

A STUDY ON THE SAFETY CONTROLS OF GRAVEL TRUCKS IN TAIWAN

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Abstract: The ministry of traffic announced the beginning of the 'Safety Control Program for Gravel trucks' in May of 1994, aimed at effectively ending gravel trucks drivers disobeying traffic regulations and causing accidents. However the outcome did not live up to expectations due to an ineffective management system and lack of manpower to enforce it. Accidents still occur each year in which gravel trucks cause casualties and serious financial damage. This raises doubts in the community about the safety control measures the government has imposed on gravel trucks. Therefore this article analyses the causes and explores the problems of the safety controls of gravel trucks in Taiwan, proposes a solution to the problem and introduces effective management measures. Hopefully, with the guidance and assistance of the government, gravel transportation companies will be forced into setting up effective regulations governing their transportation and furthermore, educating drivers in following safety regulations while driving. Then it will be possible to effectively improve the safety of gravel trucks.

Key words: Gravel trucks, Safety of Vehicle Driving, Management Procedures.

1. INTRODUCTION

The economic miracle of Taiwan is a well-known phenomenon and transportation workers contributed greatly to this economic success. The government and society as a whole often forget this. Nonetheless, there have been many cases of traffic accidents in recent years involving vehicles transporting gravel (Gravel trucks), causing casualties and serious financial damage.

Accidents in Taiwan involving gravel trucks caused 81 deaths and 74 injuries in 1999 (see Table 1). This raised doubts in the community about the safety control of gravel trucks imposed by the government. Therefore this article analyses the cause and explores the problems in the safety control of gravel trucks, proposes a solution to the problem and introduces effective management measures. Hopefully, with the guidance and assistance of the government, gravel transport companies will be forced into setting up effective regulations governing their transportation and furthermore, educating drivers in following safety regulations while driving. Then it will be possible to effectively improve the safety of gravel trucks.

Table 1. Fatal Accidents Involving Gravel Trucks, 1994 Through 1999

Year No. Of	1994	1995	1996	1997	1998	1999
Accidents	189	145	131	208	245	146
Deaths	162	80	60	109	70	81
Injuries	127	99	53	85	96	74

2. DEFINITION

The 'Vehicles Transporting gravel (Gravel trucks)' as referred to in this article includes, (1) Tilt-to-unload style vehicles and semi-trailers loaded with gravel; (2) The vehicle registration of the Tilt-to-unload style vehicles and tow trucks printed with loading capacity (Length x Width x Height) (Including yellow painted vehicles with gravel trucks labels and yellow painted vehicles without gravel trucks labels). These vehicles may be 'commercial vehicles' that belong to transportation companies, or may also be 'private vehicles' that belong to gravel sites and soil pre-mix sites.

According to data provided by the Road and Traffic Authority, the statistics on tilt-to-unload style vehicles up to 1999 (see Table 2) show these are mostly vehicles transporting gravel, the rest of the vehicles transport other goods (for example scrap metal or agricultural products). The types of vehicles in number 2 are large trucks and semi-trailers. The number breakdown of the vehicles is 19,858 large trucks (796 with labels) and 7,077 semi-trailers (5,830 with labels), totaling 26,934 vehicles (with a total of 6,626 with labels). Vehicle use includes private and commercial use, with the number being 13,016 and 13,918 respectively.

Table 2. Statistics Supplied by the Road and Traffic Authority on tilt-to-unload style vehicles up to 1999

Vehicle Type Vehicle Use	Tilt-to-Unload Style Vehicle			Vehicle Attached with Label		
	Large Trucks	Semi-Trailer	Total	Large Trucks	Semi-Trailer	Total
Private	12609	427	13036	326	289	615
Commercial	7249	6649	13898	470	5541	6011
Total	19858	7076	26934	796	5830	6626

