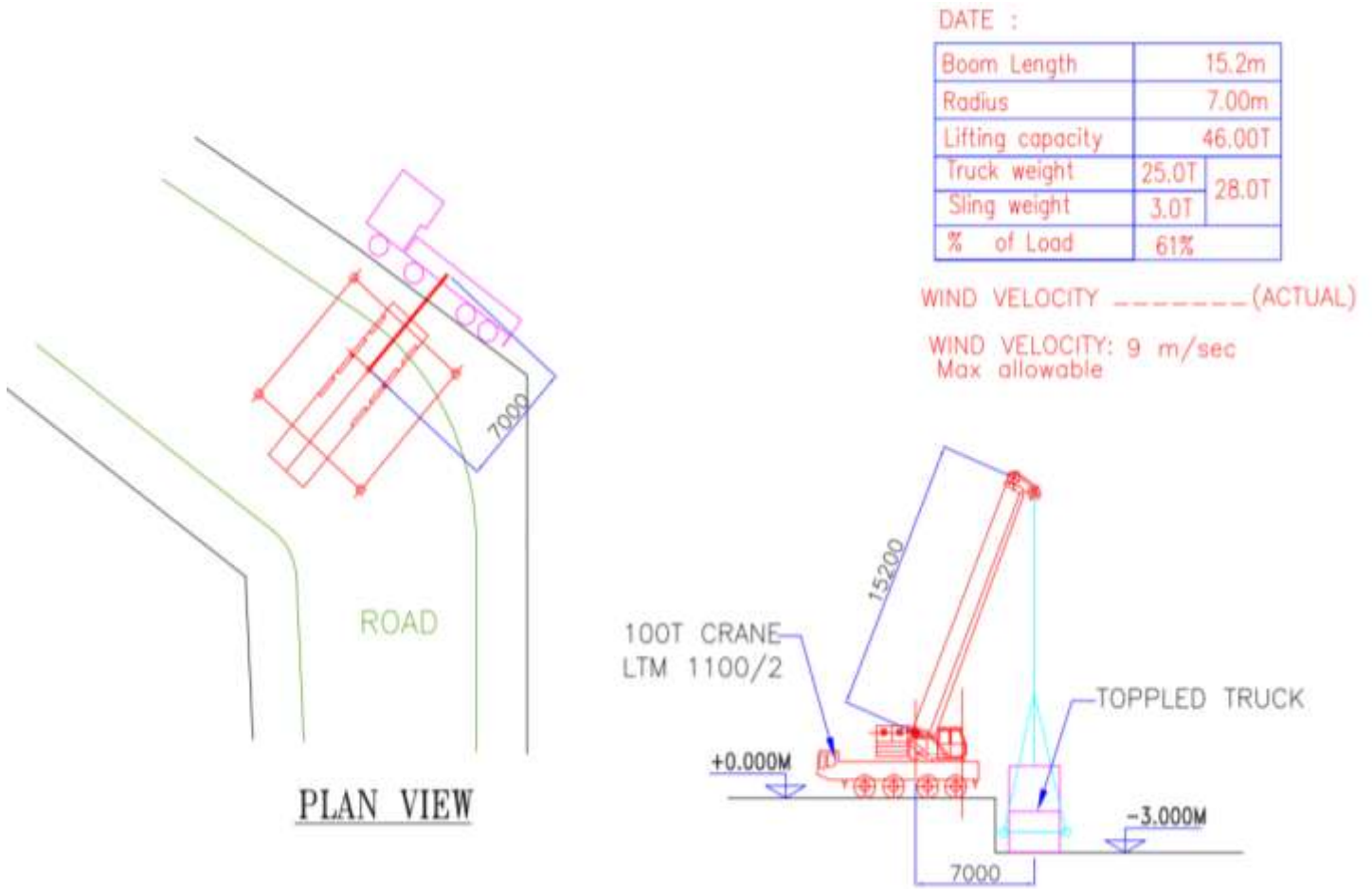


Figure.5. Lifting Plan for rigid truck (dimension 10.5m X 3m) 3m down the floor level

- When the vehicle is resting on its side, it is more prone to the fire. The vehicle would have had a burst fuel tank. Hence the priority is to be given to discharge the fuel from the tank using the proper equipment or ensure that there is no leakage and the tank is having sound mechanical integrity.
- Look for the battery, if the access to the battery is safe and applicable then disconnect the battery from the vehicle.
- Look for the persons inside the vehicle cabin. If there are people struck inside the truck cabin, then at this type of the incident open the Vehicle roof by cutting the pillars/ post of the roof structure and fold it down. Always cut the seat belt first before the pillars/posts are being cut.
- This will allow you to access the victims and get them out safely.
- The load in the vehicle is to be considered before tilting the vehicle back to its normal state, as the vehicle's point of the balance is very largely dependent on the load it is carrying(as shown in figure.6.).

