

An evaluation of the axle load application in Jordan

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The subject of axle loads has been the Jordanian government's major concern for many years. Despite the fact that the government has passed the law No.36 for the year 1983 which regulates the axle load limits, this law hasn't been enforced fully yet. Furthermore, the government has issued a series of decisions since the year 1983 concerning the allowed axle loads. However, these decisions haven't been enforced due to either the pressures from interest groups or as a result of unexpected circumstances such as the first Gulf War (Iraq-Iran war). This paper attempts to examine and evaluate the enforcement of the axle loads law after eighteen years of passing it. Moreover, it concludes that this law hasn't been fully implemented yet. Another finding is that the current law doesn't cover all the aspects, which determine the costs of goods' transportation and road maintenance. In addition, this paper also examines the reasons behind the failure of the enforcement of this law and recommended solutions to achieve full enforcement of this law in order to put an end to the vast process of roads deterioration in Jordan.

لقد كان موضوع الحمولة المحورية كل اهتمام الحكومة الأردنية لسنوات عديدة. وعلى الرغم من أن الحكومة قد أقرت قانون رقم ٣٦ لعام ١٩٨٣ الذي ينظم حدود الحمولة المحورية، إلا أن هذا القانون لم يتم تطبيقه كلياً بعد. كما أن الحكومة قد أصدرت سلسلة قرارات منذ عام ١٩٨٣ والمختصة بالحمولات المحورية المسموح بها. إلا أن هذه القرارات لم تنفذ على أرض الواقع نتيجة للضغوطات التي تفرضها المجموعات المستفيدة أو كنتيجة للظروف الغير متوقعة مثل حرب الخليج الأولى (الحرب بين العراق وإيران). هذا البحث يحاول فحص وتقويم تطبيق قانون الحمولات المحورية بعد مرور ثمانية عشر عام على إقراره، كما أنه يخلص إلى أنه لم يتم التطبيق الكلي لهذا القانون بعد. ومن النتائج الأخرى للبحث عدم تغطية القانون الحالي لجميع الجوانب التي تحدد تكاليف نقل البضائع وصيانة الطرق. بالإضافة إلى أن هذا البحث يعتمد إلى فحص الأسباب التي تكمن وراء فشل تطبيق هذا القانون والحلول المقترحة للوصول إلى تطبيق كامل لهذا القانون لوقف تدهور حالة الطرق في الأردن.

Key words: Axle load, Law enforcement, Road maintenance

1. Introduction

As a result of the vast deterioration of roads in Jordan, The Jordanian government passed the law No.36 for the year 1983 regulating the axle load limits. This law sets the limits for the dimensions and weights of different truck types. However, it was not fully implemented due to the many exceptions given to many private and public trucks in addition to industrial companies.

The purpose of this study is to evaluate the application of the axle load law after eighteen years of passing it. This study also attempts to draw some conclusions, to offer a number of recommendations intended for the improvement of the axle load regulations and to deal with the obstacles, which resulted during the process of application of the law No.36-1983.

2. Background

As a result of the first Gulf War (Iraq-Iran war) that erupted in the early 1980s, the port of Aqaba became a major port for importing goods to Iraq. Consequently, the roads experienced heavy traffic due to the overload, which inflicted severe damage to the roads. Fig. 1 shows the map of Jordan, illustrating the Jordanian borders, which it shares with the neighboring countries. The map shows the major route that was used heavily in transportation of goods from the southern port of Aqaba on the Red Sea up to Ruwehied in the north east of Jordan near the Iraqi borders as well the road network in Jordan.

The Jordanian government accordingly reacted to this deterioration of major highways by the passing of the law No.36 for the year 1983, which specifies the dimensions and weights of trucks. This law limited the total width of the truck to 2.6 meters and it's

maximum height to 4.2 meters. Hereunder, table 1 shows the total of lengths permitted for different types of trucks, as stated by the law No.36-1983 [1].

