CHARACTERIZING LOAD LIMIT OFFENCES IN INDONESIA; A STATISTICAL APPROACH ON OVERLOADING CASES AT WBSs

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RINGKASAN

Overloading telah memberikan beban tersendiri kepada pengelola jalan di Indonesia karena jumlah pelanggaran yang tinggi dan besarnya pelanggaran terhadap batas beban yang diijinkan. Direktorat Jenderal Perhubungan Darat menengarai bahwa terjadinya kesalahan pengelolaan pada jembatan timbang (WBS) memberikan sumbangan yang besar terhadap kegagalan metode ini untuk menghentikan overloading dari jaringan jalan. Sebuah perubahan telah dicanangkan dengan mengubah pengelolaan jembatan timbang yang semula dikelola oleh Dinas Perhubungan mulai diserahkan kepada swasta. Empat jembatan timbang di Sumatera disertakan dalam pilot projek ini. Makalah ini menggunakan data yang disediakan oleh 4 jembatan timbang tersebut untuk memperbaiki pemahaman terhadap situasi overloading. Tiga ratus enam puluh kasus dipilih secara random dari 10.000 kasus di 4 jembatan timbang. Dari analisis deskriptif dan cross-tabulasi yang telah dilakukan, terlihat bahwa overloading tidak semata-mata berkaitan dengan upaya untuk menutup biaya operasi transportasi, tapi sangat berkaitan dengan upaya memaksimalkan sumber daya untuk mendapatkan keuntungan dalam penyediaan jasa angkutan barang. Pemahaman lebih dalam dengan melihat persepsi aktor dan motivasinya dalam memutuskan overloading sangat disarankan untuk memecahkan persoalan ini lebih jauh.

Kata Kunci : *Pelanggaran beban, kontrol beban, angkutan barang, penanganan overload*

SUMMARY

Overloading has caused headache to Indonesian Road Authority due to its rates and severity. The Directorate General of Land Communication (DGLC) suspected mismanagement of Weigh Bridge Station (WBS) significantly contributes to the ineffectiveness of WBS in deterring overloading offences from the road network. A change was set up by involving private sector in WBS management. Four WBSs in Sumatra were included in the pilot project. This paper utilized the data provided by the pilot project to characterize overloading offences captured by the WBSs. Three hundred sixty (360) cases were randomly selected from over 10,000 cases of 4 WBSs. Descriptive and crosstabs analyses were conducted indicating that overloading has not been simply related to trucking cost coverage but rather related to the utilization of resources in freight transport. Deeper understanding by conducting insight look towards the motivation of overloading is strongly recommended in solving the problem of overloading.

Keywords *: Overloading Offences, Weigh Control, Freight Transport, overload countermeasure*

INTRODUCTION

Overloading has caused great concern for Indonesian road authority since the last 2 decades. The Directorate General of Highways (DGH; 1998) reported 12 road links in Java suffering from overloading by 30 % of total truck population while those in occur at 9 links rating over 30% of the total truck population.

From the preliminary survey of Sumatra Regions Road Project (DGLC, 1999) in Riau, Banda Aceh, and North Sumatra, it was discovered that 30-40 % of trucks, which offended load limit, carrying over 100% excess of weight limit. For some extreme cases, trucks committed excessive load weight approaching 150 % over the statutory weight limit (STWL).

Anticipating the failure of load limit enforcement due to incompetent management of the weigh bridge stations (WBSs), the Directorate General of Land Communication (DGLC) has initiated the involvement of private sectors in managing WBS since 2004. Four WBS in Sumatra were included in the initial project of WBS privatisation. This makes the WBS operates effective, reliable, and fair. It is expected that the new management of WBSs could gradually reduce the rate and magnitude of load limit offences in Indonesia.

