No. C1-9100/TC/2012

Transport Commissionerate, Kerala,
2nd Floor, Trans Towers, Vazhuthacaud, Thiruvananthapuram-14,
[☎ 0471-2333337/2333317 FAX 0471-2333314]
[e-mail - tcoffice@keralamvd.gov.in]
Dated, 16-06-2012.

From

The Transport Commissioner,
Thiruvananthapuram.

To

All Deputy Transport Commissioners
All Regional Transport Officers
All Joint Regional Transport Officers

Sir,

Sub:- Motor Vehicles Department – Pilot Study on effect of overloading of Road Infrastructure – Final Report forwarding of for strict implementation – Reg.

Ref:- Government letter No. 5220/B2/2012/Tran dated 18-04-2012.

Your attention is invited to the above reference. Vide reference cited, Government have forwarded the pilot study on effect of overload of Road Infrastructure conducted by Central Road Research Institute (CRRI). The detailed study report is available in the official website of CRRI. Copy of the recommendation made in the study report is enclosed herewith for information and necessary action.

Yours faithfully,
Sd/-
Joint Transport Commissioner,
for Transport Commissioner

Approved for issue

Senior Superintendent

s.g.

CPRI

Chapter 8

Conclusions and Recommendations

It has been well established by various studies that overloading trend to create more damages to the existing pavements and there by increase the overall investment in road sector. Several studies have revealed that with 10% overloading above the permissible limit, pavement life gets reduced by about 35% and with 30% overloading, and pavement life gets reduced by about 65%. For example a road designed for 10 years and with overloading of 30% (5tonnes more pay load), it would last for only 3.5 years, implying further investment at accelerated intervals.

At the present costs of construction, taking into consideration of the existing loading pattern of heavy trucks, it is estimated that an overloading of vehicles to an extent of 10% will result in an additional maintenance and rehabilitation cost of about Rs. 20 lakhs per lane km over and above the normal maintenance and rehabilitation expenditure for a pavement designed for 15 years. Further, when overloading increases to 30%, this additional cost will go up to more than 3 times i.e. about Rs. 60 lakhs/lane/Km extra in 15 years. Therefore, it may be concluded that overloading leads to high cost in management of pavements in addition to increase in VOC and emission level.

The conclusions and recommendations of the pilot study carried out on various aspects are summarised below:

8.1 Flexible Pavement

The conclusions may be drawn from the HDM – 4 analyses, which has been carried out to assess the effect of overloading issues related to maintenance and vehicle operating costs are detailed below:

- The intervention of pavement maintenance (roughness based) for actual loading conditions (high overloading case) is higher in comparison to no overloading and medium overloading cases.

- It has been found that the difference in the fuel consumption for two axle and multi axle trucks for no overloading and high overloading (actual condition) case is ranging from 10 to 13% and for no overloading and medium overloading (VDF 8) is ranging from 5 to 8%.
- The difference between total Vehicle Operating Cost (VOC) for entire fleet plying on the study sections for no overloading and high overloading (actual) is from 3 to 4% and for no overloading and medium overloading (VDF 8) is from 1 to 3%.

8.2 Rigid Pavement

- The rigid pavement design life of 20 years for a 22 cm thick concrete pavement, reduces very rapidly even with slight overloading of 12 T.
- Each increment of 2 T in single axle load beyond legal load limit of 10.2 T requires an increase of 2 to 2.5 cm in the thickness of the pavement with design life of 20 years.
- In monetary terms, each increment of 2 T in single axle load would require Rs. 3.15 to 3.60 lakhs per lane per kilometer to be spent for providing extra thickness of concrete so that the pavement may sustain its design life of minimum 20 years.
- A concrete pavement initially designed for 10.2 T single axle load may sustain tandem axle load up to 26 T. In other words, overloading may be allowed if and only if the load is carried on tandem axles up to a limit of 26 T.

8.3 Bridges

- While evaluating the performance of a bridge for overloading, attention should be paid to age of bridge and the design standards prevailing at the time of construction of the bridge.

- The existing single lane with span less than 25m in our road network which are designed for loading as specified by IRC, prior to 1966 are susceptible to effect of over loading.
- The two lane bridges which are designed for IRC class AA loading may also be vulnerable to overloading, if the condition of the bridge is not satisfactory.
- The two lane RC slab bridges may be able to carry a minimum safe axle load of 20T, provided the slab is in good condition.
- The procedure to evaluate the performance of the existing reinforced concrete bridges subjected to overloading is discussed above with a case study of RC Slab Bridge.
- In India, there is a need to develop an integrated system for monitoring truck loads and verify the truck load carrying capacity of bridges so that they can be classified in terms of the truck load that can be safely passes through.

