Inaugural Issue

HTOA Publication

# HEAVY HAULERS

FIRST HEAVY LIFT JOURNAL OF INDIA

January 6, 2015

HTOA Hydraulic Trailer Owners Association

Ministry of Road Transport & Highways

NHAI

## Inauguration of Web Portal for Online Approval of movement of Over Dimensional (OD) & Over Weight Cargo (OWC) by Modular Hydraulic Trailers

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भारत सरकार,
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MINISTER OF ROAD TRANSPORT
HIGHWAYS & SHIPPING
GOVERNMENT OF INDIA
PARIVAHAN BHAVAN, NEW DELHI-110 001

## Message

The launch of a Web Portal for Online Approval Facility for Movement of over Dimensional Cargo & over Weight Cargo (ODC/OWC) by Modular Hydraulic Trailer is a significant achievement of our Ministry of Road Transport & Highways with a huge potential to contribute towards major policy initiatives of Prime Minister Shri Narendra Modi like **Make in India & Digital India.**

I congratulate the entire team of Ministry of Road Transport &Highways for accomplishing this task in association with the Hydraulic Trailer Owners Association (HTOA) which is also organising a seminar on **"Heavy Transport in India".**

I am glad that the first Indian heavy lift journal "***Heavy Haulers***" is also being launched on this occasion highlighting the innovations, industry domain expertise, technical papers, interviews, news & regulatory issues across the heavy and abnormal load sector.

I am told the journal will provide technical papers and articles on key topics ranging from the major heavy equipment manufacturer, project cargo movement along with various other relevant issues like fleet management, health, safety and environment, crew skill development, regulatory issues, insurance and financial services, vehicle maintenance, skill development, cranes and heavy lift.

It is heartening to note that the journal will be the voice of the heavy lift industry and provide senior executives, academicians, manufacturers of heavy equipment, manufacturer of heavy haulage puller & axles, regulators, Insurance and IT/ITES services with targeted editorial space promoting the latest thinking, best practices and market trends.

Yours

**(Nitin Gadkari)**

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MINISTRY OF ROAD TRANSPORT & HIGHWAYS

I would like to congratulate my team at Ministry of Road Transport & Highways for working for launching the "Web Portal for Online Approval Facility for Movement of ODC/OWC by Modular Hydraulic Trailers" to facilitate the industry. It will also regulate the movement of ODC/OWC in order to ensure speedy and safe transport of large power equipment across the length and breadth of our country.

I would also like to congratulate the Hydraulic Trailer Owners Association for launching of the first Indian heavy lift journal "Heavy Haulers" during the event on **"Heavy Transport in India"** with the theme as *"Entering into a new era through digitalization"* on **6th January, 2015** at **Hotel Le Meridien, New Delhi**. The initiative is much timely and needed for the industry as this will not only strengthen the knowledge base of the industry but also add value on the technical aspects.

**(Vijay Chhibber)**

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भारत हेवी इलेक्ट्रिकल्स लिमिटेड

**Bharat Heavy Electricals Limited**

# Message from CMD, BHEL

I would like to congratulate Ministry of Road Transport & Highways for launching 'Web Portal for Online Approval Facility for Movement of Over Dimensional & Over Weight Cargo (ODC/OWC) by Modular Hydraulic Trailers'. BHEL, in association with HTOA has been piloting the cause for faster clearances and movement of these consignments to execute projects under defined timelines and for keeping pace with the infrastructure development required in the country.

This new measure will be a major boost to the heavy industries to be able to provide safe and timely delivery of heavy equipment across the country and facilitate 'Make in India' campaign. This will lead to identification of corridors being frequently used for such movements, which will pave way for development of Over Weight Express Corridors in due course. This will also help in online bridge inventory across the country for route selection and maintenance of the bridges and highways.

I would also like to congratulate the Hydraulic Trailer Owners Association on the launch of the first Indian heavy lift journal '**Heavy Haulers'** during the event on '**Heavy Transport in India'** with the theme '*Entering into a new era through digitalization'*.

I believe that the journal will act as a platform for knowledge exchange of innovative ideas and international best practices to add to the growth of the industry for the mutual benefit of all the stakeholders.

January 2015

(B. Prasada Rao)

# HTOA - Hydraulic Trailer Owners Association
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## Office Bearers

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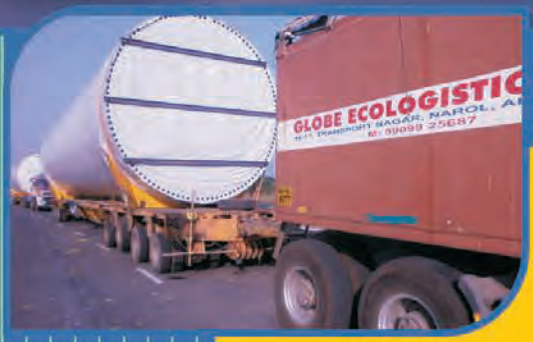

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# Editorial

# HEAVYHAULERS : Dawn of a New Era

Girish Mirchandani

"Let's go invent tomorrow instead of worrying about what happened yesterday". This is one of the pearls of wisdom from Steve Jobs and somehow it perfectly suits the Hydraulic Trailers Operators in India. All these years they have been struggling to build a working environment that is conducive for efficient and effective movement of over dimesnional and over weight cargo . Unfortunately they found themselves in a secluded corner where neither the Government recognised their importance nor did the large equipment user fraternity took cognisance of the problems faced by the Hydraulic trailer Operators.

Hydraulic Trailer Owners Association (HTOA) articulated concern and constrains faced by the heavy transport segment to all stakeholders since its inception in 2007. Most of the large projects schedules having National importnace were adversly hit due to transit delay of critical equipment in movement of over dimensional / overweight consignments. The Regulatory framework, Technical competency, Training & skill development , Mapping of road and bridge structure , Natioanl heavy haulage movement data are still not captured at single plateform, which is core input for future integrated infrastucrte planning and development. While academic institutions , Research & development agency addressed the importance of overall framework development for Project implemention but all stakeholders were having different platforms, individual feasibilty reports and therefore had different

communcation channels which lead to absence of any data consolidation on single platform. The Digital India drive of Goverment under vision of Shri Narendra Modi , Prime Misniter of India encouraged HTOA to look for unique platform for all stakeholders to share their data, views, suggestions and recommendations to make collective efoort in Nation building. MoRTH extended a friendly hand to HTOA in transforming this thought to a reality.

Shri. Nitin Jairam Gadkari , Union Minister for Road Transport & Highways (MoRTH) & Shipping with his motivated team made sure that this segment get the importance that it deserved.

Ministry extended their support for streamlingning heavy haulage in India with landmark initiave by launching web portal for online approval of movement of Over Dimensional (OD) and Over Weight Cargo (OWC) on January 6, 2015. This will lead to consolidation of key data at single platform to falicaite timly movement in regulated framework which is due course will help to develop condusive eco system for stakeholders to collaborate in fast decisions for timely implementation of projects of National importnace.

Simultanesoly HTOA moving with Government came out launching first heavy lift Journal of India "HEAVYHAULERS" on January 6,2015; in order to disseminate the initiative of Government , sharing best global heavy haulage and HSE practices , ground relaities of heavy movemnt in India with collective effort and suggestion of all stakeholders to make India a better and safer place for movment of heavy equipments.

HEAVYHAULERS will bring to you news and reports from across the globe on the developments in Heavy movement, besides educative materials from experts, analysts and professionals . We would also welcome valuable inputs from our readers.

Here is wishing everyone a Very Happy New Year.

# Chairman Note

## "Inauguration of web portal for Online Approval Facility of Movement of OD/OWC on Modular Hydraulic Axle Trailers"

**Manish Kataria**

### Background

Current provisions of CMVR,1989 empowers Central Government only to permit registered capacity of GVW > 49 MT to any motor vehicle.

Bridges in India are designed as per IRC loading arrangements, the largest of which is a hypothetical multi axle (7 axle) articulated tractor trailer combination with maximum GVW of 100 MT under specified axle spacing.

In light of the constant emphasis of Central Government to curb overloading on Indian Roads and rise of project size from micro to mega level the requirement of road transportation of heavy weight indivisible equipment was being observed on a rising trend.

To address such demand Central Government issued many notifications in favour of vehicle owners (applicants) for permitting GVW>49 MT considering recommendations from State Transport Commissioners for modular hydraulic trailers(MHT), which are the only available globally accepted technology for road transportation of over weight consignments. Such trailers were initially imported but with rise in demand few manufacturing units developed in India

also. However the movement of such loaded trailers was to be undertaken subject to compliance of many stringent conditions, one of them was seeking permission for each & every movement from concerned road & bridge authority.

Absence of modular hydraulic trailer in specified category of vehicles in CMVR,1989 and non-availability of MHT loading arrangement with different axle spacing started leading to multiple operational issues in movement of MHT on road, mainly:

1. Idling of MHT for want of registration which could only be made possible after Extraordinary Gazette Notification of each trailer by the Central Government which was highly time consuming & almost repetition of same exercise for each & every trailer.

2. Detention of trailers in transit for want of permissions from each & every road & bridge unit falling enroute.
3. Harrasment of trailer operators at field unit level while moving with load.
4. Project delays due to abnormal transit delays.
5. Risk to R&B structures.

Hydraulic Trailer Owners Association (HTOA) brought this issue to the notice of the Central Government and considering the importance of such movements Ministry along-with ARAI, HTOA, TBGE consortium of ministry empanelled bridge engineers, vehicle manufacturers and all other major stakeholders worked hard to address the issues which lead to:

1. Issue of landmark guidelines on 24/01/13 giving recognition to different type of loading arrangements of MHT and laying of procedure for grant of permission under single window system by nodal officer, which were pratically implemented vide Order dated 20/05/14.
2. Release of draft notification for amendment to CMVR,1989 for inclusion of hydraulic trailers & Puller Tractor on 28/01/13 & thereafter on 28/05//2014.
3. More than 600 permissions issued from June, 2014 to Nov'2014 in time bound manner by Nodal officer at MoRTH, New Delhi.

Appointment of nodal officer under single window system & thereafter nature of such movements further established the importance of the same w.r.t. power projects and other Infrastructural developmental projects. For a power starving & developing country like India it was of utmost importance that efforts be made for seamless movement of heavy equipment in India.

The newly formed Government took landmark initiative to digitalize the process leading to online approval for movement of OD/OWC on MHT with minimum loss of time to expedite timely deliveries of heavy equipment which shall promote "Make In India" vision becoming a reality.

Final Notification for long pending amendment to CMVR,1989 is also being published.

## The Event

Ministry of Road and Highway is organising a public event along with Hydraulic Trailer Owner Association (HTOA) on 6th January 2015 at Le Meriden Hotel , New Delhi – to launch web portal for online approval facility for movement of OD/OWC by MHT from origin to destination under single window system.

This will facilitate grant of permissions for GVW upto 169 MT on real time basis against online deposit of prescribed OWC fee and for GVW>169 MT in a time bound manner not exceeding 30 days from the date of online submission of request.

On this occasion a full day session on,

## Heavy Transport in India: Entering a New Era through Digitilisation

shall also be conducted wherein all major stakeholders like Heavy Equipment manufacturer, Project Owners, EPC companies and various research and academic institutions from across the country have been invited to discuss & lay the road map for future plans.

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## MINISTRY OF ROAD TRANSPORT & HIGHWAYS

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RW-NH-350 721112010-S&R(B) Dated: 20th May, 2014

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3. The Engineers-in-Chief and Chief Engineers of Public Works Departments of States/U.Ts dealing with National Highways, other Centrally Sponsored Schemes and State Schemes.
4. The Chairman, National Highways Authority of India (NHAI), G- 5&6, Sector-10, Dwarka, New Delhi-110 075.
5. Director General (Border Roads), Seema Sadak Bhawan, Ring Road, New Delhi-110 010.
6. General Secretary, HTOA, 405 Prestige Chambers, Kalyan Street, Mumbai-400009.

**Sub: Guidelines for movement of Over Dimension laver Weight Consignment (OD/OWC) on National Highways pending completion of condition survey of bridges.**

Ministry has issued guidelines for granting permission for movement of overdimension and overweight vehicles on the Bridges of National Highways vide Ministry letter No. RW-NH-35072/1/2010-S&R(B) dated 24-1-2013 dated 27.6.2013 and 20.9.2013 and circular nO.RT-11042/13/2008-MVL dated 10.10.2013. The guidelines issued on 24.1.2013 allows the movement of ODC/OWC after Bridge Condition Survey by a Ministry empanelled consultant in category II &111.In order to regulate & streamline the OWC/ODC movement, which are otherwise moving illegally without proper permissions thus endangering safety of NH Bridges, Ministry is in the process of getting Condition Survey of bridges on periodic basis.

The matter of movement of ODC/OWC pending completion of Condition Survey has been discussed in the Ministry and it has now been decided to follow the procedure as under so as to ensure smooth and safe movement of ODC/OWC on National Highways.

### 1) Movement of Empty Multi Axle Hydraulic Trailers

The movement of Empty Multi Axle Hydraulic Trailers alongwith the puller under different combinations with Gross Vehicle Weight upto 100 Metric Tons

having load distributed uniformly on all axles of hydraulic trailer will be allowed to passover all the Bridges having span length of 50 m or less enroute, except on Distressed Bridges (bridges which are unsafe for carrying IRC loading) without charging any fee except toll, if any with following conditions:

a) For two lane bridges (Le. carriageway width between 5.3 m to 9.6 m), the Empty Hydraulic Trailer shall be taken along centre line of the carriageway and no other vehicle shall pass on the bridge during such movement.

b) For wider bridges (Le. more than two lanes), the Empty Hydraulic Trailer can pass along with other vehicles on the remaining lanes of the carriageway.

## 2) MOVEMENT OF LOADED MULTI AXLE HYDRAULIC TRAILERS

Based on discussion with stakeholders it has been noted that Hydraulic trailers while carrying ODC/OWC can broadly be divided into two categories:

(i) ODC/OWC moving on type HT1 to HT3 or others with maximum GVW including Puller weight upto 169 MT.

(ii) ODC/OWC with GVW (including Puller weight) greater than 169 MT moving on type HT-4 to HT-13 wherein generated load effects considering movement with precautions described in Enclosure-I of Circular dated 24/01/2013 are higher than load effects generated by IRC loads for which the bridges are designed but are within permissible limits of overstressing as per IRC: SP-37:2010

**For the category (i) the procedure for granting movement permission will be as under:**

- The HT operator shall apply to the Nodal Officer Le. CE (Bridges), MoRTH in the prescribed format enclosed as Annexure-I alongwith the proof of fee deposit as per this circular.
- Nodal Officer shall issue permission for movement after verifying acknowledgement of fee deposit. Further, NH authorities enroute shall be instructed to allow the movement on the bridges having span length of 50 m or less enroute for different type of carriageways, except on Distressed Bridges (bridges which are unsafe for carrying IRC loads).
- In case of bridges not covered in the circular dated 24.01.2013 and bridges having span length OF more than 50 rnts, Regional Officers of the Ministry and NHAI shall check adequacy of such bridges as per IRC:SP-37:2010 and forward their recommendation to the Ministry for granting movement permission by the Nodal Officer.

For category (ii) described above with GVW > 169 MT moving on type HT-4to HT-13 but within the limits prescribed in Charts (C4TO C13)forming part of guidelines dated 24th January 2013, it has been decided that the Movement permission shall be granted by the Nodal Officer l.e. Chief Engineer (Bridges)at MoRTHas per procedure mentioned below:

- HT operator shall submit request to the Nodal Officer at MoRTH in hard copy duly sealed & signed and also forward a soft copy to the Nodal Officer with a copy to concerned Regional Officers of MoRTH and NHAI & concerned Project Directors of NHAI falling enroute as per format at Annexure-I.
- Copy of the same shall be forwarded by the Nodal Officer to concerned Regional Officer of MoRTH and NHAI (falling enroute) electronically for their comments.
- It will be the responsibility of concerned ROs of MoRTH and NHAI to process such request maximum within 15 days of receipt & forward details of Distressed Bridges (bridges which are unsafe for IRC loading) alongwith the bridges not covered under Guidelines dated 24/01/13 including bridges having span length of more than 50 mts, if any.
- In case no response is received from Regional Officers of Ministry as well as NHAI within stipulated time, Ministry shall presume that there is no distressed bridge enroute and the permission for movement shall be processed/disposed maximum within 90 days of receipt of request.
- Based on the comments of ROs, Nodal officer shall advise HT operator to deposit required fee as per this circular.
- HT operator shall deposit fee within 3 days of receipt of intimation and movement permission shall be

granted against submission of proof of fee deposit.

- In case of bridges not covered in the circular dated 24.01.2013 and bridges having span length of more than 50 M, ROsof the Ministry and NHAI shall check adequacy of such bridges as per IRC:SP:37:2010and forward their recommendation to the Ministry for granting movement permission by the Nodal Officer.
- Copy of permission so granted shall be electronically forwarded to concerned RegionalOfficer, MoRTH,NHAIand Htoperator.

3. The ODC/OWCfee structure asdecided by the Ministry is as under:

| Category No. | Type of HT load duly carrying ODC/OWC | Rate per 50 km or part thereof of total trip journey on National Highways (in Rs.) |
|---|---|---|
| Category-l | HT-l to HT-3 | 1000.00 |
| Category-2 | HT-4to HT-6 | 2000.00 |
| Category-3 | HT-7to HT-9 | 3000.00 |
| Category-4 | HT-I0 to HT-13 | 4000.00 |

**3.1 Fee shall be deposited in following account:**

Title: Indian Highway Management Company Limited
Bank: Canara Bank, NHAI Branch, New Delhi-ll0075
Account NO.8598201006217
IFSC:CNRB0008598

The movement of hydraulic trailers carrying ODC/OWCwithout depositing required fee shall not be undertaken and all the NH authorities enroute shall ensure that no movement shall be allowed without MoRTH permission. In case movement is found without the proper permission, it has been decided to charge two times of stipulated fee from origin to destination alongwith detention of HT vehicle for at least seven days as penalty to desist from illegal movement.

This is being issuedwith the approval of the Competent Authority and shall come into force w.e.f 21 day of May,2014.

Yours faithfully,

(A.P. PATHAK)
Chief Engineer (S,R &T) (Bridge)
For Director General (Road Development)&SS

Copywith enclosures for information and necessary action to:

1. All technical Officers in the Ministry of Road Transport & Highways
2. All Ros and Hos
3. The Secretary General, Indian Road Congress
4. The Director, IAHE
5. Technical Circular file of S&RSection

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2. Sr.PPSto Secretary (RT&H)
3. PSto DG(RD)&55

**Annexure-I**

**(Format for seeking approval of movement of OW/ODe by MHT)**

Ref.No.: Date:

To,
The Chief Engineer-Bridges-S&R

Ministry of Road Transport & Highways,
1, Parliament Street,
Transport Bhawan,
New Delhi-11001

**Sub:** Approval for movement of Modular hydraulic trailer carrying OD/OW Consignment over HT.....type.

**Ref:** Guidelines No. RW/NH-/35072/1/2010/S&R(B) dt. 24/01/2013 and dated .....

Sir,

We wish to inform that we are entrusted/entrusting the job for transportation/to ..... (name of transporter) of .....(consignment detail) from M/s ..... (Consignor name & place) to M/s..... (consignee & destination) weighing..... MT on Modular Hydraulic Trailer.

2. Details of puller tractor & Modular hydraulic trailer being deployed for said movement are as under:

Vehicle Combination Type: HT .....

| S.No. | Vehicle type | Vehicle Reg. Details | No. of axle rows | RLW Capacity (MT) | Copy of RC attached |
|---|---|---|---|---|---|
| 1. | Puller Tractor | | | | |
| 2. | Modular Hydraulic Trailer | | | | |
| 3. | Modular Hydraulic Trailer | | | | |
| 4. | Modular Hydraulic Trailer | | | | |
| 5. | Modular Hydraulic Trailer | | | | |
| 6. | Attatchment( if any) | | | | |

## 3. Details of load:

| Load | | | |
|---|---|---|---|
| **Length (M)** | **Width (M)** | **Height (M)** | **Weight (MT)** |
| | | | |
| | | | |

## 4. Details of route to be followed is as under:

| S. No. | NH No. | From (Km.) | To (Km.) | Distance (in Km.) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

5. Alongwith the above details following documents/undertaking/affidavit are also attached for ready reference and record.

i. An Affidavit by the applicant/transporter that all the information provided are correct and the deployed HT/HTs are technically fit and distribute the load equally on each axle, which are equal to or less than 18 MT/Axle.

ii. Proof of fee deposit as per Ministry circular.

iii. Attested/notorized certificate relating to the gross weight of the consignment issued from consignor/consignee.

iv. A notorized Affidavit by the applicant/transporter on Rs. 100/- stamp paper that while making the movement on National Highway they will carry a certificate from the consignor that each Axle is carrying load, which is less than 18MT. This affidavit should be based on actual load measurement after loading the consignment on Hydraulic Trailer, by a suitable equipment.

v. Notorised Indemnity Bond for compensating damage to bridge property due to the movement of ODC/OWC, if any.

6. We request you to kindly make a record of subject movement and favour us with permission for movement with an advice to concerned field officials to extend co-operation for smooth movement.

Anticipating your favourable consideration.

Thanking you,

Yours faithfully,

Designation, Name& signature of applicant

Encl : Route & Load Details.

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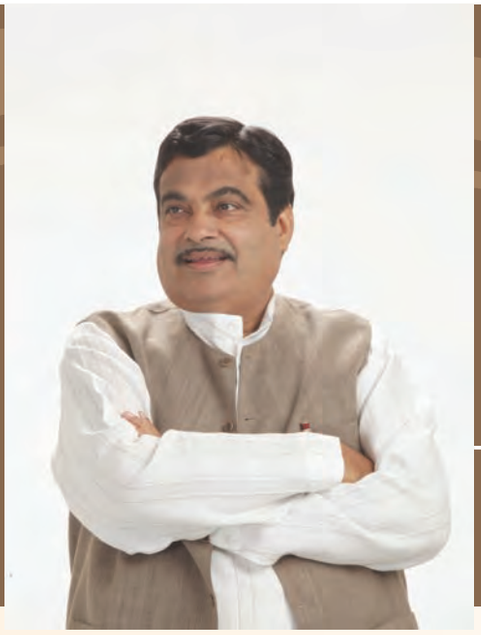

# Online facility
## will lay roadmap for future

**Mr Nitin Gadkari**
Union Minister – Ministry of Road Transport & Highways

# HTOA & Ministry
## played vital role in online facility

Ever since Mr Nitin Gadkari took charge as the Minister of Road Transport & Highways, the Ministry has been abuzz with activity. The officials, including the Minister, have been interacting continuously with the stake holders and putting in their best efforts for improving the working conditions of the transport industry and at the same time improving the efficiencies. The launch of the online facility for movement of ODC is the result of one such activity in the ministry that will bring a huge reprieve to the operators. Member of the Editorial Board for Heavy Haulers Mr Girish Mirchandani met Mr NItin Gadkari and inquired about the road transport industry. The following are excerpts from the interview:

**Q1. Government has been fighting since last so many years to curb overloading, but till date the registration process for vehicles having gross vehicle weight more than 49 MT is very restrictive. What Ministry thinks to address the issue? Is Ministry thinking to liberalise the system.**

A1. We have already approved draft notification for necessary amendment in CMV Rules for addressing the above issues and the final Gazette Notification will be published within a fortnight.

**Q2. Post final notification, will the operators be able to get hydraulic trailers registered immediately against purchase in line with other regular vehicles.**

A2. Yes, certainly, we are looking forward to promote use of multi axle vehicles effectively in order to control the overloading on roads.

**Q3. As per government existing provisions hydraulic trailers has to take permissions from multi-lateral agencies for their movement. What measures Ministry is taking to address such issues.**

A3. My Ministry has already issued guidelines dated 24/01/2013 for single window clearance in which permission is being granted by the nodal officer of the Ministry for smooth movement of hydraulic trailers on national highways throughout the country to save time and avoid delays in transport. Now we are going ahead for launching a web portal for online approval facility on real time basis. This service will act as a milestone in movement and operational issues in respect of hydraulic trailers.

**Q4. What about other conditions which are no more of relevance now.**

A4. New notification will over rule all existing conditions which discourage use of hydraulic trailers.

**Q5. Enforcement powers of motor vehicles rest with State Government. How do you plan to address the harassment by State Authorities even after operators seeking permissions from MoRTH against pre deposit of requisite fee?**

A5. We are extremely bullish to promote seamless movement of cargo for projects which are of National Importance. As mentioned earlier, the online facility will act as single window permission from origin to destination and portal shall be accessible to State Authorities as well to avoid any lapses. Ministry is also deliberating for a 24*7 toll free control room for registration &time-bound redressal of grievances, if any in this regard.

**Q6. With the growing size of Power Plants& other industrial projects, over weight cargo movement are increasing. Do Ministry intend to revise Bridge codes to address this issue in long run?**

A6. We have already taken into cognizance such heavy loads moving on hydraulic trailers and necessary inclusions have been effected in Indian Road Congress code for load and stresses i.e. IRC 6. New bridges on Highways will be designed & built as per the new code to take care of large & heavy loading arrangements.

**Q7. Do ministry intends to improve on existing bridges for such higher capacities.**

A7. This online facility will lay a road map for future road infra planning in our Nation. Depending on the volume on specific corridors Ministry plans to improvise the existing bridges and IRC will work towards amending codes for up-gradation of existing structures.

