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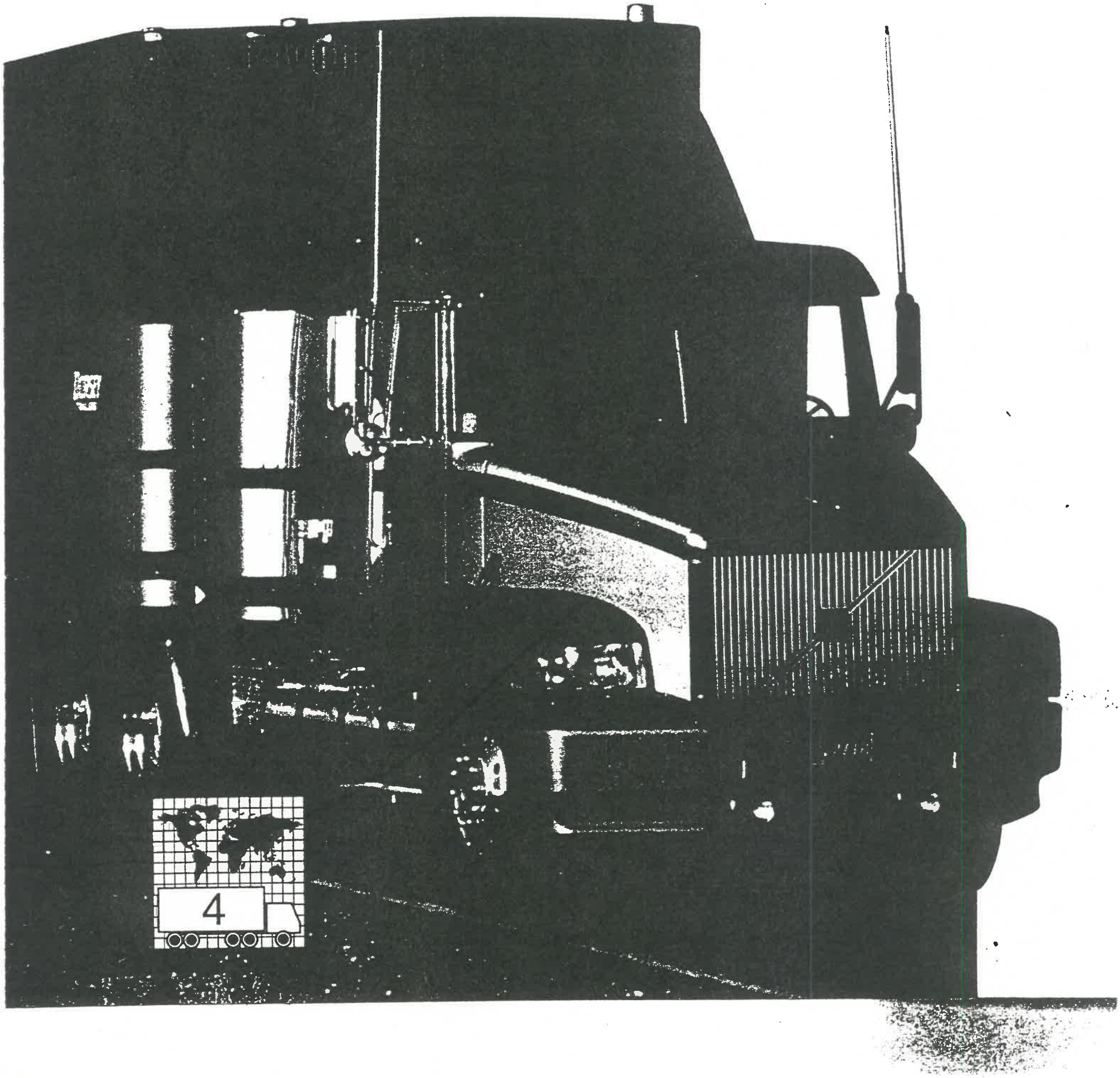

A SYSTEM FOR MONITORING OVERLOADED VEHICLES

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ABSTRACT

Although road management and maintenance management systems are commonly used, less attention has been given to monitoring overloaded vehicles, despite the fact that the greatest damage to the pavement is caused by overloading. In many cases, vehicle weighing is not under the control of the road authority. This paper describes a vehicle overloading management system and its implementation since 1988 in the province of KwaZulu-Natal, South Africa. The benefits accruing to the road authority through its introduction are many: its use as a management tool; the ability to identify problem vehicle configurations, problem loads and problem hauliers who have a deliberate policy of overloading their vehicles; the ability to monitor trends of average and maximum overloads over time; and so on. The monitoring system has proved to be very successful - average overloads have reduced significantly over the past seven years. The system has been introduced to all nine provinces in South Africa and has recently been installed in Malawi. By reducing overloading, the haulage industry has benefitted and is now able to tender more fairly for contracts. The paper also describes major problems facing the road authorities in South Africa with regards control of vehicle overloading and highlights some of the important factors that should be addressed in order to achieve an effective enforcement programme.

