

FULL PAPER

Investigation and analysis of effect of tear phenomenon of hydraulic hoses of road construction machineries on loss and profits of projects

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This research study aimed at evaluating the effect of tear phenomenon of the hydraulic hoses of the road construction machineries on loss and profits of the projects. One of the important and main challenges of the heavy and semi-heavy machineries which are used in the road construction industry is the hose tear phenomenon. This incident depends on several factors including, the performance amount of machinery, weather conditions, natural and artificial factors, quality and kind of the hose, pressing method of the hose, and specially the skill of the operator. The consequences of the hose tear include the sleep of machineries regarding to their heavy expenses of purchasing or hiring, reduction of the efficiency of the other machineries, lag behind the time scheduling for completing the project, inappropriate performance quality of the project, and economic, social and political consequences. In this research, a real comparison between the expenses in two conditions of presence and non-presence of the hose pressing device in the workshop of the section 4 of the Arak-Khoramabad freeway, located at the 30 km of the Biranshahr-Khoramabad road was investigated to achieve the best condition, maximum profit and minimum loss. After evaluating all the conditions of the hose tear in the studied machineries, the results demonstrated that the presence of hose pressing device in the workshop was appropriate and cost-effective regarding to the economical aspect, performance quality of project, time scheduling of the project, social and political views. Therefore, it is suggested that the hose pressing device can be used in all constructive projects where the machineries play a considerable role in their performance.

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KEYWORDS

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Introduction

Nowadays, the hydraulic hoses of these machineries are used in a wide range of market and industry including the oil industry, related processes of drilling, machineries of road construction industry, mines, and welding as the device for

transmitting the gas and high pressure liquids in machineries and processes of the industrial plants [1]. The lifetime of these hoses depend on some factors such as structure, material, weather conditions, manner of usage, and maintenance. The tear of these hoses is one of the main problems of the machineries of road construction industry

especially of the machineries which are used in the Arak- Khoramabad freeway project. The purpose of Arak- Khoramabad freeway project is to connect the north parts of the country to its south parts which not only can facilitate the traffic of 11 provinces of the country but also plays a significant role in economic growth and development of the country [2]. One of the most important challenges of the road is the breakdown of machineries of the workshop especially the heavy and semi heavy machineries. As known, these machineries need the hydraulic oils for moving their arms up and down. These oils flow connected to the oil pump and they are the main factor in rising the arms and jacks. These hoses are depreciated due to the high pressure of the oil, incorrect installation, lack of precise connections, impact with stones and body of the machinery and totally the high pressure which leads to their tear [3]. The tear of these hoses does not occur only during the operation. It can also occur in the static mood or normal movement due to wear out of them which considered as the main factor. Regarding the location of the workshop of the

section 4 of the Arak- Khoramabad freeway which is in 25 km of the Biranshahr- Khoramabad road, if these problems occur, the repairman should disconnect the hose from the machinery and if there not any pressing device in the workshop, the hose should be transferred to the closest place for repair or replacement. In this research, two conditions namely the presence and non-presence of the pressing device in the workshop is investigated with focus on those machineries which have the most consumption of the hose which discussed as follows [1-5].

Consumption quantity of the hoses in the workshop of the section 4 of the Arak- Khoramabad freeway

There is about 19 bulldozers in this workshop which unfortunately just 11 of them are active due to the various reasons and the rest are inactive and are in the parking. It should be noted that, these 11 bulldozers are active and semi-active so they do not have the required efficiency [4].

TABLE 1 Average hose consumption of some of the machineries in the workshop

Machineries	Quantity of machineries in the workshop	Quantity of hose consumption per month	Quantity of hose consumption per year	Quantity of hose consumption in 3 years
Loader	3	2	72	216
Mechanical excavator	2	2	48	144
Wagon drill	3	5	180	540
bulldozer	11	5	660	1980

If the project is finished within three years with these expenses and machineries,

therefore, the total hydraulic hose consumption will be 2880.

