

# Environmental and Social Due Diligence Report

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Project Number: 47083-004  
December 2019

## INDIA: Accelerating Infrastructure Investment Facility in India – Tranche 3 MEP Sanjose Kante Waked Road Private Limited (Part 2 of 3)

Prepared by India Infrastructure Finance Company Limited for the India Infrastructure Finance Company Limited and the Asian Development Bank.

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पंजीकृत पावती द्वारा



भारत सरकार

श्रम एवं रोजगार मंत्रालय

कार्यालय क्षेत्रीय श्रम आयुक्त (केन्द्रीय)

डॉ. मुकुन्द बिल्डिंग, तीसरी मंजील, एफ. एल. गोमस मार्ग,  
वास्को-द-गामा, गोवा - 403 802

फाइलसंख्य : RV-46(L) No. 23/2017/CL

दिनांक: 05.3.2019

प्रेषित,

M/s. MEP Sanjose Kante Waked Road Pvt. Ltd.,  
Rep. by The Director,  
B-1, 406, Boomrang Chandivali Farm Road,  
Near Chandivali Studio,  
Andheri, Mumbai 400 072.

विषय : Contract Labour (Regulation and Abolition) Act, 1970 and Central Rules,  
1971 - Application for renewal to License No. RV-46(L). No. 23/2017/CL  
dated 03.3.2017.

आदरणीय महोदय,

Please refer to your Application No. nil dated 02.3.2019 for renewal to License No. RV-46(L). No. 23/2017/CL dated 03.3.2017 alongwith Form II, Original License, and DD No. 000566 dated 02.3.2019 for Rs. 375/- towards renewal fee drawn DNS Bank, Kuwarbhav Branch, Dist. Ratnagiri.

Your License No. RV-46(C)/L. No. 23/2017/CL dated 03.3.2017 is returned herewith (in original) duly renewed and same is valid upto 02.3.2020 which may please be acknowledged.

भवदीय

(एन. एम. शेटी)

क्षेत्रीय श्रम आयुक्त (केन्द्रीय)

वास्को-द-गामा, गोवा

प्रतिलिपि प्रेषित :-

- 1) The Labour Enforcement Officer (Central), Ponda at Vasco-Da-Gama, Goa for information.
- 2) The Executive Engineer, PWD, National Highway Division, Ratnagiri.

क्षेत्रीय श्रम आयुक्त (केन्द्रीय)

वास्को-द-गामा, गोवा



Regd .AD/ by hand.

भारत सरकार  
श्रम एवं रोजगार मंत्रालय  
क्षेत्रीय श्रम आयुक्त (केन्द्रीय) का कार्यालय  
एच. एल. गोमस रोड, डॉ. मुकुंद बिल्डिंग, तीसरी मंजिल  
वास्को-द-गामा, गोवा - 403 802.

NO:RV/CL/L/No.23/2017/NH

DATE.20.2.2018

To

M/s MEP SANJOSE KANTE WAKED ROAD PVT. LTD.

Rep. by the Director

B-1,406, Boomrang, Chandivali farm Road

Near Chandivali Studio, Andheri(E)

Mumbai 440072.

SUB: Application for Amendment and Renewal of Licence No.  
RV/CL/L.No.23/2017 dated 3.3.2017.

Dear Sir,

Please refer to your application No. nll dated 17.2.2018 for amendment and renewal of above subjected licence.

Accordingly your Licence No RV/CL/L/No.23/2017 dated 3.3.2017 is returned herewith (in original) duly amended for additional 250 workers (Total workers = 300) and renewed and the same is valid upto 2.3.2019 which may please be acknowledged.

भवदीय

(एन.एम.शेट्टी)

क्षेत्रीय श्रम आयुक्त (केन्द्रीय)

वास्को-द-गामा, गोवा

Copy forwarded to :

1. The Labour Enforcement Officer(Central)Ponda at Vasco da gama Goa for information.
2. The Executive Engineer ,National Highway Division, Ratnagiri for information.

क्षेत्रीय श्रम आयुक्त (केन्द्रीय) वास्को-द-गामा गोवा



भारत सरकार  
श्रम एवम् रोजगार मंत्रालय  
क्षेत्रीय श्रम आयुक्त (केन्द्रीय) का कार्यालय  
डाक्टर मुकुन्द बिल्डिंग, तीसरी मंजिल  
एफ. एल. गोमस मार्ग, वास्को-द-गामा, गोवा

REGD AD/By Hand  
Date: 3.3.2017

NO: RV-46(L)No.23/2017

To

M/s MEP SANJOSE KANTE WAKED ROAD PVT.LTD.,  
Rep. by the Director,  
B-1,406, Boomrang Chandivali Farm Road,  
Near Chandivali Studio, Andheri (E)  
Mumbai 440072.

Sub: Contract Labour (Regulation and Abolition) Act, 1970 and Central Rules 1971 .

Your application for grant of License for the work of " Rehabilitation and Upgradation of NH-66,(Old NH 17) from KM 281/300 to 332/200 (Kante to Waked section) to four lanes in the State of Maharashtra under NHDP-IV on Hybrid Annuity Mode" in the establishment of the Ex. Engineer, Public Works Department, National Highway Division, Ratnagiri. Please refer to your application in Form IV on the above subject.

The LICENCE NO RV-46(L) No.23/2017 dated 03.03.2017 in respect of the above said work, for employing of 50 ( Fifty Only ) maximum contract labour valid upto 02.03.2018 in original is sent herewith which may please be acknowledged.

The Application for renewal of License in Form VII (in triplicate) should reach to this office not less than 30 days before the date on which the License expires.

भवदीय

  
(एन.एम.शिंदे)

क्षेत्रीय श्रम आयुक्त (केन्द्रीय)  
वास्को-द-गामा, गोवा

1. Copy with a copy of License and Form IV is forwarded to the Labour Enforcement Officer (Central), Ponda at Vasco da gama Goa for information and necessary action.
2. Copy for information to the Executive Engineer, PWD, National Highway Division, Ratnagiri.

क्षेत्रीय श्रम आयुक्त (केन्द्रीय)  
वास्को-द-गामा, गोवा

Form VI  
See Rule 25(1)  
Government of India  
Ministry of Labour & Employment  
Office of Licencing Officer &  
Regional Labour Commissioner (Central)  
Dr. Mukund Bldg., F.L.Gomes Road  
Vasco da gama Goa.

LICENCE No. RV/CL/L.No.23/2017

DATE: 03.03.2017

## L I C E N C E

LICENCE is hereby granted to M/s MEP SANJOSE KANTE WAKED ROAD PVT. LTD., Rep. by the Director, B-1.406, Boomrang Chandivali Farm Road, Near Chandivali Studio, Andheri(E), Mumbai 440072 under Section 12(1) of the Contract Labour(Regulation and Abolition)Act,1970 subject to conditions specified in ANNEXURE.

This LICENCE is for doing the work of " Rehabilitation and Up-gradation of NH-66,(Old NH 17)from KM 281/300 to 332/200 (Kante to Waked Section) to Four Lanes in the State of Maharashtra under NHDP-IV on Hybrid Annuity Mode " in the establishment of the Executive Engineer, Pulic Works Department , National Highway Division, Ratnagiri .



THE LICENCE SHALL REMAIN IN FORCE TILL 02.02.2018.

( N.M.Shetty )  
Regional Labour Commissioner(C),  
Vasco Goa.  
Signature and seal of Licensing Officer  
**REGIONAL LABOUR COMMISSIONER (C) VASCO**  
**AND**  
**REGISTERING OFFICER / LICENSING OFFICER**

### RENEWAL OF (RULE 29)

	Date of Renewal	Fees paid for renewal	Date of expiry
1.		License Fees paid Rs. <u>48</u> & renewed upto <u>23/2018</u>	<u>20/2/18</u> M.L.C(C), Vasco, Goa
2.			
3.		License Fees paid Rs. <u>375</u> & renewed upto <u>02.3.2020</u>	क्षेत्रीय आ. (कें), वास्को R. L. C. (C), Vasco
4.			

Signature & Seal of  
Registering Officer

NO. RV/CL/L.No.23/2017

Dated:3.3.2017.

License fees Rs.38/-

Security Deposit Rs 4500/-

THIS LICENSE IS SUBJECT TO THE FOLLOWING CONDITIONS:

1. The License shall be non transferable
2. The number ~~50 (Fifty only)~~ <sup>300 (Three hundred only)</sup> Except as provided in the Rules the fees paid for the grant or, as the case may be for renewal of the License shall be non refundable. Amended on 20/2/18 Dr. B. A. (K), Vasco da Gama (C), Vasco
3. The rates of wages payable to the workmen by the contractor shall not be less than the rates prescribed for the Schedule of employment under the Minimum Wages Act, 1948 where applicable and where the rates have been fixed by agreement, settlement or award, not less than the rates fixed.
4. In cases where the workman employed by the Contractor perform the same or similar kind of work as the workman directly employed by the principal Employer of the Establishment, the wages, rates, holidays, hours of work and other conditions of service of the workmen of the contractor shall be the same as applicable to the workman directly employed by the Principal Employer of the Establishment on the same or similar kind of work provided that in the case of any disagreement with regard to the type of work the same shall be decided by the Dy. Chief Labour Commissioner (central), whose decisions shall be final.
5. In other cases the wage rates, holidays hours of work and conditions of service of the workman of the Contractor shall be such as may be specified in this behalf by the Dy. Chief Labour Commissioner (Central).
6. In every establishment where 20 or more workmen ordinarily employed as Contract labour there shall be provide two rooms of reasonable dimensions for the use of their children under the age of six years. One of such rooms shall be used as play room for the children and other as bed room for the children. For this purpose the contractor shall supply adequate number of toys and games in the play room and sufficient number of cots and beddings in the sleeping room. The standard of construction and maintenance of the crèches shall be such as may be specified in this behalf by the Dy. Chief Labour Commissioner (Central).
7. The licensee shall notify any change in the number of workmen or the condition of work to the Licensing Officer.
8. A copy of the license shall be displayed prominently at the premises where the contract work is being carried on.
9. The Licensee shall within fifteen days of the commencement and completion of each contract work submit a return to the Inspector appointed under Section 28 of the Act intimating the actual date of commencement or as the case may be completion of such contract works in Form VI-A
10. No female contract Labour shall be employed by any contractor before 0600 Hrs. or after 1900 Hrs. provided that this clause shall not be apply to the employment of workmen in pithead baths, crèches and canteens and as to midwives and nurse in Hospitals and dispensaries.