INTRODUCTION

The deterioration of the road pavement is largely a function of the traffic loads acting on the pavement. Between fifteen and twenty per cent of all heavy vehicles on South Africa's roads are overloaded and these vehicles contribute approximately sixty per cent of the damage to the road infrastructure. The aim of vehicle overloading enforcement is to minimise this damage, thereby optimising the funds available for road construction and maintenance, and to improve safety for the road user.

In the light of the significant reduction in funds available for construction and maintenance of urban roads in South Africa, the preservation of this huge investment has become a priority for road authorities there.

The control of overloading of heavy vehicles has been a problem in South Africa for many years. Increased traffic volumes and the competitive haulage market have resulted in increased numbers of overloaded vehicles. Overloaded vehicles significantly reduce the life of the road network, and severely damage the road pavement and, to a lesser extent, bridges. The present deregulation of the transport industry is likely to aggravate this situation.

CONTROL OF VEHICLE OVERLOADING

The provincial road authorities in South Africa weigh vehicles statically on a regular basis throughout the year. During 1993, almost 95 000 vehicles were weighed at weighbridges throughout the country, of which 40 per cent were overloaded. This is 45 per cent higher than the number of vehicles weighed in 1992.

A Vehicle Overloading Management System has been developed by the Division of Roads and Transport Technology, initially in conjunction with the KwaZulu-Natal Department of Transport, for the analysis of weighbridge data. During 1991 the system was implemented in the other provinces in South Africa, so that currently all data is collected in a uniform manner for compilation into a national database. The program is able to perform various analyses which assist the provinces in identifying problem areas. The output sheet gives detailed information on all vehicles weighed at a specific weighbridge site during a specific period. Another report sheet lists a number of transport companies which operate in each province, together with the number of vehicles weighed from each company and the number that were overloaded. Transport companies guilty of regular overloading can thus be identified. A monthly or annual breakdown of overloading statistics at each weighbridge site can help authorities identify problem routes and thus plan their enforcement strategy.

Other reports can assist the Road Traffic Inspectorate. For example, sugar cane is a troublesome commodity to transport because of its variable moisture content. This crop is harvested during the summer months along the coastal plain of KwaZulu-Natal and the traffic officers would

LEVEL TOLERANCES

Unacceptably high level tolerances on the concrete approach slabs of single axle scales has been a particular problem in the province of the Western Cape. Inconsistent mass readings from different weighbridges due to a variation in the levels of approach slabs has resulted in the Attorney-General of that province terminating all weighing activities for overloading enforcement until the approach slabs of the problematic weighbridges have been upgraded. In some cases the single axle scales have been replaced with 4 x 3 metre axle unit scales which are able to weigh tandems and tridems as single units.

Experimental research conducted at a multi-deck weighbridge during 1994 by the Division of Roads and Transport Technology, CSIR, has highlighted the tridem axle unit as being very sensitive to the level tolerances of the approach slabs of single axle scales. Steel plates were used to simulate a range of 'bump heights' of adjacent axles, axle units or groups of axles during the weighing process. It was found that in general, the bump height of axles or axle units of adjacent groups of axles has a negligible effect on the mass accuracy of the axle or axle unit being weighed. However the bump height under an axle *within* an axle unit (tandem or tridem) has a significant effect on the load distribution within the axle unit being weighed. A bump height of 20 mm under one axle of a tridem unit may cause a load variation of up to 40 per cent. This reduces to approximately 10 per cent for a bump height of 5 mm. Tandem axle units were found to be less sensitive and a bump height of 20 mm may cause a load variation of up to six per cent.