From a number of experiences, encountering overloading is not a simple work. It requires better understanding upon the behaviour and the decision making process of overloading behaviour. This paper is aiming at providing statistical evidences of overloading cases in Indonesia to enable further development of overloading countermeasures for Indonesian Road Network. This paper begins with overview of overloading situations in Indonesia taken from a number of studies completed by the Institute of Road Engineering, DGLC, Bina Marga, and other overseas research. A series of statistical analysis is conducted to find out the relationships between overloading magnitude and the possible observed parameters taken from DGLC report in 2004. Eventually, this paper recommends further actions to address overloading offences and achieve a complete understanding of overloading phenomenon which has troubled Indonesian roads for decades.

GENERAL SITUATION OF OVERLOADING CASES IN INDONESIA

The Load limit

The Government of Indonesia through Government Regulation (PP) no. 43 year 1993 defines values of maximum axle load (MAL) in relation to Road Class. The highest road class is the Class I-arterial road that sets for MAL over 10 tones, while the lowest is the Class IIIC-local road, which is designated for MAL 8 tones. The detailed road classification in accordance with PP no. 43 year 1993 is shown in Table 1. Inline to this statutory, Ministry of Communication issued Ministry Decree no. 5 year 1995

which guides management and operation procedures of weigh control for road-freight transport. In this legislation, HGV or truck is considered to offend load limit if the corresponding truck is loaded 5% over its maximum axle load for the corresponding road. Other definition says that a truck is considered to breach load limit if total weight of the truck 5 % exceed total permitted weight of the truck as it is mentioned in the examination book of the corresponding truck (known as Statutory Weight Limit; STWL). The last definition is operational and used as threshold for load limit violation for the weighbridge station (WBS). This indicates that the policy of Indonesian Government upon load limit offence is though. Five percent tolerance in load limit seems to be too tight and would be difficult to operate.

Table 1.
Maximum Axle Load for Specific Road Class in Accordance with PP no. 43 Year 1993

Road Class	***Road Functions***	***Vehicle Characteristics***		***MAL (Tones)***
		Length (m)	**Width (m)**	
I	Arterial	18	2.5	>10
II	Arterial	18	2.5	10
IIIA	Arterial/Collector	18	2.5	8
IIIB	Collector	12	2.5	8
IIIC	Local	9	2.1	8

Overloading Behaviour and Its determining Factors

1. Truck Types and Travel Distance

As it has been found in other countries, overloading cases in Indonesia spread widely between HGVs. It occurs mostly between long hauled trucks which strikes most of back-bone roads. A weigh in motion (WIM) survey along the Java Northern Arterial Road (Oetojo et al, 2000) exhibited the configuration of overloading offences between HGVs. It was found that HGVs category 3 (Rigid truck, 1.2 H) was the most frequent overload offenders. The highest rate of offences committed by category 3 was 62.35% of the category population. Other category which were also committed overload offences, including category 4 (Rigid T 1.22; 55.6 %), category 5 (Rigid T 1.2-2.2 or T 1.2.2.2; 33.33%), category 6 (Rigid T 1.2-2.2 or T 1.2.2-2.2; highest rate 20.38%), category 7 (Articulated T 1.2-2; 33.33%), category 8 (Articulated T 1.2-22; 31.43%), and category 9 (Articulated T 1.2-222; 33.71%). Obviously, trucks with smaller number of axles are likely to overload rather than those with large number of axles.

Over 50 % of overloading cases involve category 3 HGVs (1.2 Rigid Truck) with long distance journey. These were more likely to occur at the area of ferry ports than at other areas (Oetojo et al, 2000; Santoso et al, 2000; DGLC, 2004). While most of ferry ports connect strategic national route, this would be consistent with TRB's (1999) finding on a Wisconsin study which reported the 15% weight violation at Rural Interstate System, 17.6% on the Rural Principal Arterial System. It seems that the available space and capacity of the ferry caused great difficulties for bigger truck to manoeuvre. This leads trucking company to use smaller vehicles instead of 1.22 HGVs or larger. Consequently, truckers tend to utilise maximum capacity of the truck.