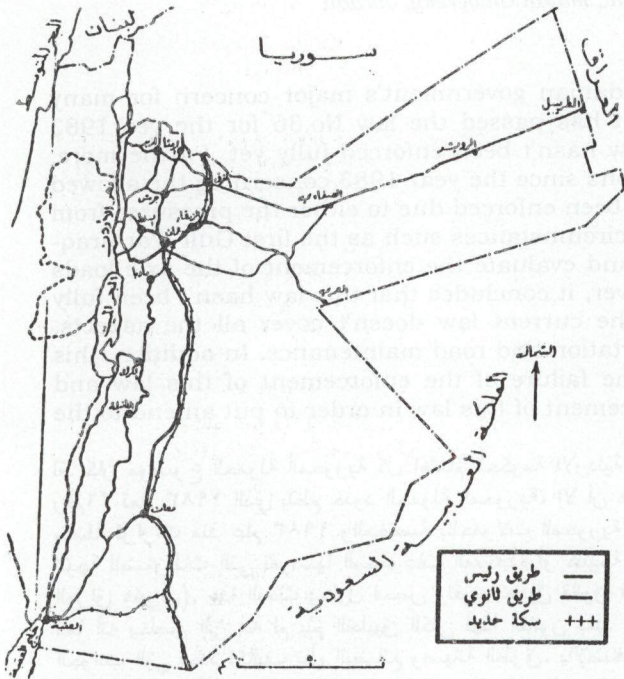


Fig. 1. Map of Jordan.

Table 1
The allowed total length for different types of trucks

Truck type	Total length (meter)
2-Axle Truck	10
3-Axle Truck	12
2-Axle Truck	16.2
2-Axle Trailer	
2 or more Axle Trucks	18
2-axle trailer	
2 or more Axle Truck	18.5
3-Axle trailer	

Whereas, table 2 lists the trucks' classifications and weights, as set by the law No.36-1983. Article 6 from this very law limits the weight of a single axle to 13 tons. Furthermore, it also limits the weight of each of the double or triple axle to 9 tons if the distance between the centers of any adjacent axle ranges between 1.35 to 2.4 meters. If this distance exceeds 2.4 meters, the maximum load allowed on each of the axles would reach that of 13 tons. The maximum allowed load to

the steering axle of any type of truck was set to 7.5 tons. Moreover, the law rounded these gross weight figures shown in table 2. For example, vehicle class 1, the gross weight is $7.5 + 5(9) = 52.5$ tons which is rounded to 50 tons.

However, table 3 [2] lists a comparison of the maximum allowed axle loads in the region of the Economic & Social Commission for Western Asia (ESCWA) while table 4[3] lists the percentages of countries with various single-axle loads. Table 3 also shows that there are large variations within the ESCWA. As for table 4, it shows that 73 % of the North Central, South American countries use less than 10 tons per single load where as this percentage was reduced to 60% in Asia. While Jordan is considered as a part of Asia and lies in the range of 32% as a user of 13 tons as the maximum allowed load on a single axle.

The previous background shows that Jordan doesn't differ from the rest of the world. However, applying the axle loads laws has taken Jordan a longer time and up to this date it has failed in achieving complete enforcement regarding the axle-loads law passed in 1983.

The Jordanian government formed a committee in 1991[4] as a step toward the enforcement of the law No.36-1983. The aforementioned committee represented each of the following ministries:

1. Ministry of Public Works & Housing
2. Ministry of Planning
3. Ministry of Transport & Communication
4. Ministry of Finance
5. Ministry of Industry & Commerce

The committee [5] studied the problem taking into consideration two scenarios; which were either abiding by the legal axle loads set by the law No.36-1983 or there was the other choice of not abiding by the law. Consequently, the committee stressed in their findings on the importance of quick enforcement of law No 36-1983. For they found that the result of not abiding by the provisions of this Law would annually increase the expenditure of pavement layers by an amount of 61.65 million Jordanian Dinar (J.D) for the next twenty years. As a result, the Jordanian government purchased ten portable axle scales in 1992 and used them for the sole

purpose of monitoring the internal transportation only. These scales were placed at Zarqa Refinery, Al-Rusyfah, Al-Juwaydeh, Al-Ramtha, Al-Hussinyah and Al-Quwayrah.