PENALTIES

The maximum fine that can be imposed by a traffic officer for admission of guilt for overloading was increased from R300 (US$ 85) to R1 000 (US$ 280) per vehicle on 1 July 1992, according to the Criminal Procedure Act. This means, for example, that an articulated vehicle can be given a maximum fine of R2 000 (US$ 560) if both the truck tractor and the semi-trailer are severely overloaded. In practice, however, fines for overloading seldom exceed R1 000 (US$ 280) per vehicle combination.

These fines are negligible compared with the damage done by the vehicle on the road and the higher profit made by the haulier in transporting a heavier load. In fact it makes sense, from an economic point of view, for the haulier to make additional profits by carrying a heavier load and running the risk of a R200 (US$ 55) to R1 000 (US$ 280) fine!

Although the maximum fine for vehicle overloading that can be imposed in a court of law was increased from R2 000 (US$ 560) to R8 000 (US$ 2 220) in June 1990, and from R8 000 to R24 000 (US$ 6 670) in July 1992, fines above R1 000 (US$ 280) are seldom imposed by the magistrate, and it seems unlikely that the change in legislation will affect the actual fines imposed in court. Although the traffic officer also has the authority to issue a ticket to appear in court, instead of an admission of guilt fine, this is seldom done because of the high percentage of acquittals as described in the section on magistrates' courts.

In the present scenario, the major deterrent to vehicle overloading in South Africa is the possibility of an overloaded vehicle being prevented from proceeding until it complies with the regulations. This may involve a significant time loss to the haulier because the load must either be redistributed on the same vehicle (in cases where the load is incorrectly distributed) or transferred to another vehicle (in cases where the vehicle is grossly overloaded). In the former instance, the haulier will normally have to hire a crane to shift the load and in the latter instance, another vehicle must be sent to the weighbridge site to carry the excess load. Depending on the distance between the weighbridge site and the nearest haulier depot, this may prove very expensive.

In the past, hauliers were allowed to stockpile excess load in the parking-off areas and have it collected at a later stage either by the same vehicle or another vehicle from the same company. However, the parking-off areas became cluttered with unclaimed sugar cane, timber, granite etc. which had to be cleared at the expense of the traffic authorities. This led to the present situation where cargo is not allowed to touch the ground and must be transferred directly from one vehicle to another.

Compared with fines for overloading in many other countries, fines in South Africa are very low. A more effective method of imposing penalties is to have a schedule of fines relating an overload to a fine either by a formula or a table. Thus a penalty commensurate with the degree of overloading can be imposed without the violation having to go to court. For example, in Sweden, a vehicle which is 20 tons overweight (a situation which is not uncommon in South Africa) would automatically be fined the equivalent of R61 000 (US$ 17 000) in Sweden. The haulier would probably get away with a R2 000 (US$ 560) fine in South Africa. In California, the fine would be approximately US$ 9 000.

ALTERNATIVE ROUTES

If a driver of a heavy vehicle is aware that the vehicle he is driving is overloaded, he will obviously try to avoid any operational weighbridges by using a feasible alternative route. With the widespread use of CB radios by drivers of heavy vehicles, it does not take long for the news to spread that the traffic police have started a weighing exercise at a particular weighbridge. This poses a great problem to the traffic authorities in situations where one or more feasible alternative routes exist. In some cases extra manpower is used to monitor the alternative routes with portable vehicle screeners such as the vehicle load monitor, so that overloaded vehicles taking these routes can be escorted to the weighbridge for accurate weighing and subsequent prosecution.

The strategic location of new weighbridges on a road network is thus critical to ensure an effective enforcement programme. In metropolitan areas alternative routes are numerous and the only way of achieving effective enforcement in these areas is through the use of portable weighing equipment in conjunction with a permanent weighbridge.

Table 1 : Number of vehicles weighed and overloaded in KwaZulu-Natal from 1988 to 1994

Year	Vehicles weighed	Vehicles overloaded (total)	Vehicles charged (total)	Vehicles overloaded (Reg 365)	Vehicles overloaded (Reg 365A)	Percentage overloaded	Percentage charged
1988	27 284	7 323	7 139	7 071	874	27	26
1989	15 950	8 102	6 820	7 985	976	51	43
1990	15 472	9 280	7 085	9 126	1 336	60	46
1991	31 725	16 195	11 927	15 663	3 356	51	38
1992	33 108	13 897	10 057	13 722	1 309	42	30
1993	47 395	17 673	12 175	17 651	312	37	26
1994	39 230	13 643	6 803	13 579	1 620	35	17

Note: The 'Vehicles charged' and 'Percentage charged' columns reflect the change in tolerance levels from 5 to 15 per cent.

