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A Review on Work Zone Safety During Blackspot Improvement Construction Under Blackspot Management

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Abstract: ***Massive Road building and development is being taken up in India, under various schemes, such as National Highway Development Project (NHDP) and Prime Minister's Rural Road Development Schemes (PMGSY). Activities of improvement of about 45,000 kms of National Highways and around 400,000 kms of rural roads besides numerous urban roads are going on, all across the country. To ensure safety of all, there is a need to adopt an efficient and effective plan for management of traffic in work zones which are already blackspots. Work Zone Traffic Management Plans (WTMPs) are required to meet the safety needs of regular traffic as well as works traffic, ensuring minimum disruption in access to properties and movement of pedestrians. This research is a case study of road accident scenario on NH-152(Ambala-Zirakpur section). In 28.05 kilometers long stretch it has 24 identified accidental black spots, indicates that about 12-13 km of the road length has engineering faults and lack adequate infrastructure as per the requirements of the vehicles/pedestrians. This research talk about management of activities involved during its blackspot rectification work in work zone areas. As per this approach we have divided whole stretch into 5 corridors and described management of activities with main concern of safety, cost and time. At last, we have compared traditional approach of blackspot improvement and corridor approach of black spot improvement and finally concluded our study in form of guidelines which can be adopted during black spot rectification using corridor approach.***
Keywords: Road Improvement, Blackspot, Work Zone, National Highways, Safety, Management, Corridor Approach.

I. INTRODUCTION

For development and transitional economies, road construction and maintenance activities are an essential component of the growth of the road network. For economic growth and overall quality of life, the transportation network must be expanded and improved, which results in construction zones across the system. Road construction equipment, construction traffic, construction employees, and regular operational traffic all are included in these zones. Normal operational traffic won't be present during the construction of a new road, but care must be taken to prevent and/or eliminate conflicts between construction traffic, construction machinery, and workers. Work zone accidents are brought on by a number of things, including frequently changing road conditions that often catch drivers off guard, inadequate warning signs for both regular and construction traffic, a lack of audible warnings for workers, and insufficient provisions for safety equipment to protect workers. Normal traffic is never more than 15 meters away from building sites in most work zones.

Lack of concentration, driving too quickly for the road conditions, failing to cede the right-of-way, and following too closely are major causes of work zone accidents. Creating a working space that does not affect the regular traffic flow by segregating and sheltering the site is the greatest strategy to decrease work zone accidents.

India is undertaking extensive road construction and development under a number of programmes, including the Prime Minister's Rural Road Development Schemes and the National Highway Development Project (NHDP) (PMGSY). All around the nation, work is being done to improve the approximately 45,000 km of national highways, the approximately 400,000 km of rural roads, and numerous urban roads. The management of traffic in work zones must be done in a way that is both efficient and effective in order to ensure everyone's safety. Work Zone Traffic Management Plans (WTMPs) are necessary to meet the safety requirements of both regular traffic and construction traffic, guaranteeing the least amount of disturbance to pedestrian movement and access to properties.

The definition of road accident blackspot on National Highway as given in Ministry's 0M No. RW/NH-15017/109/2015-P&M(RSCE) dated 28.10.2015 is as under**:**

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"Road Accident Blackspot is a stretch of National Highway of about 500m in length in which either 5 road accidents (in all three years put together involving fatalities/ grievous injuries) took place during the last 3 calendar years or 10 fatalities (in all three years put together) took place during the last 3 calendar years."

A work zone is a portion of a roadway where construction and maintenance activities are altered for operating conditions for road users. The movement of employees and construction equipment required for the construction and maintenance activities would necessitate a designated area for their performance as well as the movement of supplies required for the activities. The work zone could become a conflict zone since it has both regular traffic and construction traffic, which could interrupt regular traffic and provide hazards. Signs, channelizing devices, barriers, pavement markings, and/or work vehicles are frequently used to identify a work zone. The first warning sign, high-intensity rotating flashing, oscillating, or strobe lights erected along the roadside, or a sign mounted on a moving vehicle posted to designate the work zone are the starting points, and continues to delineate the channelized vehicle paths till up to the end road work sign (IRC: SP: 55-2014).

The term "temporary traffic control zone" refers to a section of a roadway where temporary traffic control devices, flaggers, police, or other authorised personnel are used to temporarily alter the flow of traffic while facilitating roadwork and managing regular traffic operations in a secure and effective manner. A temporary traffic control zone is defined as the area between the first advance warning sign or flagger and the last traffic control device where normal traffic conditions resumes. Temporary Traffic Control Zone has five elements as follows:

1) *Advance Warning Zone:* It is here that the approaching danger should be announced and where drivers should be made aware of the upcoming change in road conditions.
2) *Approach Transition Zone:* The portion of the roadway where traffic is directed to divert from its usual course through this zone is where road users are rerouted from their usual route.
3) *Activity Zone* – It is the stretch of the roadway where work is being done on it.
4) *Terminal Transition Zone:* Traffic in this area will be rerouted through the transition zone from the alternate path to the original path.
5) *Work Zone End Zone:* The conclusion of the work zone must be marked by the last traffic control device, such as a sign indicating the completion of road work.