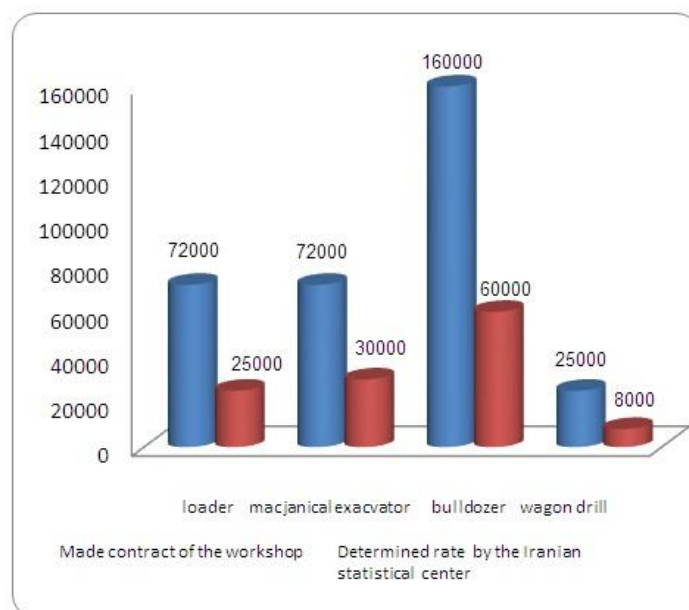


FIGURE 1 Comparison of the made contract of the machineries of the workshop with determined rate of Iranian statistics center

According to the above-mentioned information, if the price of 1 m Iranian 4 wire hose be 80000 Tomans, the results will be as follows.

TABLE 2 Cost estimation (Tomans) of the hose consumption for per machinery

Machineries	1m of four wire hose	Consumption of 1 m of hose	Annual consumption	3 year consumption
Loader	80,000	480,000	5,760,000	17,280,000
Mechanical excavator	80,000	320,000	3,840,000	11,520,000
Wagon drill	80,000	1,200,000	14,400,000	43,200,000
bulldozer	80,000	4,400,000	52,800,000	158,400,100
Total	-----	6,400,000	76,800,000	230,400,000

* All the expenses are in Tomans

Of course there are other machineries in the workshop which their hose consumption is one or two times within several months; however, they were discarded in this research.

Non-presence of hose pressing device in workshop and its consequences

According to the report of the Iranian Mine and Industry Ministry, 2010 on Troubleshooting of the hydraulic systems, the quantity of hose consumption of each machinery is completely different based on their activities and lifetime, weather

conditions and maintenance conditions [5]. Therefore, the mechanic of the workshop should disconnect the hose from the machinery and transfer it to the closest place for repair or replacement. In this situation, there are some expenses regarding the type of the machinery including the expenses of sleep of machinery, commute to the city, purchase of equipment, and wage.

If the repair, replacement and re-installment of any rupture hose take one day (sleep of machinery) in each time, the results will be a follows:

Sleep expense of bulldozer in one day

If one bulldozer excavates 800 m³ in average every day and 400 m³ of that land made of stone and the other 400 m³ made of soil, the results will be as follows:

The cost of excavation in the stone and loose soil land is 3600 and 620 Tomans for each meter, respectively.

$$400 \text{ m}^3 \times 3600 = 1,440,000$$

$$400 \text{ m}^3 \times 620 = 248,000$$

$$1,688,000$$

Sleep expense of loader in one day

If each loader has 200 load services in average every day and the cost of each load be 2000 Tomans, the results will be as follows:

$$200 \times 2000 = 400,000$$

Sleep expense of mechanical excavator in one day

If each mechanical excavator has 180 load services in average every day and the cost of each load will be 2000 Tomans, the results will be as follows:

$$180 \times 2000 = 360,000$$

Sleep expense of truck in one day

If each truck has 35 shipping services in 1 km every day and the cost of each service will be 8000 Tomans, the results will be as follows:

$$35 \times 8000 = 280,000$$

Sleep expense of wagon drill in one day

If one wagon drill makes 180 m hole in average every day and the average of each hole be 6000 Tomans, the results will be as follows:

$$180 \times 6000 = 1,080,000$$

Average of paid expense for the sleep of each machinery

The total results are as follows

TABLE 3 Average of paid expense for the sleep of each machinery (Tomans)