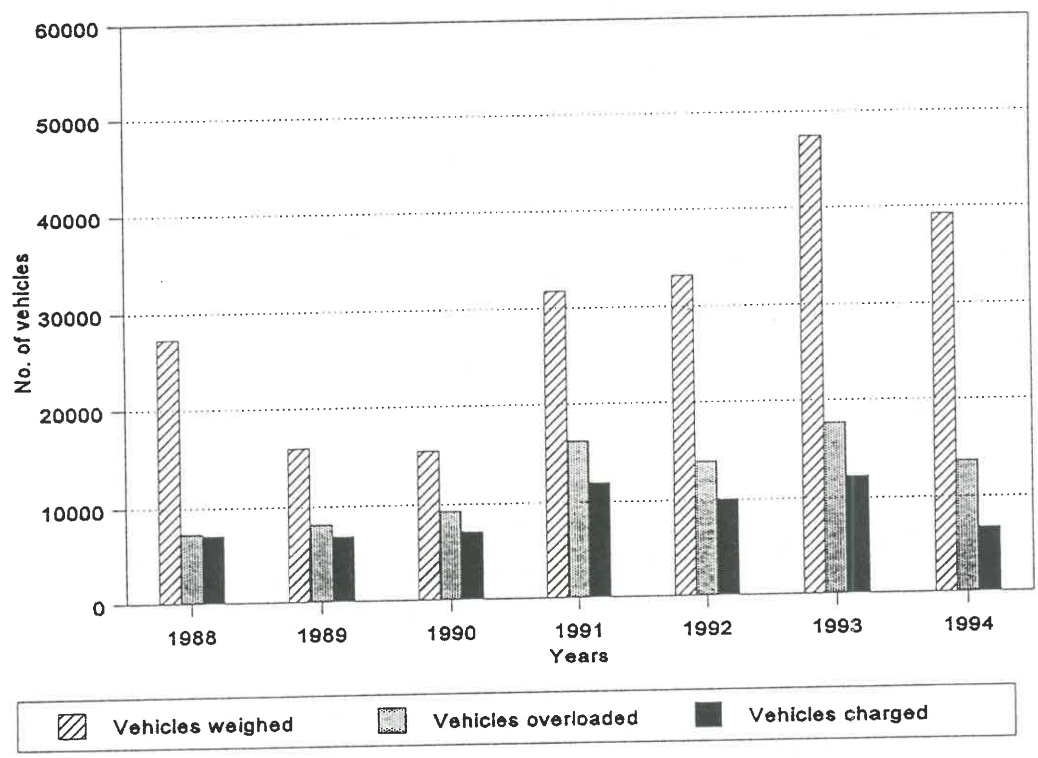

Figure 2. Vehicles weighed, overloaded and charged per year in KwaZulu-Natal: 1988 to 1994