( N.M. Shetty )  
Licensing Officer

Under the Contract Labour (R&A) Act, 1970

&

Regional Labour Commissioner (Central)

Vasco Da Gama Goa.





**Royal Sundaram**  
General Insurance

**Royal Sundaram General Insurance Co. Limited**

Western Regional Office: Delphi, C-wing, 201-204, 2nd Floor

Hiranandani Business Park, Powai, Mumbai - 400 076.

Tel. No.: 022-42227373 | Toll No.: 1860 425 0000

E.mail: customer.services@royalsundaram.in

Website: www.royalsundaram.in

Registered Office: 21, Patullo Road, Chennai - 600 002.

IRDA Registration Number - 102 | CIN-U67200TN2000PLC045611

Date : 06/12/2019

To,

MEP Sanjose Kante Wakad Road Private Limited

410, Boomerang, Chandivali Farm Road,

Near Chandivali Studio, Andheri East,

Mumbai 400072

**Sub: Risk Confirmation:**

**Workmen's Compensation Insurance Policy**

We thank you for insuring with Royal Sundaram. It is our privilege to have you as our customer.

We are in receipt of your premium of Rs.3,885/- towards below policy as per our quotation.

Insured :	MEP Sanjose Kante Wakad Road Private Limited
Policy Type :	Workmen's Compensation Insurance Policy
Policy Period :	02.12.2019 TO 01.03.2020 (3 months)
Occupancy :	Road Construction
Risk Location :	Kante Wakad Road Project Site, Ratnagiri, Maharashtra - 415637
Sum Insured :	INR 49,09,377/-
Workers Details :	31 workers
Premium (Including S.Tax) :	Rs 3,885/-
Hypothecation	

**Payment Details**

Amount :	Rs 3,885/-
Date :	01.12.2019
Cheq No	NEFT - Ref No. IN3670191202BK94
Bank	NEFT

The policy is under preparation and will be sent to you shortly.

Risk confirmation is subject to Payment received.

Thanking you and assuring our best services at all times.

For Royal Sundaram General Insurance Co. Ltd.

Authorized Signatory



OK



Read-

- 1) MEP Infrastructure Developers Ltd. A-412,Boomerang,Chandivali Farm Road, Near Chandivali Studio,Andheri [E],Mumbai-400072. Letter, Date- 18/9/2017,6/12/2017
- 2) Superintendent of Police Ratnagiri's Marathi letter No.जिविशा/40254/2017 दि.21/12/2017 received on 4/01/2018
- 3)Sub Divisional Magistrate, Ratnagiri's Marathi letter No.क्र.एमएजी/एनओसी/कावि/2017दि.21/12/2017
- 4)Executive Engineer,National Highway Div. Ratnagiri Marathi letter क्र.जा.क्र. रामवि/रत्ना/रेशा/पे.पं./2017/खानू/2532 दि. 26/12/2017 received on 4/01/2018
- 5)जिल्हा उद्योग केंद्र रत्नागिरी पत्र क्र.जा.क्र.जिउकें/रत्नागिरी/नाहरकत/2017/2421,दि.16/12/2017
- 6) Deputy Director, Industrial Security and Health Kolhapur Marathi Letter No.जा. क्र.ससंओसुवजा/ना.प्र.पत्र/आरपीके/3502/2017 दिनांक 21/12/2017 received on 3/01/2018
- 7)मा.जिल्हादंडाधिकारी रत्नागिरी यांजकडील दिनांक.28/01/2018 ची मंजूर टिपणी.

### No Objection Certificate (Petroleum Rule 2002-Rule 144(i))

This is to certify that there is no objection for installation of Class 'B'[HSD] Petroleum storage at survey No.1721, Village- Khanu, Tal-Ratnagiri Dist.Ratnagiri shown in attached blue print to MEP Infrastructure Developers Ltd, A-412,Boomerang,Chandivali Farm Road, Near Chandivali Studio,Andheri [E],Mumbai-400072.The copy of approved plan is attached herewith.

This no objection certificate is issued subject to the following conditions

1. The applicant shall take all necessary steps to prevent any untoward incident arising out of storage of petroleum products & the applicant shall alone be responsible for any loss caused to any property or human life due to accident, negligence, natural calamity etc.
- 2.The existing road side trees, if any shall not be cut as far as possible & the approach shall be located suitably without getting obstruction by road side trees.
- 3.The junction of the approach road with main road shall be properly designed & constructed to the satisfaction of Public Works Department.
- 4.Applicant shall take necessary licence under Petroleum Rules,2002
- 5.. The applicant shall follow all conditions specified by Maharashtra Pollution Control Board.
- 6.No smoking shall be allowed except in spaces or buildings specially approved for the purpose by the Chief Controller.
- 7.No fire furnace, source of heat or light capable of igniting inflammable vapours shall be allowed except in the firing space of stills and boilers.
- 8.Any accident,fire or explosion,occurring in the licenced premises,which is attended with loss of human life or serious injury to person or property shall be immediately reported to the nearest Magistrate or to the officer-in-charge of the nearest police station and by telegram to the Chief Controller.
- 9.The diameter of any tank for storing petroleum Class B does not exceed 9 metres.The distances specified in condition may be reduced by the licensing authority in cases where special precautions are taken and where there are special circumstances which,in his



opinion, warrant such reduction.

10. Every care shall be taken to prevent any petroleum escaping in to any drain, sewer, harbor, river, water course or a public road and enclosures or sumps must not be permanently connected with any drain or sewer.

11. The licensee shall keep daily records and accounts of all receipts and issues of petroleum in such form as the Licensing Authority may from time to time prescribe and shall exhibit his stock and record to an inspector or a sampling officer on demand.

12. No Objection Certificate is hereby granted for the construction of Class- B' [HSD] or any other structure as per N.A. approved plan.

13. The Person who would be handling the petroleum Class- B' [HSD], should be trained, educated and experienced.

14. The applicant shall take all necessary steps to prevent any untoward incident arising from fire and electricity.

15. The applicant shall take all necessary permission for Storage of Class 'B' [HSD] Petroleum storage (30KL) Petroleum storage from Explosive Dept. before installation.

16. The applicant shall make all necessary Security Measures like Fire Fighter Equipment, Security Gaurd, CCTV Camera, Compound wall Before Class 'B' [HSD] Petroleum storage installation.

17. The N.O.C. holder should be obtain necessary permissions from all concerned Departments/Organisations if necessary.

18. This N.O.C. is valid till the completion of Rehabilitation and up-gradation of NH-66 from Km 281/300 to Km 332/200 to four lane of Maharashtra under NHDP-IV on Hybrid Annuity mode.

19. If the applicant employs 20 or more workers, then it is necessary to apply for registration and license under the Factory Act 1948.

20. If the applicant violates any of the conditions mentioned above this No. Objection Certificate will stand cancelled automatically.

Approved by District Magistrate  
Ratnagiri.



*Chand*  
Addl. District Magistrate  
Ratnagiri

No/Dc/home-I/SR/03/2018  
Dist. Magistrate's Office  
Ratnagiri Date -29/01/2018

Copy - 1) The Deputy Chief Controller of Explosives, Nagapur.

2) Jt. Chief Controller of Explosive, C.B.D. Belapur, Navi Mumbai 400614.

3) MEP Infrastructure Developers Ltd. . A-412, Boomerang, Chandivali Farm Road, Near Chandivali Studio, Andheri [E], Mumbai-400072.