**Q8. Currently the online facility on real time basis is being restricted to certain load limits. Is the Ministry open to extending this facility for heavier loads in due course?**

A8. Yes, we are going ahead for carrying out conditions survey of our existing bridges in the country and based on these datas these facility will be extended to heavier loads also i.e. HT4 onwards. This facility will help us understand the volumes and plan for further course of action, accordingly we intend to declare over weight expressways for hydraulic trailers in due course of time.

**Q9. Government's priority to OD/OWC movements being made smooth can be seen from this landmark initiative of online approval facility. Whom do you give credit for this??**

A9. I appreciate the efforts being put in by my team of devoted officials of Bridge zone, NIC and also Hydraulic Trailer Owners Association who have played a very vital role. The team was very transparent in sharing their concerns which were laid keeping in mind the vision to ensure safe movements of OD/OW cargo on Indian roads.

**Q10. You have recently published Draft Road Safety Bill 2014 with motto to replace existing MV Act 1988. There also nothing specific can be seen for Hydraulic Trailers, transportation of OD/OWC.**

A10. Ministry is hosting a joint seminar with HTOA on Heavy Transport in India on 6thJanuary only to understand the issues that haven't been attended to so far. We will ensure that necessary provisions are incorporated in the New Bill to address the issues emerging out of the seminar and also take in to consideration HTOA's views on the same.

**Q11. Developed Nations use waterways as a frequent mode of transport for OD/OWC movements which have no dimensional & weight barriers, whereas not much can be seem in India. What is your plan on the same?**

A11. Ministry has already taken a note of the issue and we plan to develop jetties well equipped to cater such requirements on National Waterways in a timely manner. We welcome private participation for faster &

committed development of such facilities. Allahabad to Kolkatta corridor is being developed as a model which will cater requirement of mega projects in the states of U.P., Bihar, M.P.,Jharkhand&W.Bengal. IWAI will act as a nodal agency for study & development of the required infrastructure with a long term view. This will also promote economical, timely & safer multi modal transport in due course of time.

**Q12 Overweight movements require high horse power engines. It is being observed that old established Indian Commercial vehicle manufacturers like TATA & Ashok Leyland have never attempted to upgrade their products to the desired levels.However; globally there are solutions like Truck-Trailer, Double Trailer & Road Train, which are used for transporting higher load, thereby reducing the vehicle density on highways and improving the overall transport efficiency. Is the ministry looking at/open to clearing such solutions in India.**

A12. Ministry will look into the same and take measures to promote necessary Research & development for up-gradation of products with a vision to promote MAKE IN INDIA and bring products at a reasonable price for users. We welcome global manufacturers to establish their manufacturing facilities in India.

**Q13. State transport departments are taking into consideration overloading penalties as a source of revenue. Wherein on the other hand Overloading is a direct threat to Road safety and Government has to incur huge expenses in maintenance of roads & bridges.**

A13 Yes the issue has come to our notice and we have also empowered toll plazas to check overloading & restrict such movements. We will call for a National high level meeting shortly to specifically address this problem. The threat as of today is not the gross vehicle weight but violation of axle load limits for which our Road & Bridges are designed.

**Q14. Ministry is collecting fee for permitting loaded hydraulic trailer movements in 4 categories, whereas these vehicles are also subject to toll. This is a dual burden and absence of different ODC categories in toll notifications is acting as a source of exploitation at field level.**

A14 We will ensure that all HT categories are clearly classified in Toll schedules. The hydraulic trailers are high tech vehicles which promote safe movements and thus, we will try to keep the user fee at minimum level in order to discourage overloading on articulated tractor trailers. In addition to this, issues pertaining to harassment of hydraulic trailers by toll operators will also be dealt with strictly in a timely manner.

**Q15. One can see on highways over dimensional cargo movement being stuck up due to height constraints by under passes, welcome boards and electrified railway lines. What is Government planning on this issue?**

A15. We will work to ascertain & address the issue in the best possible manner. We have already signed MOU with railways to construct ROB on all level crossings on Highways in a time bound manner.

**Q16 With online facility very soon Government will be having centralized data base of distressed bridges, which may affect OD/OWC movements.**

A16. Government will never compromise on safety and therefore, adequate measures will be taken to rehabilitate distressed structures on priority with enhanced design capacities. To have better co-ordination on the issue, Ministry may think for a National ODC cell for strategic planning & suggesting movement through possible alternate routes.

**Q17. There is a long pending demand of Bridge Inventory System and condition survey of bridges.**

A17. ODC portal will be upgraded to required level within three months to act as a platform for uploading of National Bridge data base. The field officers will be responsible for regular updation of data to avoid any communication gaps in order to promote safety. With regards to periodic condition survey, we are at advanced stage of finalization of consultants for getting this conditions survey and inventorisation done of all bridges which will be monitored through a bridge management system.

**Q18. At the last, how do you see to enforce this permission system in fairness to avoid any revenue leakages or corruption at ground level?**

A18. Adequate measures will be undertaken to ensure consignor/consignee are also held responsible in such cases.

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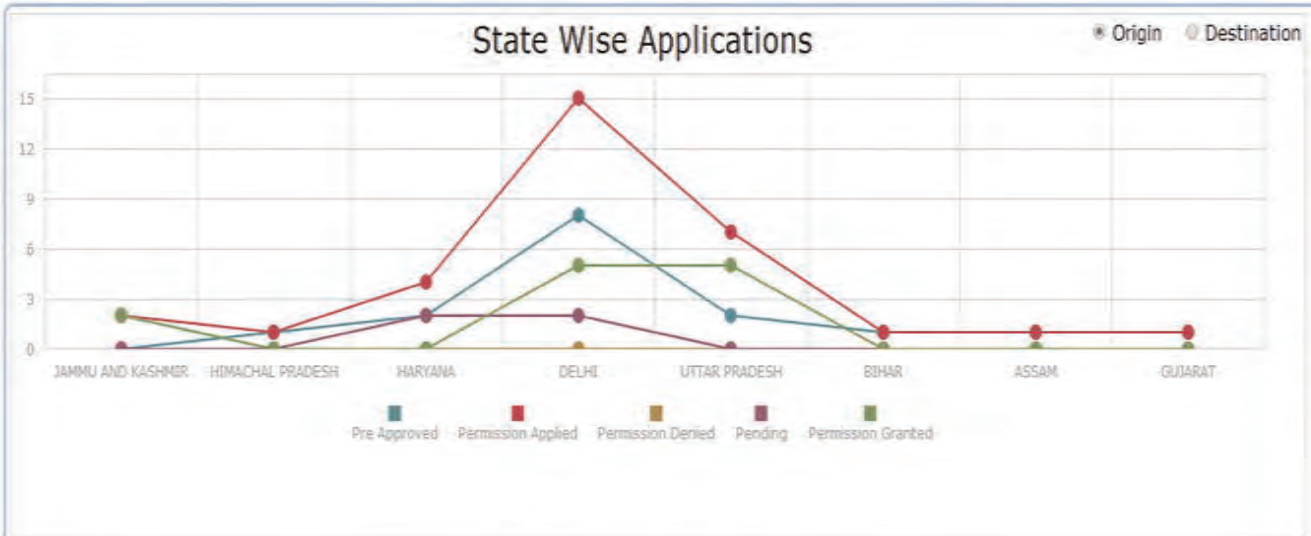
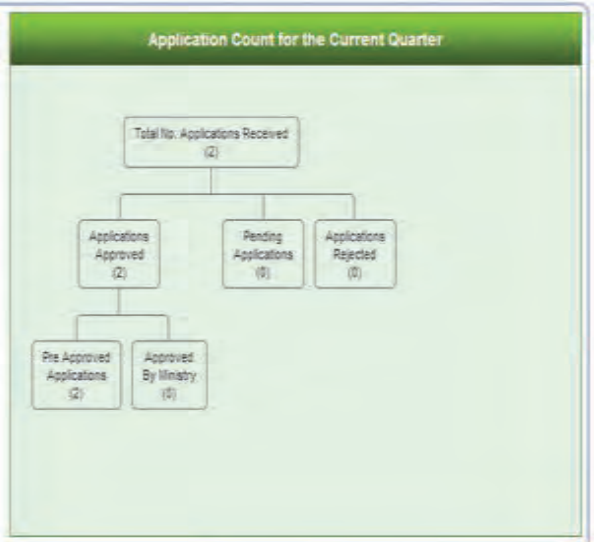
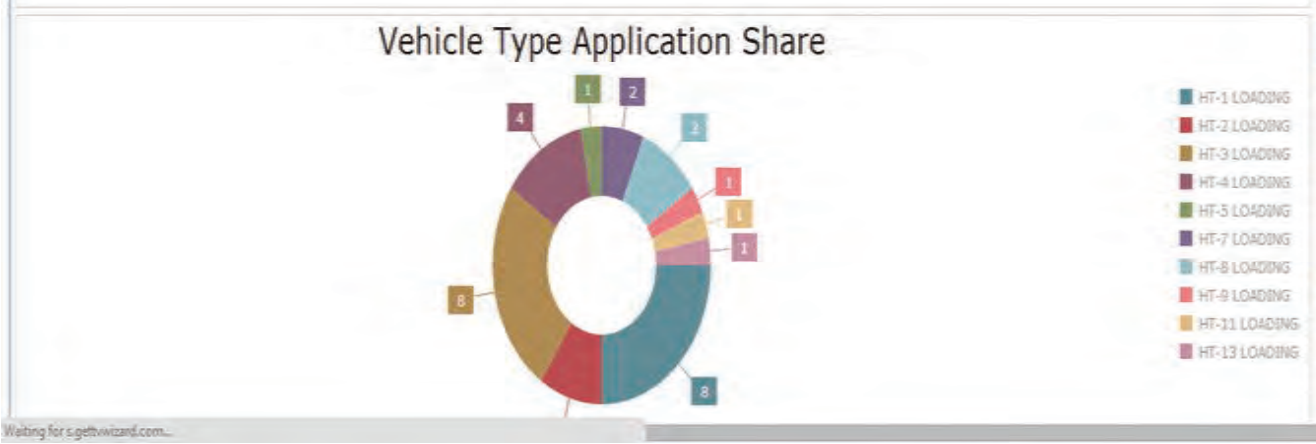
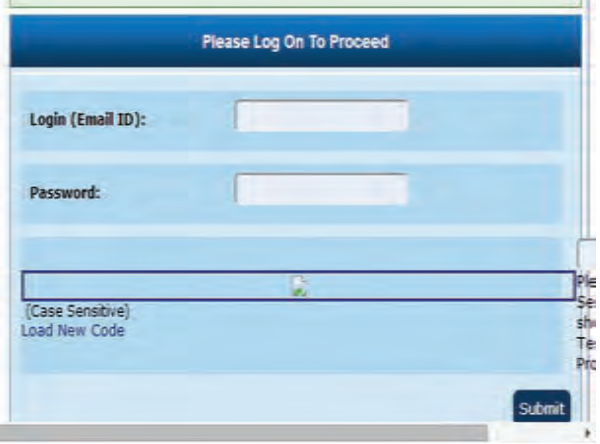
## OVER DIMENSIONAL/OVER WEIGHT CARGO MOVEMENT-ONLINE APPLICATION PROCESSING

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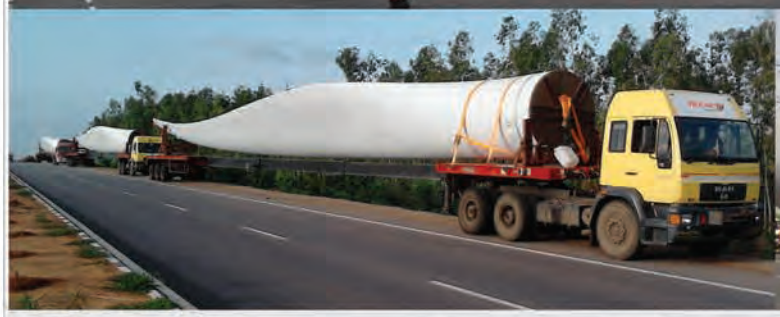


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# Big Cranes, needed or not??

Richard L Krabbendam
Heavy Lift Specialist & Founder - Krabbendam Advies Service

## History - Introduction

When I started my career in Heavy Transport & Lifting with Big Lift, back in 1973, we were very proud that we owned the biggest mobile Crane in Europe. It was the Gottwald MK500 truck crane, which was bought in 1968 by van Twist in Dordrecht, who was acquired by the Holland America Line in 1971 together with Van Der Laan Shipping & Trading and continued to operate under the new name "Big Lift". In 1968, when it was introduced, it was even the biggest crane in the world. With a max. lifting capacity of 350 tons at 6 m radius and 18 m boom length, and a lift capacity of 250 Tons with 18 m main boom and 8 m fly-jib at a radius of 10 m, it "only" had a load moment of 250x10= 2500 Ton-meter. It had a max. main boom of 101 m and with fly-jib combination of 83 m main boom and 75 m Fly-jib it's top sheave reached at a max height of 162 m. The weight of the 350 Tons main block was an impressive 6 Tons (see pictures Fig.1+2 below). What a difference with todays monster cranes like Mammoet's PTC DS-200, Sarens SGC-120 and ALE's SK350 and others. The ALE SK350 stands out with the biggest load moment of 350,000 ton-meter and a max. lift capacity of up to 5000 Tons!


Fig.1 the 350 tons Main block of the MK500


Fig.2 The Gottwald MK500 from 1968 lifting a 100 tons test load

## What will be the limit?

A question, we asked ourselves back in 1973, walking around the yard and looking at our big machines of those days. The question can be answered simply by saying: YES, we can built any type of crane, provided there is a market for it and that it can be operated economically. At first glance you would say: "How can such a big crane, which costs many millions of Dollars make any money?" As the mobilization, rigging and rental cost are high as well and in many cases also requires quite a large crane to help it to be put together. Look at it from a different perspective: What savings can be made when we use a much larger crane then originally planned? Lets take a simple example.

## Exchange of a Reactor and Regenerator Head at an Oil Refinery.

Typical weights for an Oil Refinery reactor are in the range of 200-400 Tons and a Regenerator Head with its Cyclones can be as heavy as 200-600 tons or more. This work could probably be done by using a large crawler- or truck crane in the range of 600-1000 tons and should be positioned as close a possible to the foundation of the reactor and regenerator. (See fig. 3 below). By positioning the crane as close as possible to the foundation and rigging the crane at that position, means that the plant must be shut down and all production comes to a halt. The revenue of a Refinery in full production can easily run in the half million dollars per day or even higher figures, so in case we can limit the "out of production time" the Refinery can save significant money. How can we limit the "Out of Production time"? Just by hiring in a significantly bigger crane, that can do the planned lifts from outside the Plant boundary. Such cranes are available nowadays and although the cost may run into the millions of Dollars, in the overall picture, you just need to compare the "Plant out of production time" against the extra cost of hiring in a much larger crane. By rigging the very large crane outside the plant boundary, the plant itself can stay in production and make money. Most of these large cranes have an A-frame boom design and are broken down in sections, within standard container sizes, so mobilization and demobilization can be done efficiently. The counter weights (up to 5000 Tons) are created by empty container size boxes, which can be filled on site with sand, ore or other heavy bulk material locally available.

Fig.3 The Mammoet PTC200-DS lifting a Pressure vessel

## Some Typical lifting capacities for these large Cranes

ALE owns and operates two of these large cranes, one is the SK190, with a max. load moment of 190,000 ton-meter and the biggest one is the ALE SK350 with a max. load moment of 354,000 ton meter. In the field this means the SK350 can lift a load of 525 Ton at an outreach of 108 m (based

on a ring diameter of 61.4 m with a 141 m main boom. The ALE SK350 is of a very particular design (in house development) in which the counterweight is positioned in the Center of the crane, with the boom slewing around this centrally positioned counter weight (in this case 4000 Tons). Why do I say outreach here, instead of radius? Normally the SK350 is only outfitted with that part of the ring structure, that is only covering the area, over which the crane needs to slew. (See Fig on following page). Outreach is now taken from the boom pivot point to the Center of the load. To convert outreach into radius, you need to add half the ring diameter to it. Which means, the crane can lift a load of 525 tons at a radius of 108 + 30.7 = 138.7 m, resulting in a load moment of 138.7 x 525 = 72,817 ton-meter. (The net available load moment is: 108 x 525 = 56,700 Ton meter) The SK350 can be outfitted with different ring diameters, hereby even increasing it's already significant lifting capacity. With a ring diameter of 98.4 m, the lifting capacity with a 141 m main boom is still 600 tons at an outreach of 108 m (= 157.2 m radius; equivalent to a load moment of 94,320 ton meter and a net load moment of 108 x 600 = 64,800 ton meter). The term outreach is in this

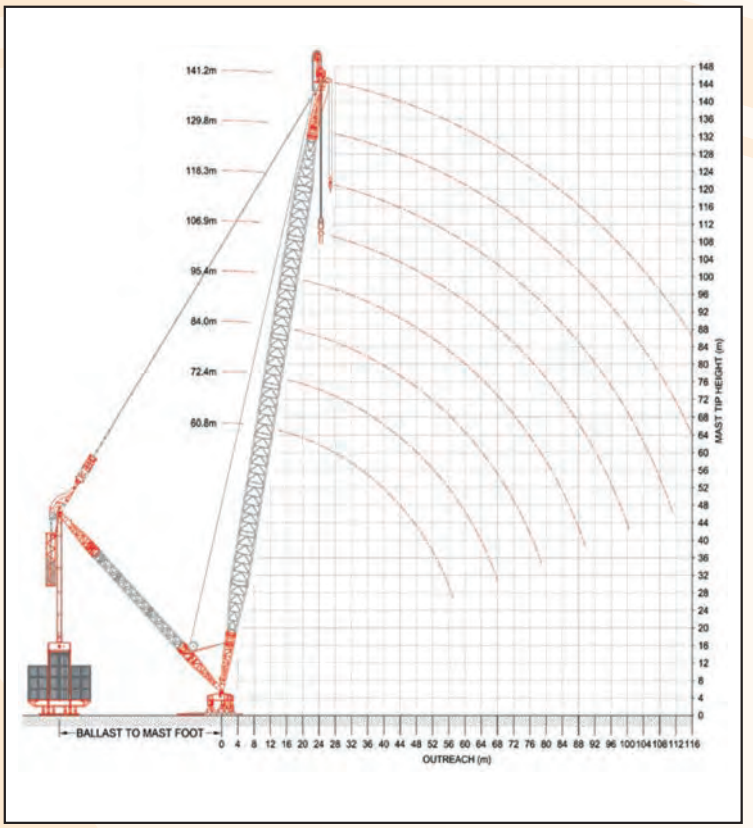


Fig.4 Side view of the ALE SK350 with 141 m main boom

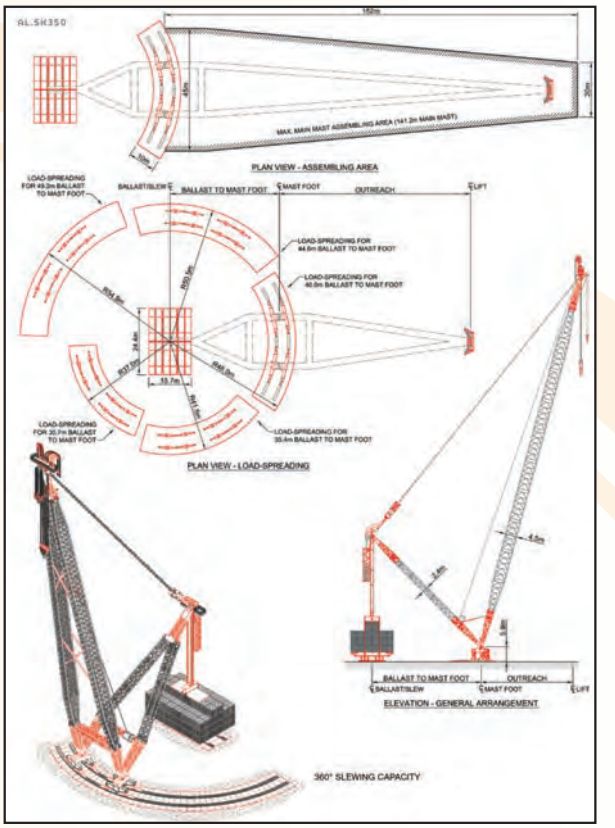


Fig.5 The counterweight of the SK350 is fixed in the Center of the Crane. Different ring diameters are possible

crane a better choice then radius, as the area within the ring is never useful. Typically on all these large cranes are the A-Frame shaped main booms, which obviously can absorb side loads a lot better then the single booms known in conventional truck- or crawler cranes.

## Mammoet's PTC200-DS and Sarens SGC120

Fig. 6 The ALE SK190 lifting a 2200 Tons Pressure vessel in Ruweis, UAE.

Let us now have a look at Mammoet's flagship the PTC200-DS (max. load moment of 200,000 ton meter). Mammoet owns and operates also two very large cranes (PTC140-DS and PTC200-DS) with this typical A-frame design, one with a load-moment of 140,000 ton meters and a max. load moment of 200,000 ton meters respectively. The Mammoet DS-200 is basically a full ringer crane, which original design was made by Huisman Equipment around an existing Demag CC4800 crawler crane back in 1996. With 3000

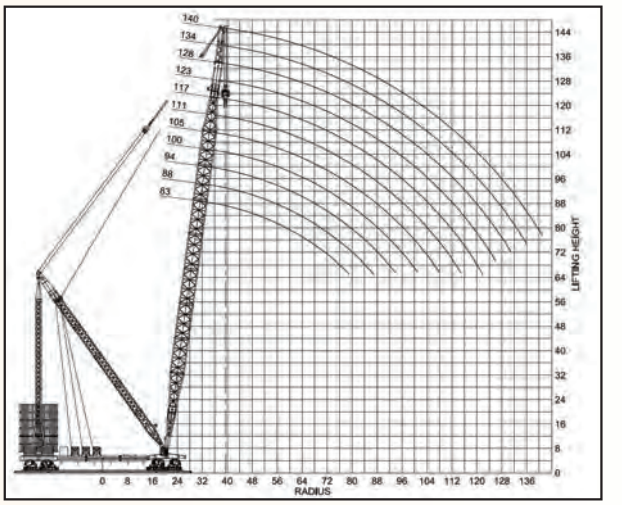


Fig.7 Side view of the Mammoet PTC200-DS with 140 m main boom

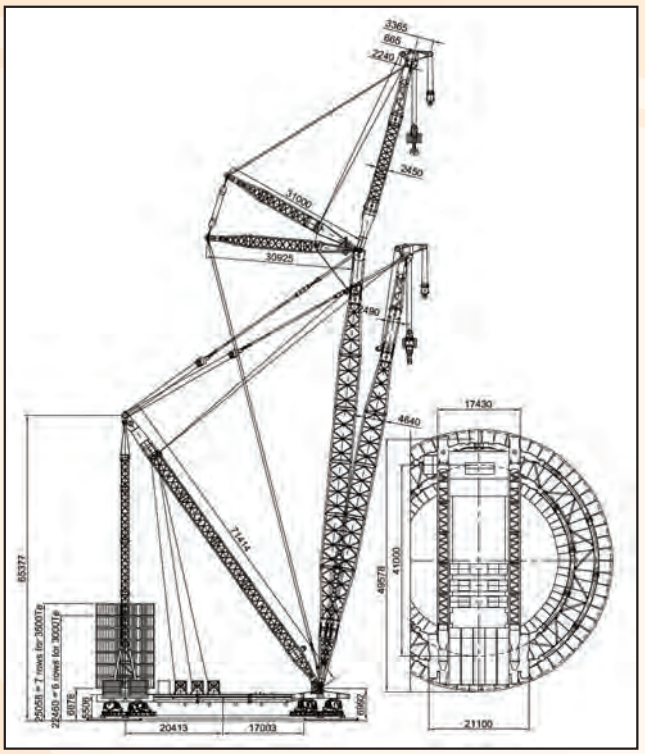


Fig.8 Side view of the Mammoet PTC200-DS

tons of counterweight rotating on the ring, with a ring diameter of 41 m and 140 m main boom the crane can lift a load of 405 tons at a radius of 141 m (equivalent to an outreach of 120.5 m or a load moment of 57,105 ton meter or net: 48,802 Ton meter). Also various ring diameter can be selected with the appropriate load chart. Still not as strong as the ALE SK350. Also Sarens has a large in house developed and built ringer crane based on an A-frame main boom on a ring with a diameter of 28,4 m with 3600 tons of counter weight. This crane the Sarens SGC120 has a max. load moment of 120,000 ton meters. The max main boom has a length 130 m and offers a lifting cap. of 536 Tons at 120 m radius (equivalent to an outreach of 105. 8 m and a load moment of 64,320 ton meter or net: 56,708 Ton meter). When outfitted with a main boom and fly-jib, the Sarens crane and can lift 307.5 Tons at 130 m radius, equivalent to 115.8 m outreach and 39,975 ton meter load moment or net: 35,608 Ton meter (with 130 m main boom + 89.5 m Fly-jib it reaches a hook height of 175 m!) The weight of the complete 30 sheave block is 102 Tons and must be added to the load being lifted. Each and every crane has its specific pro's and con's and carefully needs to be investigated for a particular application.

Fig.9 The SGC-120 lifting the dome of the Flamanville EPR reactor building, which weighs 260t and has a diameter of 43m.