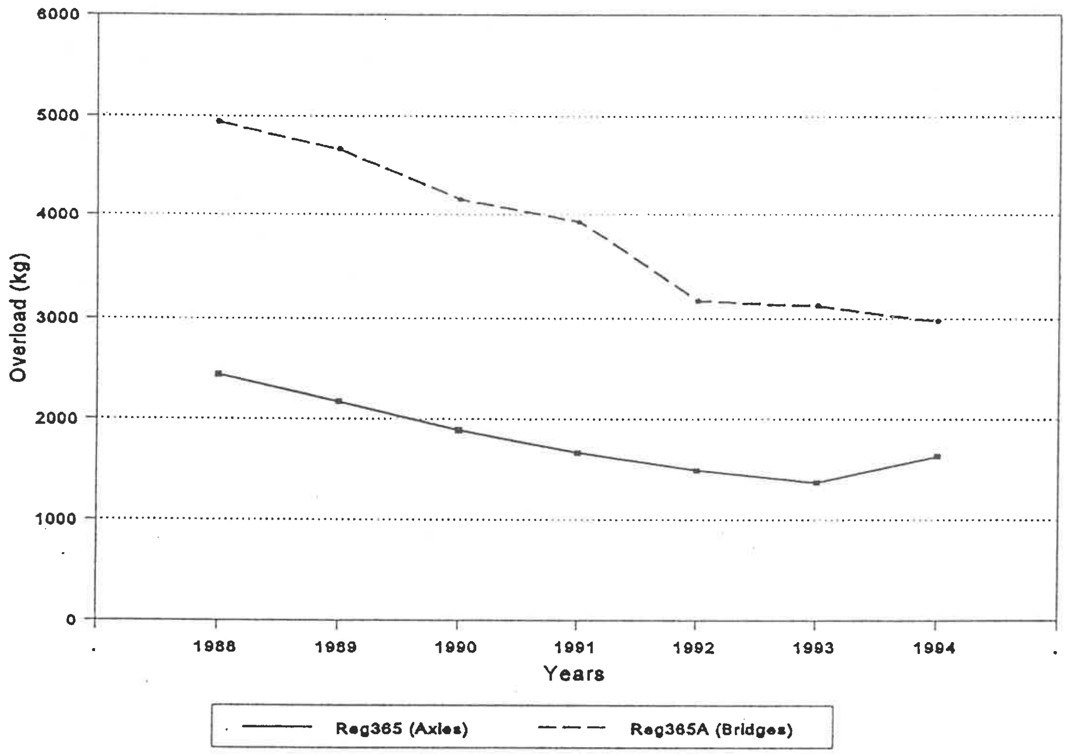

Figure 3. Average overloads in KwaZulu-Natal: Regulations 365 and 365A: 1988 to 1994

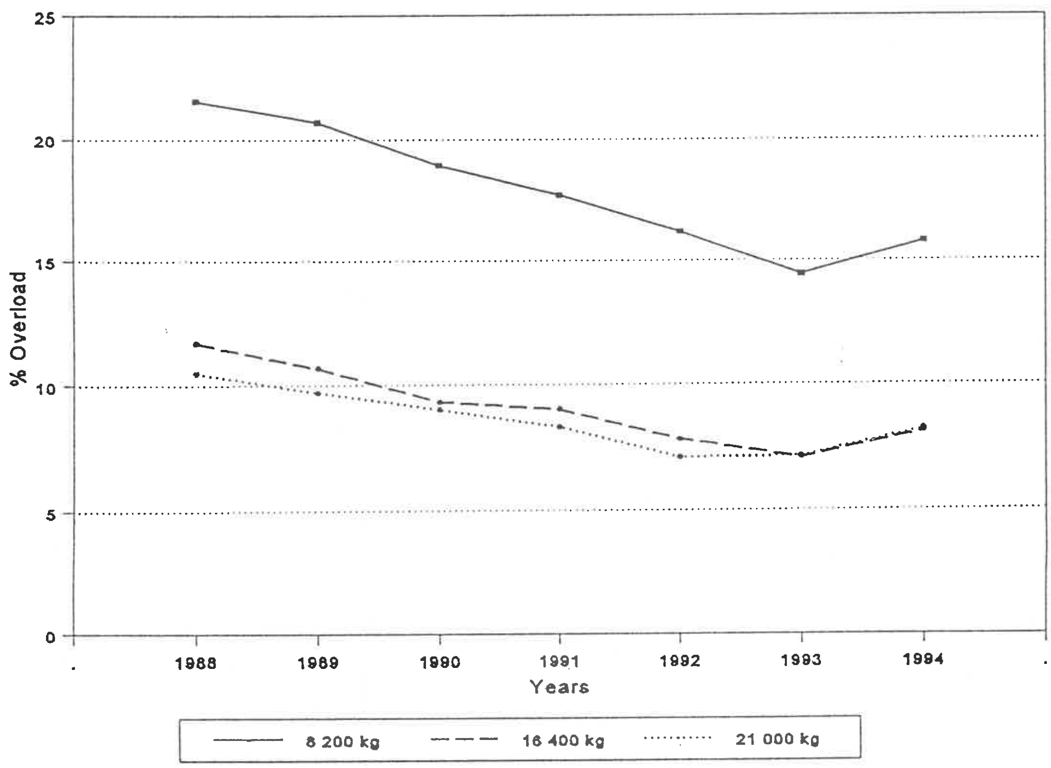

Figure 4. Average overloads in KwaZulu-Natal: Single axles, tandems and tridems: 1988 to 1994