4) The superintendent of police, Ratnagiri

5) The Sub-Divisional Magistrate, Ratnagiri



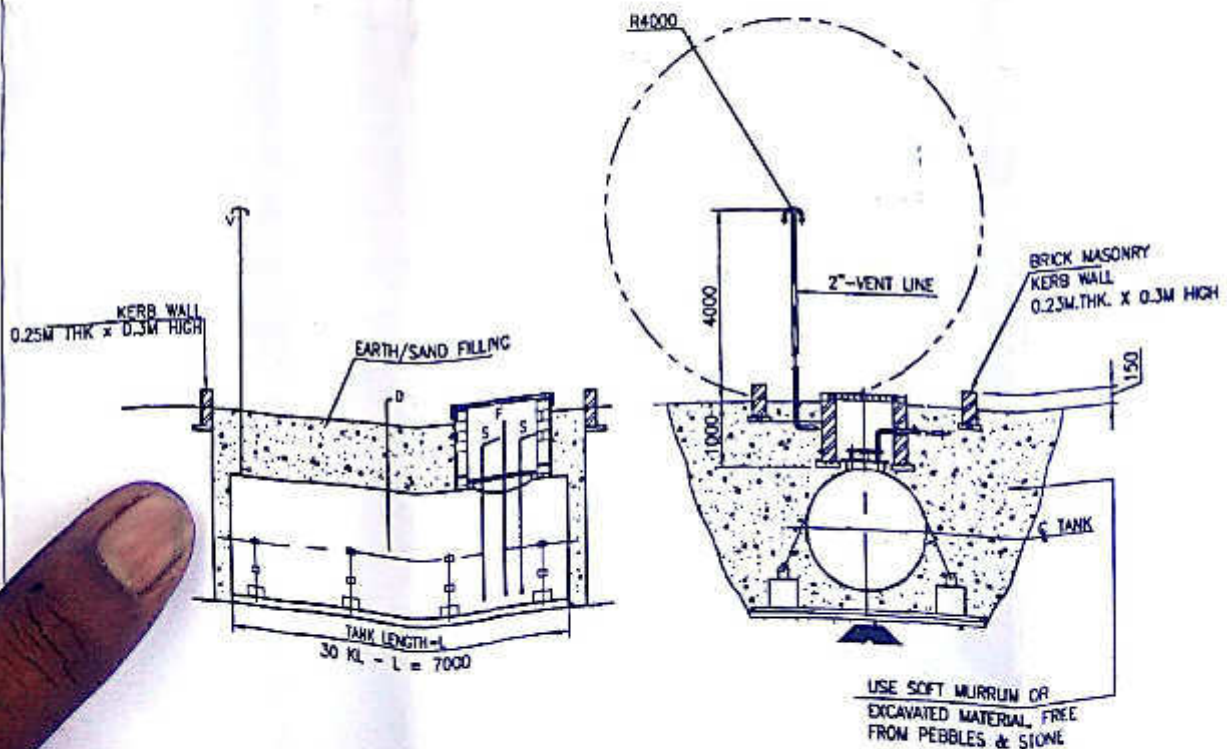
Recommended vide this office  
No 1 DC/Hbme-1/SR 10312018  
Date-29-01-2018



*Original*  
Addl. District Magistrate,  
Ratnagiri.  
PROPOSED  
CONSUMER PUMP



MOUZA/SURVEY MAP



TYPICAL SECTIONAL VIEW  
SHOWING VENT LINE ON TANK TOP  
(APPROVED BY COOE VIDE REF. P3(9)224/99/1 DTD. 16/12/2003.)



Project: Rehabilitation and Up gradation of NH-66 (old NH-17) From Km 281/300 to km 332/200 (KANTE TO WAKED SECTION) to four lanes in the state of Maharashtra under NHDP-IV on Hybrid Annuity Mode

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Document: Traffic Management Plan

Document No : MEP/KWRPI / TMAO

Rev: 00

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TRAFFIC  
MANAGEMENT

SANJOSE KANTE WAKED ROAD PVT. LTD.

## TRAFFIC MANAGEMENT PLAN

Submitted to

**PUBLIC WORKS DEPARTMENT.**  
(Ministry of Road Transport & Highway)  
Govt. of India.

For

Rehabilitation and Up gradation of NH-66 (old NH-17) From Km 281/300 to km 332/200 (KANTE TO WAKED SECTION) to four lanes in the state of Maharashtra under NHDP-IV on Hybrid Annuity Mode

**Client:**

Ministry of Road Transport and Highway

**Concession Agreement No.** July  
28<sup>th</sup> June 2016

**Concessionaire:-**

MEP SANJOSE KANTE-WAKED ROAD PRIVATE LIMITED.  
B1 406, Boomrang,

Chandivali Farm Road,

Near Chandivali Studio

Andheri East.

Mumbai, Maharashtra.-400072.

Website: [www.mepinfra.com](http://www.mepinfra.com)







Project: Rehabilitation and Up gradation of NH-66 (old NH-17) From Km 281/300 to km 332/200 (KANTE TO WAKED SECTION) to four lanes in the state of Maharashtra under NHDP-IV on Hybrid Annuity Mode.

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Project: Rehabilitation and Up gradation of NH-66 (old NH-17) From Km 281/300 to km 332/200 (KANTE TO WAKED SECTION) to four lanes in the state of Maharashtra under NHDP-IV on Hybrid Annuity Mode.

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Project: Rehabilitation and Up gradation of NH-66 (old NH-17) From Km 281/300 to km 332/200 (KANTE TO WAKED SECTION) to four lanes in the state of Maharashtra under NHDP-IV on Hybrid Annuity Mode.

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## 1. Introduction

Traffic on our roads has increased many times and will continue to do so, as many roads are either operating or expected to operate at their maximum capacity in the near future. Under these circumstances the existing methods of maintenance and construction compromise safety and cause delays and inconvenience which are no longer acceptable. A change in design and implementation practices is, therefore, necessary to overcome the problems. Road construction and maintenance work is hazardous for both the site operative and the road user. At work sites in rural areas, traffic is never more than 15 meters away. In addition, speeding vehicles create a whirlwind of dust around the work place and noise from the traffic and maintenance equipment often masks the sound of an impending accident. Under the present system, the traffic operations and provisions during improvement/maintenance works depend entirely upon the engineer. This has been found to be unsafe and inefficient. Besides, non-uniformity in the methods of traffic control and placement of signs at various locations increases confusion for road users. In our country, where the travel distances extend up to 300 km or more and where the majority of heavy vehicle drivers are, at best, only semiliterate, there is a need for adopting uniform traffic methods and devices at construction zones to ensure the safety of both the road users as well as the construction workers. The current techniques of road improvement wherein traffic is allowed to use part of the existing carriageway create considerable problems for traffic. Sometimes delays can be extensive leading to driver's frustration and then tendency of over speeding to make up time. All this is detrimental to road safety. It is necessary that the existing work procedure and contract conditions are standardized to provide for the proper management of the construction site so that all road users (that is pedestrians, cyclists, motor cyclists, animal traffic and vehicular traffic) are properly and safely accommodated. The basic objective of these guidelines is to lay down procedures to be adopted by field engineers to ensure the safe movement of traffic and also to ensure the safety of workers at site undertaking the Construction.

## 2. Scope

Construction zones are an integral part of any road system. This is more so in a developing country like India where most of the road construction has been designed as a 'stage construction' process. These guidelines set out the standards and procedures for Temporary Traffic Control when carrying out works on NH 66. It gives practical guidance to users of the guidelines when implementing temporary traffic control needed to do work on NH 66 and road related facilities. Work activities include but are not limited to bore-hole exploration, excavation, construction, maintenance, utility works and stationing associated construction vehicles and equipments.

## 3. Objective

The two primary objectives of temporary traffic control are:

- i. To manage the traffic as efficiently and safely as possible under all work conditions.
- ii. To lay down procedures to be adopted by field engineers to ensure the safe and efficient movement of traffic and also to ensure the safety of workers at site undertaking the construction. Traffic control aims to give adequate warning and clear information to motorists about the nature of works on site. This will translate into correct actions required in order to pass the work site safely. Traffic control shall also include measures to safeguard pedestrians when necessary. Proper traffic control also protects those who a





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Document: Traffic Management Plan

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directly involved in carrying out the works. It is necessary that the existing work procedure and contract conditions are standardized to provide for the proper management of the construction site so that all road users (that is pedestrians, cyclists, motor cyclists, animal traffic and vehicular traffic) are properly and safely accommodated.

#### 4. Process

The process of ensuring safe work zone conditions is divided into three stages

- (i) Before start of work
- (ii) During execution and
- (iii) Partially completed section.

4.1. Before Start of Work: Contractor is responsible for preparing a site specific Traffic Management Plan (TMP) as specified. The plan must be approved by the Engineer. In case of non compliances, the plan must be revised and resubmitted for approval. After Engineer's approval on the plan, it has to be implemented on the ground and again approved by the Engineer. Work cannot start without getting the necessary approval from the Engineer; PMC's representative must check the document compliance and field compliance on a sample basis.

4.2. During Execution: The traffic management arrangements must be checked on ground as per the checklists provided in these guidelines by Engineer. Warning must be issued if compliance is below 80% and work must stop if compliance is found to be below 70%, or repeated noncompliance.

4.3. Partially Completed Section: Often due to staged construction method, partially completed sections are opened for traffic operations. TMPs must be prepared before opening the section for traffic to indicate temporary markings and temporary signage.

#### 5. Definitions

For the purposes of these guidelines, the following definitions apply unless the context otherwise requires:

- (1) "advance warning zone" means the area to warn the road user of the approaching hazard and to prepare them for the change in driving conditions.
- (2) "transition zone" is the area in which the traffic is guided into the altered traffic flow pattern around the working zone.
- (3) "working zone" means the entire section of the road over which temporary traffic control related to the work activity is exercised.
- (4) "carriageway" means that part of the road exclusive of any shoulders constructed for use by vehicular traffic.
- (5) "traffic control" means the process required to regulate, warn and guide road users and advise them to traverse a section of a road in the proper manner.
- (6) "traffic control devices" means the signs, cones, barriers, flashing lamps or other devices placed temporarily on or adjacent to a road to regulate, warn, or guide road users.
- (7) "detour" means traffic is directed to another road to bypass the closed area.
- (8) "diversion" means traffic is diverted to a temporary road or lane placed in or next to the carriageway.





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## 6. Guiding Principles

The guiding principles for safety in road construction zones are to:

- (i) Warn the road user clearly and sufficiently in advance;
- (ii) Provide safe and clearly marking lanes for guiding road users;
- (iii) Provide safe and clearly marked buffer and work zones;
- (iv) Provide adequate measures that control driver behavior through construction zones. Roads with construction sites have higher accident rate, when compared with similar sections of road without construction sites.