## Pilot Projects Launched for Emergency Care of Road Accident Victims

The Minister of State for Road Transport and Highways, Shri Pon. Radhakrishnan informed the Rajya Sabha today that in order to give a boost to emergency care of the accident victims, pilot projects has been launched by the Ministry on Gurgaon - Jaipur section of NH 8, Mumbai – Vadodara of NH – 8 and Ranchi – Rargaon - Mahulia of NH 33 for providing cashless treatment to road accident victims for 48 hours at expenditure up to a limit of Rs. 30,000. GPS enabled ambulances, connected with a central control room through a toll-free number 1033, are stationed at distance of 20 km to transport the injured to the hospitals for treatment within the 'Golden Hour'. The Ministry of Road Transport and Highways, under the scheme "National Highways Accident Relief Service Scheme (NHARSS)" provides 10-ton cranes and small medium cranes for hilly areas and ambulances to States/ UTs for relief and rescue measures in the aftermath of accidents by way of evacuating road accident victim to nearest medical aid centre and for clearing the accident site. Their deployment is done by the respective State Governments/ UTs on National Highways on accident prone stretches, having an average distance of 50 Kms. Ambulances, Route Patrol Vehicles and Tow Away Cranes are also provided at an average length of 50 kilometer on NHs entrusted to NHAI. List of all Ambulances, Cranes & Route Patrol Vehicles along with their locations is available on NHAI website www.nhai.org

# Willing To Take Pro-active Steps To Realise 'Make In India'

## R. NARAYAN

For the first time in the history of independent India, we have a Government which has good governance and development as its priority. Our Honourable Prime Minister, Shri Narendra Modi has taken up the challenge of fast forwarding India into a modern economic power house. His initiative reflects the aspirations of millions of Indians to achieve full economic progress of the country, through changes in Government policy, Laws and Regulations.

HTOA, since its inception in the year 2007, has played a crucial role in the infrastructural development of the country by helping to bring about changes in the permission procedures for hydraulic trailer transportation. This has greatly helped in faster movement of heavy and over dimensional machinery required for power projects, refineries, oil exploration and drilling, metro projects, wind energy, petrochemical projects, nuclear power projects and all other industrial projects.

Evidently, the 'Make in India" vision of our Honourable Prime Minister can become a reality only if logistical bottlenecks are removed so that plant and

machinery can be delivered to project sites safely and within the shortest possible transit time. The losses arising from project delays and cost overruns is not only a National financial loss but is a direct disincentive for would-be investors .It must be appreciated that the new government has recognised these problems and are willing to take pro-active steps to realise the 'Make in India' goal.

## Members of the HTOA through their continuous efforts have made considerable progress in this regard:

- Brought about awareness within the Govt. about the role played by Heavy/Over-dimensional transporters
- Provided all the ODC transport operators a common platform to find solutions to their problems.
- Maintained continuous dialogue with the Govt. which has resulted in laying down proper procedures for safe movement of ODC/OWC cargo on hydraulic trailers.
- It has by and large removed arbitrariness from the process of issue of permissions for ODC transportation.

Needless to say this progress could not have been achieved without support of The Ministry of Road Transport and Highways and other stake holders.

A major milestone will be achieved on 6th January 2015, when the Honourable Union Minister for Transport and Highways, Shri Nitin Gadkari inaugurates the event of launching of MoRTH online web portal for granting permission of movement of ODC/OWC consignments on Hydraulic axles across pan India. This will help in getting quicker permissions for transportation of ODC consignments and speed up the construction of Industrial projects. However development of proper and hindrance-free roads, highways, waterways, coastal shipping and railways especially with regard to cargo movement is essential for rendering 'Make in India' an economically viable proposition.

Looking ahead, we must go beyond the current world standards in infrastructure development. The special requirements of ODC/OWC cargo must be taken into account while developing dedicated road and rail cargo corridors, inland waterways and coastal shipping facilities.

The Govt. needs to speed up the process of collecting data on existing bridges so that they can identify weak bridges and wherever possible replace them with stronger bridges. The current laws and rules need to be reviewed and changed to remove bottle necks in the movement of ODC/OWC cargo both by road and waterways.

Finally with the Govt. leading the way, all the stake holders should come together to make comprehensive changes in current rules and procedures which will bring about transparency, uniformity in interpretation of rules and time bound procedure for issue of movement permission.

# HTOA :

## A Collaborative platform for Hydraulic Trailer Operators

**Hrdraulic Trailer Owners Association (HTOA) was formed in the year 2007 (Registration Number: U74900MH2007NPL171944 / 2007-2008) under the Companies Act 1956. HTOA has been successful in representing the members through its Office Bearers and Board Members at various Government Departments and Clients to address the problems and serve the nation. The Association is a non-profit making body and works for the benefit of the members and in the interest of public with total commitment to work in a professional and efficient manner.**

### Objectives of HTOA:

**(A) THE MAIN OBJECTIVES OF THE ASSOCIATION TO BE PURSUED BY THE COMPANY ON ITS INCORPORATION ARE:**

To acquire and disseminate knowledge about the working of Hydraulic Trailer operations in different countries and induce the members to raise the standards of service to various core industries by issuing circulars, pamphlets and periodicals and similar such documents.

**(B) THE OBJECTS INCIDENTAL OR ANCILLARY TO THE ATTAINMENT OF THE MAIN OBJECTS ARE:**

To facilitate formulation of constructive policies for bringing about overall improvement in hydraulic axle operators / project transporters conditions all over India.

To collect, classify and circulate information relating to the hydraulic axle operators/project transporters among the members and/or to the public at large in order to highlight the progress and overall development of the project transportation all over India.

To communicate with concerned authorities / clients on problems raised by members regarding hydraulic trailer operations, seek clarifications and solutions to the problems confronting the interest of the members and disseminate the same among all concerned.

To organize Trade and Industrial Missions comprising of members, specialists and entrepreneurs both in India and abroad, to arrange meetings with the Foreign Trade and Industrial teams visiting India.

To formulate expert opinion on topical subjects and to submit wherever necessary recommendations to the concerned authorities and to render advice to the members

To render expert advice to the members from time to time on different problems and solutions thereto in connection with taxation and other legal matters.

To encourage, assist, guide and render specialized services in hydraulic trailer operation to small / large scale industries.

To act as an Information Centre, to collect literature, books, periodicals, magazines and other publications from all over the world, to disseminate factual information on all matters concerning business and industry, to establish and run a modern library for reference assistance and advantage of the members.

To publish books and brochures on subjects of topical interest and proceedings of seminars and conferences organized by the Hydraulic Trailer Owner's Association.

To act as a Centre for extending common facilities to the members.

To act as a centre of studies and research on subjects of interest to members.

To organize exhibitions and/or take up mass communication projects by means of news, letters, circulars, notices, newspapers, magazines, periodicals, cinemas, television, radio etc.

To promote the business of hydraulic trailer transportation.

To establish effective communication for supporting or opposing the policies of the Government in the interest of the Association.

To impart training and guidance to young persons

with a view to enabling them for employment in association members

To arrange facilities for books, guides, data and information, to conduct courses and to hold examinations in professional as well as vocational disciplines.

To establish or support or aid in the establishment and support of associations, institutions, funds and trusts calculated to benefit employees or ex-employees of the Association or their dependents and grant them pensions and other allowances.

To import upto-date scientific knowledge about the working of Hydraulic Trailers and make available the result of scientific research carried on in other countries about the use of fuel, lubricants etc.

To represent to the Government or other authorities for the construction, maintenance and improvement of motorable roads in the country in achieving the objects of the Association.

To represent to the Government for the construction of bridges, waiting rooms, parking places and other structures tending to assist the convenience or development of the transportation of any kind.

To discuss, support, oppose any legislative or executive measures by all legitimate and constitutional means which affect or are likely to affect the Hydraulic Trailer Trade.

To guard and defend all lawful and legitimate rights and privileges.

To take up, consider, discuss and put forward the view points of the Hydraulic Trailer operational trade on any question generally affecting the trade by organizing, promoting, attending conferences, organizing lectures and other useful function.

To arbitrate dispute, among its members where its assistance in that matter is sought.

To arbitrate disputes inter se amongst members and their clients where assistance in that matter is sought and to secure services of experts, technical and other experienced persons as expedient.

To cater for the social and economic welfare of its members.

To consider all matters affecting the hydraulic trailer transportation business.

To fix and maintain a standard level of Road Freights for different stations operated by hydraulic trailer operators and to take necessary steps to stabilize rates and eliminate under bidding, under quoting and unhealthy competition.

To device ways and means for realization by its member moneys due to them in the said trade or business and assisting them in all possible ways for this purpose.

To become members of other trade organizations like those engaged in the Transport trade, Chambers of Commerce, and other such organizations, which are devoting their attention towards the welfare of hydraulic trailer operation for the mutual benefit of the hydraulic trailer operators.

To carry on propaganda in the press by contributing articles or advertising Cinema slides, posters, Hand Bills to popularize hydraulic trailer operation and to publish official organ or organs if deemed necessary.

To represent officially the views of the hydraulic trailer operation to Government of India, State Government or other suitable authorities, local Chambers of Commerce, Trade Association or any other public or private bodies and to nominate representatives to serve on the Committee appointed by the Government or Legislative Bodies of some other agency.

To take up such steps by personal or written appeals, public meetings, or otherwise as may from time to time be deemed expedient for the purpose of procuring contributions to the funds of the Association in the shape of Donations from members and non-members subscriptions and admission fee or otherwise.

To affiliate such other Unions or other Associations, Companies or Corporations whose aims and objects of the Association, movable or immovable property and construct, and maintain, vary or alter any building or works necessary or convenient for the purpose of the Association.

To purchase, take on lease, or hire or otherwise to acquire as a gift for any one or more other objects of the Association, movable or immovable property construct and maintain, vary or alter any building or work necessary or convenient for the purpose of the Association.

To facilitate collection, or help to collect, debts due to members from their constituent.

To act as Trustee(s) for persons indebted to the members and others and to make arrangements for securing of such debts by installments or otherwise to take a security therefore in the name of the Association to enforce such security whenever and

wherever necessary.

To charge fees, either lump sum or, on percentage basis, as may be fixed, for services rendered to the members and others.

To draw, accept, endorse cheques, bills, hundies, notices or other negotiable instruments and to operate on the accounts of the Association with any bank or bankers.

To sell, manage, lease, mortgage, dispose of or otherwise deal with all or any part of the property of the Association.

To provide and maintain a General Fund to be raised by any means (by levying monthly subscription) and also at such rates as may be desired by the Association in General meeting and to utilize the General Fund.

To invest any money of the Association not immediately required for any of its objects, in such a manner as may from time to time be determined.

To subscribe to any local or other charities and to grant donations for any public purpose and to provide super annuation funds for the servants of the Association and otherwise to assist any such servants, their widows and children.

To secure and obtain from any Government, Municipal, local or Railway authorities or public Body or Bodies or industrial concerns and manufacturer and powers, rights, privileges, licences or concession, which the Association may think fit for the benefit of the members of the Association.

To provide for and grant scholarships for studies, inland and overseas or otherwise to the dependents of the members and for their employees on such terms and conditions as may be deemed fit from time to time.

PROVIDED that the objects set forth in the several paragraphs of this clause shall have the wildest possible construction and that the objects specified in each paragraph of this clause shall, except, when otherwise expressed in such paragraphs; be independent of the main object and shall be no way limited or restricted by reference to or inference from, that PROVIDED FURTHER that the Association Company shall not support with its funds or endeavour to impose on or procure to be observed by its members other any regulations would make it a trade union.

To undertake and execute any trust or agency business which may seem directly or indirectly conducive to any of the objects Association. The object of the Association extend to the whole of India.

The income and property of the Association wherever derived, shall be applied solely for the promotion of its objects as set forth in this memorandum.

To establish and support and to aid in establishment and support of any other Association formed for all or any of the objects of the Association.

To transfer all or any part of the property, assets, liabilities and engagements of this Association to any one or more Companies, institutions, Societies or Associations with which this Association is authorized to amalgamate.

To purchase otherwise acquire and undertake all or any part of the property, assets, liabilities and engagements of any one or more of the Companies, Institutions, Societies or Associations with which this Association is authorized to amalgamate.

To frame bye-laws, rules and regulations for the conduct of the Officers and staff in order to carry out the various objects of the Association.

To nominate representatives of the Association to the various Government and similar bodies and or Chambers of Commerce including similar bodies.

Provided that the association shall not support its funds or endeavour to impose on or procure to be observed by its members or any other delegations or restrictions which, if any object of the company would make in trade union.

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# Design of Project Cargo Logistics Network: An Eco-system Framework

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In this paper, we develop an ecosystem for project logistics. Systems engineering study of Heavy Cargo logistics is an important subject but not given enough attention in the academic world. Project logistics is a term used to broadly describe the national or international transportation of large, heavy, high value or a critical (to the project they are intended for) pieces of equipment. It is important for infrastructure building, power generation, manufacturing companies and in many other applications. Each application is unique and has its own challenges. Here we develop a frame work that is applicable to Project Cargo logistics. Using this ecosystem framework, we study the execution, innovations, risks and the Governance issues in heavy cargo projects. Finally, we consider the project cargo logistics network design.

## Introduction to Project Logistics

One of the realities of the globalized world is the need to transport valuable raw materials, components and modular assemblies and manufacturing equipment , Capital goods over great distances. In the manufacturing supply chain networks, inbound logistics generally involves the transport of low weight, high value components to the manufacturers. However, moving large, heavy and expensive equipment—frequently with great difficulty and at great expense across countries is important for manufacturing companies, in contexts such as opening a new facility overseas or selling manufacturing equipment to a foreign firm. The Indian Government's focus on issues such as infrastructure development, making India a global manufacturing hub, creating energy security, etc, will simultaneously fuel growth and also create demand for Project Cargo logistics activity. Heavy engineering and capital equipment movements for energy, mining and infrastructure projects, construction, railway – metro projects have to be done efficiently. Given the fact that the products are heavy (cargo weight from 50T to 800T to be moved on Indian Road), and are of awkward sizes and shapes with sharp metallic edges, safe and secure transport requires good packaging, on the site material coordination, lift management and

information coordination and management across partners. Turbines, reactors, stators, ammonica converter, CO2 splitter , boilers, transformers, manufacturing machinery, statues of legendary people, etc are examples of heavy loads that are frequently moved.

In the following sections, we define the term global project logistics network and develop a framework based on the project cargo ecosystem that can address the performance, risk and Governance issues.

## Global Project Logistics Landscape

The cargo logistics service chain starts with the shipper approaching the logistics company for transporting the heavy weight and over sized cargo. This is followed by freight weight, volume and price estimates, documentation, permissions and approvals, risk analysis and insurance requirements. The multimodal transport route to the destination is to be mapped, the rail or road route need to be selected, the packaging, loading and unloading processes need to be designed, the skilled manpower need to be made avaialble at various points in the route. In land route involving road or train, it is essential to map the route with trees, on the canal or overhead bridges, high voltage power lines, etc. The assets that are needed in additions transport vehicles such as Moduler hydraulic axle trailer, cranes, Jack, Gantry and other equipments need to be acquired. Preloading documents, cargo export documents, permissions, letter of credit, insurance, details of equipment delivery at the destination including unloading and installation, etc need to be checked. When the cargo reaches the destination, the unloading operation needs to be carefully planned with coordination from multiple agencies. The cargo can be IOT enabled so that the machines and its parts can talk to each other and can send messages to the stake holders during loading, transport and unloading.

The Odd dimesnon cargo and Over weight cargo logistics shipments are subjected complex safety and trade regulations. These are constantly changing and are different for each nation. Compliance is not optional and non-compliance involves fines and shipment delays. Each project delivery takes several days to weeks and requires complex paper based documentation requiring dozens of approvals from regulatory authorities. In case of international transport trade compliance can involves 50-100 supporting documents which are paper based. Often resubmission of documentation becomes necessary because of loss or misplacing of the documents.

## Governance of the Global Project Cargo management

Indian companies are yet to reach scale and footprint in managing Global Project management . Some of the Large multinational companies like DHL, Panalpina, Geodis, Schenker, K+N with their Global presence and alignemnt with local expert partner are able to orcestrate Global project cargo management .

In last 10 years, many Networking plateform like GPLN, Proejct Cargo Network (PCN), Cargo Equipment Experts (CEE) , WWPC are providing network to independent companies specializing in international projects movements by air, sea and land as well as cranes and lifts and the customized handling of oversized, out-of-gauge and heavy lift cargo. These network partners provide them global access.

The end customer is need management of Global sourcing of all type of goods from small parcel to heavy equipment of more than 800T single piece, the expactation from logsitics solution provider is to provide seamless movement of cargo, documents and infirmation as per project schedule.

The Global heavy transport networks are often “reliant on thousands of independent suppliers and partners located in many countries”. Each of the companies has their own focus and an information intensive orchestrator can take the governance role. The orchestrators know their stake holder's supply chains in great detail. They collect and share the information as required for delivering a requested logistic service.

The governace model of global project logsitics company is based on how efficuantly they play the role of orchestrator and move goods, docments and

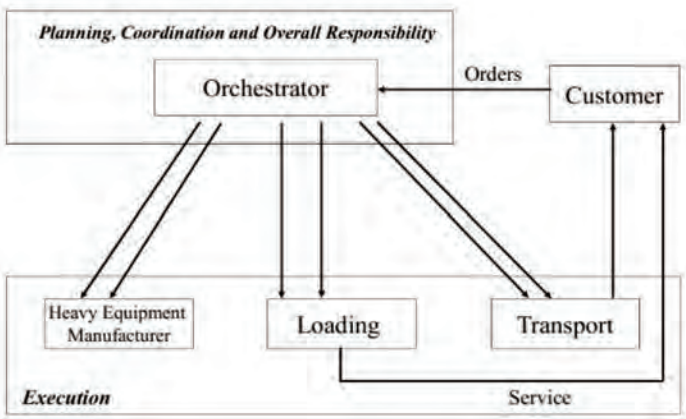


Figure1: Orchestrator Governance model for Project Logistics

infirmation from point of origin to the plant or consumption location.

A well defined Governance structure has the following features:

- Identifies functions relating to government, trade, social groups, labour, resources and heavy weight cargo delivery mechanisms
- Allocates the tasks and responsibilities to stakeholder organizations
- Builds systems for effective communication, coordination, and integration of effort in both the horizontal and vertical directions.
- Manages a control room for monitoring and execution of the planned activities in timely and efficient manner under normal as well severe conditions.

For goal-directed organizational networks such as the project logistics networks with a distinct identity, governance is necessary to ensure that participants engage in collective and mutually supportive action, that conflict is addressed, and that network resources are acquired and utilized efficiently and effectively. For each project cargo order, a separate logistics chain is formed. The governance model consists of three steps.

Step1: Partner selection based on structural features such as asset specificity and capabilities and also the social network with the Government and other partners, etc.)

Step2: Coordination: Determines who does what and when and communicating to everyone

Step3: Execution: Monitor order status so that processes work as per plan & control exceptional events

Orchestration is a popular governance model in several globally distributed manufacturing and service networks. There are several successful examples in several industry verticals.

## Project Logistics Service Providers

There are several International logistics companies providing transport of heavy equipment in the country. They include Lift & Shift, Boxco, Allcargo logistics, Globe Ecologistics, Nabros Transport, Procam Logistics, Lemuir, Premier Trasnport, Kataria Carriers in addition to the Global Project forwarding players such as FH Bertling, Geodis, DHL, Agility, Kuehne & Nagel, Panalpina, and several others. The current Indian Project cargo market ( both ODC & Non ODC project cargo) is estimated to be around $14 Billion and is expected to grow up to $40B in the next five years. Although logistics is performed mainly by private operators, its performance of the whole depends on such government interventions as infrastructure, customs and cross-border trade facilitation, etc.

## The project Cargo Ecosystem

The ecosystem framework for any supply chain or service chain is introduced in [1] categorizes the various entities under the following four major categories:

1. Project Logistics service chain
2. Government, Social and Business Institutions
3. Resources: including Human, Natural, Financial and Industrial
4. Delivery Service infrastructure

The items 2-4 together are termed as Investment climate and are determined by the political, economic, resources such as water, power and finance, logistical and IT infrastructure, human resources, trade regulations and industry clusters. For services growth and also to attract foreign direct investment it is

important to have the proper investment climate. Figure 1 shows the ecosystem for project logistics services. This is valid for any country and gives a one page view of all factors that makes the international logistics work.

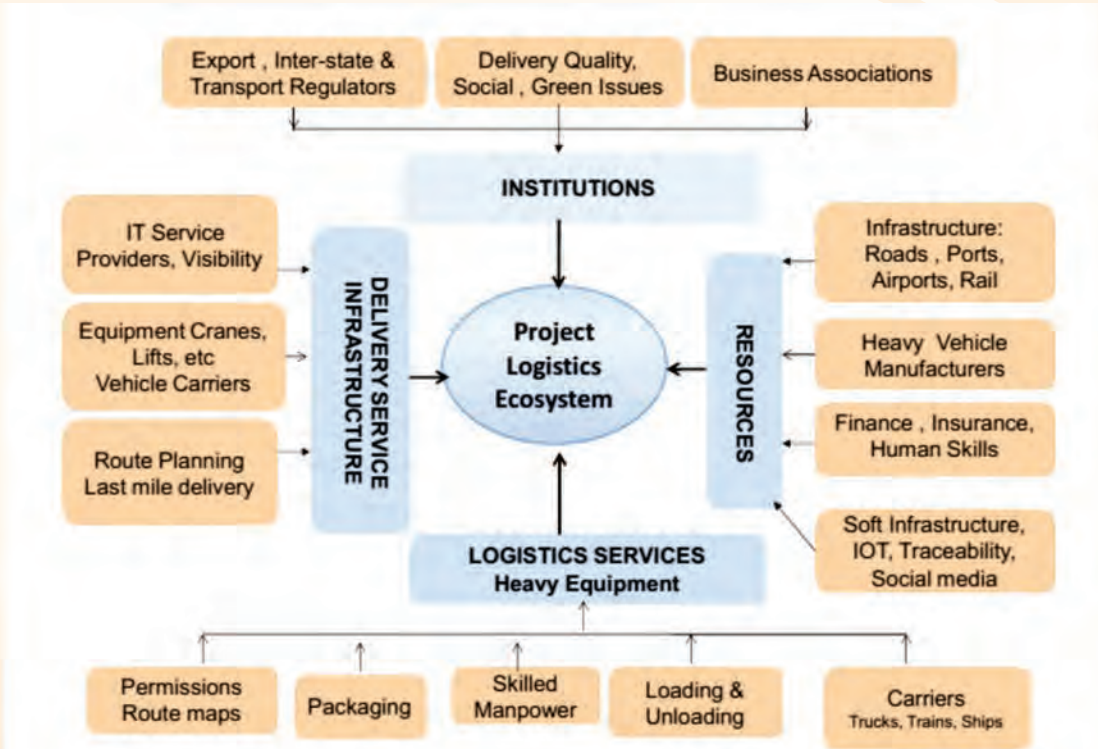


Figure 2: The Project Logistics Ecosystem

The Ecosystem shows all the actors influencing the effectiveness and efficiency of the project logistics function. The Institutions play a significant role while the freight is crossing the borders. The port and airport infrastructure the availability of the software and other logistics players also are factors for the efficient functioning of the heavy cargo logistics. The project logistics function is executed by a group of logistics players based on the competency, assets ownership, special equipment availability and coordinated by the project logistics orchestrator. The above ecosystem framework can be used for the design of the project logistics network.

The MakeinIndia vision and Digitization initiative of India will be create oprtunity and space for many project cargo and heavy haulers but unlike general forwarding business which is network based business model, the project cargo business is equipment and skill based business model and therefore Project Logistic Eco system is depended on role of Institution (i.e the Implementation of policies by Regulator and Infrastructure availability) . The technology and heavy haulage engineering is key to successful execution of any project cargo movement.

## Risks in Project Logistics

Because of the interconnected nature, global heavy transport networks are often "reliant on thousands of independent suppliers and partners located in many countries". Consequently, they affect and are affected by risks at various stages, from the source of cargo to the destination, and these risks are not always within the confines of the company's control. Risk management is one of the key issues during the planning oversized goods safe transportation. Fiscal policy (tariffs – the charges rates for using transport infrastructure, permission getting procedures, routing coordination procedures, and decision–making regulation) influences choice of transportation mode and load transportation route. Resource risks include factors such as wrong selection of transportation mode and loading methods, lack of

skilled manpower, infrastructure deficit in ports, storage, etc. Other risks include breakdown of power, water, labour strikes, failure of it infrastructure due to network, hardware or software failures or virus attacks, or natural disasters leading to the inability to coordinate operations, supply chain visibility failure and lack of execution or governance mechanism.

Companies doing business on an international scale must assume that disasters will occur, even if the probability of their occurrence is low. In a connected world, causality is not linear but net-like; even small risks can have unpredictable impact on the cargo delivery. Design of resilient project logistics networks is an important topic and should be given attention. We propose mitigating the risk using order based Governance which involves: partner selection, coordination and monitoring and execution. Here, for each order, based on the state of the ecosystem elements, the orchestrator selects the logistics partners to minimize the risk before the order completion.

## Recent Technological Innovations in Project Logistics

Technology has brought several innovations into logistics. There are several new innovations happening in logistics due to developments such as Industry 4.0 and Industrial Internet. Also, the rise of social media such as face book, Twitter, Google circles etc, mobile phones and cloud computing have affected the logistics industry tremendously. The route survey and feasibility study is being done with the help of Google maps , 3D photo , status of bridges and structure provide advance information about the potential bottlenecks on the route. Also, there are several recent developments in the Internet of things and augmented realty, which improve the efficiency of the logistics operations. The developments in Internet of things in particular, sensors for monitoring the health of equipment in critical network industries such as power and airline transport is changing the maintenance process from scheduled to predictive maintenance.