Machineries	Sleep of each machinery (daily)	Sleep of each machinery (monthly)	Sleep of each machinery (1 year)	Sleep of each machinery (3 years)
Loader	400,000	2,400,000	28,800,000	86,400,000
Mechanical excavator	360,000	1,440,000	17,280,000	51,840,000
Wagon drill	1,080,000	16,200,000	194,400,000	583,200,000
bulldozer	1,680,000	92,400,000	1,108,800,000	3,326,400,000
Total	3,520,000	112,440,000	1,349,280,000	4,047,840,000

Regarding the 11 active bulldozers in the workshop and the average consumption of each machinery which is 5 hoses per month, we can conclude that the average consumption of all the bulldozers is 55 hoses within one month. In other words, all the bulldozers consume about 2 hoses per day. These machineries are belonged to some organizations, so we pay the sleep cost of the machineries daily or annually. In other words, this amount will be 4,047,840,000 Tomans within the 3-year project. However, we do not pay such a cost to anybody

practically. Therefore, this calculation method is not correct and we should calculate the sleep cost of the machineries based of their performance volume which will be explained in the next parts. Due to the extensive contribution of the soil operations in each project, the productivity of the active and inactive machinery was in the profit and loss of this project. In these conditions, the efficiency of each machinery (sleep of each machinery) is as follows:

The breakdown of one bulldozer avoids 800 m³ excavations per day which leads to

reduction of excavation volume and delay of the project based on the time scheduling. So it is considered as a negative point in all political, economic and etc. aspects. Regarding the dependency of machineries to each other in the soil operation, the breakdown of each of them not only causes the cost of repair of that machinery, but also it includes the sleep cost and reduction of efficiency of the other machineries.

The loading of one loader or mechanical excavator is 1600 m³ (about 200 excavation services) every day which is 2 times more than the excavation amount of a bulldozer. In other words, the activity of two bulldozers in ever day (1600 m³ of excavation) is equal to loading of 200 services of a loader or mechanical excavator. Therefore, the result of sleep of one bulldozer is equal to 5 h or half a day sleep of a loader or mechanical excavator. According to the operation volume of each machinery, the results are as follows:

TABLE 4 Sample of the sleep rates of the bulldozer and its effects on the efficiency of the other machineries

Machineries	Sleep of each bulldozer (daily)	Sleep of each bulldozer (monthly)	Sleep of each bulldozer (1 year)	Sleep of each bulldozer (3 years)
Loader	95,000	570,000	6,840,000	20,520,000
Mechanical excavator	95,000	570,000	6,840,000	20,520,000
bulldozer	1,680,000	92,400,000	1,108,800,000	3,326,400,000
Total	1,870,000	93,540,000	1,122,480,000	3,367,440,000

TABLE 5 Sample of the sleep rates of the loader and its effects on the efficiency of the other machineries

Machineries	Sleep of each bulldozer (daily)	Sleep of each bulldozer (monthly)	Sleep of each bulldozer (1 year)	Sleep of each bulldozer (3 years)
Loader	380,000	2,280,000	27,360,000	82,080,000
Mechanical excavator	76,000	456,000	5,472,000	16,416,000
bulldozer	336,000	2,016,000	24,192,000	72,576,000
Total	792,000	4,752,000	57,024,000	171,072,000

Regarding the closeness of the loading quantity of the loader and mechanical excavator and the wage of each mechanical excavator and loader in workshop which are 360000 and 400000 Tomanss, respectively, in this research we assume the amount of 380000 Tomanss as the average wage of both of them. Therefore, the half a day sleep price of one loader or mechanical excavator is equal to 190000 Tomanss.

The sleep effect of one bulldozer not only reduces the efficiency of the mechanical excavator and loader but also affects the trucks and decreases the loading of a truck from 200 to 80 loading services.

The rent of each truck was 30000 Tomans per hour, so for the 10 business hours in each day, the amount was 300000 Tomans daily. Therefore, if the total efficiency is halved, the efficiency of a truck will be 50% or 150000 Tomans per day.