2. Type of Load

The occurrence of overloading spreads over the variation of load type. Santoso et.al. (2000) found that overload

is likely to occur on a road which allowing the accommodation of C-class mining transports. Lou Dan (2003) also reported that overload was most likely committed by trucks which hauled low-price materials, such as coals and construction materials. It seems that overload correlates to major local product or commodities which its price is low and overloading offence is committed due to economical reasons.

3. The Advance of Truck Technology

Overload might also be driven by the presence of a better truck technology that provides higher axle capacity and stronger engines to enable carriers taking greater payload than those use an older technology. For Indonesia case, there are two underlying problems associated with truck technology. First, truck manufacturers are more likely to produce category-III HGV (1.2) than other category. The gross vehicle weight (GVW) of this single axle type varies between 10 and 24 tones. During year 1995, for example, it was reported that 18,051 units of this type were produced, while for multi axle trucks of the category-V HGV were 628 units only (DGLC, 1999C). This can contributes largely to overloading problem because one axle of this type is able to carry 13 tones of load. Second, as an impact of the severe economic crisis in 1997, large numbers of second-hand multi axle trucks were imported from many Asian countries, especially China. The dimensions of these trucks were mostly designed for countries which have better infrastructure than Indonesia. These trucks look bulky and have longer rear-overhang than those are manufactured in Indonesia. The overhang seems to provide greater opportunity for drivers, truck operators, or goods owners to travel with more weight on-board. It certainly increases the number and severity of overload offences.

The Truck Size and Weight Study (USDOT, 2000) has also estimated the attraction of larger size and the suspension system of the recent truck which allows truckers to take more load than before. Truckers are likely to divert to larger size and weight because it is possible to reduce costs of transport. This indicates that the development of truck technology would increase the possibility of overloading in the network. There is also a tendency

that truckers are likely to optimise the capacity of their truck size.

4. Trucking Management

Size of fleet managed by truck operator would influence the level of control toward the compliance of drivers to the company policy. The larger size of the fleet, the control over truck load is getting lower. This would make greater possibility for the truck to overload which may reduce the replacement timing of the fleet (Pattullo, 2004). The situation can be worse when business pattern between truck owner and drivers allows for drivers to take any risks in increasing their take home pay.

Since many truck owners could not establish a good payment system for drivers, most likely drivers would take overloading risks. Santoso et al (2000) reported that 8 out of 10 truck drivers who travelled in overload situation admitted their significant roles in taking the risk of overloading. Considering small numbers of respondent have been interviewed by these authors, this might be misleading. In many cases, truck drivers do not own the truck, therefore, cannot decide to travel in overload situation or not. They merely operate the truck and do not have sufficient power to refuse orders either from the operator management or goods' owners in transporting goods. Unless drivers enjoy significant incentive for overloading, there is no reason for drivers to take such large risks in their journey.

THE HYPOTHESES

Overloading seems relating to a number of observable factors. Even though clarifications are required in relation to magnitude and effects of each factor upon overloading behavior, a number of hypotheses can be generated from information provided above. It is clear that overloading violation is committed by a variation of Heavy Goods Vehicles. The occurrence of overloading violation varies between single (1-2) and double (1-2.2), long and short distance journey, between transported goods, and hauling capacity. The hypotheses then:

- Since overloading is considered effective to encounter high transport costs, then large possibility increases in number of axles would decline the magnitude of overloading.
- Increases in distance of delivery would increase the magnitude of load limit offences.

- Low costs hauled goods would exhibits more severe offences in magnitude.
- As every hauler would try to optimize resources, increases in hauling capacity, which is expressed as statutory weight limit (STWL), would possibly increase the magnitude of overloading; and
- Since overloading is influenced by observable factors, then each of these factors would exhibit its relative importance upon magnitude of overloading.