3. REVIEW OF SAFETY ISSUES OF GRAVEL TRUCKS

3.1 The Main Causes of Gravel Trucks-Related Accidents

Gravel trucks drivers are usually paid according to the number of trips made. Therefore many drivers work overtime and often speed to increase their income. Drivers spending too much time on the road are the ones mostly likely to have a negative effect on safety. Speeding while driving lowers their reaction time and increases the risk of causing accidents. Also, many drivers who have their licenses suspended or cancelled for committing frequent traffic offences and who avoid vehicle check-ups have to pay extra attention to spotting police vehicles, and lose concentration on the road conditions resulting in higher accident risks. This can be illustrated and analyzed (As shown in Table 3) from the causes of 520 accidents (Gravel trucks as the directly involved) during 1997-1999. The driver as the main cause accounts for 91.35%, loading related failures and machine breakdowns account for 4.23% and 4.42% respectively. Of the 91.35%, 15% of the drivers did not keep a safe distance with the car in front of them, 12.88% did not pay attention to the front of the car, 5.58% did not follow road signs and directions,

5.19% did not slow down to the legal speed limit, 5% did not turn or change lanes properly, 4.42% did not keep a safe distance and 4.23% turned right against traffic regulations.

Table 3. The Main Causes of Accident Involved in Gravel Trucks

Main Cause of Accident	No. Of Cases	Rate %	Main Cause of Accident	No. Of Cases	Rate %
Illegal Passing	9	1.73	Not Keeping a Safe Interval	23	4.42
Giving way to Cars Against regulation	19	3.65	Carelessness when Pulling Out	12	2.31
Improper turning (or changing lanes)	26	5.00	Losing Control While Driving Drunk	13	2.50
Turning Left Against Regulation	8	1.54	Not Paying Attention to the Front of the Car	67	12.88
Turning Right Against Regulation	22	4.23	Not Following Road Signs and Directions	29	5.58
Backing Up Against Regulation	14	2.69	Not Following Specific Sign (Lane) Restrictions	16	3.08
Losing Control at High Speed	16	3.08	Other Factors Regarding the Driver	96	18.46
Slowing Down Against Regulation	27	5.19	Insecure Loading	22	4.23
Not Keeping a Safe Distance	78	15.00	Machine Breakdown	23	4.42
			Total	520	100

3.2 Characteristics of Gravel trucks Involved in Accidents

The safety of a truck is affected by its stability, and the stability of a truck is related to its size, load, weight distribution and the combination of the vehicle. Of the 520 accidents (Gravel trucks as the directly involved) analyzed in 1997-1999 (see Table 4), the types of vehicles involved were 41.15% commercial-use semi trailers, followed by 23.85% of commercial-use tractors, 19.81% commercial-use large trucks and 4.81% were commercial-use full trailers. If these types of vehicles are combined into two types: single-pile large trucks and trailers, then the chance of accident for trailers was 73.08%, and accidents causing deaths and injuries were 69.05% and 82.01% respectively. The chance of accidents for single-pile large trucks was 26.15%, and accidents causing deaths and injuries were 19.93% and 15.57% respectively. The type of vehicles colliding most often with Gravel trucks were private passenger cars at 35%, followed by motorcycles at 26.92% (18.65% sport bikes and 8.27% scooters), private vans at 5.96%, 4.23% pedestrians and 4.04% bicycles.

Table 4. The Vehicle Type Involved in Gravel Trucks Accidents

Vehicle Type		No. Of Cases	%	Subtotal	%
Single -Pile Trucks	Commercial-Use Large Trucks	103	19.81	136	26.15
	Private-Use Large Trucks	31	5.96		
	Private-Use Vans	2	0.38		
Trailer	Commercial-Use Full Trailers	25	4.81	380	73.08
	Private-Use Full Trailers	4	0.77		
	Commercial-Use Semi-Trailers	214	41.15		
	Private-Use Semi Trailer	7	1.35		
	Commercial-Use Tractors	124	23.85		
	Private-Use Tractors	6	1.15		
Other	Piece Together Vehicles	1	0.19	4	0.77
	Hit and Run	3	0.58		
Total		520	100	520	100