## 7. Phases of Traffic Control

There are five phases of traffic control for major projects:

1. Planning Phase: - To identify and include traffic control requirements in the contract specification, work program and method of construction.
2. Design Phase: - To design the Traffic Control Plan in detail, with regard to types, location and layout of traffic control devices for submission to the road authority for approval.
3. Implementation Phase: - To install the temporary traffic control devices safely in accordance with the approved Traffic Control Plan.
4. Operation and Maintenance Phase: - To inspect the Traffic Control Plan and devices regularly by day and night to ensure that they are effective and absolutely safe.
5. Close out Phase: - To remove all the traffic control devices safely and reinstate the permanent traffic scheme.

## 8: Traffic Control Zone

The construction zone describes that area of the road which is affected by the works and which affects traffic flow and road users. The main area of interest can be called in this context as the "Traffic Control Zone". It includes all those areas of carriageway in advance of the actual work site which are required for advance warning of the hazard as well as safety zones, the transition zones and the working zone itself. These elements are shown in Traffic Management Plan.

1. In rural areas, the problems at many construction zones is accentuated by the availability of only an undivided carriageway, which may involve problems of either the temporary acquisition of land for diversions, or the sharing of the limited remaining road space by road users under some form of traffic control. In any case it should be ensured that road user is properly segregated from the working zones.

2. In urban areas where construction zones are likely to be even more constrained, diversions may have to be taken over adjacent sections of the road network in addition to the sharing of road space to road users (for example, shuttle working under signal control). The effects of construction zones may therefore be felt over a wide area.

3. The Traffic Control Zone can be divided into four components, that is, the Advance Warning Zone, the Transition Zone, the Working Zone and the Termination Zone. All construction zones will have a working zone, which is flanked, by a transition zone for each direction of approaching traffic and an advanced warning zone will proceed these in turn.





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## 9. Advance Warning Zone

a. The "Advance Warning Zone" is the area to warn the road user of the approaching hazard and to prepare them for the change in driving conditions. It is essential for traffic control in the construction zone. It should provide information on:

- (i) The presence of the hazard through the "Road Works Ahead" sign, accompanied by the distance to the hazard;
- (ii) Any change affecting traffic arrangements (such as a reduction in the number of lanes and/or in the speed limit) within the traffic control zone;
- (iii) Extent of the hazard (for example; the length of restriction); and for general information;
- (iv) The type of hazard.

b. The advance warning zone is where the reduction in speed of vehicles should be notified. The drivers should be advised to reduce their speed so as to achieve the desired transition zone. The information in this zone is conveyed through a series of traffic signs along the length of the zone.

## 10. Transition Zone

a) The transition zone is the area in which the traffic is guided into the altered traffic flow pattern around the working zone. This is one of the most crucial zones as far as safety aspects are concerned because most of the movements involved are merging/turning movements.

b) At other construction zones, it may be necessary to divert traffic away from the original carriageway and the design of the temporary road geometry through the transition zone should take into account the following factors:

- i. the turning radius of the longest vehicle that generally uses the road should be the ruling radius for curves;
- ii. where changes in vertical profiles are required, these should be shallow enough to allow safe passage of animal drawn vehicles (if these are present in significant numbers);
- iii. the zone should have good drainage to avoid any ponds on the road surface;
- iv. sources of dust should be minimized. This is not only essential for good visibility but also for clearer maintenance of signs and barricades in the zone.

c) The traffic is taken across the transition zone mostly with the help of signs, barricades, channelizing devices and pavement marking. The various types of barricades and channelizing devices are discussed in detail in later paragraphs. The guiding principle for their design is that they should convey the message clearly and unambiguously. The colour and shape of the signs should also be as the standards noted in later paragraphs to eliminate the confusion caused by use of different signs for the same purpose.

d) All the signs/barricades and road safety devices are to be maintained properly and kept clean of dust at all times. Sufficient stock of these should be maintained at the site so as to replace the damaged or vandalized signs/barricades. Proper lighting arrangements for illuminating these signs must be made during the night hours. Most of the accidents at nights involve collision between vehicles and objects rather than vehicle to vehicle collision. Reflective paints/sheets must therefore be used for the signs/barricades and road safety devices so that these are visible at all times.





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e) Very often, the road width available through the transition and working zones is quite insufficient for simultaneous passage of both the up and down traffic. In both the cases, a waiting area with a properly demarcated stop line has to be provided for the vehicles.

## 11. Working Zone

- a) The working zone is where the actual construction is being undertaken.
- b) Speeds should continue to be controlled in this zone because of the close proximity of moving construction plant and workmen.
- c) The path of the traffic must be very clearly delineated through the traffic control zone to avoid vehicle intruding into the work area. Delineation and channelizing devices discussed below must be used effectively for this purpose. Where the work site uses machinery with revolving booms like cranes or excavators the intrusion of moving parts must be taken into account when determining the lateral clearances for the buffer or safety zone.

## 12. Components of Working Zone

The working zone comprises the following components briefly in Traffic Management Plan.

- (1) Work Area — Area occupied physically by the works.
- (2) Work Space — Space set aside around the works area for workers, equipment and material. Method of construction will determine the space needed for the work.
- (3) Traffic Space — Area where traffic is routed through the activity area. Traffic space must be properly delineated and channeled to guide traffic through safely. Road capacity and traffic demand will determine the width of the traffic space.
- (4) Safety Buffer — Space separating traffic space from workspace. No storage of equipment and material, parking of vehicles, or presence of worker (except maintenance activity) is allowed for the safety of the workers and road users. It allows an errant vehicle to stop in time before hitting the workspace. The two types of safety buffers are the longitudinal safety buffer and the lateral safety buffer.
  - (a) Longitudinal safety buffer is a space upstream of a workspace.
  - (b) Lateral safety buffer is to separate workspace from traffic space.

## 13. Termination Zone

- a) The termination zone provides a short distance to clear the work area and to return to normal traffic lanes. It extends from the downstream end of the work area to the sign indicating the end of work zone.
- b) A downstream or closing taper may be placed in the termination zone. It may be useful in smoothening the flow of traffic. However, it may not be advisable when the trucks carrying material move into the work area by reversing from the downstream end of working zone.
- c) There may be occasions when termination zone could include a transition. For example, if a taper is used to shift traffic into opposing lanes around the work area, then the termination zone should have a taper to shift back to its normal path. This taper would then be in the termination zone for the opposing direction of traffic.
- d) If the construction zone is situated on a divided-carriageway, there will need to be a smaller length transition zone to return the traffic to the original lanes.





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## 14. Tapers

Tapers may be used in both the transition and termination areas. Whenever tapers are to be used in close proximity to an interchange ramp, crossroads, curves, or other influencing factors, the length of the tapers may be adjusted.

Support: Tapers are created by using a series of channelizing devices and/or pavement markings to move traffic out of or into the normal path.

Length: The recommended ratios for taper length are shown in the Table 1-1

Table 1-1 Recommended Ratio for Taper Length (N)

Speed (km/h)	40	50	65	80
Merging	1:5	1:10	1:25	1:40
Shifting	1:3	1:5	1:13	1:20
Shoulder	NA	NA	NA	1:5

Note: If the ratio shows 1:40, N = 40

Examples of the taper length calculation are shown in APPENDIX -I and the summary is given in Table 1-2.

Table 1-2 Summary of Taper Length calculated

Design Speed	Taper Length	
	Merging Taper	Shifting Taper
Km/h	(m)	(m)
80	140	70
65	90	50
50	40	20
40	20	10
30	20	10

The following factors shall be considered when designing a taper. They are: —

- (1) Tapering of more than 1 lane should be done one lane at a time. The distance of the tapers is twice the normal taper length.
- (2) A longer taper is not necessarily better than a shorter taper (particularly in urban areas) because an extended taper tends to encourage sluggish driving and delay lane changes.
- (3) The start of the taper should be located such that its full length is visible at 60m to 100m ahead. The start of the taper should be located at the upstream of a bend so that it is clearly visible on the approach.
- (4) Transition area is also a safety zone. Nothing other than traffic control devices are allowed in the transition zone.
- (5) Devices should be spaced such that the taper would appear uniform and continuous to approaching motorists, and traffic cannot weave around them easily.





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## 15. Other Aspects

The distance between two traffic control zones should be such that the flow of traffic can return to normal stream between them. The length of traffic control zone will vary and depend on the work being undertaken. The lengths of the advanced warning and transition zones are governed by the speed of approaching vehicles and the locations of the site. The recommended lengths for each component of the zones for a well located site (with a clearly visible approach) are given in Table 3-

3. It may be necessary to extend the advance warning zone where approach visibility is poor and this will vary on a site by site basis but should not be less than that specified. On occasions additional signing to that discussed later may need to be provided to give not only sufficient warning but additional reminders through the advance warning zone. The longitudinal and lateral buffer zone clearances are shown in Table 2-1.

Table 2-1: Recommended Lengths of Traffic Control Zones

Average Approach Speed (km/h)	Length of Advance Warning Zone, D (m)	Length of Transition Zone (m)	Length of Working Zone (m)
50 or less	150	50	Varies
51-80	150-300	50-100	Varies
81-100	300-500	100-200	Varies
Over 100	1000	200-300	Varies

There may be different situations in construction zone requiring full or partial, closure of roads for example

- Closure of berms only e.g. repairs to slopes, construction / maintenance of road side drains, gravelling/paving of hard shoulders, maintenance of traffic signs, repairs to parapets of cross drainage works, guard rails;
- Closure of small areas of the carriageway only, e.g. repairs to potholes, resurfacing, renewing road markings;
- Closure of lane of the carriageway along with the closure of berms e.g. widening of the carriageway, repairs to culverts, flood damage repairs. These types of works can further be classified according to availability or non-availability of space for operating the displaced traffic on the remaining portion of the carriageway and shoulders.
- Closure of the entire road width for undertaking repairs to pavement or culvert. Gaps in the work area may be avoided as these may falsely give an impression to the road users that they have passed the work area. The guide signs in this regard should be installed at appropriate locations.