Table 2
Truck types, classification and maximum gross weight allowed



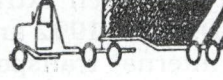


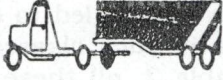
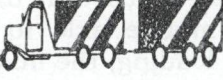





Trucks Classification.	Truck Type	Empty Weight	Gross Weight
1		22	50
2		21	44
3		20	46
4		18	40
5		14	30
6		21	45
7		20	48
8		16	36
9		12	27
10		10	21
11		17	44
12		19	45

Table 3
Maximum allowable axle loads in the ESCWA region

Country	Maximum axle load (tons)
Jordan	13 single axle
Syria	12 single axle
Egypt	10 single axle 16 Double axle 22 Triple axle
Saudi Arabia	6 Steering axle 13 Single axle 20 Double axle 21 Triple axle
Yemen	7 Steering axle 13 Single axle 18 Double axle (20 if s>1.2 m) 27 Triple axle (30 if s>1.2 m)
Lebanon	14 Single axle
Bahrain	11.2 Single axle 14.7 Double axle
Kuwait	10 Single axle
Qatar	Not Known
Iraq	6 Steering axle 12 Single axle 18 Double axle 25.5 Triple axle
UAE	13.5 Single axle

However, the process of monitoring the Jordanian borders shared with neighboring countries wasn't launched until 1997(see table 6). In January 1993, [5] and as a step toward enforcing the axle load regulations, the Jordanian government asked all concerned parties to gradually reduce the loads in order to meet the provisions of law No.36-1983. Hereunder, table 5 shows the gradual reduction issued by the Ministry of Public works & Housing. The table emphasizes that all parties must comply with the 13 tons single-axle load by February 13, 1995. As shown in table 5, even by the end of the grace period (Feb., 1995,column 5), the government order didn't reach the figures shown in column 6.

3. Analysis

As discussed in the previous section, the Jordanian government has up to now struggle to enforce the law No. 36-1983. However, only one-axle scales were put at Qatrana near

Karak by the end of 1996. Table 6 [6] shows the number and location of the working fixed axle scale in Jordan until May 2001.

In addition, there are only four portable digital axle scales, which are currently working in Jordan while the required amount of portable scales needed to cover all of Jordan's road network is about 10 scales.

One of the major limitations of fixed axle scales shown in table 6 (except for WIN station at Al-Quwayrah) is that the weight is given as gross weight and not on each axle. This indicates that the gross weight may not exceed the weight required by the law as mentioned previously in table 2 but one or more axle may exceed the weight limit as cited in article 6 of the law No.36-1983. Table 7 [6] shows an example of a printout of a portable scale, which reads the load on each axle as well as the total gross weight. The bold figures in the table highlights the cases where the total loads are less than the acceptable load and therefore no penalties are enforced. However, it is obvious while examining these figures, the many single axles exceeding the allowed loads and not penalized by the government, despite the heavy damage inflicted to the roads and the violation of the law. For example, axle 4 and 5 in class 2 vehicle (the bold one) are each exceeding the allowed axle load (between parentheses), which is determined by the law to be 9 tons.

Another major problem [4], which was encountered during the application of the axle law, was the many exceptions granted to different public and private companies. These exceptions include the following:

- Trucks carrying Potassium Company products.
- Trucks carrying Cement Company products.
- Trucks carrying Phosphate Company Products.
- Tankers carrying fuel and oil from Iraq.

The government has justified these exceptions on the grounds that they are strategic goods and the government has granted these companies grace period up to the end of 1998 to comply with the law. These exceptions also inflicted high damage to the roads and showed that the government has not dealt with all the trucks on equal bases.

However, today only the following are granted exceptions:

- Extra 5 tons (over the acceptable) were permitted without penalty to all Iraqi trucks.
- All gas tankers are free from penalty regardless of their weight.
- Lobbed trucks are not penalized regardless of their weight since they weren't covered by the law.
- Potassium Company trucks were excluded from the required length as set in table 2. The length of Potassium trucks reached up to 40 meters.
- As of July 1999, the fuel tankers were allowed to carry an extra 5 tons without Penalty.