TABLE 6 Sleep rates of the mechanical excavator and its effects on the efficiency of the other machineries

Machineries	Sleep of each bulldozer (daily)	Sleep of each bulldozer (monthly)	Sleep of each bulldozer (1 year)	Sleep of each bulldozer (3 years)
Mechanical excavator	380,000	1,520,000	18,240,000	54,720,000
loader	76,000	304,000	3,648,000	10,944,000
bulldozer	336,000	1,344,000	16,128,000	48,384,000
Total	792,000	3,168,000	38,016,000	114,048,000

Delay expense of the project

If we consider 5 days on average in each month for the unauthorized closure of the workshop due to the high quantity of the rupture hoses of the machineries, so according to the 36 month time scheduling of project completion, totally 180 days will be added to this time. On the other hand, according to the expense of each month includes the salary of the personnel, equipment, machineries, commute, and foods was about 300,000,000 Tomans, these amount increased to 1,800,000,000 Tomans after 6 months. This additional cost increased the time of the project completion and reduced the income.

Hour sleep expense of investment

The following formula is used to calculate the hour sleep price of the investment [6].

$$\frac{B-C}{S} = \frac{0.7B}{S}$$

S=Useful life of machinery based on each hour

TABLE 7 Sleep expense of inactive organizational machineries (bulldozer) in Tomans

Machineries	Bulldozer (Tomans)
Sleep expense of each machinery in one hour	51,000
Sleep expense of each machinery in one day	51,000
Sleep expense of each machinery in one month	15,300,000
Sleep expense of each machinery in one year	183,600,000
Sleep expense of each machinery in three years	550,800,000

The above-mentioned expense is just for one bulldozer, so with considering the 8 inactive bulldozers in the workshop this

B=The price which the owner paid for purchasing the machinery in cash (cash purchase price)

C=Amount which resulted from the sale of depreciated machinery

$$B=0.3$$

Method of calculating the sleep of investment in one bulldozer

Useful life of machineries (S) based on each hour will be calculated as follows [7]:

According to 10 business hours per day and useful life of each machinery within 5 years, the results will be as follows:

$$365 \times 10 \times 5 = 18250 (s)$$

$$C = 0.3 B$$

$$C = 400.000.000$$

$$B = \frac{400.000.000}{0.3} = 1.333.333.333$$

According to the above-mentioned equation:

$$\frac{1.333.333.333 - 400.000.000}{18250} \cong 51.000$$

So the sleep expense of each bulldozer in one hour is about 51000 Tomans.

amount will be increased to the 4,406,400,000 Tomans. The following table

represents the calculated loss of sleep of the 8 inactive bulldozers.

TABLE 8 Volume of excavation based on 1 m³ in the case of activeness of the defective bulldozers

Volume of excavation of each bulldozer (m ³)	Volume of daily excavation (m ³)	Volume of monthly excavation (m ³)	Volume of excavation in 1 year (m ³)	Volume of excavation in 3 years (m ³)
800	6400	192000	2304000	6912000

In conclusion, on average the 6912000 m³ excavation includes 3456000 m³ excavation in the solid land and 3456000 m³ excavation in the loose land

$$3456000 \text{ m}^3 \times 620 =$$

$$2,142,720,000 \text{ Tomans}$$

$$3456000 \text{ m}^3 \times 3600$$

$$= 12,441,600,000 \text{ Tomans}$$

$$14,584,320,000 \text{ Tomans}$$

Other additional expenses:

Other additional expenses are including the expenses of commute to the city, purchase of connections and couplings and installment

and press of the hose. The individual price for each of the aforementioned items was demonstrated in the following chart (Chart 2).

- Expense of every commute to the city is estimated 15000 Tomans.
- Expense of purchasing of the connections and couplings is estimated 12000 Tomans.
- Expense of installment wage is estimated 10000 Tomans.

In the following chart, the mentioned expenses are represented for three-year project.