## 16. Highway passing through villages and small towns

- The same basic rules and layouts will apply in urban areas but may be it would be necessary to modify the layouts according to site requirements. At all times the safety of all road users as well as the workmen should be taken into account.
- In urban situations, where road works are to be carried out, more attention should be





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given to the problems of pedestrians and non-motorized vehicles in heavy traffic volumes. As far as possible, the road works should be carried out at night, whenever night time road repairs are not possible, then only day time repairs should be carried out. Repairs during peak hours should also be avoided.

iii. Road users should be channelized and routed through and around area under repair with minimum of delays. Driver behavior should be effectively influenced so that the speeds are reduced to desired levels on approaches to construction zones. Traffic calming devices like rumble strips and speed humps should be used wherever necessary. The traffic control and construction activity should be coordinated in such a manner as to provide for safe and efficient flow of traffic together with safe, efficient and rapid progress of construction activity.

iv. As pedestrians are likely to be present at urban sites, there must always be safety or buffer zone between the outer pedestrian barrier and the traffic.

v. Availability of proper sight distance for the movement of vehicles at the recommended speed for the stretch in the work zone should always be kept in the mind.

## 17. Traffic Control Devices

### General

Traffic control devices are the equipments and installations over and on the road, which individually and collectively perform the following tasks;

- a) warn the road user;
- b) inform the road user;
- c) guide the road user;
- d) modify road user behavior;
- e) protect the road user and the vehicle;
- f) ensure safe passage to the road user; and
- g) provide a safe working area.

A traffic control device in order to be effective should,

- (i) Fulfill the intended need;
- (ii) Command attention and respect of road users;
- (iii) Convey the message in a simple and clear manner;
- (iv) Allow adequate time for proper response from road users; and
- (v) Have adequate conspicuity both in day and night.

The primary traffic control devices used in work zones are signs, delineators, barricades, cones, pylons, pavements markings and flashing lights. The following general rules should apply to all traffic control devices with the traffic control zone.

(i) Comprehension: All traffic control devices should be capable of being easily understood. A particular device must convey one and only one meaning. Good and clean condition of the device aids comprehension;

(ii) Visibility and Stability: Devices should be within the cone of vision of the driver and be placed such that it allows adequate response time at the average speed or the desired speed through the traffic control zone. All traffic control devices should be clearly visible by day and night, at these speeds and under the usually prevailing climatic conditions. They should be kept properly aligned and legible at all times. Foliage or any other obstruction should not be allowed to impede the view of these devices, nor should wind, road dirt or the like be allowed to obscure their face. The traffic control devices must be able to resist the local wind pressure, rain and the Vibrations etc, of the passing traffic but these should not act as rigid obstacles in the event of a collision.





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### 17.1 Signs

The road construction and maintenance signs fall into the same three major categories as do other traffic signs, Mandatory/Regulatory Signs, Cautionary/Warning Signs and Informatory/Guide Signs. The main signs that would be utilized are shown in Figure 3-10, Figure 3-11 and Figure 3-12. These guidelines also cover signs that are not included in IRC: 67 but are considered desirable to aid drivers' comprehension of the route through the road works. Each sign should be well located so that its message is seen and is clear, which will be assisted if the surroundings are devoid of "unnecessary" signs and other clutter. These signs should be of Class B Sheeting as per IRC:67-2011.

#### 17.1.1 Sign Placement

The correct positioning and size of signs will ensure that it can be observed and recognized, thereby providing the driver with more time to react and take action. The following principles should govern the positioning of signs:

- a) Their location should have clear visibility;
- b) They should be so placed that driver would have adequate time for responses.
- c) As a general rule, signs should be placed on the left-hand side of the road. Where special emphasis is required, duplicate signs should be installed on the left and right side of roadway. In case of hill roads, the sign shall generally be fixed on the valley side of the road unless traffic and road conditions warrant these to be placed on the hill side.
- d) Roll up signs mounted on portable supports may be placed within the roadway itself.
- e) Roll up signs may also be mounted on or above the barricades.
- f) The signs should be covered or removed when they are not required. Signs should normally be mounted.

(1) Approximately at right angle to the line of sight facing the traffic.

(2) Slightly skewed from the traffic if mirror reflection occurs such that it reduces legibility of the sign.

(3) Do not obstruct existing traffic signs.

(4) Typical clearances (minimum) for post-mounted signs are as follows:

Vertical - 2.5m above ground level

Lateral - 0.6m from edge of traffic lane

On kerbed roads, the extreme edge of the sign adjacent to the road shall not be less than 600 mm away from the edge of the kerb. On un-kerbed roads, the extreme edge of the sign adjacent to the road shall be at a distance of two to three meter away from the edge of the carriageway depending on local conditions but in no case, shall any part of sign come in the way of vehicular traffic. Where signs are in position for some time and pedestrians are expected, the lower edge of the lowest sign should not be less than two meter above the surface on which it stands. Where pedestrians are not expected, signs may be mounted on trestles (tripod) but during wet conditions should be mounted away from the traffic "splash" zone so that they do not become obscured by dirt. Trestle mounted signs are particularly for short term temporary works. These should be so placed that pedestrians' movements are not obstructed. In urban conditions, it may not be possible to erect new sign poles in footways crowded with public utilities and "A" frames may be the only alternative. Signs for longer term works should follow normal rules for the mounting of permanent signs.

The legend on all signboards shall be Hindi/English/Regional language and should follow the format given in Table 3-1.





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Table 3-1: Format of Legends on Shoulder Mounted Signs\*

SL. No	Language	Font type
1.	Hindi	Hindi7
2.	English	Transport Medium
3	Regional Language	As per Local Practice

(\*Source: IRC-67:2011)

#### 17.1.2 Mandatory/Regulatory Signs

Mandatory/Regulatory Signs impose legal restriction on all traffic. It is essential, therefore, that they are used only after consulting the local police and traffic authorities. The most likely type of regulatory signs to be used in traffic control zones are Stop, Give Way, One Way, Straight Prohibited/No Entry, Left/Right Turn Prohibited, U-Turn Prohibited, Overtaking Prohibited, No Parking, No Stopping and No Standing, Compulsory Keep Left/Right, Compulsory Turn Left/Right, Compulsory Ahead, Compulsory Ahead or Left/Right Turn, Axle Load Limit, Height Limit, Length Limit, Width Limit, Restriction Ends, Maximum Speed Limit (Figure 1, Figure 2, Figure 3)

i Various other signs that are needed to regulate traffic may be required which have not been standardized. They should conform to the general requirements of shape and colour, and their message should be brief, legible and clearly understandable.

i. The minimum size of Regulatory signs must be as follows:

- Give Way Sign – 900mm Equilateral triangle
- Signs which are Circular in shape – 900mm diameter

ii. The colour of Regulatory signs should be White Base Red Border and Black Letter/Symbol/Legend etc. However, for Stop sign and No Entry sign, the scheme shall be Red Base and White Letter/Symbol. The border of Stop sign shall be of White colour. Other regulatory signs as per Figure 2 shall be of coloured.





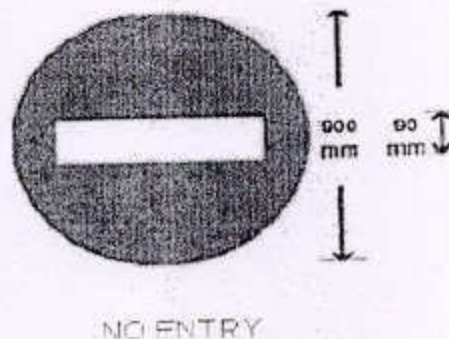
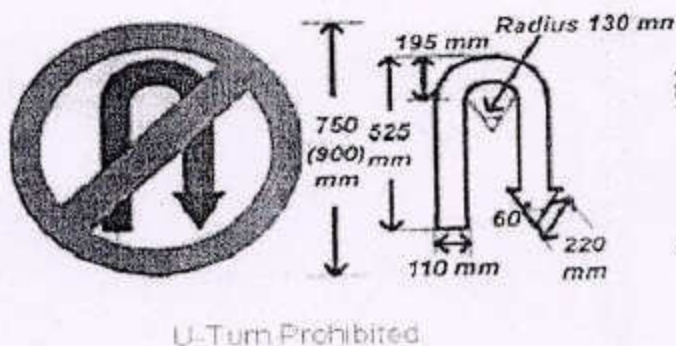
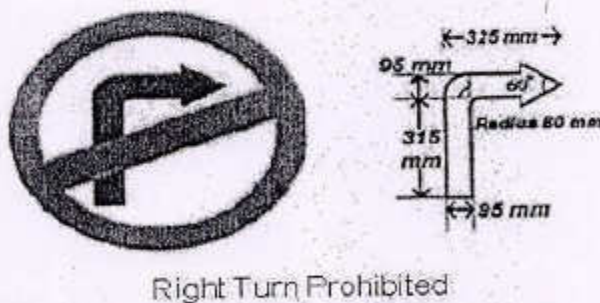
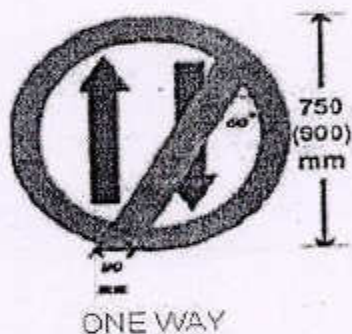
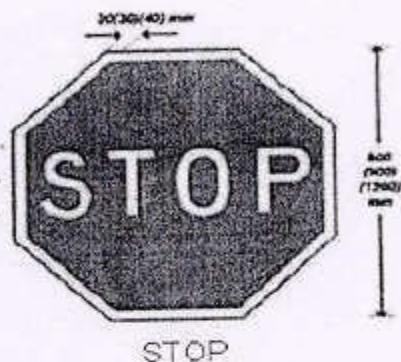
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### FIGURE – 1: REGULATORY SIGNS