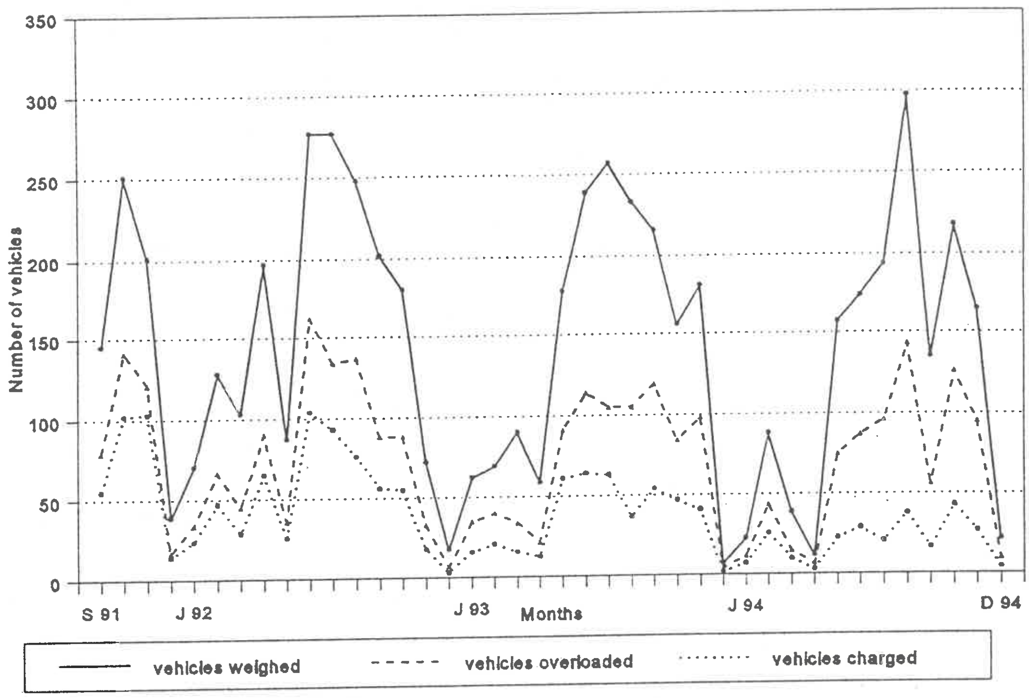

Figure 6. Vehicles weighed, overloaded and charged per month of UNITRANS: September 1991 to December 1994

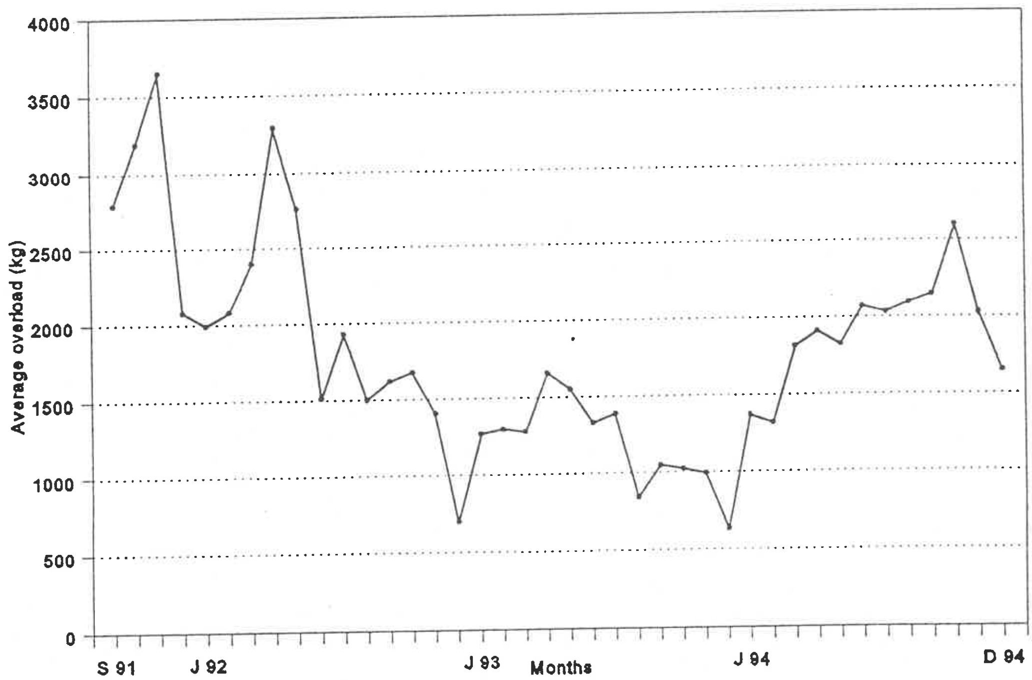

Figure 7. Average monthly overloads of UNITRANS: September 1991 to December 1994