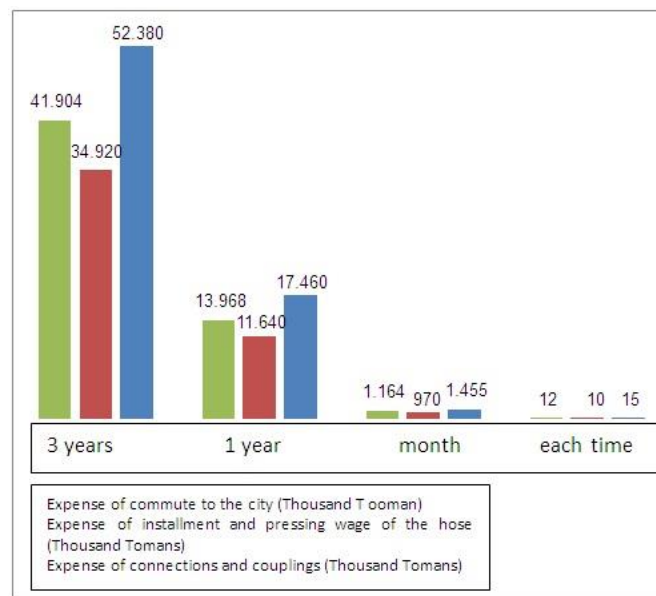


FIGURE 2 Total average of additional expenses for repair and replacement of each hose

All the expenses in the lack of hose pressing device in the workshop have been demonstrated in the Table 9.

TABLE 9 Evaluation of all expenses of the breakdown of the hose of the intended machineries in the case of non-presence of the hose pressing device in the workshop (Tomans)

Expenses	Day	Month	1 Year	3 Years
Sleep expense of machineries	3,454,000	101,460,000	1,217,520,000	3,652,560,000
Expenses of the connections and couplings	12,000	1,164,000	13,968,000	41,904,000
Expense of installment and pressing wage	10,000	970,000	11,640,000	34,920,000
Commute expense	15,000	1,455,000	17,460,000	52,380,000
Expense of 1 m of the hose	80,000	7,760,000	93,120,000	279,360,000
Operator expense	----	-----	----	-----
Total	103,737,000	112,809,000	1,353,708,000	4,061,124,000

Unfortunately, due to the lack of pressing device in the workshop, there is a problem of tear of hoses daily or though once a day. According to the previous experiences, the required time to repair or replace the hose of device was 1-3 days. Disadvantageous and lack of attention to this matter leads to heavy consequences in the future such as the incapability of the complex and criticism of the managers.

According to the activation of the night shift of the workshop, lack of hose pressing device leads to having less time, increasing the sleep of the machineries and reducing the efficiency. On the other hand, investigating this matter can also increase the expenses considerably.

However, the main reason of the rapid tear of hose is the use of machineries with the low efficiency which work more than their useful lifetime. In the European countries if the efficiency of the machineries reaches 0.6 or 60% or after passing 5-6 years after of working the machinery, the mentioned machinery will be out of order and is sent to the parking [8].

Presence of hose pressing device in workshop

If the hose pressing device is presented in the workshop, undoubtedly the required time for connecting a coupling or connection to the hose by the operator is maximum 2 hours. In this case, the pressing operation of the hose was conducted by the mechanic of the workshop. Therefore, the mechanic of the workshop just spends the time for changing the hose of machinery. In the other words, using the hose pressing device can have the following advantageous [9]:

- Reducing the sleep time of the machineries which is very valuable.
- Reduction of the expenses regarding the calculation of the rent of machineries based on each hour.
- Job creation and employment of the professional and non- professional forces for education.
- Prevention of increasing the time of project.
- Making money: Supplying of the hoses of the other workshops.
- More efficiency
- Lack of limitation in the night shifts.

In these conditions, the sleep time of machineries decreases and reaches some few hours. So, if 2 h is considered as the sleep average of each machinery, after omission of

the pressing wage and commute expenses to the city, the results are as follows.

It should be noted that the hoses are bought in long meter rolls and the connections are purchased in bulk with the high quantity. Therefore, the cost of each meter of the hose and each connection will be near 60000 and 7000 Tomans respectively.

As mentioned before, the average value of 800 m³ excavation by one bulldozer in 1 day is about 1,680,000 Tomans and if we want to calculate this amount for per hour, it should be divided on 10 business shifts:

$$1,680,000 \div 10 = 168,000$$

It means that the value of each working hour of a bulldozer is 168,000 Tomans based on its performance volume. So if this machinery be inactive for 2 h in a day, then:

$$168,000 \times 2 = 336,000$$

If each loader has 200 loading services on average per day and the average of each loading is 2000 Tomans, the results are as follows:

$$200 \times 2000 = 400,000$$

If the value of each loading by the loader be 400,000 Tomans every day, for calculation of

TABLE 10 Average paid expense for the sleep of each machinery (Tomans)