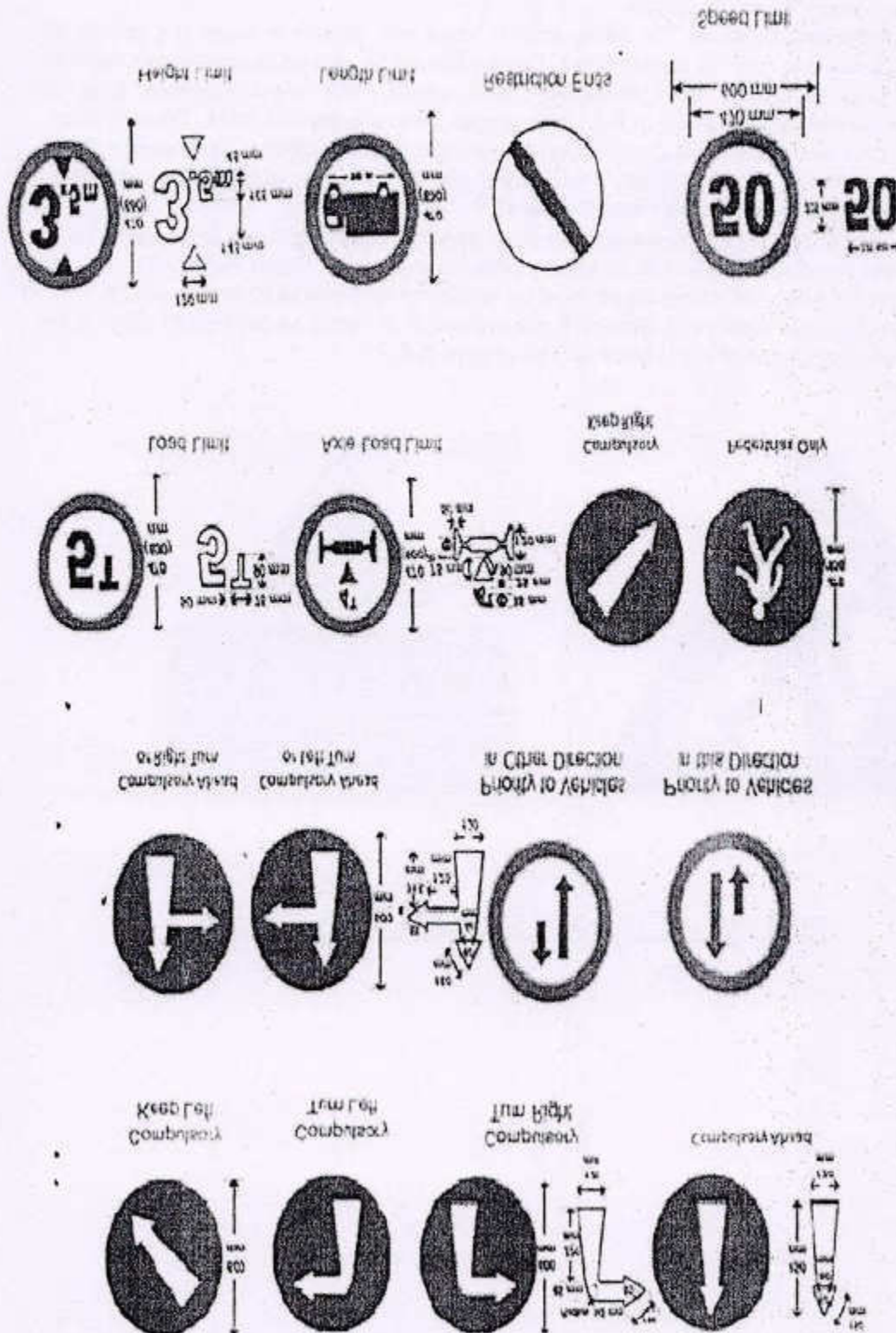
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### 17.1.3 Cautionary/Warning Signs

Cautionary/Warning Signs in the traffic control zone are utilized to warn the drivers of specific hazards that may be encountered. Drivers should be alerted to potential hazards in sufficient time to adjust their movement and speed. The most common type of cautionary/warning signs for use in the traffic control zone are: Men at Work, Road Widens, Right lane Diverted, Right Lane Closed, Left lane closed, Median Closed, Diversion to Other Carriageway, Traffic Signal Ahead, Two Way Operation, Rough Road, Loose chipping, Divided Road and divided Road Ends (Figure-4)

- In case of divided carriageways, the signs should be provided both adjacent to the shoulder and on central median so as to be visible from all lanes. (Refer Table 3-2)
- The minimum size of Warning Signs must be 1200mm×1200mm of Rhombus shape.
- All Warning Signs shall have Orange Base of Class B sheeting as per IRC-67:2011 & the letters/symbol/legend shall be of black colour. (Figure-5 & 6)



**FIGURE - 4: OTHER REGULATORY SIGNS**



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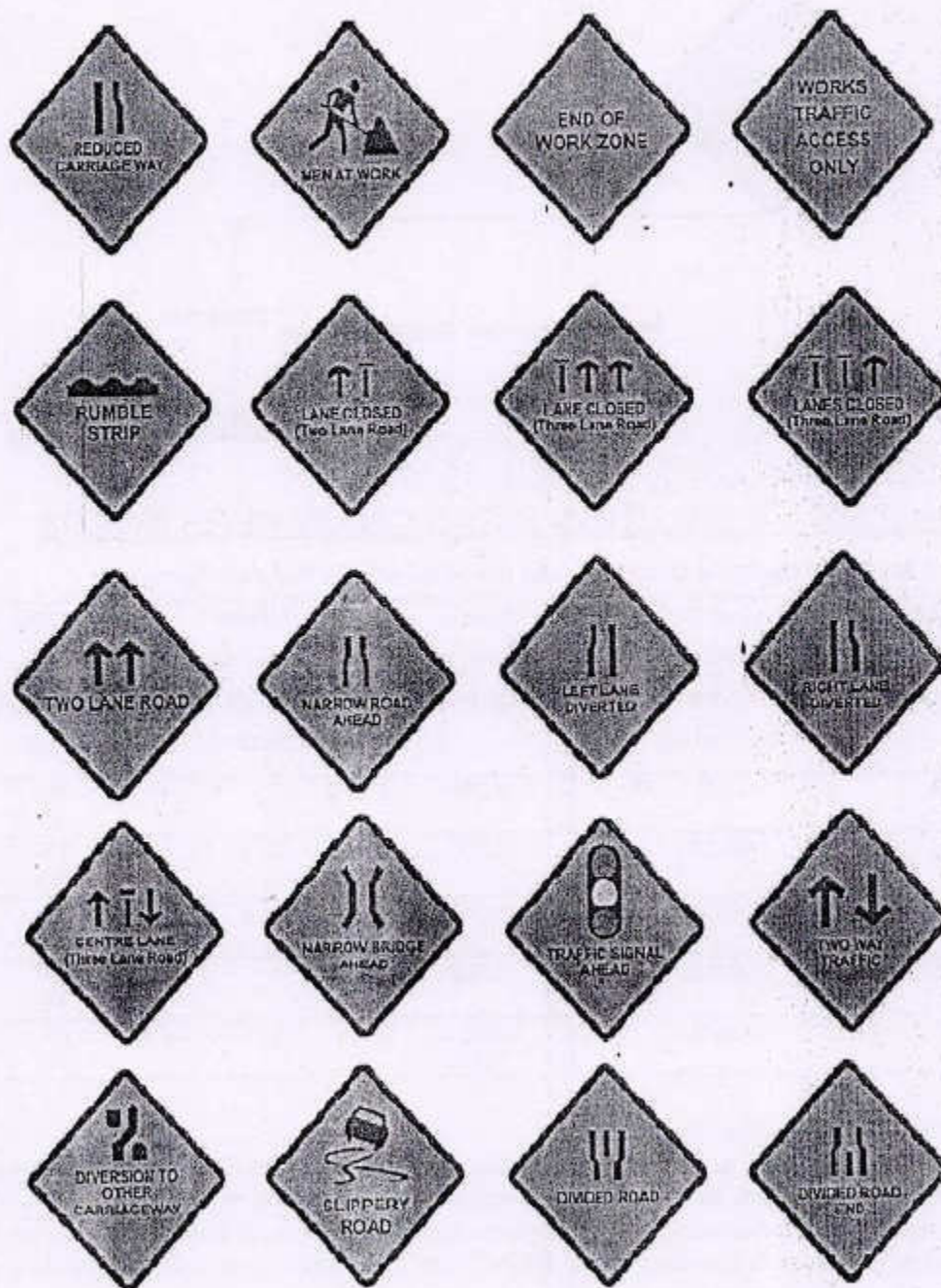
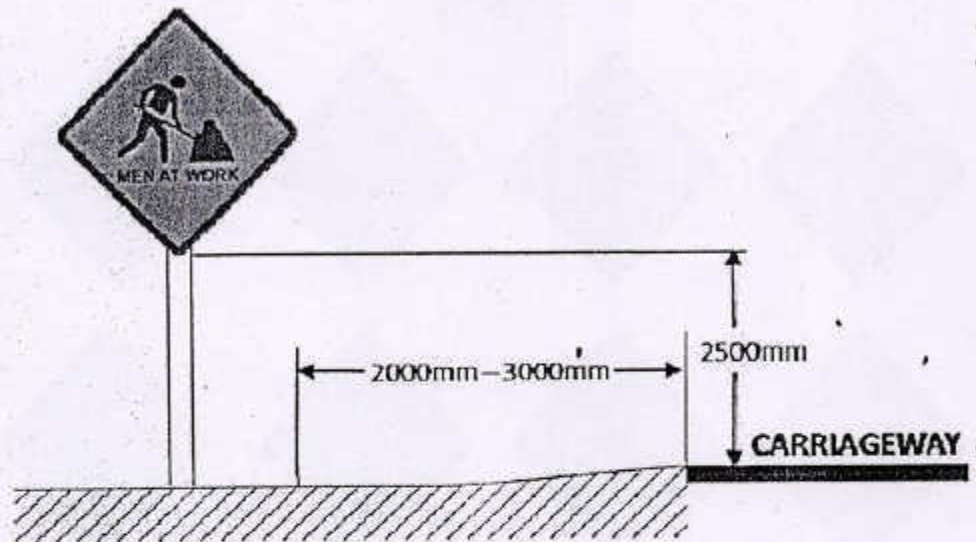