METHODOLOGY

The approach

Rate of load limit offences is measured from 2 indicators, namely frequency of overloading and magnitude severity of overloading. Frequency of overloading represents number of offences occurred for specific measuring period within the determined location. It is expressed in percent population of the overall good vehicle weighed at specified WBS. Magnitude severity of overloading exhibits the difference between total vehicle weight and statutory weight limit (STWL) as is written in the examination book of the corresponding vehicle. This paper is addressing overloaded vehicles. The data used in this paper, therefore, is limited to overloading report issued by the specified WBS. Statistical analysis has also been made on the basis of overloading severity approach.

Data

The data came from WBS report of the Directorate General of Land Communication, Ministry of Communication-Indonesia. The measurement period was from June 2004 to August 2004. The overall number of cases was over 10.000 consisted of single and double rear axle truck. Due to limitation capacity in analysis, only 360 cases were included in the analysis. These were selected from vehicles which plate number ended with number 0, 9, 8, 6, and 4.

Locations

Three out of four WBSs were considered appropriate to include in the analysis due to consistency reason. These consisted of Kamang at the Province of Riau, Lubuk Selasih at

the Province of West Sumatera, and Seumadam at Province of Nangroe Aceh Darussalam. All observed WBSs located at the primary arterial roads. Out of 360 cases, 120 cases were randomly taken from each WBSs (See Table 2).

Variables

Aside from locations and month of observation, 4 variables were visually observed. These include number of axles (AXLES), statutory weight limit (JBB;STWL), total vehicle weight (WEIGHED), and type of the truck (TRUCKTYPE). Two variables were self reported or written in haul documents, namely type of load (LOADTYPE) and origin-destination of the hauled goods (FROM-TO). The total weight of vehicle was transformed to OVERLOAD and percentage magnitude of overload (PCTOVER) by reducing STWL from WEIGHED and percentage of OVERLOAD from STWL respectively. Those which self-reported then were transformed to categorical variables as shown in Table 3. To keep consistency with Ministry of Communication Decree no. 5 Year 1995, the level of offences then is represented by percentage magnitude of overload (PCTOVER).

The transformation of load type to load category was based on the estimated effect of such goods to local economic activity and products. Increases in category number indicated these goods have larger multiplier effect to economic development of the surrounding area of the WBS. Table 3 provides information about the structure of load category as it is associated with its multiplier effect to local economy.

Table 2.
Location of Observations

	Frequency	Percent	Valid Percent	Cumulative Percent
KAMANG	120	33,3	33,3	33,3
LUBUK SELASIH	120	33,3	33,3	66,7
SEUMADAM	120	33,3	33,3	100,0
Total	360	100,0	100,0	

Table 3.
Transformation of Self Reported Variables

Self Reported	Transformed to	Components	Remarks
Load Type (LOADTYPE)	Load Category (LOADCAT2)	Category 1	*Very low multiplier effect*, adversely impact on the environment, such as timber
		Category 2	*Low multiplier effect*, adversely impact on the environment, including home appliances, office appliances, and paper, and Coal
		Category 3	*Medium multiplier effect*, Food and Beverages, Iron, and textile.
		Category 4	*High multiplier effect*, including such as building materials, and consumer goods
		Category 5	*Very High Multiplier effect*, such as Agriculture, fisheries products and their supporting materials including manures and fertilizer
From-To	Distance Category	Within Province	
		Inter Provinces in the Island	
		Inter-Islands	

Analyses and Tests

In order to figure out the overload situation of the observational data, a series of descriptive analyses was carried out. This aims at finding out the configuration of overloading violation among axles, load category, and distance category. While comparing MEANS between categorical variables, t-tests were carried out. The relationships between overloading offences and truck capacity were tested to find out Pearson correlation between both variables.

RESULTS

In general, the average percentage of overloading magnitude for the whole observation was 91.67% (*N=359, SD = 17.95*), with the maximum offences reached 150% and the minimum 24%. If the top 15% were overlooked from the data, then the maximum magnitude of overloading will be 109 % exceeded the weight limit (STWL). The distribution of offences magnitude looks distributed normally between the observed trucks. The data looked skewed to the left from the normal curve.

