IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

# A CRITICAL STUDY ON INEFFICIENCY IN ADMINISTRATION CONCERNING POTHOLE ACCIDENTS

**S. Mohamed Aysha**

## ABSTRACT

*As Indian citizens, we all expect proper road transportation facilities, but it is very evident that India has been lagging when it comes to administration part. It is imperative to figure out the reason behind the pothole-related traffic incidents which are increasing frequently day by day. According to information provided to the Parliament on 14th December 2022, a total of 3,625 traffic accidents occurred nationwide due to potholes in 2021. The research disseminates on the pothole accident that occurs in India as a result of water stagnation on the road during rain, improper road maintenance, negligence, and official corruption. The paper highlights several impending issues regarding pothole incidents. This serious issue might spread to the highways if government officials did not maintain and regulate the potholes on Indian rural roads. The businesses raise the rim quality, which boosts the worth of manufacturing. To prevent the formation of potholes, the author suggests the proper measures that can be taken to curb the issues. Later the author concludes this paper by giving her observation and suggestion to prevent pothole accidents.*

**KEYWORDS:** Transportation, Administration, Authorities, Potholes.

## I. INTRODUCTION

Transportation is seriously hampered by hazardous road conditions. For safe and comfortable mobility, hazardous road surface conditions are a major issue. The significance of the nation's road system can be compared to the significance of human blood veins. It should be constantly examined and fixed as needed for better road surface quality. Roads are the most popular form of transportation in India, carrying 90% of passengers and 65% of freight. Even with such a vast network, traveling in India is exhausting due to the narrow roads and poor maintenance. Nowadays, Driving is a stressful and possibly dangerous activity no matter where you are driving. With the population growing exponentially during the past 20 years, the number of automobiles has also expanded dramatically. Traffic congestion and accidents occur as a result of the road infrastructure not being able to accommodate the number of vehicles *[1]*. The supporting soil first becomes more fragile when water is introduced to the underlying soil structure. The asphalt surface in the impacted region is then worn down by traffic and damaged. Asphalt and the soil beneath it are both ejected from the pavement as a result of constant traffic

activity. Potholes are tiny bowl-shaped holes that form on the flexible pavement's top layer, usually after rain. The most frequent discomfort or fault that appears on flexible pavements with bituminous coating, at various remote sites, is the development of potholes. In various terrains with varying topography, soil, drainage, and environmental factors, highway pavements are built. These areas could eventually become weak points, which would lead to the development of potholes. If the potholes are ignored, the combined effects of water and traffic will cause them to grow rapidly in both depth and area, eventually becoming large-sized potholes. Maintenance workers should therefore fill each pothole as soon as possible as it forms, and in the shortest amount of time.

## II. RATIONALE FOR POTHOLE

Potholes are primarily caused by the presence of water, however, the manner in which they occur varies slightly depending on the design and materials of the road pavement. Of course, many other non-structural factors can contribute to potholes, such as diesel (or other chemicals) spills, mechanical damage from vehicle rims, accidents, and fires, damage from falling rocks in cuttings, animal hooves on hot pavement, and poor road design over certain subgrades, such as expansive, collapsible, and dispersive soils. The majority of potholes develop during the wet or rainy season, but they can also grow and worsen during the dry season as a result of traffic, localized irrigation, ponding, and/or seepage of water, etc. In addition to transitory wet circumstances brought on by driving. The latter can typically be distinguished by the area's hydrophilic (water-loving) plant life. The stimulus events in pothole formation depend on whether the bituminous pavement surfacing is asphalt or a thin bituminous-surfacing seal (locally known as "chip and spray," surface dressing, surface treatment, or chip seal). These discrepancies are covered in this article.

### A) ASPHALT FISSURES

Asphalt fissures can emerge in two different ways. They are either brought on by water seeping into a less permeable interface inside the asphalt layer, resulting in stripping of the asphalt, or by the asphalt cracking due to wear and tear or aging (binder shrinkage).

**Cracks in the asphalt surfacing**

Asphalt surfaces frequently crack due to inadequate support (inappropriate material kinds or thicknesses, or too much water), which causes the asphalt to fatigue crack. In contrast, environmental cracking might happen as a result of the sun's ultraviolet rays, heat, oxidation, or any factor that caused the asphalt to shrink. Further, cracking is caused by reflection cracking, which results from the shrinkage of underlying stabilized materials as the epoxy-coated stabilizer hydrates. High surface deflections under traffic pressure are typically caused by an underlying weakness in the support layers, specifically, if the material soaks. Moisture may seep beneath the pavement due to poor drainage in the area or may enter the pavement layers through developing cracks from above. Environmental and traffic-related cracking that results in potholes typically begins with the asphalt next to the crack spalling, which then grows larger over time and with used to form a pothole. The pavement won't suffer much harm if the cracks are sealed or the spalling is promptly corrected, but if they are left unattended, water will

enter the crevices and cause the road to deteriorate more quickly *[2]*. Regardless of the reason for the cracking, water seeping into the road through the surfacing during wet weather can hasten the development of potholes, as has been observed regularly in recent years.