FIGURE – 5: WARNING SIGNS





**FIGURE – 6 : CAUTION SIGNS ON UN-KERB ROADS**

Table 3-2 Minimum Sightline Distances and the Minimum Size of the Signs

Average Speed (km/h)	Distance of first sign in advance of the first channelizing device (m)	Size of Warning Sign (mm)	Minimum number of signs in advance of the hazard	Distance E to "End of Work Zone" Sign (m)
Under 50	100	1200	3	10-30
51-60	100-300	1200	3	10-30
61-80	120-300	1200	3 or 4	10-30
81-100	300-500	1200	4	30-45
Over 100	1000	1200 to 1500	4	30-45

#### 17.1.4 Informatory/Guide Signs

Informatory/Guide signs are required at traffic control zones to provide the necessary information and guidance for the alternative route and work being done. These signs shall have white arrows/border/letters on blue/green background. Fluorescent Orange sheeting shall conform to Class B sheeting as per IRC-67:2011. The commonly used guide signs are public telephone, hospitals, etc.

#### 17.2 Delineation and Channelizing Devices

Delineation and channelizing devices shall be used in conjunction with other devices to:

- (1) Separate traffic from the workspace, pavement drop-offs, pedestrian paths, or opposing traffic.
- (2) Guide road users safely by indicating clearly the edge of the route and the path they should take.
- (3) Guide and direct the approaching vehicles smoothly and gradually into the designated lane/s to pass the work zone safely.





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The two forms of devices serve slightly different functions.

(1) Channelizing: Refers more to the formation of the navigational paths. Devices are used to direct vehicles into pre-determined paths in a safe and orderly manner.

(2) Delineation: Refers more to the marking of boundaries. Delineation devices are installed to indicate clearly the alignment of the road and width of the path in which the vehicles should maneuver.

The channelizing devices such as cones, traffic cylinders, drums and water-filled barricades are placed in or adjacent to the roadway to control the flow of traffic. These should normally be retro-reflective (Class B sheeting as per IRC-67:2011).

#### 17.2.1 Traffic Cones

a) Traffic cones are 500mm, 750 mm and 1000mm high and in square shape at base and are often made of plastic or rubber and normally have retro-reflective white bands (Class B sheeting as per IRC-67:2011). (Refer Table 3-3).

Table 3-3 Height of Cones, Cylinders and Drums according to Class of Sheeting

Size & No. of Reflective Sleeve	Class of Sheeting	Height of Cones /Cylinders /Drums(mm)
Two Sleeves of 100mm each	Class B as per IRC-67:2011	500
Two Sleeves of 150mm each	Class B as per IRC-67:2011	750
One Sleeve of 300mm	Class B as per IRC-67:2011	1000

a) Their advantages are that they:

- cause minor impediments to traffic flow and capacity
- are well recognized and understood, without damaging vehicle when hit
- can be easily stored and transported
- can be fastened to the pavement and self-restoring when hit.

b) Their disadvantages are that they have minimal respect of drivers, can be equally penetrated, displaced and knocked over and require special treatment for night times.

c) Cones are easily blown over or displaced unless their bases are loaded with ballast or anchored. It may, therefore be sometimes necessary to double the cones in order to provide added weight, use the cones with special weighted bases, use heavier weighted cones or use weights such as sand bag rings to provide increased stability but this weight should not present a hazard. The cones should be placed close enough together to give an impression of continuity. The spacing of cones should be 3 m (close) or 9 m (normal) or 18 m (wide). Where cones have to be used at between 45° and 90° to the line of traffic, their spacing should be 1.2 m. large size cones should be used where speeds are relatively high or wherever more conspicuous guidance is needed.





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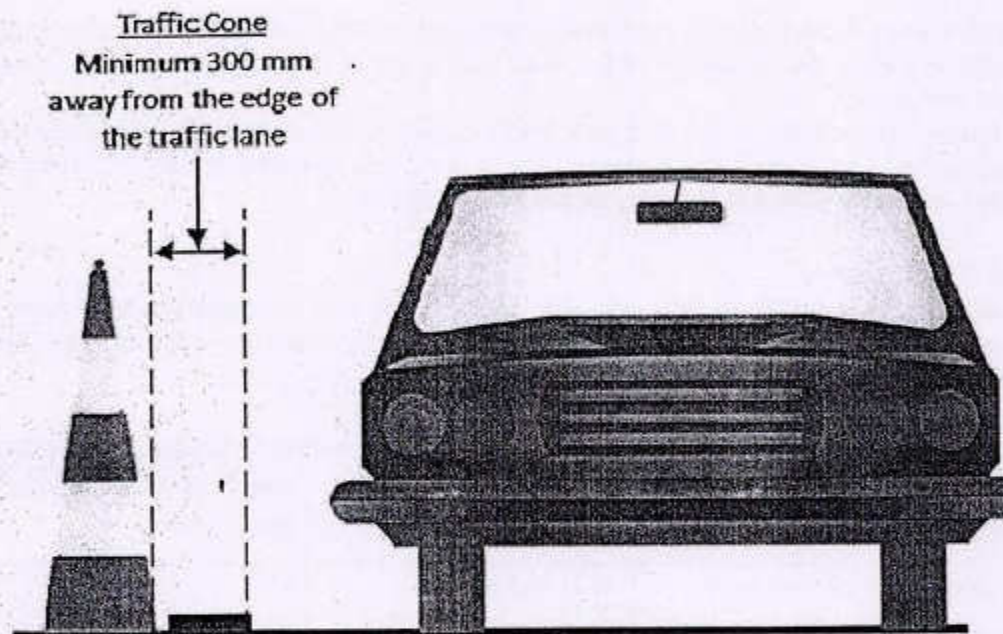
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d) They may be used in long duration works in conjunction with temporary pavement marking. They shall be placed at least 300 mm away from the edge of the traffic lane (Figure 3-7).



**FIGURE 7 - PLACEMENT OF TRAFFIC CONES**

#### 17.2.2 Retro reflectivity specs for the sleeve

Sleeve shall display essentially the same colour both in daylight and under automobile headlights at night, when viewed at distances of 50 feet or greater with typical construction work zone placement of devices. The coefficients of retro-reflection shall be in accordance with ASTM E 810. E 810 values of 0° and 90° rotation averaged to determine conformance to the RA limits, for the minimum requirements of Class B sheeting of IRC-67:2011.

#### 17.2.3 Flexibility specs

The sleeve material shall have Class B sheeting as per IRC-67:2011 retro reflectivity requirements and shall show no cracking when conditioned for 24 hours at 0° C and wrapped and bent around a 1/8 inch mandrel in one second's time with the liners removed.

#### 17.2.4 Cone Application

Traffic cones are used to channelize traffic, divide opposing traffic lanes, divide traffic lanes when two or more lanes are kept open in the same direction, and delineate short duration maintenance and utility work. Steps should be taken to ensure that cones will not be blown over or displaced by wind or moving traffic. Cones shall have a heavy rubber base to provide stability during heavy wind loads and should not present a hazard if the cones are inadvertently struck.

#### 17.2.5 Drums

1) Drums about 800 mm to 1000 mm high and 600 mm in diameter can be used as either channelizing or warning devices. These are highly visible, give the appearance of being formidable objects and therefore command the respect of drivers.





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2) Plastic drums are lighter, pose fewer hazards to vehicles and workers and can be needed for easy transportation and storage and generally have one or more flat sides to preclude rolling. Drums may be filled up with earth or sand for stability. Plastic drums should have White reflective strip of 100 mm. Drums should be reflectorised for use at night and should never be placed in the roadway without advance warning signs.

3) Reflective sheeting shall be of Class B as per IRC-67:2011.

#### 17.2.6 Water-Filled Barricades

(a) Water-filled barricades are proprietary-made modular water filled plastic containers of various sizes and shapes. (Figure 3-8).

(b) They shall be minimum 1m tall for major roads and expressway and 0.8m tall for other roads.

(c) Each unit shall come with interlocking devices for use on tangent straight and horizontal curves with mounting devices for lighting.