Several innovations happening in the inbound logistics arena can be easily adapted to project logistics. Vehicle tracking and dispatch keeps track of the location and inventory on every vehicle. Google maps, traffic density figures, mishaps and accident figures can be used to generate the most efficient routes for transporting heavy goods. Generation of routes and manifests for the trucks is dynamically based on their inventory loads and tracking and monitoring the delivery. Large cargo firms can add data from new sensors—monitoring fuel levels, cargo location and condition, driver behaviour, etc. to its route optimization algorithms. The goal is to improve the efficiency of the company's route network, to lower the cost of fuel, and to decrease the risk of accidents. Project logistics companies can process numerical, text, voice, past records of delivery of heavy loads thorough, a BPO or Control tower.

Augmented reality (AR) can assist in loading, unloading, assembly and disassembly heavy loads. An AR-equipped collector could quickly glance at the load to check if all subassemblies are present. Currently, this is a manual error prone process. In the future, a wearable AR device could use a combination of scanners and 3D depth sensors to do this job. This measurement is compared to predefined values and the result – hopefully a match – will be displayed to the

collector. This AR system could also scan items to detect any damage or faults. Simulation can be used for disassembly and reassembly

Social media is used as a tool to listen to, and engage with experts or management. The transporter can post status on bringing clients and employees together into a virtual conversation in case of accidents, delays or other unusual situations. Supply chain reliability is a major concern for traders, logistics providers and Governments.

## Innovations in Project Logistics

There are several new to the market innovations followed in other verticals can be adapted in project logistics. A fundamental outlook change should be to combine design of heavy equipment, manufacture, project logistics and installation as a smart project logistics service. We mention a few of the other innovations possible in the four elements of the ecosystem.

*Project Logistics Service Innovation:* ICT enabled customs clearance, online permission for heavy transport, sensor networks for visibility, Design of heavy equipment for efficient project logistics

Institutions: Project logistics designs taking into account regulations such as Green, VAT, new government agenda on manufacturing and SEZs and FDI

*Delivery Services Infrastructure:* The development of smart project logistics using IOT, GPS, data integration and mining, remote monitoring and innovative governance models such as orchestration service providers

*Resources:* Smart Heavy trucks, Insurance and finance, University research on Project Logistics and Sensor networks

These innovations can improve the performance and reduce the risks of the project logistics network

## The Global Project Logistics Network Design

In the previous sections, we have presented the ecosystem map, various network partners (including manufacturing, logistics & IT), risks that the ecosystem faces, and finally the innovations needed to make it big in the industry. We also discussed the Governance model for coordination of various agencies involved in the freight transfer. Developing ICT based communication and coordination system for efficient performance of the project cargo network taking into account the possible innovations that mitigate the risks is the need of the hour. We hope to develop some cases to show case our methodology

## Conclusions

The project logistics is an important activity for emerging markets such as India since it involves transfer of heavy equipment needed for power plants, manufacturing companies and other infrastructure projects. We have developed a framework for project logistics which is helpful for risk identification and mitigation, innovation identification and development and finally governance of the end to end pickup to delivery of heavy cargo. We can use transaction cost analysis to find the total delivery cost. Also, one can formulate and solve the relevant optimization problems for route selection, partner selection using MIP or AHP or any other standard methods. Also if adequate data is available, one can solve these problems using data mining and machine learning techniques. Hopefully this paper will trigger some academic research,

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# Meghdoot Roadlines

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# Bridges in India: An Analytical Study

## ANALYTICAL STUDY OF ADEQUACY OF THE EXISTING BRIDGES TO CARRY OVER-WEIGHT VEHICLES USING MULTI-AXLE HYDRAULIC TRAILERS


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## Abstract

With the increase in demand for infrastructural growth, nuclear, hydro-electrical and thermal power plants in particular are planned in different parts of India. This has led to transportation of Over-Weight Consignments (OWC) carrying stator units, turbines and other Heavy Equipments from the factory/port to the project sites having Gross Vehicle Weights (GVW) ranging between 100 ton to 600 tons. These OWC's are required to be transported through existing roads and bridges, which are originally designed for standard Indian Road Congress (IRC) loadings. For carrying such OWC the world wide trend is to adopt hydraulic multi-axle trailers, which ensures equal distribution of load on all axles.


This paper presents a method, for comparing the effects of OWC and IRC design load vehicles for a select few types of simply supported bridges, which eventually formed the basis for issuance of a guideline for passage of OWC on existing bridges by Ministry of Road Transport & Highways (MORT&H) vide their circular no. RW/NH-35072/1/2010 S&R(B) dated 24th January 2013. The presented method is robust, reliable and a simple tool for checking of the existing bridges for passage of OWC. This methodology can be principally extended for all types of bridges, including curved, continuous, or skewed types. The authors represent the four consultants who jointly conducted this study.

## I. Introduction

Indian economy is all set to move rapidly forward. This will propel the growth in various sectors of infrastructure like roads, ports and power etc. With the increase in demand for infrastructural growth, nuclear, hydroelectric and thermal power plants are planned in a big way in different parts of the country. This has led to increased frequency of transportation of Over-Weight Consignments (OWC), carrying heavy equipment from the factory/port to the project sites.

OWC carrying vehicles require permits from multiple authorities (e,g. PWD/Transport Authority/ Municipal Corporation / Railways / NHAI) to reach their destination. The process of taking such approvals is time consuming and leads to considerable delays in transportation process. Also the transporter needs to find out the most optimum corridor for carrying the OWC vehicle from a given origin to the destination, which usually includes the evaluation of the capacity of existing flock of bridges on all possible routes. This entire process of selection of optimum route and getting permit from the authorities is extremely lengthy and time consuming. In order to smoothen the process of approval by the authorities, MORT&H took the initiative to carry out a generic study of Superstructure of existing flock of simply supported right bridges for safety during passage of OWC. This desk-study has been carried out by a group of Consultants under sponsorship of M/S Hydraulic Trailer's Owners Association (HTOA), for checking of adequacy of superstructure of these bridges to carry the OWC.

The study is based on basic data such as the axle arrangement, spacing of Hydraulic Trailer & Puller Tractor as provided by M/s HTOA, which represents broadly the entire spectrum of multi-axle hydraulic trailer vehicles in operation in the country at the moment.

## II. Study Objectives, Scope & Assumptions

### The major study objectives are as follows:-

a) To assess the adequacy of the identified span/superstructure arrangement for carrying the OWC's multi axle hydraulic trailers.

b) To prepare guidelines regarding the maximum number of multi axles hydraulic trailer units that can be permitted for a given type of consignment, span, superstructure type and deck configuration.

c) To facilitate the transporters of OWC in planning the route/s as well as the vehicle type for shipment of their consignments.

d) To enable the regulatory authorities to arrive at quick decision for regulating the safe passage of such OWC's.

## The scope of the study is as under:

a) 8 types of Superstructure considered for study (Refer Table 1). The span lengths considered for each type of superstructure are those that are generally accepted as appropriate for the identified span range, based on sound engineering practices.

b) 13 types of vehicles comprising of Multi Axle Hydraulic Trailer along with their Puller Tractor with Gross Vehicle Weight (GVW) ranging from 97 Tonnes to 601 Tonnes considered as per the data supplied by HTOA. These Hydraulic Trailers (HT) vehicles can be categorized in 3 distinct types (Refer Table 2). Load composition with their gross vehicle weight for these three Categories of HT loading is elaborated in Figures 1 to 3. Load on each trailer axle has been taken as 18 tonnes.

c) Three types of standard IRC loadings considered as given below. The applicability of these IRC loads and their combinations shall be as per Table: 2 of IRC: 6 based on the carriageway width for the present study.

- IRC Class – A
- IRC Class – 70R Wheeled
- IRC Class – AA Tracked

d) Five types of carriageway configuration considered for the purpose of study as given below:

i. Two lane single carriageway (C'way Type-1)

ii. Three lane single carriageway (C'way Type-2).

iii. Two lane dual carriageway with or without transverse structural discontinuity (C'way Type-3).

iv. Three lane dual carriageway with or without transverse structural discontinuity (C'way Type-4).

v. Four lane dual carriageway with or without transverse structural discontinuity (C'way Type-5).

## Table 1 : Types of Superstructures Considered for Study

| S. No. | Type of Superstructure | Span Lengths (m) |
|---|---|---|
| 1 | Culverts | Up to 6.0 |
| 2 | Masonry Arch Bridges | 5,10,15 |
| 3 | RCC Solid Slab / Voided Slab type bridges | 10,15,20,25 |
| 4 | RCC Girder type bridges | 10,15,20,25 |
| 5 | Cast-in –situ/Precast PSC T-Girder Composite with In situ Deck type bridges | 15,20,25,30,35 |
| 6 | Cast-in-situ PSC Box Girder type bridges | 20,25,30,35,40 |
| 7 | Precast Segmental Box Girder Superstructures | 30,35,40,45,50 |
| 8 | Steel Concrete Composite Decks with I-Girders | 30,35,40,45,50 |

## Table 2 : Type of Hydraulic Trailers

| Sl. No. | Vehicle Type | Axle Arrangement | Gross Vehicle Weight (*) |
|---|---|---|---|
| 1 | HT1 to HT9<br>(Single Trailer unit) | Trailer Unit carrying 4 to 20 axles for HT1 to HT9 respectively | 97 to 385 tonnes |
| 2 | HT10 to HT11<br>(Twin Trailers with Turn Table Bolster) | (8+8) & (10+10) axle Trailer units for HT10 & HT11 respectively | 313 to 385 tonnes |
| 3 | HT12 to HT13<br>(Twin Multi-Axle Trailer with Girder Arrangement) | (14+14) & (16+16) axle Trailer units for HT10 & HT11 respectively | 529 to 601 tonnes |

(*) Gross Vehicle Weight includes Puller Weight of 25 Tonnes

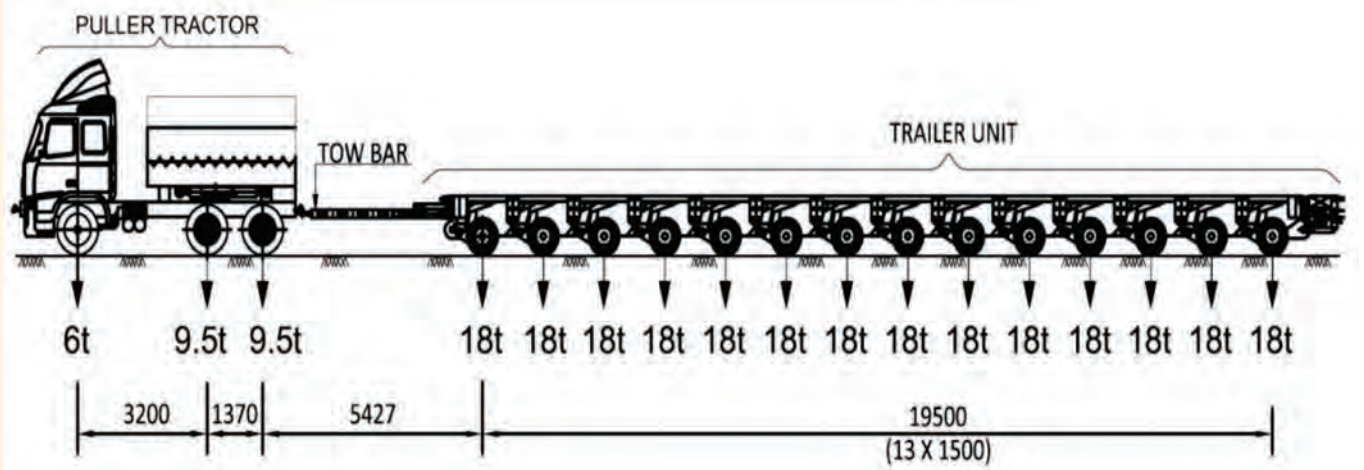



Figure 1: Vehicle Type HT6 (Typical for Vehicle Type HT1 to HT9)

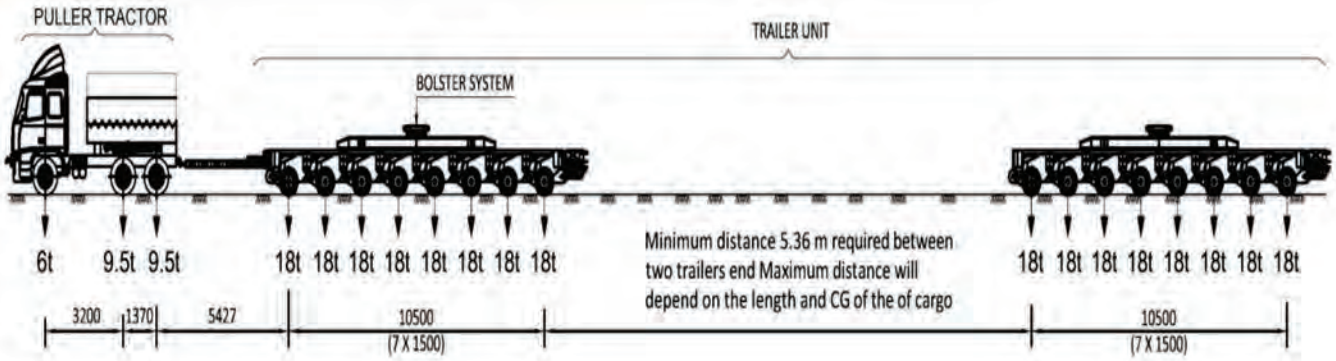



Figure 1: Vehicle Type HT6 (Typical for Vehicle Type HT1 to HT9)

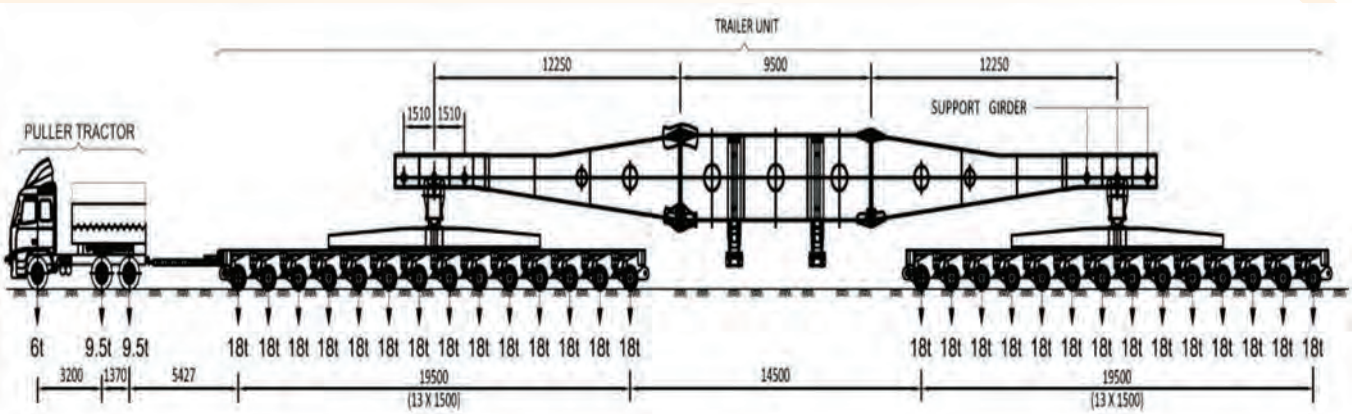



Figure 3: Vehicle Type HT12 (Typical for Vehicle Type HT12 to HT13)

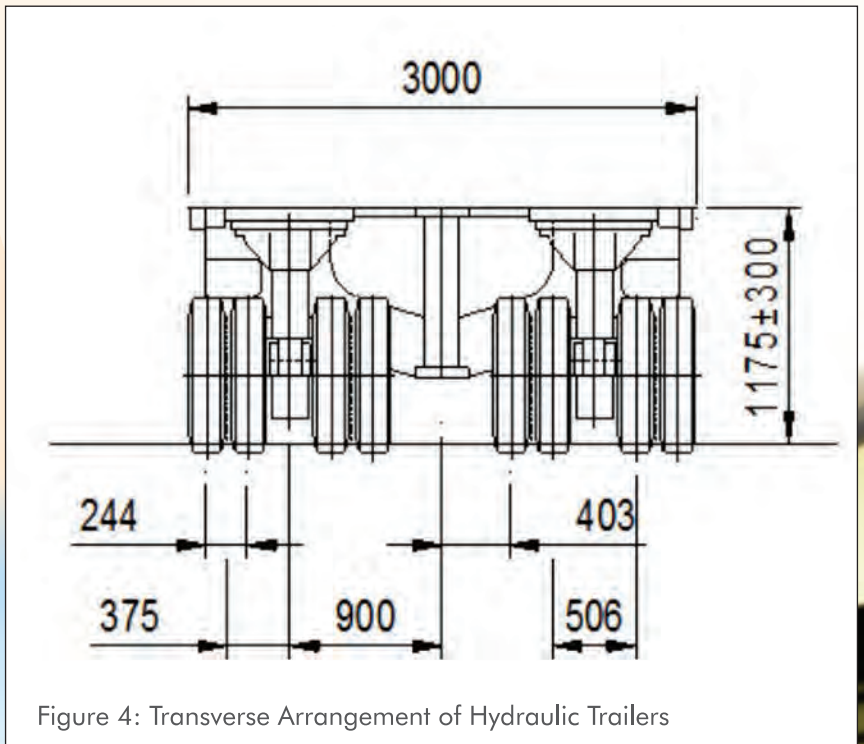



Figure 4: Transverse Arrangement of Hydraulic Trailers

## The study is carried out with the following assumptions:

a) Recommendations of the study are broadly conforming to IRC: SP: 37-2010, and limited to span lengths ranging from 5m to 50m at intervals of 5m. The spirit of IRC SP:37 is that the passage of OWC over the bridge is of infrequent occurrence and that occasional limited overstressing beyond stipulated codal limits would not cause any permanent effects or fatigue.

b) Wherever IRC: SP:37-2010 is found wanting, reference is made to other literatures and sound engineering practice

c) Bridge under consideration is in 'good' condition and capable of carrying present IRC loads (i.e., Class A, Class AA and Class 70 R) as per IRC: 6-2010. It is mandatory that the condition survey will be carried out by a competent Bridge Engineer to ascertain this, prior to passing OWC over the bridge.

d) If the load effects on the superstructure arising out of OWC loading are lower than load effects due to the IRC loading (duly enhanced to account for over stressing, in conformity with provisions of IRC:SP:37) then the bridge can be considered as safe for the former loads.

e) No dynamic impact is considered during the movement of OWC loading while assessing the design forces on the bridge. The speed of crossing of such loading on bridge is limited to 5 kmph with special precautions of avoiding application of brakes, Braking / Acceleration on the bridge and in no case the vehicle shall be stationed over the structure.

f) Only single lane of OWC will be allowed on the bridge at any given time. No other vehicle shall move on any part of the carriageway/s when this trailer is crossing the bridge. In addition, overstressing of material to the tune of 25% to 33% is permitted while checking the adequacy during the passage of OWC loading.

g) The action of wind, earthquake, and floods acting independently / simultaneously during the transportation of the OWCs is not considered.

h) The study and its recommendations are only applicable for existing flock of bridges, designed based on working stress principles, as per the codes that existed prior to 2011. They are not applicable for bridges designed as per the limit state code specified in IRC:-6-2010 and IRC-112-2011.

i) The study is not applicable for existing bridges which are evaluated and/or rated below the critical design IRC loading of class A, Class AA and Class 70 R (Wheeled or Tracked)

j) The OWC must ply at the center of the deck with a maximum tolerance of 300mm in single carriageway bridges and close to the median on bridges with no longitudinal separation of the structure for dual carriageways bridges.

## III. Methodology for Study

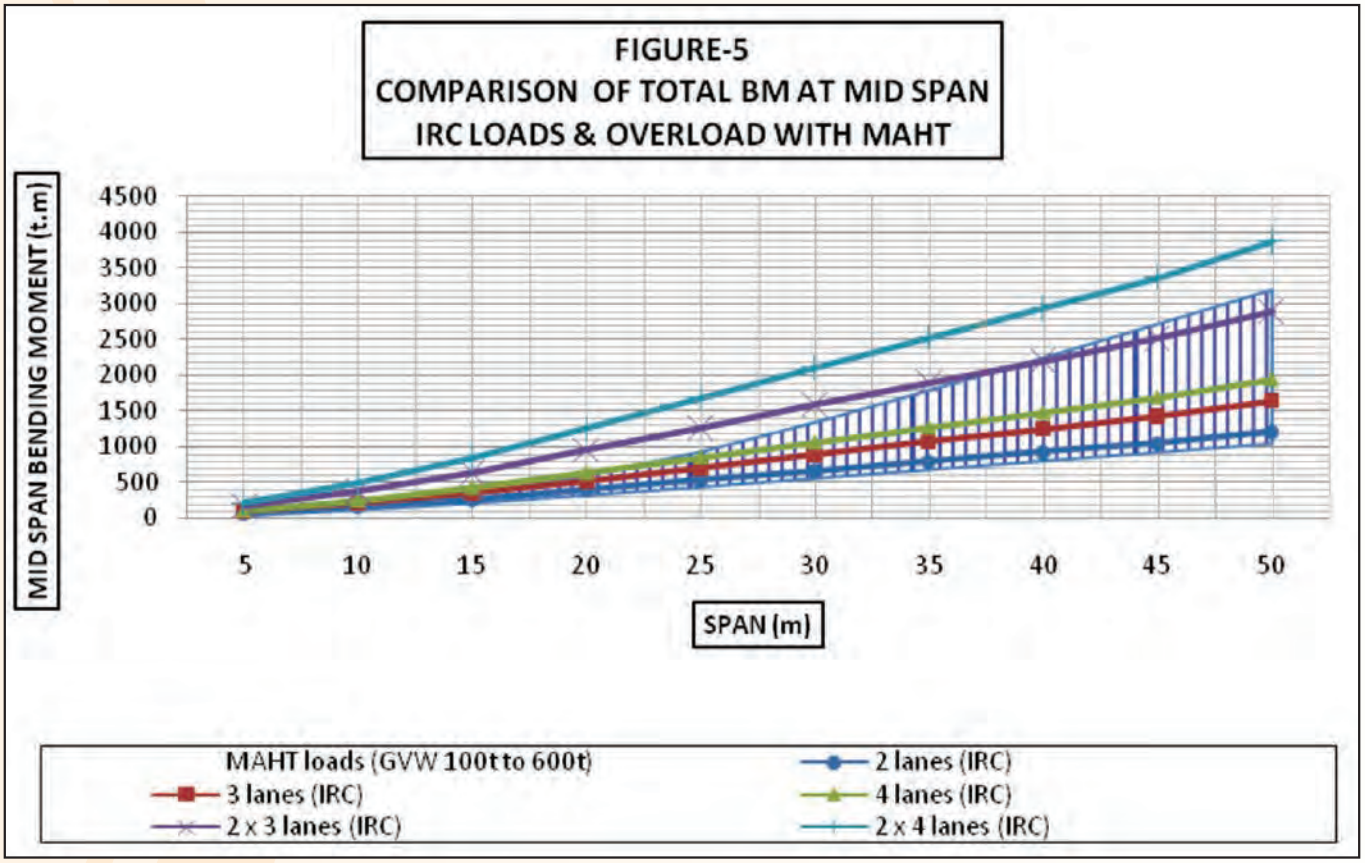
The fundamental principle adopted for the study is that for a bridge to be considered safe under HT loads, the bridge must fulfill the following criteria :

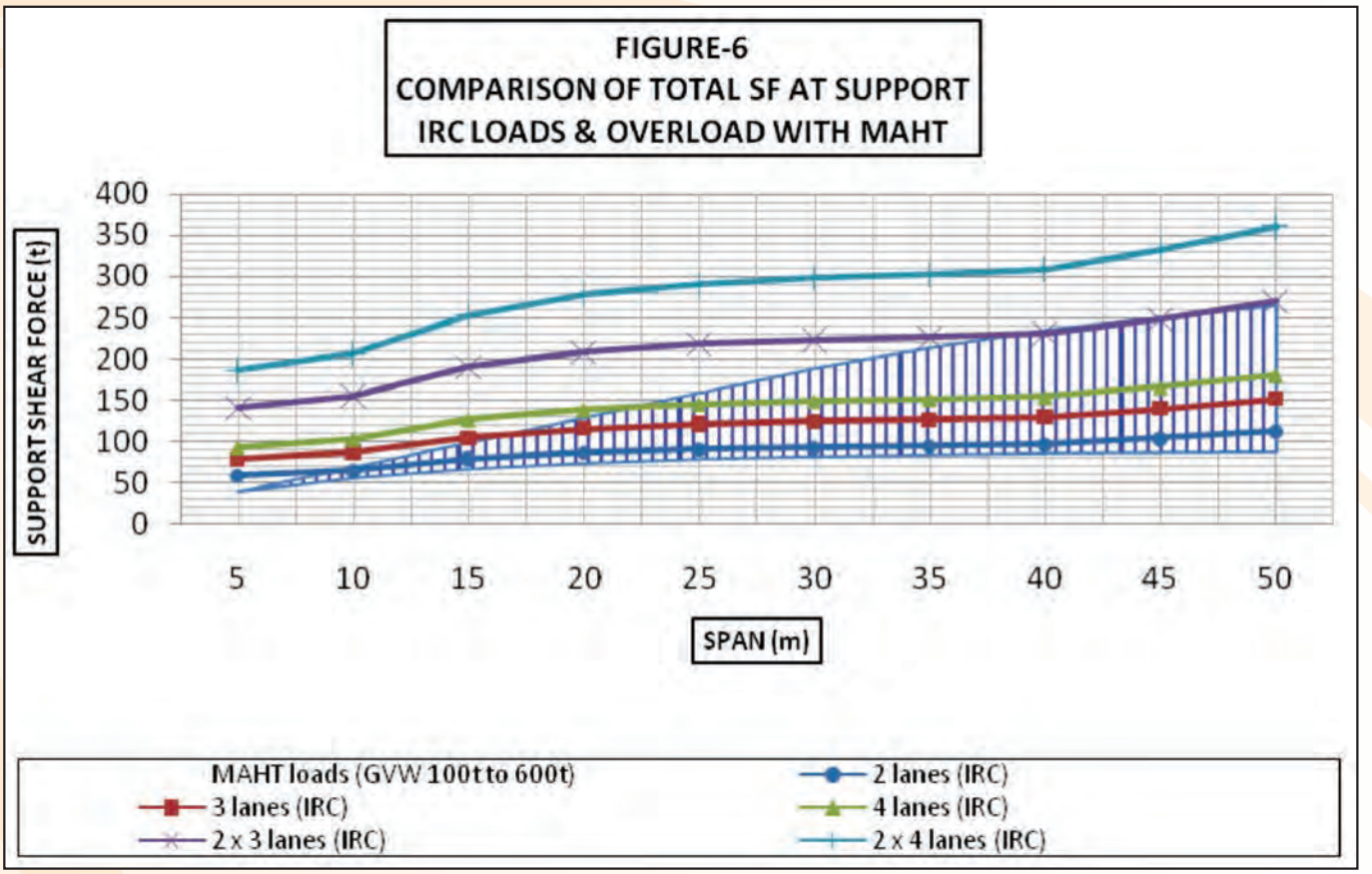
- Assumed load Capacity of Superstructure = Effects of (Dead Loads + IRC Loads with Impact (Duly enhanced for OWC as per IRC:SP:37) + Other effects due to Wind / Earthquake / Eccentricity of Dead and Live Load etc.)
- Permissible HT load effects = Assumed load Capacity of Superstructure – Effects of Dead Loads
- Safety Factor = (Assumed load Capacity of Superstructure – Dead Load Effects)/HT Load Effects

Consultants carried out the study as per guidelines elucidated in IRC: SP: 37, IRC: 6 and other relevant IRC codes and guidelines. Working stress methodology has been adopted for the study to bring out the comparison charts/tables. The comparison is made for maximum design bending moment at mid span and maximum design shear force at support for all types of Superstructure. For the purpose of this comparison, the load effects caused by IRC loading are enhanced as per the stipulation of IRC: SP-37 while comparing with load effects caused by HT loads.