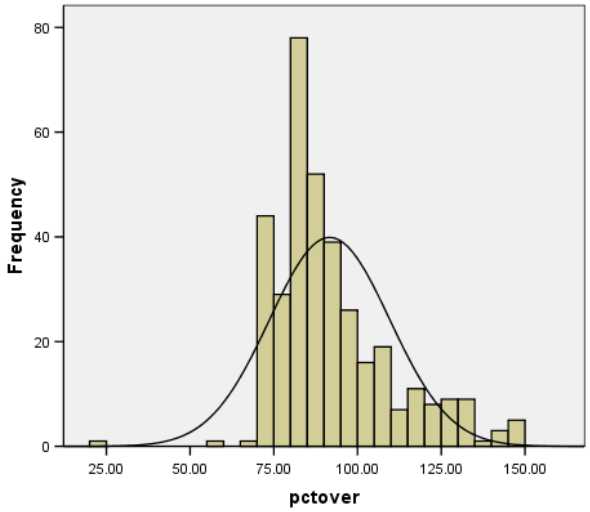

Figure 1. The Distribution of Magnitude Offences

Overloading Between Number of Axles

The 2 type of rigid trucks (1-2, and 1-2.2) showed great difference in magnitude of overloading. Truck with single rear axle has offended, on average, 83.81 % exceeding the load limit, while those with double axles offended by 97.31 % . The maximum offence committed by single axle was 130% of STWL and for double axle truck was 150% (*t=-7.562, p<.001*). Table 4 shows the difference in means of percentage overloading magnitude between single and double axle trucks.

The percentage magnitude of overloading offences shown by the axle configuration seems interesting because increases in hauling capacity is likely to increase magnitude of offences. It seems that truckers expect to utilize the maximum capacity of the truck. This also rejects the hypothesis that increases in axles would reduce the magnitude of overloading. With regard to this fact, the strategy of reducing overloading offences by increasing in number of truck-axles might not work as it is expected.

Table 4.
Compared Means of Overload Magnitude Between Single and Double Axle Trucks

axles	Mean	N	Std. Deviation	Minimum	Maximum
Double	97,3110	209	19,38611	71,00	150,00
Single	83,8067	150	11,94265	24,00	130,00
Total	91,6685	359	17,94993	24,00	150,00

Load Category and Overloading

The offence magnitude of overloading spread widely among hauled goods. Table 5 exhibits the mean value of magnitude of offences between load categories. The largest percentage overloading was committed by truck that hauled category 1 or very-low multiplier effect goods (*MEAN=105.66%, N=38, SD= 21.98*). This was followed by those carried category 3 goods which has medium-multiplier effects (*MEAN=93.28%, N=5, SD= 12.50*). The lowest overloading magnitude was exhibited by those carried category 2 goods or low-multiplier effect goods (*MEAN = 84%, N=25, SD=12.35*). Except for truck hauled category 2 goods, which showed the lowest offence magnitude, it seems that trucks hauled goods with better multiplier effect to local economy are likely to have lower magnitude in overload offences than those hauled goods with lower impact to local economy.

Figure 2 shows the mean configuration of offences magnitude between each load category. It appears that trucks loaded by very high-multiplier effect goods showing the lowest overloading magnitude. It brings in a clue that load policy might be approached from this load category. Since goods from this category enable providing significant impact to local economy, then allowing haulers taking these goods to overload might stimulate significant economic development to the surrounding areas.

Table 5.
Magnitude of Overloading Among Load Category

No.	Load category	Mean	N	Standard Deviation	Minimum	Maximum
1	Very Low Multiplier effects, adversely impact on the environment	105,6579	38	21,98313	55,00	150,00
2	Low Multiplier effect, adversely impact on the environment	84,0000	25	12,35246	71,00	132,00
3	Medium Multiplier Effect	93,2814	167	16,84582	70,00	150,00
4	High Multiplier effect	90,3810	42	17,51648	70,00	150,00
5	Very High Multiplier Effect	85,2874	87	15,68728	24,00	132,00
	Total	91,6685	359	17,94993	24,00	150,00