(d) Contractors must take note that the lettering to be pasted on the water-filled barricades, "WARNING — THIS IS NOT A SAFETY BARRIER" is for his and his agents' use only so that the two different types of water-filled barricades are used correctly. The words should not cause confusion or distress to the public.

(e) It is very stable and offers better resistance to vehicle impact as compared to traffic cones and barricades.

(f) It shall be used as traffic delineator for long-term works, to separate traffic from pedestrians when walkway is temporarily diverted next to a carriageway.

(g) It shall be placed at least 0.5m from the edge of the carriageway for expressway and 0.3m for other roads. Only one type shall be allowed on site. Using different types on one site would appear haphazard to drivers.

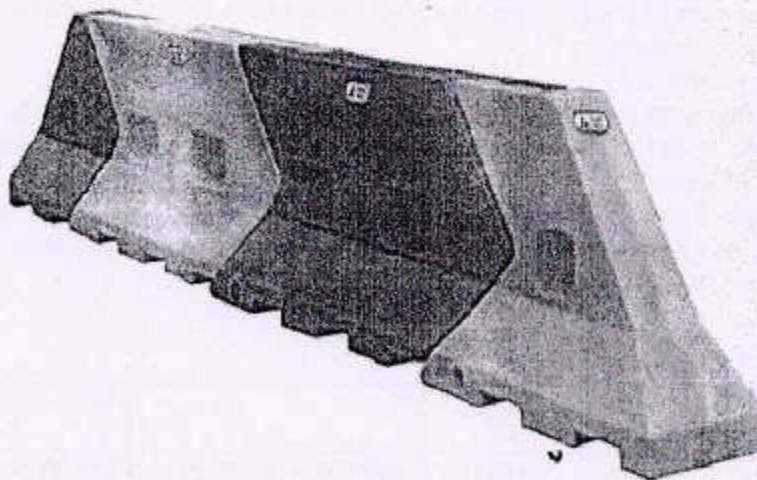


FIGURE 8: WATER FILLED BARRICADES





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Table 3-4 Summary of Delineation and Channelizing Devices

Type	Traffic Cone	Traffic Cylinder	Drum	Water filled Barricade
Colour	Fluorescent Orange	Fluorescent Orange	Fluorescent Orange	Fluorescent Orange
Reflective collars/bands and Reflective Sheeting	White band with Class B sheeting as per IRC-67:2011	White band with Class B sheeting as per IRC-67:2011	White Reflective sheet of 100 mm of Class B sheeting as per IRC-67:2011	Mounted with Fluorescent Orange Retro reflective Disc of Class B sheeting as per IRC 67:2011
Min height (mm)	700	750	800	1000
Min lateral clearance (mm)	300	300	300	300

### 17.3 Barricades

a. Barricades are intended to provide containment without significant deflection or deformation under impact and to redirect errant vehicles along the barrier. They are designed to be easily relocated and have four specific functions to:

- (i) Prevent traffic from entering work areas, such as excavations or material storage sites;
- (ii) Provide protection to workers;
- (iii) Separate two-way traffic; and
- (iv) Protect construction such as false work for culverts and other exposed objects.

b. Barricades can be portable or permanent. Portable barricades should be stable under adverse weather conditions and appear substantial but not so much as to cause excessive damage to the vehicle if they are struck. Figure 3-21 shows typical barricades; Types I and II are portable whereas Type III is permanent. The recommended dimensions of various components are given in Table 3-5.

Table 3-5: Barricade Characteristics

Type / Component	I	II	III
Width of Rail	200 mm - 300 mm	200 mm - 300 mm	200 mm - 300 mm
Length of Rail	2 m - 2.5 m	1 m - 1.2 m	1 m min - variable max.
Width of Strip	200 mm	200 mm	200 mm
Reflective Sheeting	Class B as per IRC-67:2011	Class B as per IRC-67:2011	Class B as per IRC-67:2011
Type of Frame	Heavy 'A' Frame	Light 'A' Frame	Fixed, Demountable
Flexibility	Essentially movable	Portable	Essentially Permanent



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Retro reflective Sheeting	Class B sheeting as per IRC- 67:2011	Class B sheeting as per IRC-67:2011	Class B sheeting as per IRC- 67:2011





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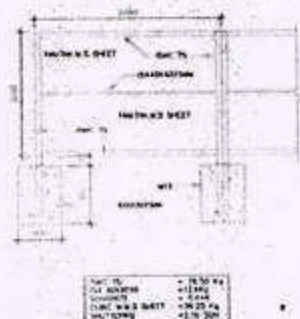
c. The horizontal members of type I and II barricades may be of wooden planks, metal or other suitable material. These should be 300 mm wide and should be painted in alternate yellow and white stripes of 150 mm width. The stripes should slope away at an angle of  $45^\circ$  in the direction traffic is to pass. Where the barricades extend entirely across the carriageway, the stripes should slope downward towards the direction the traffic must turn in detour. Where both left and right turns are provided for, the chevron stripes should slope downward in both directions from the centre of the barricade. The entire area of chevrons should be reflectorised so as to be visible from safe distance. Type I or Type II barricades shall be used when traffic is redirected. These barricades can be used inter-changeably and are more useful in repair work that is generally initiated on emergency basis. The support should be of an "A" frame configuration or hinged or otherwise flattened at the top to permit convenient folding and stacking for transportation. Since these barricades are susceptible to overturning in wind, their stability can be improved through ballast.

d. Type III barricades are the permanent type and can be made of wood, metal or other suitable material like masonry. These are erected at the point of closure when a road section is closed to traffic on construction projects. They may extend completely across a roadway and its shoulders or from Kerb to Kerb. Where provision must be made for the access of construction and supervision vehicles, type III barricades must be provided with a gate or moveable section that can be opened and/or closed as required. Signs such as "ROAD CLOSED" and "DETOUR ARROWS" should be erected on the fixed barricade.

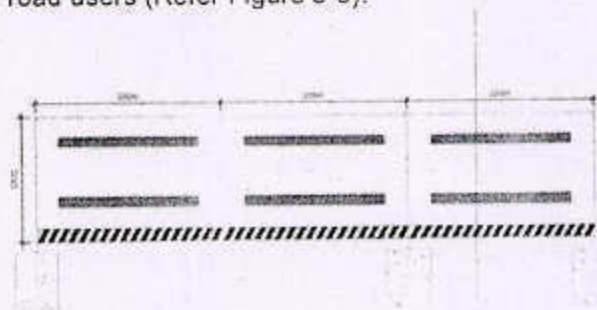
e. Where the works are to be undertaken which will continue for some time or where the space is limited and there is a need for the protection of the work force, particularly where the speed of passing traffic may be high, purpose designed concrete or plastic barricades may be used. Their design is often similar to the cross section of a New Jersey Barrier or rectangular and they are some

1.5 m to 2.0 m long with shaped ends that can be interlocked and connected. Plastic barricades available in trapezoidal shape of about 80 cm to 100 cm length can also be tried. Their use should be carefully controlled until more experience is gained with them but they offer advantages to the workforce in that the speed of impact will be much reduced should there be an accident and the workforce will feel more secure. They will enable narrower traffic lanes and buffer zones to be employed where space is a premium and vehicle speed likely to be high.

f. Type IV Barricades are used where the work area has deep excavation which must be barricaded from moving traffic and other road users (Refer Figure 3-9).



DETAILS OF FIX BARRICADING BOARDS



ELEVATION OF ONE UNIT OF TEMPORARY BARRICADING

FIGURE 9: TYPE IV BARRICADE BOARDS





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#### 17.4 Roll Up Signs:

Roll up signs are used in construction work zones to guide the traffic and in road ways for emergency traffic control (Figure 3-27). Roll up signs shall be portable, changeable and shall have provisions for application on different objects depending on the need for temporary sign.

a. Mounting of the roll up sign on the portable stand

The roll up sign shall have the back support ribs to fix on the portable stand and the roll up sign stand shall have knobs to receive the short rib of the sign fascia. The back support ribs shall be inserted in to the clamp provided on the stand and tightened using the knobs. The sign ribs shall be moved up and down to adjust the height of the sign.

b. Mounting of the roll up sign on construction or maintenance vehicles

The roll up signs shall have necessary attachments to mount it on the work zone maintenance vehicles. The back support ribs shall have dual lock high bonding tapes, mechanical fastening or snap fit clips or attached magnets. The receiving part of dual lock tape, clips or metallic attachment shall be pasted on the vehicle surface where the roll up sign needs to be mounted. The sign mounting mechanism shall with stand the weight and movement of the vehicle.

c. Mounting of the roll up sign on barricades

The roll up signs shall have necessary attachments to mount it on Barricades. The ribs at the back side of the signs shall have a dual lock high bonding tapes or a mechanical fastening system which can be removed and re applied multiple times. The receiving part of the tape of fastener shall be applied on the barricade. The locking portion of the tape or the fastener shall be permanently fixed on the ribs of the roll up signs.

The list of Road Safety Devices to be used during Construction is given below:

1. Traffic Cones and Chain
2. Drums
3. Barricades
4. Rumble Strips/Speed Retarders
5. Raised Pavement Marker (RPM)
6. Portable Variable Message Signs
7. Solar Delineators, Solar Studs & Solar Signs, etc.
8. Hand Flasher/Batons
9. Safety Vests/Jacket
10. Safety Helmets
11. Traffic Bollards
12. Spring Posts
13. Road Flashers
14. Barricading Tape/Plastic Mesh Fencing
15. Median Marker
16. Convex Mirror
17. Traffic Signs
18. Reflective Road/ Pavement Marking
19. Safety Shoes