**Water seepage through the asphalt**

When asphalt overlays separate from underlying asphalt (or other bituminous seals) due to permeability inversions, moisture effects at the interface, or possibly the presence of a stress-absorbing membrane interlayer (SAMI), the asphalt is stripped away and typically shallow potholes develop as a result. If this kind of pothole isn't sealed or fixed right away, the surface area grows larger and the asphalt beneath is abraded, which causes deeper, harder-to-repair potholes to form.

**Traffic congestion**

Excessive road deflections induced by heavy traffic loads (above the pavement design loading) lead to fatigue failures. The road surface cracks as a result of frequent high deflections or even a few passes by heavy vehicles, which allows water to seep into the base and sub-base underneath and cause the loosening of the material. To maintain road performance and stop the production of new potholes generally, overloading control is therefore crucial. This requires efficient traffic loading control to ensure that it stays within the design loading, such as by signage and enforcement.

## B) LIGHT-WEIGHT BITUMINOUS SURFACE SEALING

The most popular types of bituminous surfaces are thin seals made of bituminous material, including single and double seals, Cape seals, and slurry seals. They are often long-lasting seals, but how well they operate relies on the substance beneath, which is frequently moisture-sensitive and prone to quick deterioration in the presence of water *[3]*. Slurry and single (or even double) sand seals are particularly thin and more susceptible than other seals to potholes being created by abnormalities in the top of the base punching through the seal. To keep the seal's integrity for the duration of the design term, these require careful preventative maintenance. When water is let to access the underneath material, whether it is crushed stone, natural gravel, or cemented gravel, potholes almost always start at the top and spread downward. If properly maintained, thin bituminous-surfacing seals are thought to be fairly flexible (perhaps aside from slurry seals). Such seals can withstand quite significant deflections for a while before cracking, especially if modified binders were used in their construction. However, once cracking begins, water can quickly enter the pavement structure and failure (loss of the top structural layers and surfacing layers) happens over a considerably greater area than when the pavement is only subjected to localized "breakthrough." The pavement is impacted significantly more quickly at greater depths. Also susceptible to developing potholes are thin bituminous sealants.

## C) BIZARRE WAYS THAT POTHOLES CAN DEVELOP

There are numerous other reasons why potholes can develop. The presence of too many soluble salts in the pavement is an unusual reason for the loss of connection between the base and a bituminous surface. Solvable salts may be deposited between the seal and the base at these locations if water evaporates through the surfacing (either as a result of high permeability or the presence of any flaws, such as cracks, excessive voids, etc.). Potholes will result from this lack of bond. Since they are not part of routine maintenance, they cannot be fixed.

## D) RATIFIED SERVICE TRENCHES

Trenches are routinely dug over several urban and, on occasion, some rural highways to build or repair different underground utilities like electric lines, water reticulation systems, sewage pipes, etc. Usually, the relevant municipal body or contractors hired for this purpose complete these tasks. In either event, these ditches are rarely repaired to a high enough standard because they are frequently not done by road repair "specialists." This causes the surfacing to settle, which causes water to collect in puddles and cause cracks and potholes. It also causes the seals between the new trench and the nearby existing seal to fracture or open, which also causes to form potholes.

## E) REPAIRS NOT RELIANT ON LABOUR

Teams of construction crews will often repair the bulk of pits, usually using a mechanical compactor. However, it may be more efficient to utilize a small recycler or milling machine to remove the afflicted region and replace the material with a suitable repair material when potholing becomes severe or impacts long, linear portions of the road.

## F) INADEQUACY IN ADMINISTRATION RELATING TO POTHOLE ACCIDENTS

The inefficacy of any governmental authority, government, or public works department is a significant cause of pothole accidents. Several laws, theories, and principles might be invoked and put into action to demonstrate the public officials in charge of maintaining these roads were careless and so culpable for the occurrence of these accidents. The government sets aside a budget for building the road, and once that budget has been allocated, money is sanctioned to the contractor. The contractor's company then receives funding for the supplies needed to build the road, such as cement and concrete, and labor is employed to begin construction. Similar to how cigarettes are harmful to human health, poor or low-quality materials used to build roadways are also harmful. Governments and civil servants are equally accountable for their negligence during the checking and inspection process. If the authorities detect the error, the roads won't be in poor condition. Another issue that might claim responsibility for the poor state of roads is corruption and avarice. Engineers are also accountable since they continue to remain silent while knowing that corruption and gambling are going on. They might also receive financial aid. It is essentially the developer's job, as well as the municipal operation of anybody carrying out such construction, to create civic facilities. Periodically, the roads need to be maintained and restored.