One of the major limitations of the law is that the penalty per each extra ton had been set to be 2.5 J.D. since 1992 and was changed to 10 J.D. for internal transport and 20 J.D. for external transport (across the border) since 1996 regardless of the traveled distance [4]. It is quite evident that trucks cause more damage to roads while traveling long rather than short distances. Therefore, the existing law has failed to observe the fact that the penalty must be per ton per km rather than per ton only.

The axle law also failed to deal with some type of axles as in truck classes 1,2,7 and 12. As shown in table 2, all these type of trucks have three adjacent axles in the rear. Drivers can raise the middle axle to save tires. In general, during loading, the middle axle will be lowered, and the calculation of loads will be based on all axles. Usually, the middle axle is raised after leaving the axle scale and the total load will be distributed over the rest of the axles, which result in increasing the damage inflicted to the roads.

Another major problem lies with the shape of trailers. Table 2 shows that the height of the front of the trailer is different from the height of its back (see class 1,2,3,4,5 &6), which means that the distribution of the loads on each axle will be affected by the height of the loads in the trailers. Most of drivers tend to change the shape of their trailers so as to become plain as in trailer class 7 to carry more tonnage, which this violates the axle law, since the it was designed to deal with trucks

with a certain shape as launched from the truck's manufacturer's.

As discussed in the background, the original committee formed in 1991 recommended the application of the axle law No.36-1983 based on the economical and financial analysis. However, the study of the figures in table 8 shows that there is no relation whatsoever between the length of the roads, maintenance cost, and the application of axle load law.

Table 8 and fig. 2 [7,8] show that while the increase percentage of total length of roads ranges from 0.90 to 2.80, the maintenance cost ranges from -24 to 198 %, which gives no indication of the relationship between total roads length, and maintenance costs. Table 8 and fig. 2 show variations in maintenance costs since 1997 despite the installment of the axle load scales. As a result, it is hard to evaluate the feasibility and merits of the

original study. It is well known that the reduction of the axle loads would result in less damage to roads and consequently reduces the maintenance costs. However, the available figures in table 8 don't reflect this fact or explain the effect of partial enforcement of axle loads law on maintenance costs.

A report that was issued by the Ministry of Public Works and Housing [9] shows that class 10 vehicles, which are mainly used to carry construction materials (sand, stones, aggregates, asphalt, etc) and are the type of trucks which mostly violate the axle load. These trucks usually operate between Jordanian cities. This violation is due to the lack of enough axle scales, weakness of law enforcement and the fact that limited entrances and exits don't control roads in Jordan. Table 9 [6] shows a summary of axle load enforcement for the years 1999 and 2000.

Table 4
Global use of axle loads

Group of nations	% of Nations with maximum single-axle loads (tons)			
	Less than 8.2	8.2-10	10-13	>13
African nations	25	40	33	2
North, Central and South America	23	50	27	-
Europe	10	52	38	-
Asia	32	28	32	8

Table 5
The gradual reduction in truck loads

Truck classification	Permitted gross weight (tons)				According to law no. 36-1983
	Up To 13-2-1993	Up to 13-10-1993	Up to 13-6-1994	Up to 13-2-1995	
1	27	26	24	22	21
2	40	37	34	30	27
3	51	47	44	40	36
4	74	68	61	55	48
5	55	51	48	44	40
6	65	60	56	51	46
7	63	59	54	50	45
8	76	70	62	57	50
9	66	61	55	50	44
10	35	34	32	31	30

Table 6
Number, location and date of operation of load axle scales

Number	Location	Date of operation
2	Jaber border crossing (Syrian border)	September, 1997
2	Al-Karameh border crossing (Iraqi border)	November, 1997
1	Umari border crossing (Saudi Border)	January, 1999
1	Al-Mudawarah border crossing (Saudi Boarder)	January, 1999
1	Al-Sheikh Hussien border crossing (Palestine Border)	August, 2000
1	Al-Qatrana station (Desert Road)	1996
2	WIN station Al-Quwayrah-Nagab (Aqaba Highway)	May, 2001
10	Total	