Machineries	Sleep (daily)	Sleep (monthly)	Sleep (1 year)	Sleep (3 years)
Loader	80,000	480,000	5,760,000	17,280,000
Mechanical excavator	72,000	288,000	3,456,000	10,368,000
Wagon drill	216,000	3,240,000	38,880,000	116,640,000
bulldozer	336,000	18,480,000	221,760,000	665,280,000
Total	704,000	22,488,000	269,856,000	809,568,000

Since the efficiency of some machinery such as mechanical excavator and loader is near to each other, in order to calculate the correct figures of the average value of their volume regarding to 2-hour sleep, this amount is considered as 76,000 Tomans.

the value of each working hour of this machinery, we should divide this amount on 10 h working shifts:

$$400,000 \div 10 = 40,000$$

Therefore, the 40000 Tomans for each hour is the value of this machinery based on its performance volume. So if this machinery be inactive for 2 h due to the repair of hose in a day, then:

$$40,000 \times 2 = 80,000$$

If each mechanical excavator has 180 loading services on average per day and the average of each loading is 2000 Tomans, the results are as follows:

$$180 \times 2000 = 360,000$$

$$360,000 \div 10 = 36,000$$

$$36,000 \times 2 = 72,000$$

If each wagon drill excavates 180 m hole on average per day and the average of each hole be 6000 Tomans, the results are as follows:

$$180 \times 6000 = 1,080,000$$

$$1,080,000 \div 10 = 108,000$$

$$108,000 \times 2 = 216,000$$

The average of 2-hour sleep for intended machineries was calculated (Table 10)

Moreover, since the sleep of each bulldozer is equal to the half of sleep of a mechanical excavator or loader, so this figure can be divided between these two machineries and will be 38,000 Tomans for each of them

TABLE 11 Sleep expenses of the bulldozer and its effects on the efficiency of the other machineries

Machineries	Sleep (daily)	Sleep (monthly)	Sleep (1 year)	Sleep (3 years)
Loader	19,000	1,045,000	12,540,000	37,620,000
Mechanical excavator	19,000	1,045,000	12,540,000	37,620,000
bulldozer	336,000	18,480,000	221,760,000	665,280,000
Total	374,000	20,570,000	246,840,000	740,520,000

TABLE 12 Paid sleep expenses of the loader and its effects on the efficiency of the other machineries

Machineries	Sleep (daily)	Sleep (monthly)	Sleep (1 year)	Sleep (3 years)
Loader	76,000	456,000	5,472,000	16,416,000
Mechanical excavator	15,200	91,200	1,094,400	3,283,200
bulldozer	67,200	403,200	4,838,400	14,515,200
Total	158,400	950,400	11,404,800	34,214,400

TABLE 13 Paid sleep expenses of the mechanical excavator and its effects on the efficiency of the other machineries

Machineries	Sleep (daily)	Sleep (monthly)	Sleep (1 year)	Sleep (3 years)
Mechanical excavator	76,000	304,000	3,648,000	10,944,000
Loader	15,200	60,800	729,600	2,188,800
bulldozer	67,200	268,800	3,225,600	9,676,800
Total	158,400	633,600	7,603,200	22,809,600

If the hose pressing device be in the workshop, the total expenses will be as demonstrated in the Table 14:

TABLE 14 Evaluation of all expenses of the breakdown of the hose of the intended machineries in the case of presence of the hose pressing device in the workshop (Tomans)

Expenses	Daily or each time	Monthly	1 Year	3 Years
Sleep expense of machineries	690,800	20,292,000	243,504,000	730,512,000
Expenses of the connections and couplings	7,000	560,000	6,720,000	20,160,000
Expense of installment and pressing wage	0	0	0	0
Commute expense	0	0	0	0
Expense of 1 m of the hose	60,000	4,800,000	57,600,000	172,800,000
Operator expense	50,000	1,500,000	18,000,000	54,000,000
Total	807,800	27,152,000	325,824,000	977,472,000

It should be noted that the expenses of the consumed hydraulic oil in the case of tear of the hose are eliminated in this research due

to the sameness of these expenses in the presence or non-presence of the hose pressing device in the workshop [10].