## III. FIRST-LINE TREATMENT

The patched area must be marked with chalk, spray paint, or crayons, and ensure to include both the overall "flawed" area and some sound area. The entire region that the pothole has affected, along with any associated hardship, must be included in the indicated area. This is frequently the main problem (cracking, spalling, etc.) that initially led to the formation of the pothole. Since straight lines may be cut more precisely than rounded or oval patches, the patch should be indicated with them. To remove the surfacing and create a crisp, well-shaped patch, a diamond saw should be utilized. If necessary, the material to be replaced can be dug up with a pick and shovel or a jackhammer after the surfacing has been cut. In most cases, patches will be rectangular in shape, with sides that are parallel to the border of the road. This is unquestionably advised for huge patches that are greater than 1 m in size. Experience has shown that a diamond-shaped patch with the upper and lower apices pointing in the direction of traffic movement is more effective and long-lasting for smaller regions. Such patches are not uniformly affected by tire impact, and the stresses seem to be absorbed in diverse ways, which lessens the likelihood that the patch may shatter at the edge or deform longitudinally. While round patches would likely offer a comparable set of advantages, they are more challenging to make while maintaining acceptable aesthetic standards. The location where the patch meets the existing road is the one that breaks down the most commonly, leading to an early failure of an otherwise good patch and the development of an open crack that allows water access. It has been demonstrated that applying a geosynthetic crack-sealing strip over these joins—using one coating of bitumen emulsion to adhere the strip and a second layer on top to "waterproof" the geosynthetic—is an effective way to reduce damage at this interface. The bitumen won't stick to car tires thanks to blinding with some grainy sand. Before making any repairs, the hole that was dug out needs to be thoroughly cleaned. The cause of the pothole and the material in which it appears will determine the depth of the material that needs to be removed. It is essential to remove all loose, unbonded, and pothole-affected material, regardless of whether it is de-densified, sheared, or overly damp. After this is finished, the hole should be swept to remove any remaining loose particles. Even the greatest pothole repair will soon be compromised by the continuous breakdown of the material outside the pothole patch if unsound material is not completely removed.

### A) POTHOLE PATCHING TECHNIQUES

**Shallow asphalt**

This method of patching is typically limited to potholes that are completely within an asphalt layer and rarely calls for a layer of asphalt that is thicker than 75 or 100 mm.

Method

The entire exposed area of the patch (vertical and horizontal exposure), once the area has been identified, designated, cut, excavated, and cleaned, must be covered (painted) with an appropriate bitumen emulsion tack coat. After that, a single layer of asphalt should be raked into the hole and leveled. If the hole is deeper than around 75 mm, it needs to be filled in layers no thicker than 75 mm, each of which needs to be compacted

separately. Next, compact the asphalt using small plate compactors or hand tampers. The patch area should be thoroughly cleared of any loose debris. To prevent adhesion to tires in the period right after compaction, it is helpful to blind the spot with some fine sand or gravel. Traffic can then be allowed through the patch. Using a straight edge, inspect the final patch's surface finish for levelness. There should be no depressions or unevenness. Depending on the fill thickness, it is advised that the final surface be 5 to 10 mm above the adjacent road to allow for a minimal degree of traffic compaction over time.

**Repairing asphalt at a medium depth**

The pothole should be patched as indicated for shallow asphalt in the section. If it extends into the base course and is deeper than the thickness of the asphalt but not deeper than the base or upper part of the sub-base. However, if the pothole is greater than 0.5 m, it can be more cost-effective to partially fill it with crushed stone, untreated gravel, or natural gravel up to a 75 mm distance from the surface (cement or bitumen emulsion). This needs to be crushed to the same density as the surrounding material and should be as identical to it as feasible. needs to be crushed to the same density as the surrounding material and should be as identical to it as feasible.