In order to get a broad idea about the relative values of load effects on Superstructure, a comparison of total bending moment at mid span and total shear force at support, considering the superstructure as a single two dimensional line element unit has been made for IRC loads as well as OWC loads. The graphical representation of loads effects of IRC loads and OWC vehicle type is shown in Fig 5 & 6. This comparison is without the enhancement of IRC design forces as permitted in IRC:SP:37.

FIGURE-5
COMPARISON OF TOTAL BM AT MID SPAN
IRC LOADS & OVERLOAD WITH MAHT






Though precise margin of safety cannot be determined from the above shown figures, following inferences can be drawn:

a) With the increase in overall width of the Superstructure deck, the bridge has higher capacity to take the OWC vehicles. Two lane bridges are therefore most vulnerable and 8 lane bridges (carried by a single deck unit without structural discontinuity) have highest margin of safety for passage of OWC.

b) Vulnerability of the structure increases with the increase in span length of the bridge.

c) Arrangement of trailers and configuration of axle in the trailer has significant influence on safety of bridge.

The above simplified analysis and representation however do not cover all aspects. Influence of the following aspects will require further detailed studies:

a) Influence of Axle load & transverse axle arrangement.

b) Influence of Bridge structure type

c) Influence of Physical Condition of the Bridge

d) Design Philosophy adopted for original design.

In order to cover the above issues, detailed structural analysis for all the Superstructure types have been carried out. For Beam and Slab type of Superstructures, the analysis has been carried out for cases "with" and "without" intermediate cross girders. Separate local analysis of deck slab has been carried out to assess the impact of axle load and transverse axle configuration.

## IV. Analysis

The hydraulic trailer load data and their configuration have been simulated in the STAAD Pro software for Structural Analysis for identified structures along with other standard IRC loadings. The structural modeling and design approach as adopted for different type of superstructure is as follows:

a) Culverts do not require any special checking for passage of OWC since the IRC loads will always give higher bending moments and shear forces as compared to OWC loads, provided axle loads are restricted to 18 tonnes only.

b) For checking the reinforced cement concrete (RCC girder & slab, RCC voided slab, RCC solid slab etc.) superstructure in longitudinal direction, the bending moments at mid span and the shear forces at support section due to multi axle hydraulic

trailers and standard IRC loads are evaluated for various spans and carriageway widths. Two Dimensional grillage analysis has been carried out for all the superstructures.

The factor "K", which is the ratio of load effect caused by IRC live loading (duly enhanced by the dynamic impact factor as per IRC:6 and permissible overstressing of 33% as per Clause 11 of IRC: SP-37-2010 and reduced by age factor) to the load effect caused by HT loading for various span lengths. The detailed calculations of these factors for various types of superstructure are carried out. The effects of HT loads is however restricted to twice that of the effects of IRC loads under any circumstances.

c) For PSC bridges, as per clause 11.3(3) of IRC:SP:37:2010, tensile stresses should not lead to crack widths more than 0.3mm under the passage of OWC. Presuming that the existing bridges are designed for IRC loads as per IRC:18, the bridges would have been designed for 'no tension' condition under service loads. Since clause 11.3 (3) of IRC:SP:37:2010 permits tensile stress at the extreme fibre to the extent that crack width is not more than 0.3mm under infrequent OWC, there is a margin in design, which has been made use of while passing OWC, as per IRC:SP:37-2010. The crack width however has been restricted to 0.2mm only as an extra margin of safety over IRC:SP:37. The bending moments derived for IRC live loading has been enhanced to a value which when combined with Dead Loads, SIDLs & Pre-stress cause cracking to the extent that crack width at the extreme fibre is 0.2 mm. However, the maximum enhanced value of B.M. has been capped so that the overstress on DL+LL combination is not more than 33%. The enhanced value of bending moment is then compared to the bending moments derived for OWC loading. For comparison of Shear force, IRC: SP: 37:2010 do not specify any criteria for PSC structures. In absence of any specific provision, permissible overstressing during passage of OWC is taken as 33% on DL+LL combination, which is in line with the provisions for RCC structures. The calculations for finding crack width as well as permissible overstressing have been done for assumed sections for various span lengths and carriageway configurations. The calculations are done for inner as well as for outer girders but inner girders are governing over outer girders.

d) Masonry arch type bridges are modelled for span lengths of 5 m, 10 m & 15 m with span to rise ratio of 3, 4 and 5. Both, parabolic as well as circular arch shapoe has been considered for study. Results are compared for HT loading vis-à-vis IRC loading. Based on comparison, these bridges are judged for adequacy for carrying specific type of HT loading. The shear force, axial force and bending moments for masonry arch bridges for IRC and HT loading are evaluated in detail.

For analysis of masonry arch the multiplication factor "Karch" is evaluated. The multiplication factor "Karch" is used to enhance the axial forces, shear forces and bending moments caused by standard IRC live loadings for various span lengths. IRC:SP:37-2010 provides for permissible overstressing when over-weight vehicle crosses a bridge for various types of bridges. For masonry arch bridges, to rate the bridge the code suggests the use of nomogram, the applicability of which was found to be limited as it involves a lot of factors which needs to be assessed after site investigation and thus is not suitable for a generic desk study. Also, the nomograms are based on the analytical work of Pippard (1951) and subsequently adapted by Mexe (1963), These methods have now been formalized in the British Standard BA 16/97. On study of these documents, some anomalies were found in Clause 6.5(d) and Fig 1 of IRC:SP: 37-2010, which prompted us to look for alternative methods of capacity assessment by computer modelling of the structure.

In the absence of any specific provisions for Arch Bridges in IRC:SP: 37-2010, permitted overstressing of 33% on IRC loads, as listed in Annex 1 of IRC:SP: 37-2010, for masonry structures has been considered. Therefore, when the Masonry Arch bridges will be subjected to HT loading, the permissible values of axial forces, shear forces and bending moments could be conservatively acceptable for 33% more than the values obtained for (DL + LL) combination of IRC Loading. Assuming that there will be no overstressing due to DL, a multiplication factor "Karch" has been evaluated to give the actual enhancement on IRC live load effects.

e) For precast type segmental box girder type bridges, clause 11.3 (4) of IRC:SP:37:2010, permits flexural tension at the extreme fibre upto 2/3rd modulus of rupture, for segments with wet joints and no tension is permitted in case of bridges with dry joints. Presuming that the existing bridges are designed for IRC loads, as per IRC:18, the bridges would have been designed for a minimum reserved pre-compression condition. Since clause 11.3 (4) of IRC:SP:37:2010 permits tensile stress at the joints in case of wet jointed decks and de-compression for dry jointed decks, as against minimum reserved pre-compression, there is a margin in design, which can be made use of while passing OWC. The bending moments and shear forces derived for IRC live loading can thus be enhanced by a multiplication factor, "Kseg", (where Kseg > 1), before comparing with the bending moments derived for OWC loading. As far as shear force is concerned, IRC:SP:37:2010 do not give any specific recommendations for the permissible overstressing in shear for segmental bridges. However it is presumed that the provisions of clause 11.3 (3) of IRC:SP:37:2010 can be applied for segmental bridges also in shear. Since the enhancement factor in shear as per clause 11.3 (3) of IRC:SP:37:2010 is going to be more onerous as compared to the enhancement factor, "Kseg" from flexure, it is proposed to adopt the same factor for both shear and flexure conservatively. The factor "Kseg" is a variable, which depends on several factors such as type of segmental bridge joints, width of carriageway, material & section properties and age of bridge etc.

f) For steel Concrete Composite multi girder type bridges the factor 'Kscc', which is the ratio of load effect caused by IRC loading (duly enhanced by the permissible overstressing) to the load effect caused by HT loading for various span lengths is evaluated. Clause 11.3 of IRC:SP:37:2010 provides for permissible overstressing when over-weight vehicle crosses a bridge. Various types of bridges are covered under this clause (e,g. RCC bridges, PSC bridges, Segmental Bridges). However there is no specific provision in this clause for steel

concrete composite deck type of bridges. In absence of any specific provisions in this clause, reference is made to other relevant clauses of IRC codes for taking an approach on overstressing on rational basis. Clause 5.3.5.1 of IRC:SP:37:2010 mentions the permissible overstressing to be considered for rating of a bridge. In this clause, reference is given to Annex 1 of IRC:SP:37-2010 for permissible stresses to be considered for different materials. As per Annex 1, for structural steel and mild steel, 45% overstressing can be considered while rating the bridges. Clause 506.1 of IRC:24-2001 (Standard Specifications and Code of Practice for Road Bridges – SECTION – V : STEEL ROAD BRIDGES), 25% overstressing is permitted under Wind Load Combination (Refer Table 6.1, Classification V of IRC:24-2001). Since HT Load is an infrequent load and similar to Wind Loads, having similar probability of occurrence, it is proposed to consider 25% overstressing during the passage of HT loads. Presuming that the existing bridges are designed for IRC loads (i,e Class A, Class AA and Class 70R (Tracked and wheeled) ), as per prevailing IRC working stress code (i,e IRC:22-1986), the bridges would have been designed for normal permissible stresses with basic permissible stresses as given in clause 506.4.1 of IRC:24-2001 for the structural steel sections. The permissible overstress on (DL+LL) combination is taken as 25% for the steel concrete composite deck bridges. Due to this permissible overstressing, there is a margin in design, which can be made use of while passing OWC, as per IRC:SP:37-2010.The bending moments and shear forces derived for IRC live loading can thus be enhanced, before comparing with the bending moments and shear forces derived for HT loading. The factor "Kscc" is a variable, which depends on several factors such as width of carriageway, material & section properties, presence of intermediate cross girder and age of bridge.

g) For local effects on deck slab, a comparative study is carried out for IRC & OWC loads. Presuming that the existing bridges are designed for IRC loads, the suitability of the transverse section of bridges to carry OWC loading is evaluated. The transverse analysis for live load depends on Position of Load on cantilever or in between girders, effective width of the load across the span, basic axle load, axle configuration, impact factor etc. Since the OWC load is permitted to move only along the central portion of the bridge, comparison is made for the portion of slab in between the girders only. Clause 11.3 and Annex 1 of IRC:SP: 37-2010 permits 33% overstressing for (DL+LL) combination for concrete bridges. Therefore, when the bridge structure will be subjected to OWC loading, the values of bending moments due to DL + LL(HT Loading) can be 33% more than the values obtained for DL + LL(IRC loading).

h) The capacity of structure as assessed by IRC codes is reduced by a reduction factor to account for deterioration caused by passage of time from date of construction, and to take account for different design procedures and analysis adopted over the period of time. The following reduction factors (Table 3) are considered for this purpose:-

## Table 3 : Reduction Factor

| Sl. No. | Vehicle Type | Axle Arrangement | Gross Vehicle Weight (*) |
|---|---|---|---|
| 1 | HT1 to HT9<br>(Single Trailer unit) | Trailer Unit carrying 4 to 20 axles for HT1 to HT9 respectively | 97 to 385 tonnes |
| 2 | HT10 to HT11<br>(Twin Trailers with Turn Table Bolster) | (8+8) & (10+10) axle Trailer units for HT10 & HT11 respectively | 313 to 385 tonnes |
| 3 | HT12 to HT13<br>(Twin Multi-Axle Trailer with Girder Arrangement) | (14+14) & (16+16) axle Trailer units for HT10 & HT11 respectively | 529 to 601 tonnes |

## V. Recommendations

The recommendations regarding adequacy of bridges for a specific HT carrying OWC are presented in the form of charts, highlighting the adequacy for a given type of Superstructure, given span length, given carriageway width. 13 charts (i,e. Charts C1 to C13) are presented for HT loadings HT1 to HT13. Each chart covers all types of Superstructure except PSC segmental Box girders with dry joints, for which Chart C-14 is prepared. Colour code scheme is used to indicate whether it is safe to carry the OWC for a given span and structure type. Green colour indicates it is safe to carry the OWC on the structure and red colour indicates that OWC is safe only after reduction of GVW to the specified value. Sample of such chart is presented in Table 4 for ready reference:

## VI. Worked Example

A sample worked example for assessment of the existing bridge capacity and safety aspects is given in Annexure-I.

## VII. Conclusions

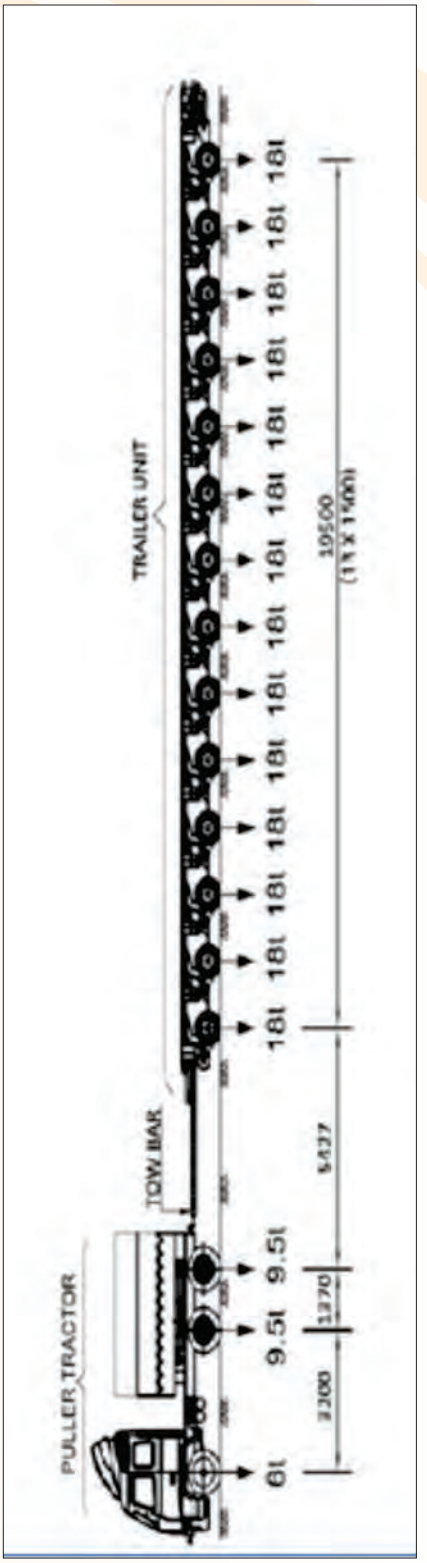
Vehicles carrying OWC threaten bridge safety and contribute to many fatal accidents. Considering the increased frequency of these vehicles on Indian roads due to exponential growth of infrastructure in the country, there is a growing need for working out a methodology of ensuring safety of existing flock of bridges for OWC loads. In this paper, a new method for comparing the effects of overweight and design load vehicles have been presented. A total of 54 span & structure type with 5 different carriageway widths has been analyzed for 16 types of live loading (13 HT loads and 3 IRC loads). A total of 54 x 5 = 270 types of structures have been analyzed with 16 load cases for each type. The results have been presented in the form of simplified charts, which can be used by the transporters. The methodology adopted conforms to the present codes and standards and therefore can be adopted for any specific bridge structure.

## REFERENCES:


1. IRC:SP:37-2010 : Guidelines for evaluation of Load carrying capacity of Bridges
2. IRC:6-2010 : Standard Specifications & code of Practice for Road Bridges – Section II-Loads & Stresses
3. IRC:18-2000 : Design Criteria for Prestressed Concrete Road Bridges (Post Tensioned Concrete)


## Table 4: Sample Chart
## (For HT6 with total GVW = 277T)

| Span / CW type | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | 266 t | | | | |
| 40 m | 251 t | | | | |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | 273 t | 268 t |
| 25 m | | 273 t | | 269 t | 263 t |
| 30 m | | 271 t | | 265 t | 261 t |
| 35 m | | 276 t | | 270 t | 263 t |
| 40 m | 277 t | 276.7 t | | 260 t | 253 t |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | 267 t | | | | |
| 45 m | 259 t | | | | |
| 50 m | 258 t | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | 276.7 t | | | NOT APPLICABLE | |
| 35 m | 259 t | | | NOT APPLICABLE | |
| 40 m | 248 t | | | NOT APPLICABLE | |
| 45 m | 240 t | | | NOT APPLICABLE | |
| 50 m | 240 t | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 270 t | | | | |
| 25 m | 246 t | | | | 269 t |
| 30 m | 237 t | | 250 t | | 276.98 t |
| 35 m | 231 t | | 272 t | | 259 t |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 256 t | | 247 t | | 257 t |
| 25 m | 238 t | 259 t | 236 t | 273 t | 250 t |
| 30 m | 234 t | 260 t | 231 t | 271 t | 246 t |
| 35 m | 222 t | 250 t | 217 t | 262 t | 244 t |



# Worked out Example – for 25m span

The 2-dimensional STAAD model is created for two lane single carriageway of 25m span Reinforced Cement Concrete (RCC) girder and slab bridge with three Girder arrangement as shown in Fig 1.1. All types and different combinations of IRC live loads are applied to the model to get critical Bending Moment and Shear Force. The HT loading is placed at centre of the carriageway with maximum allowable eccentricity of 300mm. Based on the analysis, it is inferred that inner girder is more critical than outer girder considering the passage HT load placed at centre of the bridge. For evaluating the effects of Live loads, two types of distribution analysis have done used :

i) Courbon's Method which was prevalent for most of old bridges till 90's.

ii) Grillage method of analysis.

The critical values from the above two methods are adopted. The Bending and Shear forces for IRC Live Loads & HT Loading along with the 33% enhancement on Live Load and Dead Load combination is presented in Table A-1

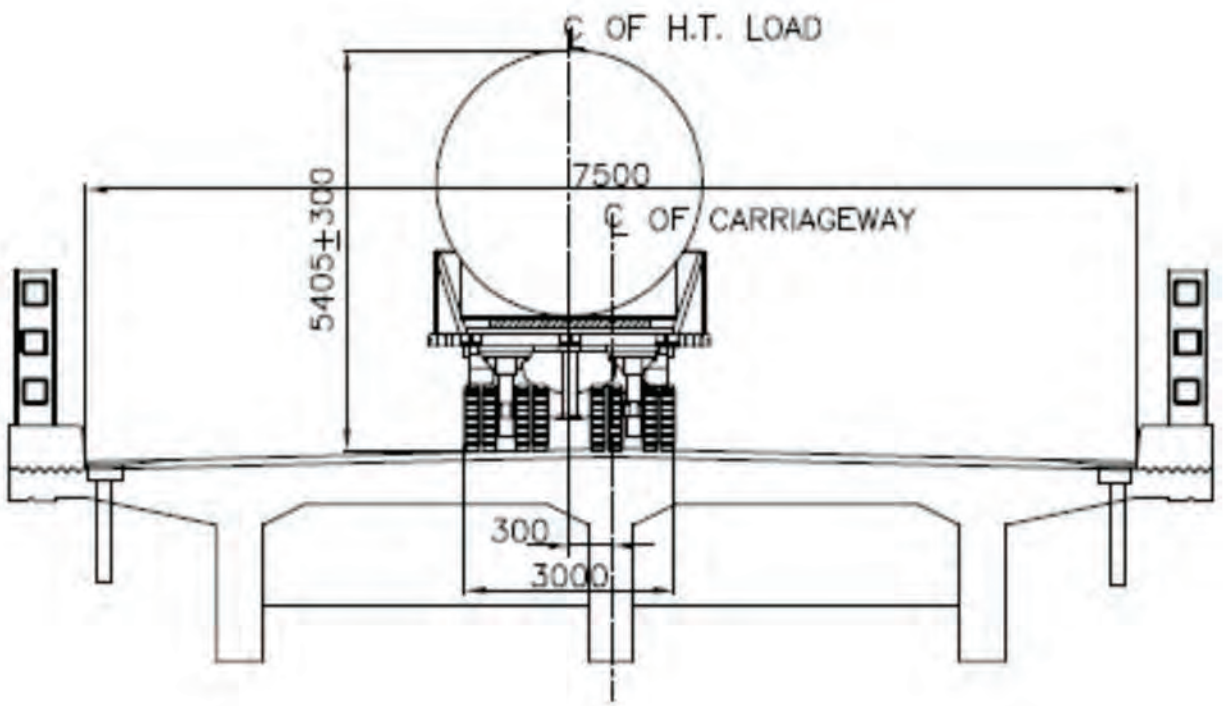



Figure 1.1: 2 Lane Superstructure Cross Section

It is apparent from the results shown in 'Remarks' Column of Table A-1 that “Krct” which is ratio of critical bending moment/Shear Force of IRC live load ( after enhancement of 33% on Dead Load and Live Load combinations) to maximum Bending Moment/Shear Force for hydraulic Trailer is always greater than one. Hence the movement of HT trailer is safe on the bridge.

TABLE NO. A - 1 : RCC GIRDER BRIDGES - DESIGN BENDING MOMENT FOR INNER GIRDER (WITH CROSS GIRDER AT END AND AT CENTER)
COMPARISON OF DESIGN VALUES BETWEEN ENHANCED IRC LOADING & HT LOADING

BENDING MOMENT AT MID SPAN( t.m)

| SPAN | CARRIAGEWAY | BM due to DL (tm) | BM due to LLac (tm) | Capacity for BM for HT Loading (tm) (DL+LLac)*1.33-DL | Design Capacity for BM for HT Loading ( tm ) (Capacity * Reduction factor i.e 0.9) | BM DUE TO HYDRAULIC TRAILER LOADS ( tm ) | | | | | | | | | | | | | Critical "Kcr" Permissible BM kt/ Max BM kt | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | HT1 | HT2 | HT3 | HT4 | HT5 | HT6 | HT7 | HT8 | HT9 | HT10 | HT11 | HT12 | HT13 | | |
| 25.0 m | 2 Lane Carriageway | 400.5 | 176.6 | 367.0 | 330.3 | 148.3 | 195.3 | 234.0 | 264.3 | 288.0 | 304.7 | 312.0 | 313.3 | 313.3 | 243.7 | 266.3 | 304.7 | 312.0 | 1.05 | Critical "Kcr" Value greater than 1, Hence safe |

SHEAR FORCE AT SUPPORT ( t )

| SPAN | CARRIAGE WAY | SF due to DL (t) | SF due to LLac ( t ) | Capacity for SF for HT Loading (t) (DL+LLac)*1.33-DL | Design Capacity for SF for HT Loading ( t) (Capacity* Reduction factor i.e 0.9) | SF DUE TO HYDRAULIC TRAILER LOADS ( t ) | | | | | | | | | | | | | Critical "Kcr" Permissible SF kt/ Max SF kt | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | HT1 | HT2 | HT3 | HT4 | HT5 | HT6 | HT7 | HT8 | HT9 | HT10 | HT11 | HT12 | HT13 | | |
| 25.0 m | 2 Lane Carriageway | 54.6 | 47.9 | 81.8 | 73.6 | 43.7 | 53.7 | 60.7 | 65.2 | 68.5 | 68.5 | 68.5 | 68.5 | 68.5 | 63.9 | 66.4 | 70.7 | 72.3 | 1.02 | Critical "Kcr" Value greater than 1, Hence safe |

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# Ministry initiative for facilitating the movement of Over-Weight Vehicles/Over Dimension consignment using Multi-Axle Hydraulic Trailers on National Highways

**AP Pathak, CE (Bridges), Ministry of Road Transport & Highways**

## 1.0 Introduction

The Over Weight Consignments (OWC) are to be transported through existing roads and bridges, which were not originally designed for such loads. Since each movement of trailer needs permission from multiple authorities such as PWD / Local Authorities / NHAI, a technical study was considered essential to take informed decisions in the matter by the authorities concerned. The Hydraulic Trailer Owners Association (HTOA) is the nodal agency representing the Hydraulic Trailer Owners. The Owners are facing the problem of delay in delivery of consignments at designated location due to pending permissions from various governing agencies

Road & Bridge infrastructure represents huge investments. To protect these assets against misuse and damage, countries have promulgated Motor Vehicle Acts that stipulates permissible axle loads, axle group combinations and vehicle dimensions. These limits are meant to ensure that roads & bridges last for their full design life with the normal maintenance expenditure.