Table 7
An example of portable axle scale printout

Vehicle classification	Truck-No.	Allowable axle load (tons)						Total loads (tons)	Acceptable loads (tons)
		Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6		
4	100913	6.08 (7.5)	13.44 (13)	12.26 (9)	11.2 (9)			42.98	40
9	51174	10.02 (7.5)	13.05 (9)	12.86 (9)				35.93	27
10	50916	7.95 (7.5)	18.65 (13)					26.6	21
10	48778	7.36 (7.5)	14.49 (13)					21.85	21
10	73364	7.72 (7.5)	17.77 (13)					25.49	21
2	4695	6.56 (7.5)	12.81 (13)	1.3 (9)	11.33 (9)	10.62 (9)		42.62	44
1	46526	5.01 (7.5)	9 (9)	8.4 (9)	6.87 (9)	7.89 (9)	9.04 (9)	46.21	50
4	55615	5.27 (7.5)	11.68 (13)	9.52 (9)	11.58 (9)			38.05	40
4	393632	6.98 (7.5)	18 (13)	10.48 (9)	10.17 (9)			45.63	40
3	48778	5.43 (7.5)	11.42 (9)	10.73 (9)	15.6 (9)	15.45 (9)		58.63	46
10	56465	7.65 (7.5)	15.68 (13)					23.33	21
10	126177	5.62 (7.5)	13.97 (13)					19.59	21
4	50558	6.07 (7.5)	12.44 (13)	11.7 (9)	11.58 (9)			41.79	40
10	73441	7.38 (7.5)	14.19 (13)					21.57	21
10	45553	7.41 (7.5)	18.58 (13)					25.99	21
4	59621	6.96 (7.5)	12.02 (13)	8.59 (9)	10.57 (9)			38.14	40
9	73122	5.35 (7.5)	9.8 (9)	9.4 (9)				24.55	27
4	53538	6.43 (7.5)	11.78 (13)	8.5 (9)	9.51 (9)			36.22	40
4	55475	6.14 (7.5)	12.15 (13)	11.49 (9)	11.4 (9)			41.18	40
10	53708	7.42 (7.5)	16.82 (13)					24.24	21

Table 8
Total length of roads and maintenance cost, (1990-1999)

Year	Total length of roads in (km)	% Increase	Maintenance cost in 10 ⁶ J.D.	% Increase
1990	6041		3.54	-----
1991	6158	1.9	4.60	30
1992	6318	2.6	13.7	198
1993	6468	2.4	16.2	18
1994	6650	2.8	18.7	15
1995	6780	1.9	18.2	-3
1996	6872	1.4	13.8	-24
1997	7022	2.2	12.6	-9
1998	7133	1.6	14.0	11
1999	7200	0.9	11.9	-15

Table 9
A Sample of Axle Load Enforcement Summary

Station	No. of weighted trucks		No. of over loaded trucks		Percent of over loaded trucks		Total over loaded (tons)		Total penalties paid (1000 J.D)	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Jaber	127523	131789	19952	19424	15.65	14.47	47913	47833	958.26	896.66
Karameh	113350	140093	2772	2048	2.45	1.46	8011	3132	160.22	62.64
Mudawareh	12849	10999	1427	930	11.1	8.46	3140	1769	62.8	35.38
Umari	28795	30215	5529	3933	19.2	13.02	11267	7309	225.34	146.18
Qatrana	42373	43274	1791	1867	4.2	4.31	2533	3209	25.35	32.19
Portable weighting scales	1960	3569	595	2100	30.4	58.84	2838	2462	28.46	122.78
Total	326850	359948	32066	30302	9.81	8.41	75702	65714	1,460.4	1,295.8

* Axle law regulations were applied to oil tankers starting 1-7-

The table shows that there is a drop in the percentage of over loaded trucks for the year 2000 in comparison with the year 1999 excluding Qatrana and the portable weighting scales. This is due to the fact that both Qatrana and the portable weighting scales are located on Jordan network (not at the borders) and they mainly monitor the internal transport. Since there are fixed border-crossing points, the table highlights the fact that Jordan borders with other countries are well monitored and the axle law regulations are fairly enforced. The table also shows the high percentage of axle load violations as recorded by the portable scales. These percentages were 30.4 and 58.84 during the years 1999 and 2000 respectively. As discussed before, the lack of enough axles weighting scales and the difficulty of controlling the entrances and exits of highways had resulted in weak law enforcement and consequently high percentage of violating trucks, which resulted in large damage to the road network. Fig. 3

shows the percentages of overloaded trucks designated for different weighting stations.