Method

If a full-depth asphalt patch is to be utilized, the entire exposed area (vertical and horizontal exposure) of the patch must be covered (painted) with a suitable bitumen emulsion after the area to be patched has been identified, designated, cut, excavated, and cleaned. Following that, the asphalt needs to be poured into the hole and leveled, usually in a single layer. If the hole is deeper than 75 mm, it should be filled in layers that are no thicker than 75 mm, each of which should be compacted separately *[4]*. The next step is to compact the asphalt using hand tampers or plate compactors, though smaller pedestrian rollers can be utilized for bigger patches. The patch area should be thoroughly cleared of any loose debris. To prevent adhesion to tires, it is helpful to blind the region with some fine sand or gravel. Traffic can then be allowed through the patch. Using a straight edge, inspect the final patch's surface finish for levelness. There should be no depressions or unevenness. To accommodate a minimal degree of traffic compaction over time, it is suggested that the finished surface be 5 to 10 mm above the surrounding road. If crushed stone, gravel, or cemented gravel is supposed to be used as a partial filler, it needs to be placed in the hole that has been prepared to the desired depth (taking into consideration the bulking factor, which is normally around 30%) and at the material's ideal moisture content. To increase the material's adhesion to the cleaned hole's edge, the edges should be wet, not drenched. By shaping the material into a "sausage," which should only fracture when squeezed between the thumb and forefinger, the ideal compaction moisture content can be determined. If the material compresses, it is too wet; if it crumbles, it is too dry. After that, this material must be compressed manually (or with a plate crusher if the hole is large enough), ideally in layers no thicker than 100 mm. To remove any disparities in permeability, the margins of the material in contact with the material must be compressed to the same extent as the rest of the material. Before placing and compacting the asphalt as previously stated, the upper surface of the compacted material and the margins of the hole above this level must first be "painted" with bitumen emulsion.

**Deep repair**

When a pothole is the result of a deep structural failure, deep fixes are required on asphalt-surfaced roads. This is typically characterized by localized crocodile cracking and is largely caused by an abundance of water in the pavement's lower portion or subpar construction materials *[5]*. Theoretically, the source of the water should be stopped before patching since otherwise, there is a high likelihood that the patched and/or nearby region may fail once more. Sub-soil drains next to the road will frequently be needed for water removal, and this will typically necessitate extensive research and drainage planning. Failure to address this if water is seeping into the pavement from below the surface.

Method

Patching in these places entails marking and cutting the surfacing as well as the removal of all failed material and any material with excessive moisture. If the drainage has not been fixed, the existing material needs to be replaced with something that has preferably been stabilized with cement or bitumen emulsion to increase its moisture resistance and structural strength. However, the original material will likely degrade before the replacement. Up to between 75 and 100 mm from the current pavement surface, the stabilized material must be compacted as tightly as possible in layers no thicker than 100 mm. The process previously mentioned will be used to lay asphalt in this upper area.

## IV. CONCLUSION

Budget restrictions result in less preventative road maintenance, which increases the likelihood of potholes. After forming for a while, potholes are frequently "repaired" haphazardly by personnel that are generally inexperienced or poorly qualified, which causes further deterioration. The fixes are rarely adequate to treat the root source of the issue, necessitating frequent visits to the site for ongoing maintenance. There are several forthcoming difficulties due to potholes. If the government officials did not maintain and regulate the potholes on Indian village roads, this significant problem may spread to the highways. While managing speed on rural roads is doable, doing it on highways is more challenging. The firms improve the rim quality, which increases the value of overall production. Potholes also cause significant environmental problems. By consuming the water stagnant in the pothole, birds will become contaminated. Potholes are breeding grounds for mosquitoes that will spread disease to people. Blind people crossing the street will encounter difficulties. The author concludes this paper by stating that the kerbstones ought to be positioned on both sides of the road. The Ministry of Road Transport and Highways should award the road contract to large contractors to avoid the formation of potholes. After the road is made available to the public, the public must maintain it properly. Races such as bike races and car races should be held on separate runways. The author concluded this paper by stating that the government and the general public work together to avoid potholes and pothole accidents.

# REFERENCE


1. Malik, Y.S. *Road Accidents in India 2016*; Ministry of Road Transport & Highways: Delhi, India, 2016
2. Atkins, Harold. N., 1983, ' Highway Materials, Soi1 and Concrete " Second Edition. Pub Reston Publishing Company, Inc., Virginia.
3. Dr. Umesh Sharma, Mr. Abhishek Kanoungo, Study of causes of Potholes on Bituminous Road, 2015
4. A.K. Mishra, Renu Mathur, Rakesh Kumar, J.B. Sengupta And Dinesh Ganvir "Distresses In Cement Concrete Pavements – A Case Study" Journal Of The IRC, October - December (2013)
5. Sandeep Choudhary and Dr. P. K. Agarwal "An Innovative Strategy For Maintenance Of Highway Pavement" International Journal Of Engineering Research And Applications (IJERA) ISSN: 2248-9622 Www.Ijera.Com Vol. 3, Issue 3, May-Jun (2013), Pp.054-060