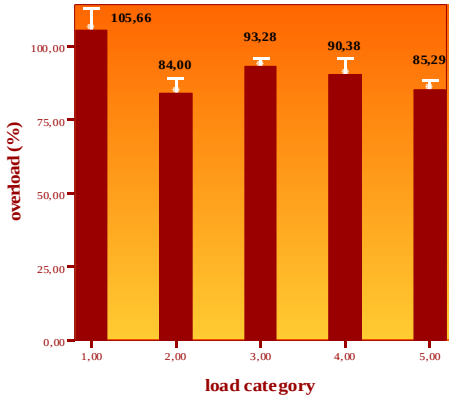

Figure 2. Distribution of offences between Hauled Goods Category

Hauling Distance and Overloading

A rational thinking in taking the risk of overloading is that overloading revenue should enable truckers to compensate transport costs or increase revenue in transporting goods from one to other point. Santoso et al (2000) suggested that the long hauled HGVs are more likely to overload than those travel in short distance, while Oetojo et al (2000) found that the occurrence of overloading between single rear axle trucks at port approaches are relatively frequent than at other areas. The observational case in Kamang,

Lubuk Selasih, and Seumadam exhibits facts that support these authors. Out of 360 cases, 41 trucks carried short distance goods (within province), 211 trucks for medium and long distances (inter-provinces) and 107 trucks travelled inter-islands (long distance).

Table 6 compares mean in the offence magnitude of overloading between short distance, medium-long distance, and inter-islands trucks. It shows that on average, there is no significant differences in offences magnitude between short distance (*MEAN= 87.71%, SD=14.54*) and medium-long distance trucks (*MEAN=88.04%, SD=15.54; t=-.126, p>.5*). However, remarkable offences occurs within inter-island truck (*MEAN=100.35, SD=20.52*). This exhibits significant difference in mean of offences magnitude between short distance and inter island trucks (*t=-3.607; p<.001*) as well as between medium-long distance and inter-island trucks (*t=-5.97, p<.001*).

The Effect of Statutory Weight Limit

The statutory weight limit is determined from hauling capacity of the truck which combines power ratio and number of axles. If truckers are willing to avoid overloading, the STWL would be a threshold in hauling. The bivariate correlation shows that offence magnitude significantly correlate to STWL ($R_{Pearson}$ *=.331, p<0.01*). The value of Pearson Correlation ($R_{Pearson}$) indicates that STWL would possibly influence the magnitude of overloading offences by 33%.

Table 6.
Compared Mean in Offence Magnitude between Hauling Distance

Distance Category	Mean	N	Standard. Deviation	Minimum	Maximum
Local Within Province	87,7073	41	14,53658	55,00	126,00
Regional, inter Provinces	88,0379	211	15,54467	24,00	150,00
Long Distance Inter Islands	100,3458	107	20,52844	71,00	150,00
Total	91,6685	359	17,94993	24,00	150,00

Table 7.
Correlation Table Between STWL and Offence Magnitude of Overloading

		pctover	stwl
pctover	Pearson Correlation	1	,331(**)
	Sig. (2-tailed)		,000
	N	359	359
stwl	Pearson Correlation	,331(**)	1
	Sig. (2-tailed)	,000	
	N	359	360

** Correlation is significant at the 0.01 level (2-tailed).

Is it possible to predict magnitude of offences using observable variables?

Using observable variables to predict the severity of offence magnitude in overloading seems unreliable. The linear regression result between offence magnitude (PCTOVER) and 3 numerical variables, namely The Statutory Weight Limit (STWL) of specified trucks, Distance category (DISTCAT), and Number of Axles (NOAXLES) exhibits that only 2 variables (NOAXLES and DISCAT) can be used as predictor for PCTOVER (See Table 8). Even though PCTOVER is statistically relate to STWL, the STWL seems inappropriate to be used as a predictor ($B=0, p>.05$). It means that changes in STWL have no effect on offence magnitude (PCTOVER). This also indicates that truckers did not pay attention to the STWL when they loaded the truck.