According to the Guidelines on Traffic Management in Work Zones (IRC: SP: 55-2014), work zones need to have the appropriate warning, delineation, and channelization equipment. To communicate site conditions, the construction work zone requires more sign boards and equipment than what is used on a typical highway. In general, traffic control devices are divided as:

a) Road Signs
b) Channelizing Devices
c) Lighting Devices

Road signs in WTMP (Work Zone Traffic Management Plan) are sub-divided as:

- Regulatory
- Warning
- Informatory/Guide signs which are further categorized

II. NEED AND SCOPE OF STUDY

On Indian highways, more traffic is anticipated in the future. The number of work zones will dramatically expand in the near future, necessitating greater efforts to increase safety in these areas. Both Indian researchers and government organizations have focused on this safety issue. Highway Work Zone (HWZ) fatalities close to cities have long been a topic of significant focus. This is true because most highways are being built close to cities or metropolitan regions, increasing the possibility of being engaged in a fatal collision. Very few studies have been conducted in the past to comprehend the specific needs of work zone safety for the drivers present at highway work zones and at blackspots, accidents are more likely to happen. To clarify the causes of WZ crashes, it is crucial to identify the WZ locations creating more crashes than usual. Work zones for construction and maintenance have historically considered dangerous areas on highways. Few of the many things that have been mentioned as contributing to the rise in accident rates are poor traffic management, improper layout of the entire work zone, inappropriate use of traffic control systems, and a general lack of understanding of the particular issues that arise in construction and maintenance work zones. Drivers must be warned of impending circumstances, guided through work zones, and warned of hazards by properly interpreting traffic control information and using traffic control devices, especially when addressing blackspots.

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There is a need to investigate the problems related to management of activities in work zones during blackspot improvement so that effective countermeasures could be developed and implemented in the near future.

III. OBJECTIVES OF STUDY

The main objective of this research is to generate new knowledge in order to effectively manage work zones that are blackspots and maximise work zone safety.

In order to achieve this goal, the primary research goals of this project are to:

1) To develop guidelines to ensure work zone safety and to efficiently manage the activities during blackspot improvement.
2) To develop guidelines to ensure proper resource optimization while working on blackspot improvement through "Corridor analysis approach".
3) To compare corridor approach of management of work zones with the traditional management technique.

IV. LITERATURE REVIEW

A comprehensive literature review was done to establish the baseline knowledge of existing research and practices related to work zone in road construction.

Christopher Ryan Huebschman (2003) [1] in their report titled "Construction work zone safety" focused on basically two things 1) determining if active warning devices or improved signing have an impact in work zone safety and 2) to determine if it is appropriate to consider temporary roads and bridges during construction activity on interstates in an effort to maintain two lanes open at all times.

Donn E. Hancher (2007) [2], Professor of Civil Engineering conducted a survey and wrote a report which was entitled as, "Improve Safety of Workers during Highway Construction and Maintenance," that focuses on highway construction worker safety.

V.R Gannapathy, S.K Subramaniam, A.B Mohamad Diah, M.K Suaidi and A.H Hamidon (2008) [3] in their report titled "Risk factors in a road construction site" highlighted on hazardous zones in a certain road construction or road maintenance site.

Jonathan Shi (2008) [4] through his work "Highway Work Zone Safety Audits at the Construction Stage" came out with conclusion that the nation's highways are in need of extensive maintenance and reconstruction work.

June H. Ross and Amanda Joy Pietz (2011) [5] in their report report titled "Maximizing investments in work zone safety in Oregon" a research project was initiated to investigate methods for maximizing work zone safety investments.

Satish V. Ukkusuri (2016) [6], Professor of Civil Engineering carried out studies and presented a report titled "Best Practices for Maximizing Driver Attention to Work Zone Warning Signs" and in his studies he has shown that rear-end crashes in the advance warning area for a work zone are the most common type of work zone crashes.

M. Imran Hayee (2016) [7] in his report "Visual warning system for worker safety on roadside work-zones" summarizes the design and development of a worker safety system using Dedicated Short-Range Communication (DSRC) to specifically address the workers' safety for the workers working around the heavy machinery.

Ghangale Prashal, Kharat Sumit, Tawhare Suraj and Mengade Tushar (2019) [8] of Civil Engineering department, Jaihind Collage of Engineering, Kuran, Pune with their work entitled "Road Safety Audit-During Construction" concluded that Accident reduction and accident prevention are the two main strategies in road safety work.