## 2.0 Bottlenecks in Movement of Hydraulic Trailer

Indian economy is all set to move rapidly forward. This will propel the growth in various sectors of infrastructure like roads, ports and power etc. With the increase in demand for infrastructural growth, nuclear, hydroelectric and thermal power plants are planned in a big way in different parts of the country. This has led to increased frequency of transportation of Over-Weight Consignments (OWC), carrying heavy equipment from the factory/port to the project sites. For carrying such OWC the worldwide trend is to adopt hydraulic multi-axle trailers, which ensures equal distribution load on all axles

OWC carrying vehicles require permits from multiple authorities (e,g. PWD/Transport Authority/ Municipal Corporation / Railways / NHAI) to reach their destination. The process of taking such approvals is time consuming and leads to considerable delays in transportation process. Also the transporter needs to find out the most optimum corridor for carrying the OWC vehicle from a given origin to the destination, which usually includes the evaluation of the capacity of existing flock of bridges on all possible routes. This entire process of selection of optimum route and getting permit from the authorities is extremely lengthy and time consuming.

## 3.0 Ministry Initiative

In order to smoothen the process of approval by the authorities, MORT&H took the initiative to carry out a generic study of Superstructure of existing flock of simply supported right bridges for safety during passage of OWC. This desk-study has been carried out by a group of Consultants under sponsorship of M/S Hydraulic Trailer's Owners Association (HTOA), for checking of adequacy of superstructure of these bridges to carry the OWC.

The study carried jointly by group of consultant known as **"TBGE"** presents a method, for comparing the effects of OWC and IRC design load vehicles for a select few types of simply supported bridges,

The study is based on basic data such as the axle arrangement, spacing of Hydraulic Trailer & Puller Tractor, which represents broadly the entire spectrum of multi-axle hydraulic trailer vehicles in operation in the country at the moment.

Generic desk-study is carried out for existing simply supported bridges for checking of adequacy of superstructure of these bridges to carry the overweight consignments by Hydraulic Trailer's Owners Association (HTOA). Following are the salient feature of this generic study :

- 10 Span lengths considered, ranging from : 5m to 50m @ 5m interval
- 12 types of Superstructure form considered
- 5 types of carriageways considered
- 13 types of OWC loads & 3 types of IRC loads taken for analysis

## 3.1 Types of Bridges and Loadings Considered in Study

The following forms of bridge and corresponding span lengths of simply supported superstructures are identified for the study.

### Table 1.0 – Types & Span Lengths of Superstructure

| Type of Super Structure | Span lengths considered for study (m) |
|---|---|
| **Culverts** | **Up to 6** |
| **Masonry Arch Bridges** | **5, 10, 15** |
| **RCC Solid Slab / Voided Slab type bridges** | **10, 15, 20,25** |
| **RCC Girder type bridges** | **10, 15, 20, 25** |
| **Cast-in –situ/Precast PSC T-Girder Composite with In situ Deck type bridges** | **20, 25, 30, 35, 40** |
| **Cast-in-situ PSC Box Girder type bridges** | **30, 35, 40, 45, 50** |
| **Precast Segmental Box Girder Superstructures** | **30, 35, 40, 45, 50** |
| **Steel Concrete Composite Decks with I-Girders** | **15, 20, 25, 30, 35** |

### 3.1.1 Types of Loadings Considered in Study

There are 13 types of Multi Axle Hydraulic Trailer along with their Puller Tractor are considered for carrying out the study so as to compare with the effects of the IRC Loads For assessment of Gross Vehicle Weight (GVW), total load on each trailer axle has been taken as 18 t. Web Portal to be launched will be limited to HT1 to HT3

**Standard IRC Loadings Considered for Study**

IRC loads and their combinations shall be as loading combination of IRC:6 are used as follows

- IRC Class – A
- IRC Class – 70R Wheeled
- IRC Class – AA Tracked

### 3.1.2 Applicability and Exclusions of Study

The applicability of the study for passage of OWC/ODC vehicle with multi-axle hydraulic trailers, over any bridge is based on the following important considerations:

Bridge types which are not specifically identified in Table-1.0 are excluded from the scope of this study. The Continuous Bridges, Cantilever Bridges, Curved Bridges, Skew bridges with skew angle greater than 20 degree, Steel Truss Bridges, Box girders with transverse prestress, Timber Bridges, Cable Stayed Bridges, Extradosed Bridges, Suspension Bridges are excluded from study

This methodology can be principally extended for all types of bridges, including curved, continuous, or skewed types by carrying out special study.

### 3.1.3 Assumption Considered in Study

The study carried out with the following assumptions:

a) Recommendations are broadly conforming to IRC: SP: 37-2010, and limited to span lengths ranging from 5m to 50m at intervals of 5m. The spirit of IRC SP:37 is that the passage of OWC over the bridge is of infrequent occurrence and that occasional limited overstressing beyond stipulated codal limits would not cause any permanent effects or fatigue.

b) Bridge under consideration is in 'good' condition and capable of carrying present IRC loads (i.e., Class A, Class AA and Class 70 R) as per IRC: 6-2010. It is mandatory that the condition survey will be carried out by a competent Bridge Engineer to ascertain this, prior to passing OWC over the bridge.

e) The speed of crossing of such loading on bridge is limited to 5 kmph with special precautions of avoiding application of brakes, Braking / Acceleration on the bridge and in no case the vehicle shall be stationed over the structure.

f) Only single OWC/ODC will be allowed on the bridge at any given time as close as to center of bridge. No other vehicle shall move on any part of the carriageway/s when this trailer is crossing the bridge. .

g) The action of wind, earthquake, and floods acting independently / simultaneously during the transportation of the OWCs is not considered.

i) The study is not applicable for existing bridges which are evaluated and/or rated below the critical design IRC loading including distress bridges

## 3.2 Guidelines for Smooth Movement of Hydraulic Trailer

The study eventually formed the basis for issuance of a guideline for passage of OWC on existing bridges by Ministry of Road Transport & Highways (MORT&H) vide their circular no. RW/NH-35072/1/2010 S&R(B) dated 24th January 2013. The method is robust, reliable and a simple tool for checking of the existing bridges for passage of OWC.

Ministry subsequently issued guidelines vide their circular no. RW/NH-35072/1/2010 S&R(B) dated 20 May 2014 for smooth movement of hydraulic trailer

This process leads to considerable convenience to the transporter and avoids delays for movement of capital goods on time and saving time in approval processes. The guidelines issued by MORTH after the study is widely in use and Authorities finding it quiet helpful to issue the approval considering in charts provided as ready reckoner

## 3.3 Steps Forward by Ministry

The MORTH has initiated a step forward to launch a Web Portal to hasten the process of approval for hassle free movement of consignment up to its point of origin to destination. This on line facility shall be available for HT1 to HT3 on real time basis. For HT4 to HT13 application can made on line and approval will be granted by nodal office of MORTH after getting comments regarding safety of bridges from field officers.

We are thankful to our Honorable Minister for his support in this endeavor and giving his precious time to make this event a success.

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# Steps for improving hydraulic axle movement

**Bharat Gandhi,** Vice Chairman – HTOA

Gvernments focus on infra development in past two decades has given us improved road & bridge infra of global standards. While the Government has put in efforts and funds in building this infrastructure, we have to make sure that this remains intact and are abused & not damaged, atleast not intentionally.

Overloading in Trucks is an apademic which can be cured .

Hydraulic trailers not being clearly defined in CMVR 1989 resulted in undul idealing of assest of sake of registration and therafter extraordinaly gazzette notification by central government with various operating conditions added fuel to the problem.

The cost of hydraulic trailers and axles is much higher than conventional tractor trailers. As a result, the operators have to invest a lot of money. In addition to equipment cost, the operators also have to pay high taxes and insurance costs. However the return on investments were very poor . The enforcement officials , in absence of clerly defined regulator framework, trated operator as milking cow.

One of the biggest concerns for the transport department is the high number of accidents occurring in the country. Thousands of lives are lost everyday on roads due to motor accidents, many of which involve trucks. Amongst many reasons, one of the reasons cited for the same are overspeeding and overloading. However by using hydraulic trailers for carrying heavy cargo the instances of accidents can be reduced since these vehicles move at a much slower pace. In terms of equipment also, the hydraulic trailers have technical benefits since the cargo weight is evenly distributed on all axles. Besides proving safety, this equipment also saves the roads from damage.

Conserding very slow movements , hydraulic trailer fitness renewal needs relaxation in terms of extending the facility to all states in stead of home state only.

We wish to emphasize that due to gigantic industrial growth registered in India, the dimensions of the equipment installed became larger and hence the dimensions have increased from 4.50 M to 6 M in Width and 4.50 M to almost 6 M in Height. The operating height of hydraulic


modular trailer being 1M to 1.20 M, it is essential to keep adequate clearance in terms of height (At least 7.50M) and width of all infrastructures on National Highways and even on State Highways and other roads too. It will be also appreciated if one dedicated free way is constructed to transport only ODC equipment without any height or width constraints. Besides, at Toll collection centres a canopy free lane is requested. We also feel that government should declear every bridge for its capacity for hydraulic trialer loading arrangements.

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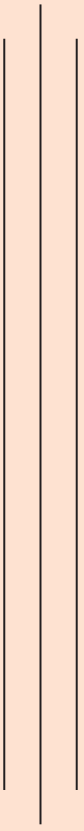

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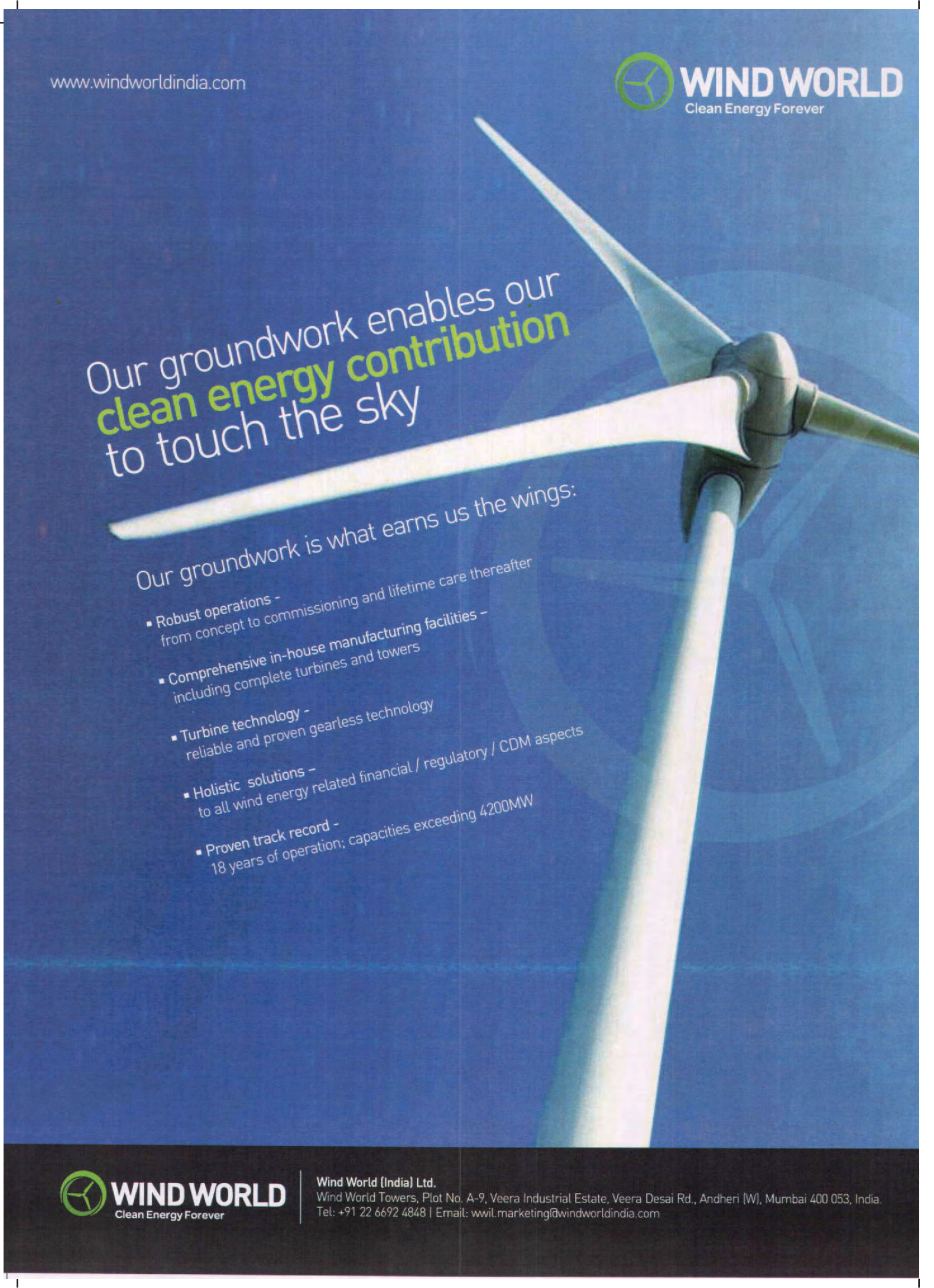

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Transport Bhawan,
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Telefax : +911123310950

No.RW/ NH- 35072/ 1/2010 S&R(B) Dated :24th January 2013

To

1. The Chairman, National Highways Authority of India, G-5 & G-6, Sector -10, Dwarka, New Delhi - 110 045
2. All Principle Secretaries/Secretaries/Engineer-in-Chiefs/Chief Engineers dealing with National Highways and other category of roads
3. The Director General(Border Roads), Seema Sadak Bhawan, Ring Road, Naraina, Delhi Cantt., New Delhi.
4. The Director General (Works), Central Public Works Department, Nirman Bhawan, New Delhi - 110 001

**Subject:** Movement of Over Weight and Over Dimensional Consignment (OW/ODC) -Guidelines reg.

Madam/Sir,

Exponential growth in infrastructure sector in general and power sector in particular has led to construction of thermal/hydro/ nuclear power plants in different land-locked parts of the country in the recent past. This has led to significant increase in frequency of Over Weight and Over Dimensional Consignment (OW/ODC)being transported by road . As per the instant practice for movement of OW/ODC, Road Transport (RT) Wing of the Ministry accords approval for registration of the trailer with maximum safe laden weight and dimensions in exercise of the power conferred by subsection 3 of Section 58 of the Motor Vehicle Act 1988. This approval is subject to the following conditions:

(i) The operations of the trailer shall be done only sparingly.

(ii) Load restrictions of various roads stipulated by the Public Works Department/Local Authorities/National Highway Authority of India/Boarder Roads Organization will be observed and permission of such authorities will be obtained every time the vehicles are put on the roads. Each of the such movement will be approved and closely monitored by the concerned road authorities in State/Union Territory/National Highway Authority of India/Boarder Roads Organization from safety point of view.

(iii) The vehicle should display all danger flags and lights, preferably the vehicle should be preceded and followed by a vehicle displaying prominently that a heavy load is passing.

(iv) Coupling of the trailers along the width of the road (side by side )shall not be permitted.

(v) The programme of the movement of the trailer should be intimated at lest ten days in advance to the Executive Engineers concerned and their clearance obtained.

(vi) The trailer shall be registered individually and not as a combination.

(vii) If so directed by the Public Works Department of a State/Union Territory/National Highway Authority of India/Boarder Roads Organization, the loaded vehicle will not be allowed to pass over the bridges on the roads in that State/Union Territory and in such cases applicants will have to make their own arrangements to', cross the rivers/nallas.

(viii) They would need to obtain permission each and every time before moving on a particular route from concerned State or Union Territory authorities/National Highway Authority of India/Boarder Roads Organization enroute in view of the oversized cargo. For each such movement, the timing should be prescribed by the concerned authority.

(ix) They would adhere to the speed limits prescribed by the authorities in State/Union Territory/National Highway Authority of India/Boarder Roads Organization.

(x) The said vehicles should be moved without any hindrance to the normal flow of traffic.

(xi) The maximum speed of the trailer for movement on the road shall not exceed 10 kms/hour.

(xii) The trailer shall be painted for the entire width by yellow and black zebra strips on the front and rear sides duly marked for night time driving /parking suitably by red lamps at the front and rear and red flags on both the sides during day time to indicate the extreme position of the vehicle clearly. In addition the entire overhang shall be covered with a 'red reflector/reflective tape to facilitate clear vision of overhang at night time.

(xiii) The owner of the trailer would be liable to pay such amount to the Government of State/Union Territory/National Highway Authority of India/Boarder Roads Organization or any other affected person where any damage is caused to the roads or road structures/other road users/person directly or indirectly due to the movement of the trailer.

(xiv) The owner of the trailer will observe restrictions ordered by the State/Union Territory Government/ National Highway Authority of India/Boarder Roads Organization time to time in this regard.

(xv) The owner of the trailer will give an advance intimation to such authority or officer specified by the State/ Union Territory Government /National Highway Authority of India/Boarder Roads Organization regarding each movement of such vehicle.

(xvi) A specifientry in Registration Certificate is to be made that the trailer owner in case of each and every movement will be required to take the permission of concerned Authority i.e. Sate Govt./Union Territory Govt./National Highway Authority of India/Boarder Roads Organization.

2. As per the condition stipulated while according approval for registration of the trailer, the owner of the trailer need to obtain permission each and every time before moving on a particular route from the concerned State/UT authorities/NHAI/BRO enroute. It has been reported that due to delay on account of permission from the concerned authorities , there are delays in movement of the trailers. This delay may perhaps be due to non-availability of guidelines for movement of OW/ODC. Since bridges are critical and vital link of the road network and safety of the same is of the concern for the road authorities.

3. In order to develop a comprehensive document which will give guideline regarding movement of OW/ODC(maximum axle load , gross vehicle weight , length of the vehicle permitted for a particular type of super-structure and for a given span length designed as per IRC loadings) , Hydraulic Trailer Owners Association (HTOA) has engaged a consortium of four consultants empanelled with the Ministry. HTOA has submitted document prepared by the consortium of the consultants. Outcome of the study is as under and the same has carved the way for issuance of these guidelines by MoRT86H.

(I The highway bridges are designed based on codes published by The Indian Roads Congress (IRC). The bridges are designed for live loads conforming to IRC:6. The IRC design vehicles do not cover the loads that are being carried using multi-axle Modular hydraulic Trailer (MHT). For granting permission for the passage of OW/ODC on any existing bridge, the assessment for adequacy of the bridge is to be carried out as per the

provisions of IRC:SP:37-2010, which furnish Guidelines for evaluation of load carrying capacity of bridges for OW/ODC.

(ii) A detailed analytical study was carried out for passage of various types and combination carrying multi-axle modular hydraulic trailers (i,e. 13 types of combinations considered) as OW/ ODC. **The study was carried out only for simply supported bridge structures with span length ranging from 5m to 50 meters and covering various cross sections with 2 lane, 4 lane, 6 lane and 8 lane width and various types of bridges.**

4. Based on the findings of this study, simplified charts (as listed below) are enclosed, which shall form the basis for operation and permitting movement of multi axle modular hydraulic trailers carrying OW/ODC throughout the territory of India. The movement shall be permitted subject to compliance of the conditions/assumptions given in Annexure 1.

4.1 The final results of the study are reproduced in enclosed charts, Chart C.1 to Chart C.13. Different 1 combinations of multi axle modular hydraulic trailers are listed in Table 1:

## Table 1 – Load Composition of type HT1 to HT13

| Chart No. | Type Of Combination | Total No.of Axles in MH TRAILER UNIT | Gross Vehicle Weight (without Puller Tractor) (MT) |
|---|---|---|---|
| C1 | HT1 | 4 | 72 |
| C2 | HT2 | 6 | 108 |
| C3 | HT3 | 8 | 144 |
| C4 | HT4 | 10 | 180 |
| C5 | HT5 | 12 | 216 |
| C6 | HT6 | 14 | 252 |
| C7 | HT7 | 16 | 288 |
| C8 | HT8 | 18 | 324 |
| C9 | HT9 | 20 | 360 |
| C10 | HT10 * | 8+8 | 288 |
| C11 | HT11 * | 10+10 | 360 |
| C12 | HT12 ** | 14+14 | 504 |
| C13 | HT13 ** | 16+16 | 576 |

(The Unladen weight of single axle is considered as 3.3 t
(*) Units with Turn Table Bolster Arrangement (Beam Weight = 16 t)
(**) Units with Girder Arrangement (Self Weight of Girder = 132 t)

The puller tractor is considered to carry a load of 25t comprising of 6t axle load in front axle and 9.5t each in rear two axles

**Note**

In order to select the appropriate chart applicable to a particular type of bridge structure, it is important to identify the characteristics of the bridge (i.e. Span Length, Structure Type, Support Condition etc). Before granting permission for passage of OW/ODC, it is important to ensure that these parameters are available with the authority and overall condition of the bridge is examined by the concerned engineer of the Department/ empanelled consultants with Ministry.

4.2 Free movement for MHT combination type HT1, HT2 & HT3 may be permitted for all specified types of bridges and for all specified span lengths. For MHT combination type HT4, HT5, HT6, HT7, HT8, HT9, HT10, HT11, HT12 &

HT13, movement shall be permitted up to Gross Vehicle Weight (GVW) as mentioned in the enclosed charts or reduced GVW reflected in specific cell.

4.3 Based on the above referred charts, a concise recommendation of study in the form of summary is presented in Table 2 below. The HT Loadings are categorized as A, B 86 C and structure types categorized as 1,2 86 3 respectively. The summary table presents the equivalency of IRC loads to different HT Loads with respect to structure type. For Longer Spans and for Type of Structures not covered in the above referred charts, specific studies may be carried out on identical system, which shall form the basis for clearance for movement of OW/ODC and also for future reference.

## TABLE 2 : SUMMARY TABLE SHOWING ADEQUACY OF STRUCTURE TYPES FOR PASSAGE OF HT LOAD

| TYPE OF BRIDGE STRUCTURE / TYPE OF HT LOADING | | | CATEGORY OF STRUCTURE TYPE | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| | | | • Culverts<br>• Masonry Arch Bridges<br>• RCC Solid/ Void Slab Bridges<br>• RCC Precast/Cast-in-situ Beam & Slab Bridges ( with or without intermediate cross girder) | • PSC Precast/Cast-in-situ Beam and slab Bridges( with or without intermediate cross girder)<br>• PSC Cast-in-situ Box Girder type Bridges | • PSC Precast Segmental box Girder type Bridges with WET joints.<br>• Composite Decks with steel beams and concrete slab bridges ( with or without intermediate cross girder) |
| HT LOADING CATEGORY | A | HT1, HT2, HT3 | PASS | PASS | PASS |
| | B | HT4 TO HT9 | PASS | • For HT4: Pass<br>• For HT 5 to HT9: Pass with Restricted GVW in some cases- Refer charts for details | • Pass with Restricted GVW in some cases- Refer charts for details |
| | C | HT10, HT11, HT12, HT13 | PASS | • Pass with Restricted GVW in some cases- Refer charts for details | • Pass with Restricted GVW in some cases- Refer charts for details |

4.4 If a route is through for a particular type of Hydraulic trailer with particular load, the route shall be deemed fit for equal or lower categories of HTs with load for a period of six (6) months immediately from the date of issuance of first permission. The permission granted along with the route and HT/load details shall be hosted on Ministry's website. The Chief Engineer (Bridges) S86R of Ministry shall act as nodal officer to receive requests and grant permission for movement of OW/ODC on National Highways within 3 months after the receipt of the Route Survey Report plan along with condition survey report of the bridges enroute prepared by Ministry's empanelled consultant.

5. Bridge authorities to implement bridge information display system as suggested in Table-3 below) for bridges with span length exceeding 20 meters for better compliance of orders.

