

Design and Fabrication of a Pothole Filling Machine

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Abstract - Development of potholes on roads and streets of India after the onset of monsoons is a common phenomenon. Quite often, potholes are repaired with antiquated techniques such as placing soil or bare aggregate in the pothole because no hot mix asphalt is available during monsoons. Some of the problems caused by a pothole, the movement of vehicles on potholes leads to vehicular damage as well as passenger injuries. Increase in number of potholes on the road results in slow movement of traffic. Traditional pothole filling techniques take a lot of man power and a lot of heavy machinery, which is an expensive process. The objectives of the project is to decrease the amount of manpower and the time required to fill the pothole. To reduce road closure due to repair of roads by creating compact machine to work in tandem with the traffic. To reduce the amount of money required to fill a pothole. Now as we take a look at the advantages of our project over the conventional system we can say that Initial investment is less and easy to maintain. Reduces labor because of single equipment. By using a single machine all the processes are done simultaneously and efficiently. No need to close the complete road only a portion of the road is closed.

Key Words: Potholes, filling machine.

1. INTRODUCTION

Development of potholes on roads and streets of India after the onset of monsoons is a common phenomenon. Quite often, potholes are repaired with antiquated techniques such as placing soil or bare aggregate in the pothole because no hot mix asphalt is available during monsoons. An economical, generic, ready-made stockpile cold patching mix has been proposed, which is manufactured in a batch type hot mix plant using local aggregates [1]. Development of potholes on Indian roads and streets after the onset of monsoons is a common phenomenon. Every year there is a public outcry and newspapers are full of pictures showing potholed road pavements. Hot mix asphalt plants are usually shut down during monsoons and no hot bituminous mix is available for filling potholes. Therefore, many potholes are either not repaired or repaired with antiquated techniques. It is quite common for the government agencies to repair potholes as follows:

Fill the pothole with soil, which is usually washed away in the first rain. Fill the pothole with bare stones, This not only provides a rough riding surface especially for motorcycles but the stone particles start to ravel out of the pothole during subsequent rains. If the stones survive in the potholes, these are not usually removed and pothole properly patched when the road or street is overlaid with hot mix. This results in reappearance of the same pothole during next year's monsoon.

There is a need to implement a simple and effective method of repairing potholes not only during monsoons but also throughout the year. This can be achieved by using the latest cold mix asphalt technology for producing and stockpiling ready-made bituminous pothole patching mix. A conventional batch type hot mix asphalt plant is used to produce a large stockpile of patching mix prior to the onset of monsoons.

As Pruthvi Singh Kandhai [1] stated that Development of potholes of roads and streets on the onset of monsoon is a common phenomenon in India. Often potholes are repaired with antique techniques such as filling it with soil or bare aggregate in the potholes because no hot mix asphalt is available during monsoon season. An economical, generic, readymade stockpile cold patching mixture has been proposed, which is manufactured in a batch type hot mix plant using local-aggregates. Which can be stockpiled for 6 months and hence can be used through the year.

The major cause of road accidents in India are potholes which has claimed 3,597 lives in the year 2017 which is significant increase from the year 2016 i.e., more than 50% increase in the number of deaths was reported in the Times of India article[2].

The FHWA manual [3] cites the throw-and-roll method as the most basic method, best used as a temporary repair under conditions when it is difficult to control the placement of material, such as winter-time. It consists of:

1. Placing the hot or cold patch material into a pothole
2. Compacting the patch with a vehicle, such as a truck

3. Achieving a crown on the compacted patch of between 3 and 6 mm

This method is widely used due to its simplicity and speed, especially as an expedient method when the material is placed under unfavorable conditions of water or temperature. It can also be employed at times when the pothole is dry and clean with more lasting results.[5] Eaton, noted that the failure rate of expedient repairs is high and that they can cost as much as five times the cost of properly done repairs. They advocate this type of repair only when weather conditions prevent proper techniques.[4].

According to an article in Hindustan times [6], the Supreme Court Thursday expressed concern over 14,926 people being killed in road accidents due to potholes in last five years and termed it "unacceptable". A bench headed by Justice Madan B Lokur said the large number of deaths caused due to potholes across the country was "probably more than those killed on border or by the terrorists". The bench, also comprising justices Deepak Gupta and Hemant Gupta, said the number of deaths from 2013 to 2017 in accidents due to potholes indicated that the authorities concerned were not maintaining the roads. The bench sought a response from the Centre on a report filed by the Supreme Court Committee on Road Safety, headed by former apex court judge K S Radhakrishnan, on the number of deaths due to potholes in India. The top court had on July 20 expressed its concern over the deaths and observed that the number fatalities due to such accidents was more than those in terror attacks. Terming the situation as frightening, the top court had asked the Supreme Court Committee on Road Safety to look into the matter. The bench had also said that people who have lost their lives as a result of accidents due to potholes should be entitled to compensation. It was a matter of common knowledge that a large number of people have died in such accidents and authorities, who were supposed to maintain the roads, were not doing their duty properly, the bench had said. Referring to media reports, the top court had said, "So many people are dying in the country due to accidents caused by potholes on roads. Reports say that more people have died due to accident caused by potholes than the deaths in terrorists' attacks". It had asked the Supreme Court Committee on Road Safety to look into this "very serious issue" and file a report within two weeks. The apex court had also said that the committee should give recommendations as the issue was a part of road safety. The matter had cropped up before the bench when it was hearing an issue related to road safety across the country.