3.3 Problems in Police Enforcement

Traffic police account for only 6.8% of in the entire police force in Taiwan (as opposed to 16.6% in Japan), therefore from a manpower planning and police force deployment aspect, they are only able to adopt a random mobile enforcement method and deploy traffic police at a few key locations. Manpower and speed monitoring cameras are seriously insufficient. Some gravel trucks even utilize radio intercoms and communicate with betel nut vendors to radio each other as soon as police are discovered, to avoid surprise inspections. This allows a lot of illegal drivers to slip through the net, and affects the enforcement duties. In addition, overloading of gravel trucks brings an NT\$3000-9000 fine, however the profits gained from such overloading exceeds the fine amounts. Furthermore, the fine does not increase as the weight of overloading increases nor for drivers with repeat offenses. There is also a lack of manpower in the decision-making and computer equipment divisions of the organization. This leads to many cases of offenders going unnoticed and not caring about the consequences, which makes the situation even worse.

Furthermore, whenever gravel trucks accidents involve deaths, 80% of courts sentence the driver to a fixed-term imprisonment of less than one year. Therefore there are no effective means to stop gravel trucks accidents from occurring.

3.4 Problems in Managing the Transportation Business

To apply for permission to operate a vehicle freight transportation business, one must satisfy the following conditions: 1. The minimum capital of the business must be over NT\$25 million. 2. The business must have at least twenty brand new trucks. 3. There must be at least one exclusive parking space for every six business-vehicles.

The conditions described above are higher than are required of standard establishments; the reason being is to allow large companies to be able handle gravel trucks. However the government does not make assessments of the companies, and most drivers

want to own their own business. This leads to many small-to-medium gravel transport companies being established. As shown in Table 5, 82.32% companies own less than five vehicles, with the average number of vehicles per company at 3.48. That scale of transportation cannot allow for effective operation and management of the business.

Table 5. The Number of Cars Gravel Transportation Companies Own

No. Of Cars	No. Of Companies	%
1~5	1606	82.32
6~10	192	9.84
11~15	106	5.43
16~20	28	1.44
20+	19	0.97
Average	3.48 (Vehicle/Company)	

4. MANAGEMENT MEASURES FOR THE SAFETY OF GRAVEL TRUCKS

To improve the safety controls of gravel trucks in Taiwan, a framework on the goals of managing gravel trucks has been established (see Figure 1). In this framework, 'Safe driving of gravel trucks' is the ultimate goal, decreasing the occurrence of traffic accidents, decreasing traffic offences and decreasing the seriousness of accidents are the three objectives, also exploring other possibilities related to the issue.

The execution of safety management controls required the participation of the government, the companies and the drivers. If related units and measures can be further coordinated, it will allow more careful and delicate work to be done and allow for the promotion of sound and orderly operation of gravel transportation businesses. The recommendations for the government, companies and drivers are as follows:

4.1 Government

Offer guidance and assistance when freight transport companies apply to operate gravel transportation businesses and supervise the companies until the regulations set by the government are met. Use traffic enforcement to monitor traffic offences, and adopt appropriate measures for shutting down long-term improperly operated companies. Reward quality companies and drivers to maintain a safe environment in the transportation industry. Specific measures being as follows:

- I. Measures before driving: includes planning reserved and forbidden-entry lanes. Examining vehicles regularly. Conducting lectures on road safety to drivers regularly. Implementing standard uniform transportation prices. Urging businesses to carry out activities that promote self-discipline. Standardizing the cargo size of gravel trucks. Setting up a self-discipline system on gravel processing sites. Setting up management regulations for public and private construction companies.
- II. Measures while driving: includes controlling pollution caused while driving. Strengthening the enforcement of sections of highway frequently traveled or where accidents often occur. Strengthening the controls against speeding and traffic offences. Carrying out controls on overloading.

- III. Measures after driving: includes rewarding quality drivers. Carrying out reviews and assessments on companies. Setting up a system of reducing points for traffic offences. Regularly publishing information on illegal companies.