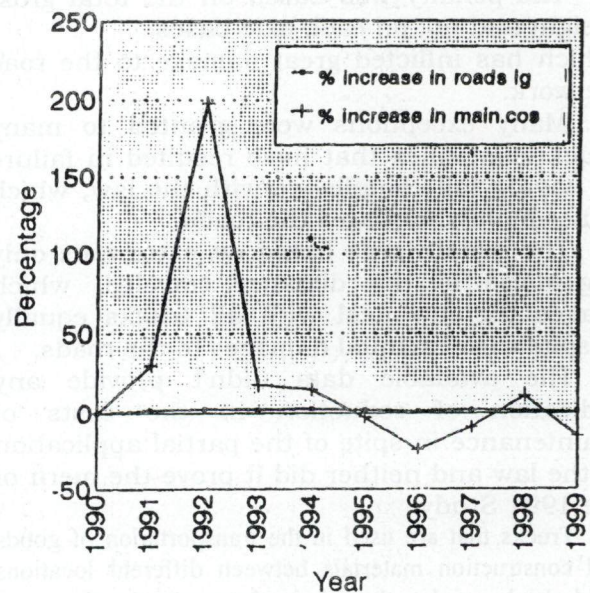


Fig. 2. Percentages of road lengths vs percentages of maintenance costs (1990-1999).

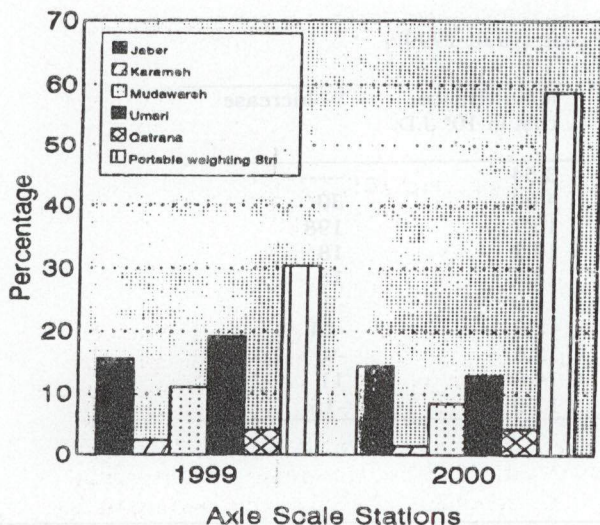


Fig. 3. Percentages of overloaded truck for different stations (1999-2000).

4. Conclusions

Based on the analysis and findings presented in this study, the following conclusions could be withdrawn:

1. The axle load law No.36-1983 wasn't fully implemented despite passing it eighteen years ago that is due to the weakness of law enforcement lack of enough axle scales and the law, which lacks comprehensiveness.
2. The penalty was based on the total gross weight and not on each axle bases, which has inflicted great damage to the road network.
3. Many exceptions were granted to many truck companies that have resulted in failure of having full compliance with the law, which consequently damages the roads.
4. The penalty was based on extra tons only regardless of the distance traveled, which makes the law deal with all trucks equally despite their unequal damages to the roads.
5. The available data didn't provide any indication of reduction in the costs of maintenance in spite of the partial application of the law and neither did it prove the merit of the 1991 Study.

Trucks that are used in the transportation of goods and construction materials between different locations inside Jordan violate the axle load more frequently.

5. Recommendations

The following recommendations are suggested based on the results of the study:

1. Re-evaluation of the Law No.36-1983 is urgently needed.
2. Law enforcement needs to be strengthened.
3. Establishment of database in order to monitor, modify and enhance the axle law.
4. Immediate nullification of all the exceptions imposed and applies the axle law on all means of transportation equally.
5. Great attention must be paid to internal transportation and enough portable scales must be provided.

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