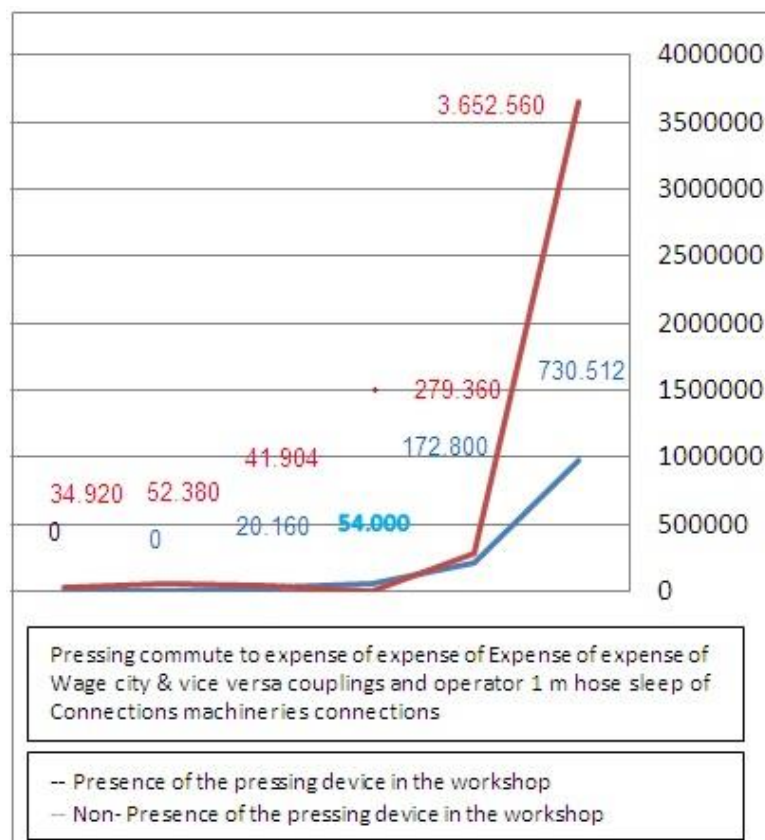


FIGURE 3 Comparison of the expense analysis (thousand Tomans) in two conditions of presence and non-presence of the hose pressing device in the workshop within 3 years

Conclusion

- 1- At first, the necessary factor for the success of the project is long time and short time programming.
- 2- Machineries are the most important and expensive sources, therefore, they need the special attention.
- 3- Incorrect installation of the hose and connections can be the main reason for the wrong performance of the hydraulic system. Therefore, accuracy, skill and patience during the installation of the parts of hydraulic systems are the best guarantee for appropriate performance of a hydraulic system.
- 4- Installation of the parts of the hydraulic systems and vice versa needs the skill and comprehensive knowledge about the

equipment and their installation methods. There are many hydraulic systems which encountered with problems or breakdown within the several months due to the incorrect primary installation or incorrect re-installation. Therefore, for the successful and high quality performance of these systems, there are some required factors such as cleaning, pay attention to the details and precise and skillfully installation of the rough equipment.

5- A defective installed connection can be separated under the pressure and be shot like a bullet in the workshop. Moreover, the oil can be splashed to the persons and the floor of the salon from the open valves. Therefore, the oil-contaminated floor will be so slipping and it always expects one victim. For troubleshooting of the hydraulic systems and

prevention to damages, there is a need for precise knowledge from the whole of the system and correct understanding of the system performance. Therefore, according to this complete knowledge and awareness, you can find the reasons of the breakdown of the system easily. Meanwhile, one of the more important advantages is that you can understand how to find the factors for prevention of the problems and breakdown in the regular repair and maintenance operations.

6- The primary consequence of tear of one hose is the splashing of the oil to the surrounding environment. The splash of oil on the exhaust of the machinery can lead to the fire of that certain machinery.

7- The first priority and purpose of this workshop is time saving. So, for achieving this purpose, the torn hose of machinery should be repaired or replaced rapidly. Therefore, purchasing the hose pressing device can decrease the required time for commuting to the city which leads to saving more money.

8- The main reason of these expenses is the use of repaired and used machineries.

9- There are about 80 hose tears within one month which is equal to approximate 3 hose tears per day.