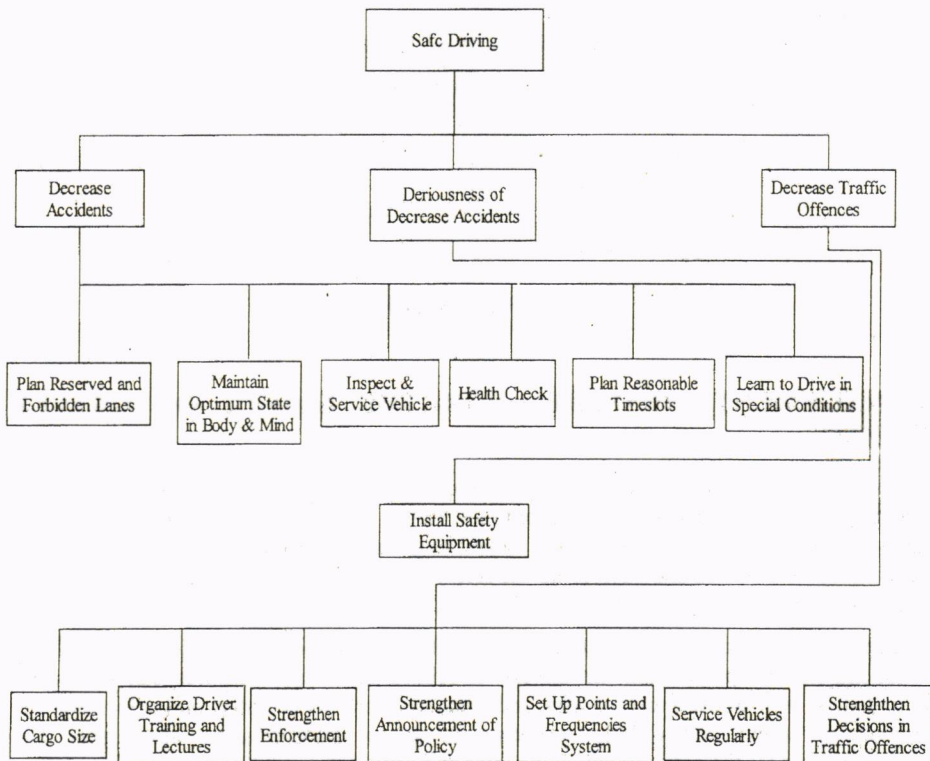


Figure 1. Framework on the Goals of Managing Gravel Trucks

4.2 Private Businesses

In accordance with the government laws, execute every safety regulation on vehicles, and carry out required examinations and management procedures. Furthermore, enforce company management of safety procedures and operating regulations. At the same time operate in coordination with government policies on transportation and management of vehicles and drivers. Specific measures being as follows:

- I. Measures before driving: includes applying for a license to manage a transportation business. Conducting regular lectures for drivers. Providing sufficient parking and rest and activity areas for drivers. Regularly servicing vehicles. Installing safety equipment in vehicles. Establishing regulations for business operation.
- II. Measures while driving: includes assisting drivers in handling personal matters. Providing information on the safe driving of vehicles. Providing roadside rescue service.
- III. Measures after driving: includes reporting the conditions of the business back to the directors of the organization. Setting up files of driving records. Assessing the

abilities of drivers.

4.3 The Drivers

To be the front line of a gravel transportation business, one should obey all traffic laws and regulations, the company's management regulations and also regularly service vehicles. Also, examine the vehicle before driving, obey driving regulations while driving and register necessary information after driving. These shall be the minimum obligations and must be strictly obeyed. Specific regulations being as follows:

- I. Measures before driving: includes inspecting the cargo being transported and all equipment. Examining the conditions of the vehicle. Maintaining an optimum state of body and mind.
- II. Measures while driving: includes confirming operations of various conditions. Filling out daily driving records.
- III. Measures after driving: includes cleaning, servicing and examining vehicles. And reporting back of daily driving records.