8.4 Emissions

- Overloading adversely reduces the engine efficiency resulting in substantial increase in the amount of visible (particulate matter see Table) and invisible tail-pipe emissions.. All these factors have a compounded adverse effect on fuel efficiency, operation of trucks, economy and the environment.

Loading Pattern	NOx (g/km)	HC (g/km)	CO (g/km)	PM (g/km)
Standard Loading	3.17	0.01	0.59	104.13
Over Loading (10%)	7.16	0.35	0.62	134.85
Over Loading (20%)	75.05	2.6	3.59	289.42
Over Loading (30%)	119.2	2.63	9.97	611.75

8.5 Vehicle Operating Costs

- It was interesting to note that in the case of MAVs, fuel consumption rate is likely to increase significantly due to excessive loads. This can be attributed to the randomness in the data and aggregation of all types of trucks beyond two axle under one category as MAVs due to paucity of data.
- Further, the fuel consumption rate is expected to stabilise and remain constant irrespective of the loading patterns. This trend can be noticed in all the vehicle types as presented in the above figures. Considering this, the goods vehicle operators may be inclined to overload their vehicles beyond the standard pay load by resorting to chassis tampering and increasing the tyre pressure and thus try to reap maximum revenue during each trip. However, during this process, the damage caused to their vehicles has been neglected by them and this is likely to result in increased Vehicle Operating Costs (VOC) in the long run.
- From this study, it can be inferred that the fuel consumption rate is likely to be more pronounced if the standard pay loads are exceeded by more than 25 % in all types of goods vehicles. To understand the fuel consumption levels for varying levels of pay loads beyond the capacity of different types of goods vehicles, field experiments were done by resorting to second method.

8.5.1 Fuel Consumption - Field study

- The fuel consumption varied from 172.7 ml/Km (empty; unladen) to 398.6 ml/Km (30% overloading) during the constant speeds of 20 Km/hr to 50 Km/hr (at an interval of 10 Km/hr).
- The fuel consumption for the same loading conditions (legal limit and 10% to 30% overloading) varied from 15% to 64% depending on the extent of loading and the different constant speeds of the vehicle.

- For 10% overloading (against legal limit), over constant speeds of 20 Km/hr to 50 Km/hr speeds, the increase in fuel consumption varied from 2.5% to 8.6%.
- Similarly for 20% overloading and 30% overloading, the increase in fuel consumption varied from 9.1% to 16.1% and 13% to 24.6% respectively.
- As the present study was limited to 50 Km/h and 30% overloading on a single vehicle, there is a need for extending the study over other range of constant speeds beyond 50 Km/h and for different vehicle types.

8.6 Recommendations for VDF

In India, road pavements are designed as per IRC:37-2001. It states that designing a new pavement, the VDF should be arrived at carefully by carrying out specific axle load surveys on existing roads. Where the information on axle loads is not arrived and the project size does not warrant conducting an axle load survey, the indicative values of VDF upto a mximum of 4.5 is recommended. Even if the load carried out by the various commercial vehicles is within the permissible limits, the VDF would be 0.59 for LCV, 2.67 for truck/buses and 2.77 for multi-axle vehicle (with front axle of 6 tonne and rear tandem axle of 19 tonne). Overloading results in higher VDF and thicker pavement lead to increase in initial cost of construction.

8.7 Measures to Control Overloading

- Law enforcement agencies should take stringent actions against the truck operators for overloading and need for enforcement at source of loading (ports, industrial areas etc.) itself.
- Setting up of weigh-in-motion stations and highways authorities should be empowered to enforce the axle load limits and mage the weighbridge stations.
- Heavy penalties should be levied exceeding the legal limits at the rate per tonne and goods should be offloaded.

- Discourage modification in design (tyre size, no. of springs etc.) to suit overloading by incorporating essential features in Registration Certificate.
- Encouraging the multi-axle vehicles to carry more goods, there by reducing VDF and its damages.
- Installation of Vehicle Overloading Management System to minimise the damages to the roads.
- Road authorities should be advised to continue to design road pavements taking into account axle load spectrum studies on actual basis.

8.8 Further studies

It is proposed to have detailed long term studies on axle load spectrum and it's effect on various types of road pavements, bridges and other aspects in detailed under various design, geo-climatic and regional considerations so as to determine the correct damages accused by overloading of trucks and cost involved. This will also help in determining the optimal design and construction standards for various types of pavements and bridges.