The most extensive types of damage that have been caused by potholes on vehicles are alignment problems, damages to the under carriage, mufflers, shocks, axles, tires, and rims. At low speeds, hitting a deep pothole can cause damage to tires, wheels and steering alignment but the cost of repair probably would not justify an insurance claim. At higher speeds, can cause severe damage and risks loss of control of the vehicle which could result in impact with other vehicles, the curb or roadside objects.

Potholes usually result of water in the underlying soil structure and traffic passing over the affected area. Water first weakens the underlying soil; traffic then fatigues and breaks the poorly supported asphalt surface in the affected area. Continued traffic action ejects both asphalt and the underlying soil material to create a hole in the pavement.

2. METHODOLOGY

There are many telltale signs that herald the return of spring. The days start to get longer. The birds return. Flowers are in bloom. And, of course, potholes become more and more common along our roadways. The latter can be bad news for your vehicle. All it takes is one good jolt from a pothole to affect your vehicle's handling. When you consider the cumulative effect of driving over them repeatedly in spring, it can really take a toll on your vehicles:

- Suspension
- Alignment
- Tires

Some of the unseen complications of pot-holes are:

Whether you hit a pothole head-on, or you react in time to partially avoid one, it can damage your vehicle. Two things will typically affect the extent of the damage:

- The speed at which you hit the pothole
- The depth of the pothole

The decision to patch potholes is influenced by many factors: The level of traffic. The time until scheduled rehabilitation or overlay. The availability of personnel, equipment, and materials. The tolerance of the traveling public. In most cases, the public likes all potholes to be repaired promptly and forms a negative opinion of the highway agency when this fails to happen.

Potholes are generally caused by moisture, freeze-thaw action, traffic, poor underlying support, or some combination of these factors. Pothole repair is necessary in those situations where potholes compromise safety and pavement ride ability. Pothole

repair operations can usually be divided into two distinct periods. The first period is winter repairs, when temperatures are low, base material is frozen, and additional moisture and freeze-thaw cycles are expected before the spring thaw. The second period is spring repairs, when base material is wet and soft, and few additional freeze-thaw cycles are expected. Regardless of the climatic conditions, the potential safety and ride ability problems that could result from the un-repaired distress must be considered when deciding whether a pothole should be patched. A highway agency must repair potentially hazardous potholes as soon as it becomes aware of them.

3. DEFINITION OF TERMINOLOGIES

The principal parts that have been used in this system are:

Roller, chassis, engine, hopper and chain drive system.

The roller (fig 1) of diameter 400mm and length of 500 mm and this is selected based on the average size of pothole we must clean. It is made up of mild steel and it is hollow and it can be filled with sand to get extra pressure on the tar mixture. The pressure exerted by the roller is 6.48 kgf/cm².which is enough for compaction.

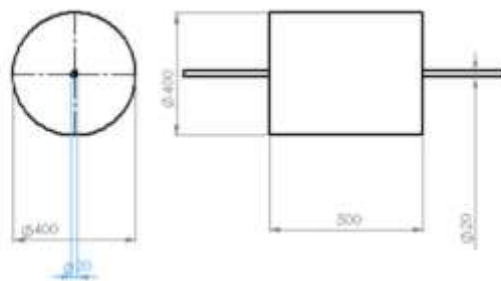


Fig -1:Roller

The shaft of the roller is made up of 45c8 steel and the dimensions of the shaft is of the diameter of 25mm and the length of the shaft is 1080 mm and it is welded with the roller.

The chassis (fig 2) of the machine is made to withstand the weight of the roller and the weight of the engine. The chassis is made up a L frame for the platform and C frame for the connection of roller to the chassis. The L frame is of dimension 35x35x5 mm. The length of chassis is 730 mm and the width is 370mm.