The two other variables seem inadequate to predict the level of offence magnitude (PCTOVER). Model summary and the ANOVA test of the linear model between dependent and independent variables indicates these variables would contribute maximum 20% to the accuracy of the prediction even though the model possibly behave consistently ($R^2=.21, p<.001$).

Table 8.
Regresion Table of Offence Magnitude and Its Predictors

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	*Std. Error*	*Beta*		
1	(Constant)	36,716	6,333		5,797	,000
	stwl	,000	,000	-,096	-,843	,400
	Number of axles	16,639	4,148	,458	4,011	,000
	Distcat	8,063	1,375	,277	5,864	,000

a Dependent Variable: pctover

CONCLUSION REMARKS

In general, the problem of overloading at the 3 observed WBSs showed terrifying situation. On average, overloading offences reached 91.67%, while the maximum offences came to 150% of the legal load limit of the truck. The distribution of overloading seems spreading widely among axles, load category, and distance of hauled goods. There are a number of interesting features can be found from this distribution, including:

(1) The offence magnitude is likely larger for the double-rear axle trucks rather than the single-rear axle trucks. This indicates that truckers tend to optimize load capacity of the truck including to take advantage from the size of the truck to overload.

(2) Overloading does not simply occur within group of trucks which haul the low price goods. The offence spreads over all types of hauled goods. It appears to reject the assumption that overloading is committed to compensate transport costs associated with the price of the goods as well as eliminates the prejudice upon trucks which haul class C mining product (sands, stones, etc) and coal. Preliminary analysis using different category of loads indicated that developing weight threshold on the basis of load category might help in addressing overloading problem.

(3) Overloading magnitude appears to be affected by the hauling distance. Nevertheless it is obvious that the presence of ports (inter-islands) within the hauling route would have larger effect to overload than the distance itself.

This gives a clue that truckers try to adjust their hauling method to anticipate the use of ferry in their route.

(4) The Statutory Weight Limit (STWL) which is represented loading capacity of the trucks is unlikely referred by truckers when loading their trucks. Even though the offence magnitude and relate to STWL, the STWL is not a predictor for the magnitude of overloading offences.

(5) Predicting the severity of offence magnitude from observed variables might not provide an accurate result. From three potential predictors which were utilized in the linear regression model to predict the level of offence magnitude, only 2 of them entitled to be the best linear unbiased estimator, namely distance category and number of axles. It is worth to note that the accuracy of the prediction using these predictors were only around 20%. There must be a number of unidentified variables provide better contribution to the prediction model, which might be resulted from self reported or insight variables.

Taking these conclusions into account then 5 following recommendations might be worthed to consider:

First, the policy of increasing the number of axles is less promising to tackle overloading behavior in Indonesia. The effect of this policy might be surprising unless a strict enforcement policy with remarkable fine is deployed for large magnitude of load limit offence. It is worth to delay this strategy until the enforcement strategy can be operated optimally.

Second, the assumption that overloading is committed by truckers to compensate the hauled costs of low price materials might not entirely true. From the spreading of overloading offences over load category, it is clear that overloading is committed to increase truckers' revenue. It is important to understand financing policy of truckers in their operation. Also, due to sensitivity of the financial issue, it would largely help if some research can focus upon the effect of overload restriction upon regional or macro economy.

Third, considering the adjustment of truckers for inter-islands hauling, it is important to review the policy of ferry and inter-islands ports. The above analysis exhibited the importance of the presence of ferry ports in the decision making of truckers.

Fourth, Transport authority requires disseminating the importance of STWL in load control including facilitating the utilization of in vehicle load control. This would change the loading policy of truckers as well as provide additional load-control method for load limit enforcement.

Fifth, Since it is necessary to develop a prediction model for overloading offences, it would be better to include variables which are unidentified by observational method. Developing new variables to utilize in the model would provide great challenges and might help policy makers to properly understanding the phenomenon of overloading.

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