10- As mentioned before, the presence of hose pressing device in the workshop can lead to job creation through employment of an operator. In the other hand, there is another solution, so the pressing of the hoses can be performed by the mechanic forces, repairmen and even drivers which result in parsimony of the expenses. It means that it is possible to decrease the 54,000,000 Tomans (wage of operator) with this solution.

11- It seems that the tear of hose is a superficial phenomenon and this not the complete natural process.

12- It is suggested that to use those hoses which have nano-particles which made of nano-materials and fibers since their resistance and tolerance are 100 % more than ordinary hoses.

13- The phenomena of the tear of the hoses does not include just the workshop of the section 4 of Arak-Khoramabad freeway but it includes all the workshops, all parts of the road construction operation and wherever the bulldozer, mechanical excavator, wagon drill, and loader are used. In the other words, it is suggested that all the workshops have the hose pressing device specially the construction site of Khatam Al-anbia (PBUH) which the above-mentioned machineries are used in most of its projects and the presence of the pressing device can definitely decrease its expenses.

14- The sleep of each machinery can decrease the efficiency of the other machineries up to 20% approximately.

15- The purchasing price of the 2 " hydraulic hose pressing device is near to 15,000,000 Tomans but this amount can increase to 20,000,000 Tomans based on the type and manufacturing company of the pressing device.

16- More than 70% of the hose tear occur in bulldozers and about the 23%, 4% and 3% of the hose tear are related to the wagon drill, mechanical excavator and loader respectively.

17- The above statistics are on average and there are other machineries in the workshop which their hose consumption is lower than the above-mentioned machineries but they were eliminated in this research. We should pay attention that since we are in equipping the workshop, the total quantity of the machineries has not been completed yet. Also there are other machineries such as Jambo and various wagon drills in the future which their hose consumption are more and therefore, the expenses more than before.

18- If the operator produces 5 hoses in the workshop daily, this quantity will reach to about 1680 pcs within one year, so it is possible to produce 5040 pressed hoses within 3 years. In other words, this plan not only meets the need of this workshop but also meets the needs of other workshops. Hence,

this leads to generating income based on the thinking and awareness.

20- The lack of hose pressing device in the workshop may cause the 4,061,124,000 Tomans expense within 3 years; however, the presence of this device in the workshop will be along with the 977,472,000 Tomans. According to the difference between these expenses which is 3,083,652,000 Tomans, the presence of hose pressing device in the workshop is necessary in order to decrease the expenses.

21- If there is 5 unauthorized closure days in one month, this figure will be increased to 180 days within the 3-year project which finally will add 180 days or 6 months to the term of the project. Therefore, according to the spending of 300,000,000, Tomans for personnel and additional expenses, if the project is finished within 3 years, the amount of these expenses will be increased to 1,800,000,000 Tomans. So according to the probabilities and current process, the project will be completed in 6 years and the expenses will increase up to 3,600,000,000 Tomans.

22- It is concluded that, the use of destroyed bulldozers in the own soil operation is more useful and profitable in comparison with the new bulldozers.

23- The disadvantages of sleep of each machinery are not limited to that certain machinery but it decreases at least 20% of the efficiency of the other machineries.

24- Since most of our machineries are out of order, if we encounter with the tear of hoses every day, the efficiency of the other machineries will be reduced. So there will be delay in project process based on its time schedule which will be along with the increase of expenses and reduction in the appropriate quality of the project as its consequences.

25- According to the progressive process of the project which is executing right now, this project will be finished probably in the next 6-7 years. So based on the above explanations, we will be encountered with

the increase of expenses in the future. Therefore, the avoidance of the hose tear phenomena or the rapid replacement of the torn hose is necessary which needs the hose pressing device in the workshop.

26- The presence of the hose pressing device in the workshop not only leads to the parsimony of the expenses but also increases the efficiency of the machineries more than before.

Suggestions

◆ Inactive machineries can be repaired at any cost:

a) The repaid machineries can be rented to the sub-contractors which can be effective in income generation.

b) These machineries can be used in the workshop for increase the operational force and prevention of any delay from the project time scheduling.

c) According to the average price of each machinery which is 400,000,000 Tomans , it is possible to sell 8 bulldozers in 3,200,000,000 Tomans and buy some new bulldozers with the 100% efficiency which leads to increase of the efficiency of the other machineries.

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