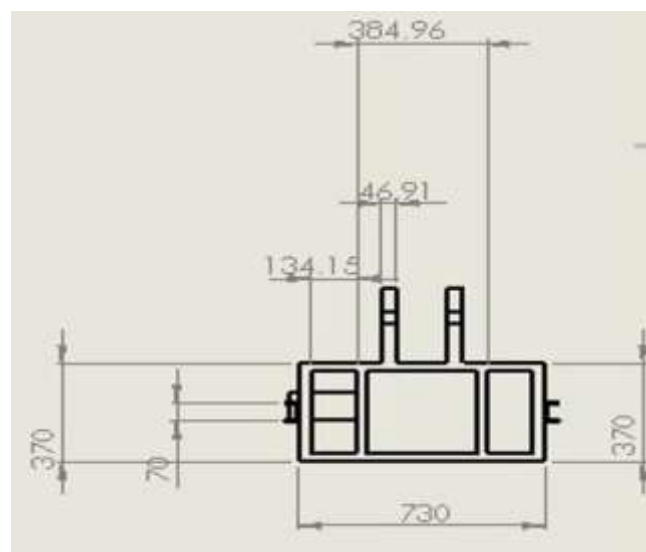


Fig-2 :Chassis

Engine (Fig. 3) used is a Bajaj CDT 2-Stroke petrol engine and the power developed by the engine is 7 bhp and the torque produced is 12.1 N-m and it is connected to the roller by the gear box and the chain drive to reduce the speed of the roller by 4 times by gear and 3 times by the chain drive.

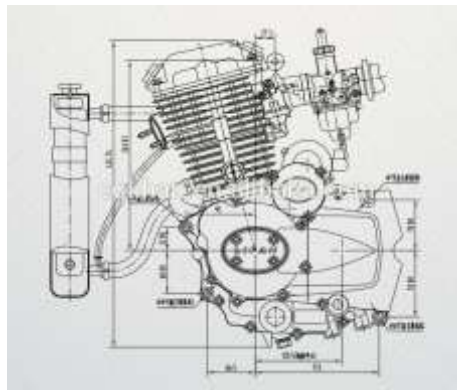


Fig-3 :Engine

Hopper (fig 4) give us the place to store the tar mixture and to use it to deposit the mixture on the pothole and it is made up of mild steel sheet metal and it is made up of truncated rectangle and cuboidal pyramids the inlet cross section is 250x300 and the outlet is 170x170 mm.

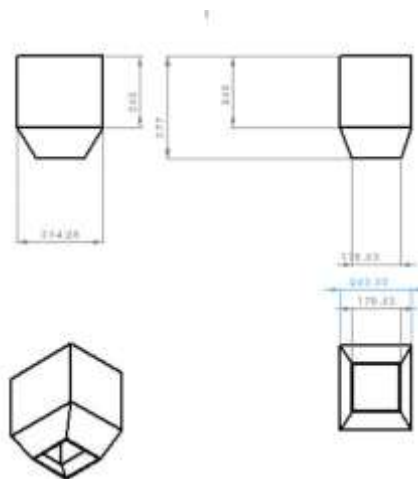


Fig-4 :Hopper

A. Final Assembly

The coal tar that is used is taken in the required quantity and the hopper is filled to the top and the engine is turned on and the roller is moved to the required place where the pothole is present. The hopper is moved to the required position and the hopper is opened and the tar falls to the potholes and when the required amount of tar is deposited the hopper is closed. With the engine the roller is made to move over the mix and compact the tar mixture. The roller is made to go 2-3 times to get the required amount of compaction. This process can be carried out to get smooth road surface. the assembly is given below in the figure 5

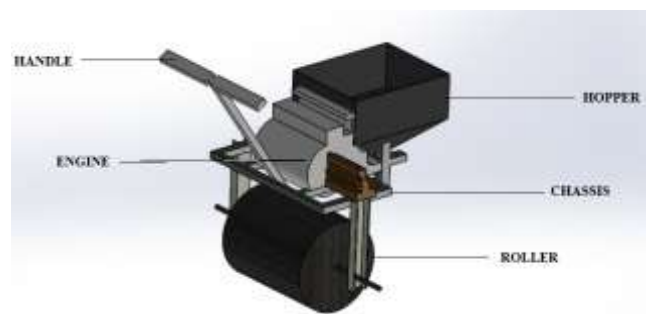


Fig-5: Assembly

4. DESIGN AND FABRICATION

Phase I

- Identification of problem
- Definition and analysis of problem
- Initial design
- Market survey
- Design alteration

Phase II

- Material procurement
- Design modification
- Final design
- Machining
- Assembly and testing
- Improvements and modification

The total cost of the project is Rs. 31,250. The pothole filling machine can be used to replace the available machines that are Present in the market. The large machines that are used in the roads are very huge and take up a lot of space and it is very difficult to transport. These can be adopted by the municipality and there is no need to give the job to contractors. This machine reduces the cost required to fill a pothole.

5. CONCLUSION

After the development and trial of "Pot Hole Filling Machine" we were able to conclude that, Based on the overall performance of the machine we can definitely say that the project will have an impact on the city's municipalities. Multiple operations such as rolling and tar discharge can be performed simultaneously. Reduces the man power and as well as time during the process. The problem of traffic disturbances while filling tar is solved as the machine is compact. The number of equipment's used to perform the work is less and hence the cost is also drastically reduced a there is only one machine used. This reduces the time cost and money to fill a pothole.

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