## Table-3 Bridge Information Display

| | |
|---|---|
| Name Of Bridge/ Crossing | |
| Location/ Chainage | |
| Name of River | |
| Type of Superstructure | |
| Type of Bearing | |
| Type of Foundation | |
| Carriageway width | |
| Span Arrangement | |
| Year of Construction | |
| Design Live Load • | |
| Bridge has been rehabilitated earlier or not | |
| Name of Controlling Authority | |
| Address of Controlling Authority | |
| Contact Telephone Number | |
| **Published on** | **Date:** |

6. The contents of this letter may be brought to the notice of all the officers of your Department dealing with bridge works on National Highways and other category of Roads. The State/UT governments may also like to issue similar circulars for movement of OW/ODC in roads under their jurisdiction.

Yours faithfully

(A.P. Pathak)
Chief Engineer(B)S&R
For Director General (RD)&SS

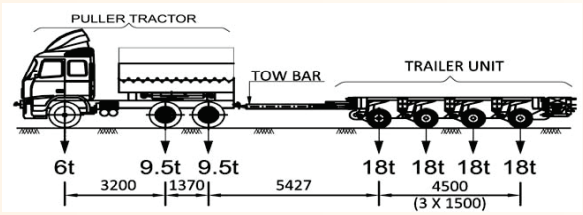
**Enclosure:** Charts C.1 to C.13
Annexure 1

Copy to :

1. All Technical Officers of the Ministry
2 All ROs and ELOs, MoRT&H
3. Secretary General, IRC, New Delhi- With request to publish in IndianHighways, Journal
4. Director, IAHE, Noida
5. PS to Hon'ble Minister (RT&H)
6. PS to Hon'ble MOS(T)
7. PS to Hon'ble MOS(S)
8. Sr.PPS to Secretary (MoRT&H)
9. PPS to DG(RD)&SS, PPS to ADG-1, PPS to ADG-2, PPS to ADG-3
10. PS to JS(T), MoRT&H
11. NIC - With request to upload on web page of the Ministry
12. General Secretary, Hydraulic Trailer Owners Association, Mumbai

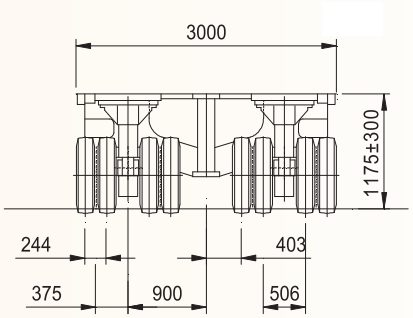
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR :** **CHART NO. C1**

**HT 1 LOADING (WITH 4 AXLE TRAILER UNITS)**




| Span ▼ CW Type ▶ | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 45 m | | | | | |
| 50 m | | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | | | | NOT APPLICABLE | |
| 35 m | | | | NOT APPLICABLE | |
| 40 m | | | | NOT APPLICABLE | |
| 45 m | | | | NOT APPLICABLE | |
| 50 m | | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |

**TOTAL GVW INCLUDING PULLER TRACTOR= 97 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

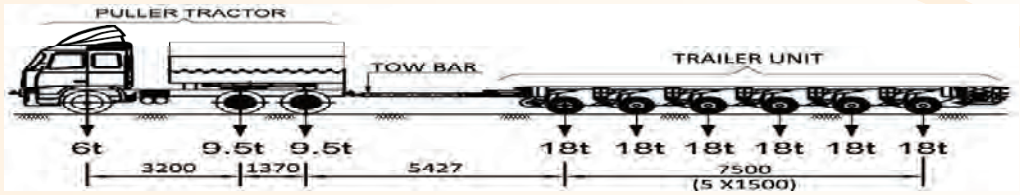
**C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY**
**C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY**
**C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY**
**C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY**
**C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY**

**NOTES :**

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.
2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.
3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY
4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 4
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)
5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES
6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

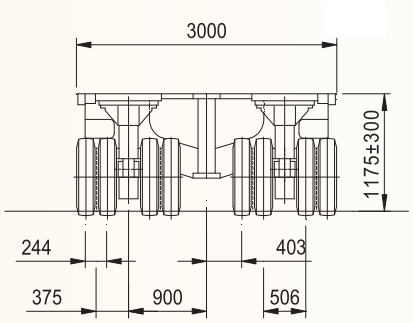
CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 2 LOADING (WITH 6 AXLE TRAILER UNITS)

**CHART NO. C 2**




| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 45 m | | | | | |
| 50 m | | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | | | | NOT APPLICABLE | |
| 35 m | | | | NOT APPLICABLE | |
| 40 m | | | | NOT APPLICABLE | |
| 45 m | | | | NOT APPLICABLE | |
| 50 m | | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |

TOTAL GVW INCLUDING PULLER TRACTOR= 133 t




TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

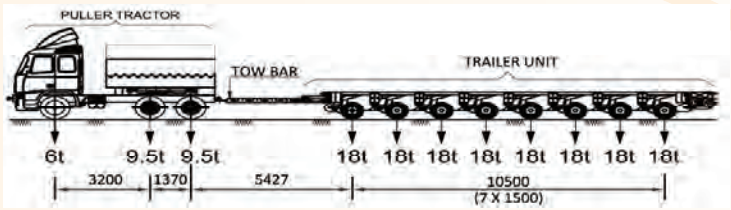
C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.
2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.
3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY
4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 6
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)
5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES
6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

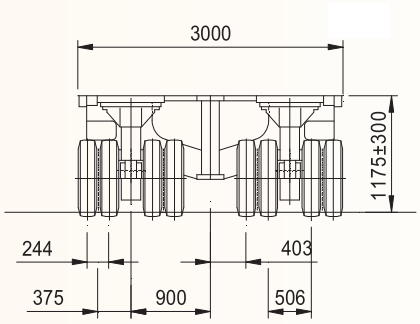
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 3 LOADING (WITH 8 AXLE TRAILER UNITS**

**CHART NO. C3**




| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 45 m | | | | | |
| 50 m | | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | | | | NOT APPLICABLE | |
| 35 m | | | | NOT APPLICABLE | |
| 40 m | | | | NOT APPLICABLE | |
| 45 m | | | | NOT APPLICABLE | |
| 50 m | | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |

**TOTAL GVW INCLUDING PULLER TRACTOR= 169 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.

2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.

3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY

4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 8

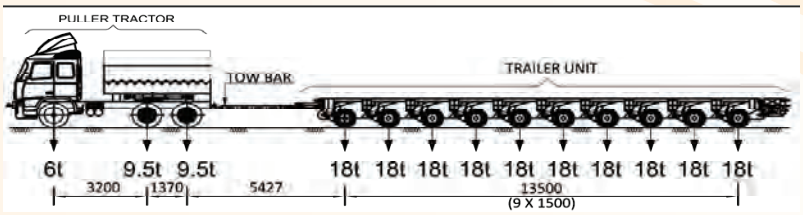
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)

5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES

6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

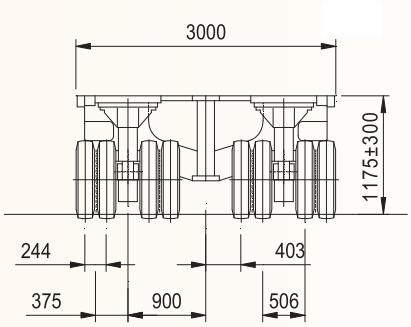
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 4 LOADING (WITH 10 AXLE TRAILER UNITS)**

**CHART NO. C4**




| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| **1. Masonary Arch bridges** | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| **2. RCC Solid/Voided slab bridges** | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| **3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| **6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| **7. PSC Cast in Situ Box Girders type bridges** | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 45 m | | | | | |
| 50 m | | | | | |
| **8. PSC Precast Segmental Box Girders type bridges - With Wet Joint** | | | | | |
| 30 m | | | | NOT APPLICABLE | |
| 35 m | | | | NOT APPLICABLE | |
| 40 m | | | | NOT APPLICABLE | |
| 45 m | | | | NOT APPLICABLE | |
| 50 m | | | | NOT APPLICABLE | |
| **9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | 201 t | | |
| 35 m | | | | | |
| **10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 201 t | | 194 t | | 201 t |
| 25 m | 199 t | 193 t | 198 t | | |
| 30 m | 199 t | | 198 t | | |
| 35 m | 186 t | | 189 t | | 202 t |

**TOTAL GVW INCLUDING PULLER TRACTOR= 205 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.

2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.

3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY

4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 10

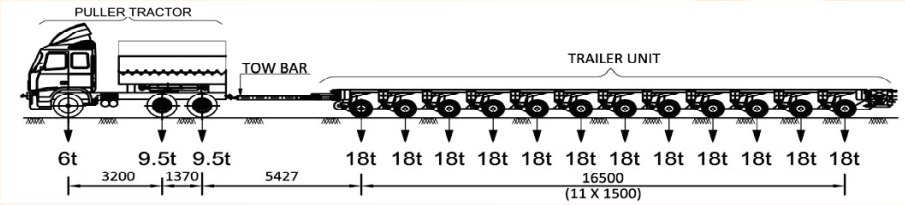
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)

5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES

6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

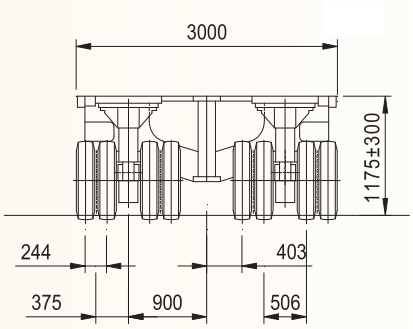
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 5 LOADING (WITH 12 AXLE TRAILER UNITS)**

**CHART NO. C 5**




| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| **1. Masonary Arch bridges** | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| **2. RCC Solid/Voided slab bridges** | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| **3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | 237 t | | | | |
| **6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 20 m | | | | 240 t | 236 t |
| 25 m | | | | | 236 t |
| 30 m | | | | 240 t | 237 t |
| 35 m | | | | | |
| 40 m | | | | 240 t | 234 t |
| **7. PSC Cast in Situ Box Girders type bridges** | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | | | | | |
| 45 m | | | | | |
| 50 m | | | | | |
| **8. PSC Precast Segmental Box Girders type bridges - With Wet Joint** | | | | | |
| 30 m | | | | NOT APPLICABLE | |
| 35 m | | | | NOT APPLICABLE | |
| 40 m | 237 t | | | NOT APPLICABLE | |
| 45 m | 231 t | | | NOT APPLICABLE | |
| 50 m | 231 t | | | NOT APPLICABLE | |
| **9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 238 t | | | | |
| 25 m | 227 t | | | | 239 t |
| 30 m | 220 t | | 225 t | | |
| 35 m | 218 t | | | | 234 t |
| **10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 226 t | | 217 t | | 226 t |
| 25 m | 217 t | 237 t | 216 t | | 228 t |
| 30 m | 216 t | | 213 t | | 227 t |
| 35 m | 204 t | 237 t | 203 t | | 222 t |

**TOTAL GVW INCLUDING PULLER TRACTOR= 241 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

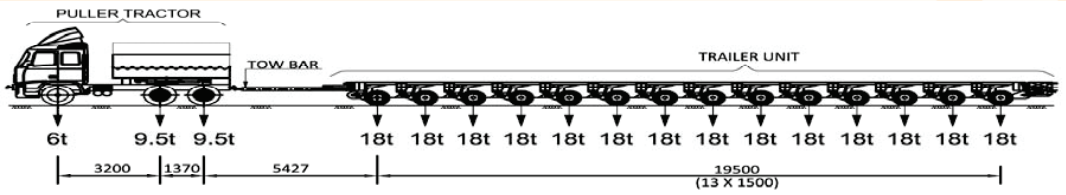
C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.
2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.
3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY
4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 12
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)
5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES
6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

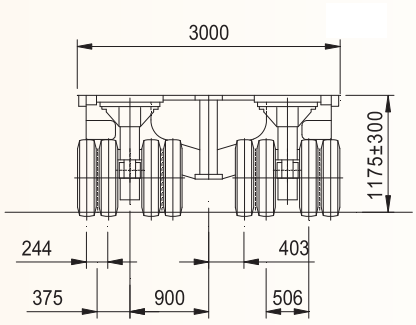
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 6 LOADING (WITH 14 AXLE TRAILER UNITS)**

**CHART NO. C 6**




| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | 266 t | | | | |
| 40 m | 251 t | | | | |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | 273 t | 268 t |
| 25 m | | 273 t | | 269 t | 263 t |
| 30 m | | 271 t | | 265 t | 261 t |
| 35 m | | 276 t | | 270 t | 263 t |
| 40 m | 276.9 t | 276.7 t | | 260 t | 253 t |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | 267 t | | | | |
| 45 m | 259 t | | | | |
| 50 m | 258 t | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | 276.7 t | | | NOT APPLICABLE | |
| 35 m | 259 t | | | NOT APPLICABLE | |
| 40 m | 248 t | | | NOT APPLICABLE | |
| 45 m | 240 t | | | NOT APPLICABLE | |
| 50 m | 240 t | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 270 t | | | | |
| 25 m | 246 t | | | | 269 t |
| 30 m | 237 t | | 250 t | | 276.98 t |
| 35 m | 231 t | | 272 t | | 259 t |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 256 t | | 247 t | | 257 t |
| 25 m | 238 t | 259 t | 236 t | 273 t | 250 t |
| 30 m | 234 t | 260 t | 231 t | 271 t | 246 t |
| 35 m | 222 t | 250 t | 217 t | 262 t | 244 t |

**TOTAL GVW INCLUDING PULLER TRACTOR= 277 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

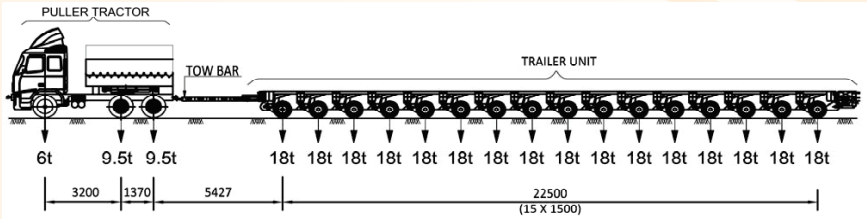
C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.
2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.
3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY
4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 14
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)
5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES
6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

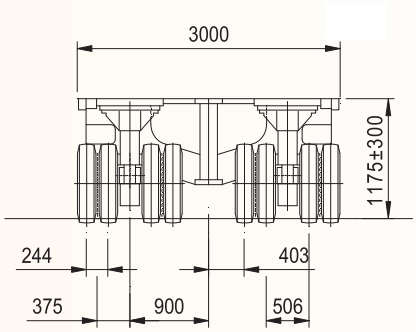
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 7 LOADING (WITH 16 AXLE TRAILER UNITS)**

**CHART NO. C 7**




**TOTAL GVW INCLUDING PULLER TRACTOR= 313 t**

| Span ↓ C'W type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | 312 t | | | | |
| 35 m | 284 t | | | | |
| 40 m | 266 t | 308 t | | | 312 t |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | 308 t | 302 t |
| 25 m | | 303 t | | 298 t | 292 t |
| 30 m | 308 t | 298 t | | 291 t | 288 t |
| 35 m | 310 t | 300 t | | 294 t | 286 t |
| 40 m | 293 t | 299 t | | 281 t | 274 t |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | 311 t | | | | |
| 35 m | 297 t | | | | |
| 40 m | 281 t | | | | |
| 45 m | 270 t | | | | |
| 50 m | 268 t | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | 297 t | | | NOT APPLICABLE | |
| 35 m | 276 t | | | NOT APPLICABLE | |
| 40 m | 261 t | | | NOT APPLICABLE | |
| 45 m | 251 t | | | NOT APPLICABLE | |
| 50 m | 249 t | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 305 t | | | | |
| 25 m | 272 t | | 311 t | | 301 t |
| 30 m | 254 t | | 276 t | | 308 t |
| 35 m | 247 t | | 300 t | | 285 t |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 290 t | | 279 t | | 290 t |
| 25 m | 263 t | 286 t | 262 t | 302 t | 277 t |
| 30 m | 253 t | 280 t | 250 t | 292 t | 267 t |
| 35 m | 239 t | 269 t | 233 t | 280 t | 267 t |




TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSIN(

2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.

3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY

4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 16

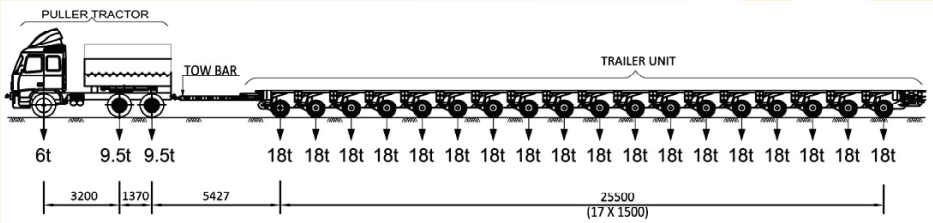
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)

5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKINC THE HT LOADS OVER THE BRIDGES

6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

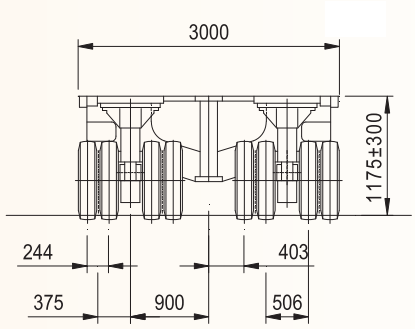
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 8 LOADING (WITH 18 AXLE TRAILER UNITS)**

**CHART NO. C 8**




**TOTAL GVW INCLUDING PULLER TRACTOR= 349 t**

| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| **1. Masonary Arch bridges** | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| **2. RCC Solid/Voided slab bridges** | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| **3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | 341 t | | | | |
| 35 m | 306 t | | | | |
| 40 m | 284 t | 333 t | | 347 t | 341 t |
| **6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 20 m | | | | 344 t | 337 t |
| 25 m | | 337 t | | 332 t | 325 t |
| 30 m | 335 t | 326 t | | 319 t | 315 t |
| 35 m | 332 t | 326 t | | 319 t | 311 t |
| 40 m | 311 t | 322 t | | 303 t | 296 t |
| **7. PSC Cast in Situ Box Girders type bridges** | | | | | |
| 30 m | 337 t | | | | |
| 35 m | 317 t | | | | |
| 40 m | 297 t | | | | |
| 45 m | 283 t | | | | |
| 50 m | 279 t | | | | |
| **8. PSC Precast Segmental Box Girders type bridges - With Wet Joint** | | | | | |
| 30 m | 321 t | | | NOT APPLICABLE | |
| 35 m | 295 t | | | NOT APPLICABLE | |
| 40 m | 276 t | | | NOT APPLICABLE | |
| 45 m | 263 t | | | NOT APPLICABLE | |
| 50 m | 259 t | | | NOT APPLICABLE | |
| **9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 340 t | | | | |
| 25 m | 302 t | | 346 t | | 335 t |
| 30 m | 275 t | | 304 t | | 339 t |
| 35 m | 263 t | 347 t | 329 t | | 312 t |
| **10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 323 t | | 311 t | | 323 t |
| 25 m | 292 t | 318 t | 291 t | 335 t | 307 t |
| 30 m | 276 t | 304 t | 272 t | 316 t | 290 t |
| 35 m | 255 t | 286 t | 251 t | 300 t | 286 t |




TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUIT

C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUIT

C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.

2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.

3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY

4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 18

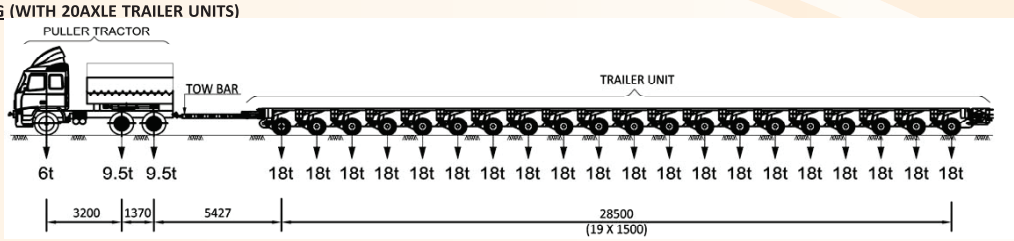
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)

5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES

6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

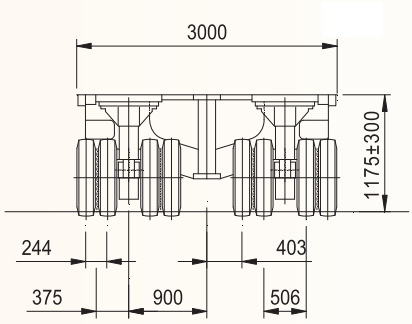
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 9 LOADING (WITH 20AXLE TRAILER UNITS)**

**CHART NO. C 9**




**TOTAL GVW INCLUDING PULLER TRACTOR= 385 t**

| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | 373 t | | | | |
| 35 m | 328 t | 382 t | | | |
| 40 m | 303 t | 359 t | | 378 t | 371 t |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | 379 t | 372 t |
| 25 m | | 372 t | | 366 t | 359 t |
| 30 m | 366 t | 356 t | | 349 t | 345 t |
| 35 m | 356 t | 354 t | | 346 t | 338 t |
| 40 m | 331 t | 347 t | | 326 t | 319 t |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | 367 t | | | | |
| 35 m | 338 t | | | | |
| 40 m | 314 t | | | | |
| 45 m | 297 t | | | | |
| 50 m | 291 t | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | 351 t | | | NOT APPLICABLE | |
| 35 m | 315 t | | | NOT APPLICABLE | |
| 40 m | 292 t | | | NOT APPLICABLE | |
| 45 m | 276 t | 379 t | | NOT APPLICABLE | |
| 50 m | 270 t | 371 t | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 375 t | | | | |
| 25 m | 333 t | | 382 t | | 370 t |
| 30 m | 300 t | | 334 t | | 372 t |
| 35 m | 281 t | 376 t | 360 t | | 340 t |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 356 t | | 343 t | | 357 t |
| 25 m | 322 t | 351 t | 321 t | 370 t | 339 t |
| 30 m | 302 t | 332 t | 297 t | 346 t | 318 t |
| 35 m | 274 t | 307 t | 269 t | 321 t | 307 t |




TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.

2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.