The above management measures and the roles, conditions and participation of the government, private companies, and drivers can be further categorized in Table 6 as follows,

Table 6. The Categorized Measures on Safety Management of Driving

Target	Government	Business	Driver
Role	<ol style="list-style-type: none"> 1. Guide & assist companies in setting up safe driving procedures 2. Supervise the carrying out of safety procedures 3. Establish and put in place road & traffic enforcement measures 4. Establish review work on driver safety 	<ol style="list-style-type: none"> 1. Coordinate with government policy 2. Carry out strict assessment of drivers 3. Set up regulations of operation 4. Manage vehicles properly 	<ol style="list-style-type: none"> 1. Follow laws and regulations 2. Regularly attend lectures 3. Obey company regulations 4. Examine vehicles properly
Before Driving	<ul style="list-style-type: none"> ♦ Establish reserved and forbidden-entry lanes ♦ Standardize cargo size of Gravel trucks ♦ Service vehicles regularly ♦ Urge companies to promote self-discipline ♦ Conduct lectures for drivers ♦ Set up systems of self-discipline in gravel processing sites ♦ Set up systems to manage public construction ♦ Send out information-packs on standard prices for public construction ♦ Strengthen the announcement of policies 	<ul style="list-style-type: none"> ♦ Apply for operation ♦ Set up regulations for company operations ♦ Conduct lectures for drivers ♦ Provide health checks ♦ Plan sensible working timeslots ♦ Provide rest areas for drivers ♦ Provide sufficient parking ♦ Install safe driving equipment 	<ul style="list-style-type: none"> ♦ Regularly examine vehicles ♦ Attend lectures on safety ♦ Learn driving procedures for special conditions ♦ Maintain optimum state of body and mind ♦ Confirm rules of transportation ♦ Inspect goods being transported and all equipment ♦ Inspect vehicle conditions

Table 6. The Categorized Measures on Safety Management of Driving (con.)

Target	Government	Business	Driver
Whilst Driving	<ul style="list-style-type: none"> ♦ Strengthen enforcement on roads frequently traveled or where accidents often occur ♦ Deduct points and fine overloaded vehicles and carry out separate unloading service ♦ Ban drivers who alter weights of freight ♦ Deduct points and fine traffic offenders and drivers who speed ♦ Control pollution 	<ul style="list-style-type: none"> ♦ Provide information on safe driving to drivers ♦ Provide road rescue service ♦ Assist drivers in handling personal matters 	<ul style="list-style-type: none"> ♦ Maintain high concentration when driving ♦ Confirm the essential elements of operating under various conditions
After Driving	<ul style="list-style-type: none"> ♦ Commend quality drivers ♦ Establish enforceable points system for traffic offences ♦ Establish enforceable vehicle incidents system ♦ Regularly publish information of illegal companies ♦ Strengthen the fines for traffic offense cases ♦ Carry out reviews and assessments on companies 	<ul style="list-style-type: none"> ♦ Set up files of driving records ♦ Assess the abilities of drivers ♦ Report conditions of the business back to directors of organization 	<ul style="list-style-type: none"> ♦ Inspect vehicles ♦ Service vehicles ♦ Clean vehicles ♦ Fill out report forms ♦ Report back driving records

5. CONCLUSION

To manage the gravel trucks well and decrease the number of accidents, the Ministry of Traffic should have clear and definite controls for companies regarding regulations and detailed procedures for safety management. The government should play the role of guiding and assisting companies in establishing safety procedures, supervising the implementation of safety controls, enforcing all road and traffic laws and carrying out reviews on safe driving. Businesses should play the role of coordinating government policies, strict assessment of drivers, establishing regulations of operation, and properly managing drivers and vehicles. Gravel trucks drivers should obey regulations, regularly attend lectures, obey company operational regulations, and complete vehicle inspections. With a complete system of safety management in place, it is possible to effectively improve the safety of gravel trucks in Taiwan.

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