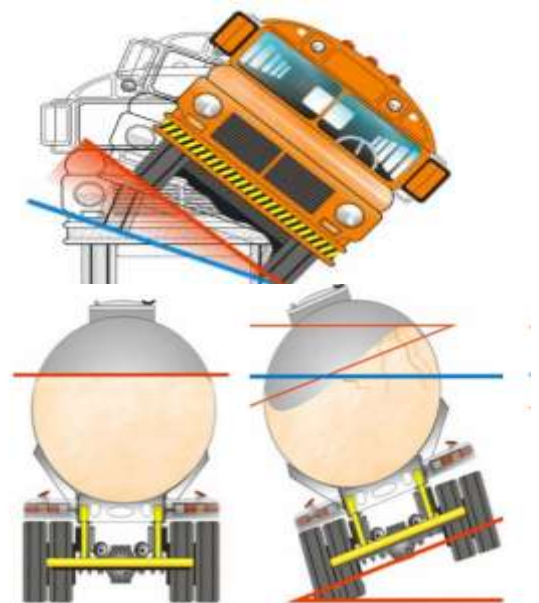


Figure.6. the Vehicle point of balance-Oscillating

- The packed loads in the truck are to be removed from the truck manually.
- Seek external assistance or the assistance from the manufacturer in case if the truck is filled with the Dangerous goods (such as Petrol, Coal, and Alternate Fuel and other Raw materials).
- In case of cement bulkers carrying loose cement or fly-ash, Transfer the loose contents using the compressor to other empty vehicles.
- Once the truck is emptied follow the pulling technique to the vehicle on its side and tilt the vehicle slowly. Ensure that the wheels on the ground are hooked to the ground utilizing rigid links/assemblies to avoid further toppling during lifting. The trucks are prone to toppling as low as the angle of 15 degrees to the floor. Hence raise the floor to a level at which the truck angle would be maintained more than 15 degrees with the floor.
- Use mud, sand to raise the level as they would act as a damping material and would absorb the impact force of the truck during tilting, thus it would additionally help us avoid jerk during the tilting operations.
- In case if the vehicle structure is of articulated type then never entertain lifting or tilting such vehicle without removing the trailer from the vehicle, and consider lifting the vehicle with truck portion separately and trailer portion separately.
- Refer the Figure.5. while creating a lifting plan.

4.RESULTS AND DISCUSSION

This plan would additionally entail the following pieces of information such as Incident/Accident Appraisal format, Vehicle inspection Checklist, Possible emergency conditions, Response and Recovery planning. In this study, the Technical rescue procedures were developed for 20 different vehicles using the cement industrial premises ranging from 1.34 to 40 tons. The lifting plan with RT100 for the truck(10.5m X 3m) carrying packed cement bag is drafted using the CADD software, the plan assumed that the truck is positioned 3 m below the Normal ground level. It is also found that the Lifting capacity of the crane is 46 ton while the boom length for the presumed situation is 15.2 m, and the working radius is 7 m. The crane is found operating at safe workload condition with the operating load at only 61 %.

5.CONCLUSION

This study entails the structure of a TERP, Procedures on towing, stabilizing and lifting the vehicle with high consideration to safety. As for as towing is concerned, this study includes the methods for determining the Minimum Breaking Strength of the recovery straps, Working Load Limit of the Shackles and the vehicle weight were detailed. Various key factors are to be considered during the vehicle lifting, such as vehicle type(Rigid or Articulated), vehicle dimension, vehicle weight, the weight of the sling and hook, boom length, working radius, working load(in terms of percentage), Load

capacity of the crane and hence the Transport emergency plan should not only hold the framework but also the specific procedures to handle the emergency conditions. It is also required to review and update the procedures periodically or whenever a new kind of vehicle (those which are not described in the Vehicle identification chart) is being used in the factory premises.

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