3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY

4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 20

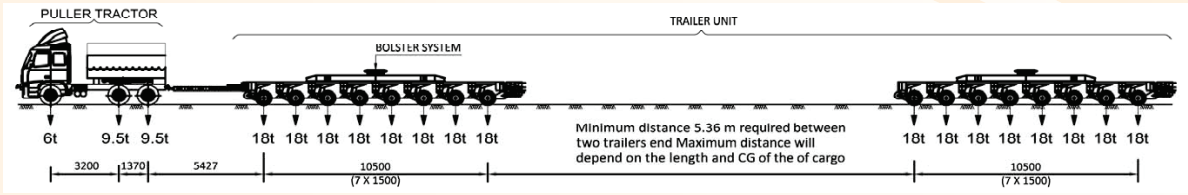
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)

5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES

6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

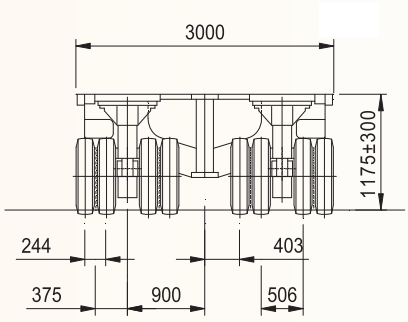
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 10 LOADING (WITH 8+8 AXLE TRAILER UNITS AND TURN TABLE BOLSTER)**

**CHART NO. C 10**




| Span / CW type | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | 304 t | | | | |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | | | | | 312.6 t |
| 40 m | | | | 305 t | 298 t |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | 304 t | | | | |
| 45 m | 304 t | | | | |
| 50 m | 296 t | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | | | | NOT APPLICABLE | |
| 35 m | 304 t | | | NOT APPLICABLE | |
| 40 m | 283 t | | | NOT APPLICABLE | |
| 45 m | 283 t | | | NOT APPLICABLE | |
| 50 m | 275 t | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | 286 t | | 299 t | | |
| 35 m | 271 t | | | | 308 t |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | 305 t | | 305 t | | |
| 30 m | 298 t | | 299 t | | |
| 35 m | 262 t | | 282 t | | 288 t |

**TOTAL GVW INCLUDING PULLER TRACTOR= 313 t**




TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

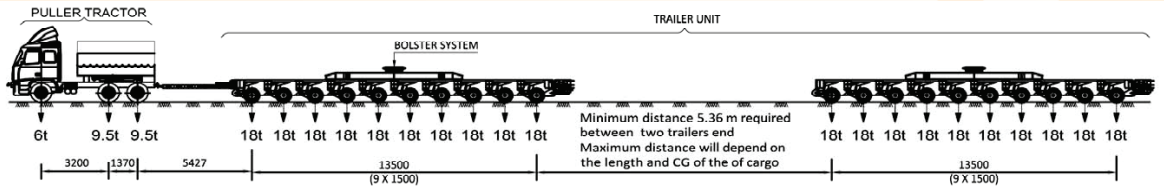
C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.
2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.
3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY
4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 16
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)
5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES
6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

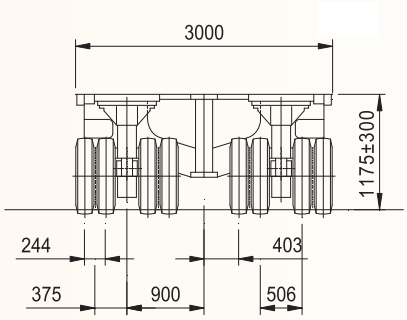
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 11 LOADING (WITH 10+10 AXLE TRAILER UNITS AND TURN TABLE BOLSTER)**

**CHART NO. C 11**




| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| 1. Masonary Arch bridges | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| 2. RCC Solid/Voided slab bridges | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | 375 t | | | | |
| 40 m | 343 t | | | | |
| 6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder | | | | | |
| 20 m | | | | | |
| 25 m | | | | | 384 t |
| 30 m | | | | 378 t | 374 t |
| 35 m | | 383 t | | 374 t | 364 t |
| 40 m | | 374 t | | 351 t | 343 t |
| 7. PSC Cast in Situ Box Girders type bridges | | | | | |
| 30 m | | | | | |
| 35 m | 375 t | | | | |
| 40 m | 343 t | | | | |
| 45 m | 339 t | | | | |
| 50 m | 325 t | | | | |
| 8. PSC Precast Segmental Box Girders type bridges - With Wet Joint | | | | | |
| 30 m | | | | NOT APPLICABLE | |
| 35 m | 349 t | | | NOT APPLICABLE | |
| 40 m | 319 t | | | NOT APPLICABLE | |
| 45 m | 315 t | | | NOT APPLICABLE | |
| 50 m | 302 t | | | NOT APPLICABLE | |
| 9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | 374 t | | | | |
| 30 m | 339 t | | 354 t | | |
| 35 m | 311 t | | | | 361 t |
| 10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder | | | | | |
| 15 m | | | | | |
| 20 m | 377 t | | 364 t | | 377 t |
| 25 m | 361 t | | 362 t | | 380 t |
| 30 m | 353 t | | 354 t | | 373 t |
| 35 m | 304 t | 370 t | 327 t | | 336 t |

**TOTAL GVW INCLUDING PULLER TRACTOR= 385 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

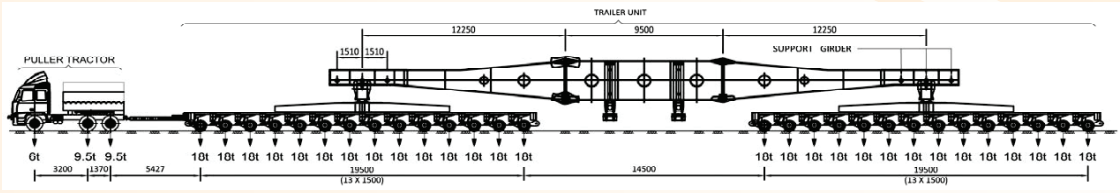
C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.
2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.
3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY
4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 16
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)
5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES
6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

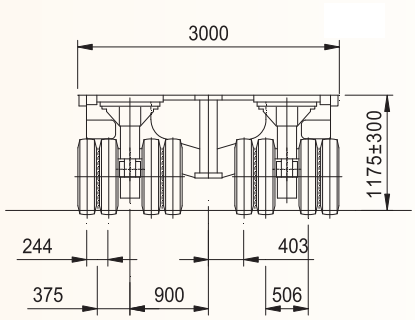
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 12 LOADING (WITH 14+14 AXLE TRAILER UNITS AND GIRDER ARRANGEMENT)**

**CHART NO. C 12**




| Span ↓ CW type → | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| **1. Masonary Arch bridges** | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| **2. RCC Solid/Voided slab bridges** | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| **3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | 508 t | | | | |
| 40 m | 480 t | | | | |
| **6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 20 m | | | | 521 t | 511 t |
| 25 m | | 522 t | | 513 t | 503 t |
| 30 m | | 517 t | | 505 t | 499 t |
| 35 m | | 527 t | | 515 t | 502 t |
| 40 m | 528.8 t | 528 t | | 496 t | 484 t |
| **7. PSC Cast in Situ Box Girders type bridges** | | | | | |
| 30 m | | | | | |
| 35 m | | | | | |
| 40 m | 510 t | | | | |
| 45 m | 494 t | | | | |
| 50 m | 492 t | | | | |
| **8. PSC Precast Segmental Box Girders type bridges - With Wet Joint** | | | | | |
| 30 m | 528 t | | | NOT APPLICABLE | |
| 35 m | 494 t | | | NOT APPLICABLE | |
| 40 m | 474 t | | | NOT APPLICABLE | |
| 45 m | 459 t | | | NOT APPLICABLE | |
| 50 m | 458 t | | | NOT APPLICABLE | |
| **9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 516 t | | | | |
| 25 m | 470 t | | | | 513 t |
| 30 m | 452 t | | 477 t | | 528.95 t |
| 35 m | 441 t | | 519 t | | 494 t |
| **10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 490 t | | 472 t | | 490 t |
| 25 m | 454 t | 495 t | 451 t | 522 t | 477 t |
| 30 m | 447 t | 496 t | 441 t | 517 t | 471 t |
| 35 m | 424 t | 478 t | 415 t | 500 t | 466 t |

**TOTAL GVW INCLUDING PULLER TRACTOR= 529 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

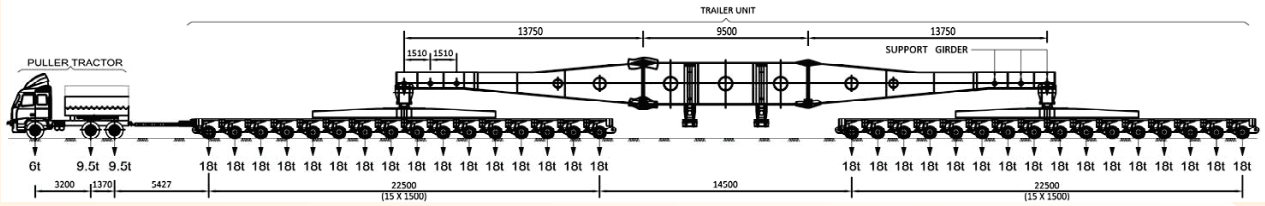
C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY
C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY
C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.
2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.
3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY
4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 28
Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)
5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES
6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

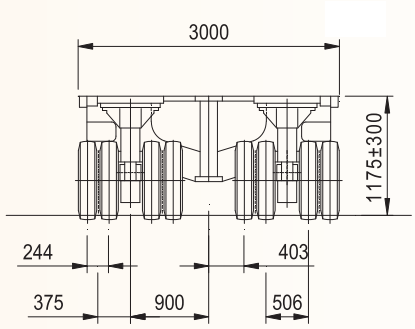
**CHART SHOWING ADEQUACY OF SPAN, CARRIAGEWAY WIDTHS & STRUCTURE TYPE FOR HT 13 LOADING (WITH 16+16 AXLE TRAILER UNITS AND GIRDER ARRANGEMENT)**

**CHART NO. C 13**




| Span / CW type | C' WAY TYPE 1 | C' WAY TYPE 2 | C' WAY TYPE 3 | C' WAY TYPE 4 | C' WAY TYPE 5 |
|---|---|---|---|---|---|
| **1. Masonary Arch bridges** | | | | | |
| 5 m | | NOT APPLICABLE | | | |
| 10 m | | NOT APPLICABLE | | | |
| 15 m | | NOT APPLICABLE | | | |
| **2. RCC Solid/Voided slab bridges** | | | | | |
| 5 m | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| **3. RCC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **4. RCC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 10 m | | | | | |
| 15 m | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| **5. PSC Precast/Cast in-Situ Beam and Slab bridges - With Int. X Girder** | | | | | |
| 20 m | | | | | |
| 25 m | | | | | |
| 30 m | | | | | |
| 35 m | 546 t | | | | |
| 40 m | 517 t | 597 t | | | |
| **6. PSC Precast/Cast in-Situ Beam and Slab bridges - Without Int. X Girder** | | | | | |
| 20 m | | | | 592 t | 581 t |
| 25 m | | 582 t | | 573 t | 562 t |
| 30 m | 592 t | 573 t | | 560 t | 554 t |
| 35 m | 598 t | 582 t | | 570 t | 556 t |
| 40 m | 570 t | 579 t | | 546 t | 532 t |
| **7. PSC Cast in Situ Box Girders type bridges** | | | | | |
| 30 m | 598 t | | | | |
| 35 m | 570 t | | | | |
| 40 m | 540 t | | | | |
| 45 m | 519 t | | | | |
| 50 m | 514 t | | | | |
| **8. PSC Precast Segmental Box Girders type bridges - With Wet Joint** | | | | | |
| 30 m | 570 t | | | NOT APPLICABLE | |
| 35 m | 531 t | | | NOT APPLICABLE | |
| 40 m | 502 t | | | NOT APPLICABLE | |
| 45 m | 482 t | | | NOT APPLICABLE | |
| 50 m | 478 t | | | NOT APPLICABLE | |
| **9. Composite decks with Steel Beams and Concrete slab bridges - With Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 586 t | | | | |
| 25 m | 522 t | | 597 t | | 578 t |
| 30 m | 488 t | | 530 t | | 592 t |
| 35 m | 474 t | | 576 t | | 546 t |
| **10. Composite decks with Steel Beams and Concrete slab bridges - Without Int. X Girder** | | | | | |
| 15 m | | | | | |
| 20 m | 556 t | | 536 t | | 557 t |
| 25 m | 505 t | 550 t | 502 t | 580 t | 531 t |
| 30 m | 487 t | 538 t | 480 t | 560 t | 513 t |
| 35 m | 459 t | 516 t | 448 t | 538 t | 513 t |

**TOTAL GVW INCLUDING PULLER TRACTOR= 601 t**




**TYPICAL CROSS SECTION SHOWING TRANSVERSE WHEEL ARRANGEMENT OF HYDRAULIC TRAILER UNITS**

**Legend:**

Safe to carry the specified load

Safe to carry marked reduced GVW

C'WAY TYPE 1 : 2 LANE SINGLE CARRIAGEWAY OR 2 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 2 : 3 LANE SINGLE CARRIAGEWAY OR 3 LANE DUAL CARRIAGEWAY WITH STRUCTURAL DISCONTINUITY

C'WAY TYPE 3 : 4 LANE SINGLE CARRIAGEWAY OR 4 LANE DUAL C' WAY WITH STRUCTURAL DISCONTINUITY OR 2 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 4 : 3 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

C'WAY TYPE 5 : 4 LANE DUAL CARRIAGEWAY WITHOUT STRUCTURAL DISCONTINUITY

NOTES :

1 THE ABOVE CONCLUSIONS ARE FOR BRIDGES HAVING DECK SLAB WITHOUT ANY TRANSVERSE PRESTRESSING.

2 THE OWC CAN SAFELY BE PERMITTED OVER ALL TYPES OF CULVERTS HAVING SPAN LENGTH < 6m.

3 THE ABOVE CONCLUSIONS ARE BASED ON THE CONDITIONS / ASSUMPTIONS GIVEN SEPARATELY

4 WHEREVER REDUCED GVW IS MARKED "RED" IN THE CHART, CORRESPONDING REDUCED AXLE LOAD CAN BE CALCULATED BY THE FORMULA : RAL = (RGVW-25) / 4

Where : RAL = Reduced Axle Load (in tonnes); RGVW = Reduced Gross Vehicle Weight (in tonnes)

5 THE TRANSPORTER SHALL TAKE PERMISSION FROM THE CONCERNED REGULATORY AGENCY BEFORE TAKING THE HT LOADS OVER THE BRIDGES

6 IN CASE OF STRUCTURES MARKED TO CARRY RGVW, FOR INTERMEDIATE SPAN LENGTHS, THE VALUES OF GVW OF CRITICAL OF THE TWO ADJACENT SPANS HAVE TO BE TAKEN.

# Annexure-1

**Assumptions/Conditions to be complied for passing of Over Weight and Over Dimensional Consignments (OW/ODC) on a Bridge**

The movement of OW/ODC on bridges shall be permitted subject to compliance of the following conditions/assumptions:

1. The spirit of IRC SP:37:2010 is that the passage of OW/ODC over the bridge is of infrequent occurrence and that occasional limited overstressing beyond stipulated codal limits due to load effects caused by OW/ODC would not cause any adverse effects.

2. The study recommendation assumes that the bridge is in good condition 86 capable of withstanding Live loads as per IRC: 6.

3. Condition survey of the bridge shall be carried out prior to passing of OW/ODC by persons having appropriate qualification, skill 86 experience. The inspection shall be carried out as per Appendix-4 of IRC-SP: 35-1990.

4. It shall be ensured that no other vehicle shall move on any part of the carriageway/ s when this trailer is crossing any major / minor bridge.

5. The vehicle should move at uniform speed of about 5 km/hr with special precaution for avoiding application of brakes. Braking / Acceleration on the bridge is strictly prohibited and in no case the vehicle shall be stationed over the structure.

6. The OW/ODC must ply at

   (a) the center of the deck (with a maximum tolerance of 300mm) in single carriageway bridges,

   (b) center of any of the carriageways for dual carriageway bridges with structural discontinuity along median (with a maximum tolerance of 300mm)

   (c) close to the median verge (with maximum eccentricity of 2.35m from c/1 of median) on bridges with no longitudinal separation the structure for the two carriageways.

7. The OW/ODC should cross the bridge under normal climatic /weather conditions.

8. It shall be ensured that the consignment shall be maintained at the centre of the platform of the trailer during movement and also that all axles are equally loaded.

9. All necessary warning signals shall be provided on the HT Puller Tractor such as painting the entire width by yellow and black zebra strips on the front and rear sides, duly marked with retro reflective stickers and installing red lamps to indicate the extreme position of the vehicles clearly for night time driving/parking. Similarly red flags on both sides should be installed for facilitating demarcation of extreme position of the vehicle during day time.

10. The vehicle shall be moved carefully under supervision and escort of responsible officers.

11. The Bridges must be carefully observed for any distress before and after each passage of OW/ODC.

12. After each passage of OW/ODC, the bridges must be carefully inspected to any occurrence of distress due to passage of OW/ODC.

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# Scania's Introduction
## of sustainable global trends to India

Headquartered in Sweden, Scania is a global commercial Vehicle solution innovator, present in over 100 countries across the globe committed for customer profitability, safety, quality and environment friendliness.

Since the entry into the Indian market, Scania has reached a number of significant milestones in Mining, ODC, long haul and bus market. Scania's emphasis on Total Operating Economy (TOE) and truly sustainable and safe transport solutions is constantly communicated through its offerings.

All the Scania products also come with the promise of market leading productivity, maximized vehicle uptime and outstanding fuel efficiency all leading to best possible Total Operating Economy (TOE). With a vision to change the Indian transportation system, Scania is tapping very opportunity to bring innovative technology and state-of-the-art products and services to India.

Sustainability is at the core of Scania's offer from a social, environmental and economic advantage while strengthening its offer of transport solutions to the Indian market.

Scania is destined to offer trucking solution from 310 HP to 580 HP for different load matrix in the over-dimensional cargo logistics. With the launch of Scania

R580 6X4 heavy duty puller, the most powerful truck, Scania has taken another step for its commitment to redefine the truck industry in India.

Connected vehicles form the basis for future services that will benefit our customers and contribute to sustainable transport solutions. The Fleet Management Service is an integral part of Scania's comprehensive global service offering, supporting the driver, as well as managing the transport operation and the vehicle fleet. The Fleet Management offers customers the possibility to monitor, analyze and control their fleet operations leading to maximized uptime and enhanced road safety. This is a major benefit for operators running all kind of operations. The Control part of the Scania Fleet Management is an advanced set of services suitable for fleet owners who want the benefits of vehicle and driver follow-up, as well as additional operational information based on maps and positioning to support their transport process.

At the forefront of sustainability Scania offers truck and bus solution on biofuels. Ethanol accounts for around 90 percent of renewable vehicle fuels available in the world today and can be sourced locally, which will reduce the need for import of oil. It is the most cost-effective biofuel in the market in terms of availability, infrastructure and accessibility. Compared to a conventional diesel engine, ethanol-powered vehicles can reduce fossil carbon dioxide emissions by up to 90 percent.

Sustainability is at the core of Scania's offer from a social, environmental and economic advantage while strengthening its offer of transport solutions to the Indian market. Inline with our commitment Scania is focus with sustainable development to nurture its focus on providing reliable, fuel-efficient transport solutions and complete innovative service offerings to customers in India. This coupled with our driver training program will enable customers and operators to have better control over the fleet and help drivers to drive more economically and more safely which in turn have a positive impact on customers' profitability. This will also help in a significant reduction of emissions and will have a lesser impact on the environment.


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# Alternate Method of Lifting

Fagioli India Pvt Ltd 100% subsidiary of Italy based company Fagioli SpA, is undisputed leader into the alternate method of lifting and placement of heavy equipments caters its services to the Power, Infrastructures, Refinery, Offshore and Shipyard industry present with a strong inventory of equipments with a core philosophy to always deliver world class service to customers and achieve the kind of accelerated growth it is aiming for."

**3030T WEIGHT CEILING GIRDERS ERECTION FOR 660MW SUPERCRITICAL POWER PROJECT AT CHHABRA, RAJASTHAN.**

Fagioli India proud to announce first of its kind lifting project of ceiling girder erection for L&T-MHI supercritical boiler girder erection at Chhabra, Rajasthan, wherein Fagioli has successfully skidded and erected 3030T ceiling girder at a height of 82 meter.

In the first phase, Ceiling Girder was skidded by 42 meter distance to the lifting point followed with erection of 3030T girder at a height of 84 meter. Similar operation will be performed for second unit of 660MW supercritical Power Project at Chhabra.

3030 T Ceiling Girder Skidding and Erection by Means of Fagioli Jacks and Rollers

Fagioli India performed second project of 800T weight **Ceiling Girder erection in Supercritical Power Project** for NTPC 2×660MW, Solapur using Fagioli Hydraulic Strand Jack arrangements. Fagioli used four L450 jacks mounted at the top of ceiling girder column at a height 104 meter. A base frame was placed underneath of five ceiling girder assembly connected with anchor housing and strands coming from strand jacks placed at the top of ceiling girder column to lift the complete assembly of 800T girder. After lifting girder assembly at 15 meter height, pressure parts, hanger rods and duct is assembled. Once, lifting of 104 meter is completed, girder assembly was holded till the time all the connection has been made with the ceiling girder support column.

The Strand Jacks technology facilitates to lift the entire ceiling girder along with other pressure parts and accessories like hanger rods, Air-cooled roof and flue gas duct at different elevations.

Now Fagioli India using own equipments has successfully lifted 171 Boilers, 120 Generators & Turbines, 11 Reactors and 36 Miscellaneous lifts till Date besides numerous lifts are in progress at various sites around India.

## Generator Lifting:

Weight: 200MT, Lift Height: 12.5 meters, Rotation: 90 degrees, Skidding: 21 meter

Fagioli India achieved another milestone after lifting of a 300MW and 200T weight Generator at Raigarh, Chhattisgarh using Fagioli gantry and tower arrangements. Generator was placed just below the lifting bay over the trailer where the lifting arrangements were absolutely ready to receive the generator with Fagioli Gantry and L300 Strand Jack. The system was load tested by keeping the job on hold for approximate time of 30 minutes, before the final lift.

To allow access in the TG area a swivel assembly was introduced with the spreader beam to allow the easy access between the central columns. The 12.5 meter lifting and 15 meter skidding was accomplished within a time frame of 2 hrs and 59 minutes.

## Ship to Shore (STS) Container Handling Crane Assembly:

ANUPAM-MHI JV awarded a contract to Fagioli for lifting and assembly of three no's STS Crane (800T weight each) at PIPAVAV PORT, Gujarat using Fagioli Strand Jacks and associated power packs.

Fagioli used 8 nos. L180 Jacks to lift the crane assembly at a 42 meter height for final installations. 2nos. L180 jacks installed on each of the STS Crane leg and 4nos. L50 jacks were installed at ground level as a guy to provide counter force to the eccentric action of lifting Jacks and also to provide the additional force to move leg 30mm outside during lifting.

Complete lifting of STS boom took place in 7 hours and during lifting continuous observations on alignments and load fluctuations monitored on theodolite and power packs respectively. Fagioli took all the precautionary measure before the lifting to make this prestigious project successful. Looking at the market condition Fagioli received good nos. of enquiries for lifting and assembly of STS cranes. The Fagioli Group have been working for half a century as a leading company in heavy transport, heavy lifting and project forwarding activities on a worldwide basis. Specialized in engineering, door to door and project cargo shipping, heavy lifting and logistics the company owns an extensive fleet of equipments facilities featuring a wide range of top quality conventional trailers, the last generation self-propelled modular transporters, cranes, towers systems heavy transport barges, river barges, self-geared and roll on/roll off ships and the most highly sophisticated lifting systems. The staff highly specialised, operates in compliance with health, safety and quality requirements.

# Volvo Trucks –
## Changing face of the trucking Industry

Volvo Trucks today is the second largest producer of heavy trucks and transport solutions in the global truck industry with operations in more than 140 countries and understands that customers have commitments to keep. Volvo Trucks in India is the first European CV maker to launch high performance trucks with a mission to drive the change in the Indian transport industry. Volvo launched the first high performance trucks in 1998 the FH12 340 6x4 for general cargo and the FH12 420 6x4 puller for the over dimensional cargo segment which created new benchmarks in transportation industry in India. Since then Volvo Trucks has been the undisputed leader and customer's most preferred truck brand in the ODC segment. Safety being one of its core value, the truck had various active and passive safety features such as seat belt, crash tested cabs, climate controlled cabins, energy absorbent material & collapsible steering, etc… which was much ahead of the industry as well as the norms. Today, Volvo Trucks is the market leader in premium European truck segment, demanding high performance transport solutions.

With uptime being a key customer deliverable, Volvo was the first one to introduce 24x7 road assistance service "Volvo Action Service" way back in 2000 to offer the round-the-clock vehicle support - a phone call away and set a new

benchmark. Based on philosophy of providing premium care for premium trucks, Volvo extends support throughout the lifecycle of the products with a wide network of company owned company operated service and parts centers as well on site support in remote locations across more than 150 locations, a unique approach in the commercial vehicle industry in India. Volvo Trucks ensure high vehicle uptime through pioneering concepts of service agreements, which has altered the industry's aftermarket approach. Genuine parts and Lubricants, Renovated parts are made available whenever and wherever the customers need be that helps the truck retains its original properties throughout its lifetime.

Our approach to transport solutions has always been holistic. We believe that drivers play an important role in the overall transportation efficiency. Hence Volvo Trucks has always focused on driver development. In fact even before, Volvo rolled out its first truck, it set up a driver training center in Bangalore. Today, Volvo Trucks driver training center has trained over 55,000 drivers who are operating Volvo vehicles across the country for both private as well as public transport. Besides this Volvo Truck driver training center continues to provide several value added services to customer to help them improve their fuel efficiency, fleet management, etc….

Over the years, Volvo Trucks has come up with several innovative and technologically advanced solutions to meet customers' business requirements, be it the 8x4 tipper concept in mining, which has today become a reference in the mining segment, or the recent innovative 10x4 Dump Truck solution, or the latest Dynafleet telematics solutions, we have always focused on increasing productivity and efficiency for our customers, doing "More with Less". With the introduction of the most technologically advanced range of products in October 2014, Volvo is pushing the limits on what premium trucks can offer, setting a new benchmark for transportation.

Today Volvo Trucks in India is synonymous with the heavy haulage and mining segment. Customers in both these segments vouch by the high productivity and reliability of these trucks.

Volvo Trucks product range in India includes the FM/FH range of Tractors in different configurations and FM Rigid Trucks for special application e.g. Fire Tenders, Sky lifts, Boom Pumps, Concrete Mixers and the FMX range of Tippers. The FH series is used in long-haulage ODC transport applications. Volvo FM Tractor series has applications in petroleum & chemicals, bulk cargo, construction and even ODC. Today, Volvo Trucks enjoys over 60 percent of the premium European heavy duty market share in India. With over 1000 tractors and 16 years of presence in India, Volvo Trucks is a significant contributor to the project cargo movement of over dimensional and over weight (>100T GCW) in India.

Volvo believes that everything can be improved and embracing new challenges, with an open mind and

finding solutions for customers is at the heart of everything we do. This approach has led to many path breaking innovations over the years setting new benchmarks over and over again. 16 years ago, Volvo started its journey in India to Drive the Change in Indian commercial vehicle industry with a state-of-the-art trucks that brought global quality for local applications. And we continue to bring in new range of products and services that set new benchmarks in quality and maintain our leadership in high performance trucks.

Hence, when anyone thinks of transport solutions in heavy haulage industry: its Volvo Trucks, as we are your Partners in Progress!


# Government Approves Scheme for I&C Centres for Motor Vehicles

The Minister of State for Road Transport and Highways, Shri Pon. Radhakrishnan informed the Rajya Sabha that the Government has approved a scheme for setting-up of model Automated Inspection & Certification (I&C) Centres for motor vehicles. Under the scheme, one such model Centre would be established in each state / UTs for replication by State Governments. During 11th Plan, the Government sanctioned 10 Centres, one each in the states of Andhra Pradesh (now Telengana), Karnataka, Gujarat, Maharashtra, Rajasthan, Himachal Pradesh, Haryana, Madhya Pradesh, Uttar Pradesh and National Capital Territory of Delhi. These Centres are at different stages of completion.

During the 12th plan, the proposals have been invited from State Governments for setting up model Centres. Preference will be given to those States where no I&C Centre has been sanctioned by the Ministry.

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To know more about the new Volvo FH & the new Volvo FM visit www.volvotrucksindia.com or write to us at vtimarketing@volvo.in

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