Yong-Cheol Lee (2020) [9] came out with his report titled "Development, Education, and Implementation of a Low-Cost Audio Sensor-based Autonomous Surveillance System for Smart and Connected Transportation Infrastructure Construction and Maintenance" and proposed a new approach for low-cost audio sensor-based autonomous site and safety surveillance of transportation construction and maintenance, which allows for faster, more convenient, and more accurate work zone monitoring.

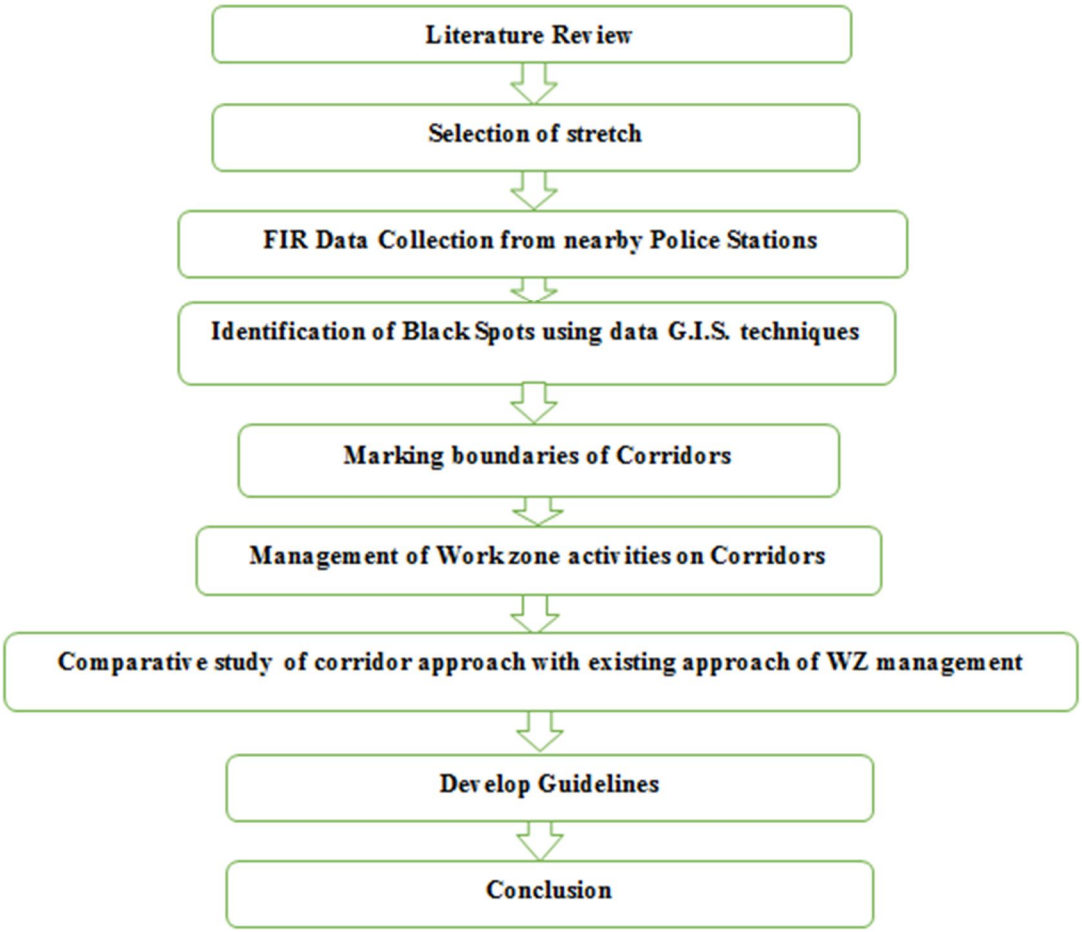
Sabysachee Mishra, Mihalis M. Golias and Diwas Thapa (2021) [10] in their report titled "Work zone alert systems" founded and suggested that Work Zone Intrusion Alert (WZIA) technologies are emerging technologies and can be highly beneficial if it is deployed on construction work zones on major highways.

V. GAPS IN LITERATURE

1) Despite the significant contributions of studies, work zone safety and efficient management of work zone activities during blackspot improvement have not been done so far in India.

2) It is critically essential to conduct additional research that focuses on evaluating the effectiveness and efficiency of applying innovative approaches to manage work zone activities during blackspot rectification in order to fill this research gap and maximize work zone safety.
3) There is a need to investigate the problems related to management of activities in work zones during blackspot improvement so that effective countermeasures could be developed and implemented in the near future.

VI. RESEARCH METHODOLOGY



VII. EXPECTED OUTCOME

After completion of the study, following are the expected outcomes:

1) A new methodology for work zone management during rectification of blackspots will be developed.
2) Efficient resource optimization will be ensured during rectification of blackspot by corridor approach.
3) Suggested methodology of work zone management will be cost effective and will enhance safety parameters.
4) Improved road user performance will be achieved.
5) There will be significant reduction in the traffic conflicts on work zones which are blackspots.

VIII. CONCLUSION

Followings are the findings from the literature review done:

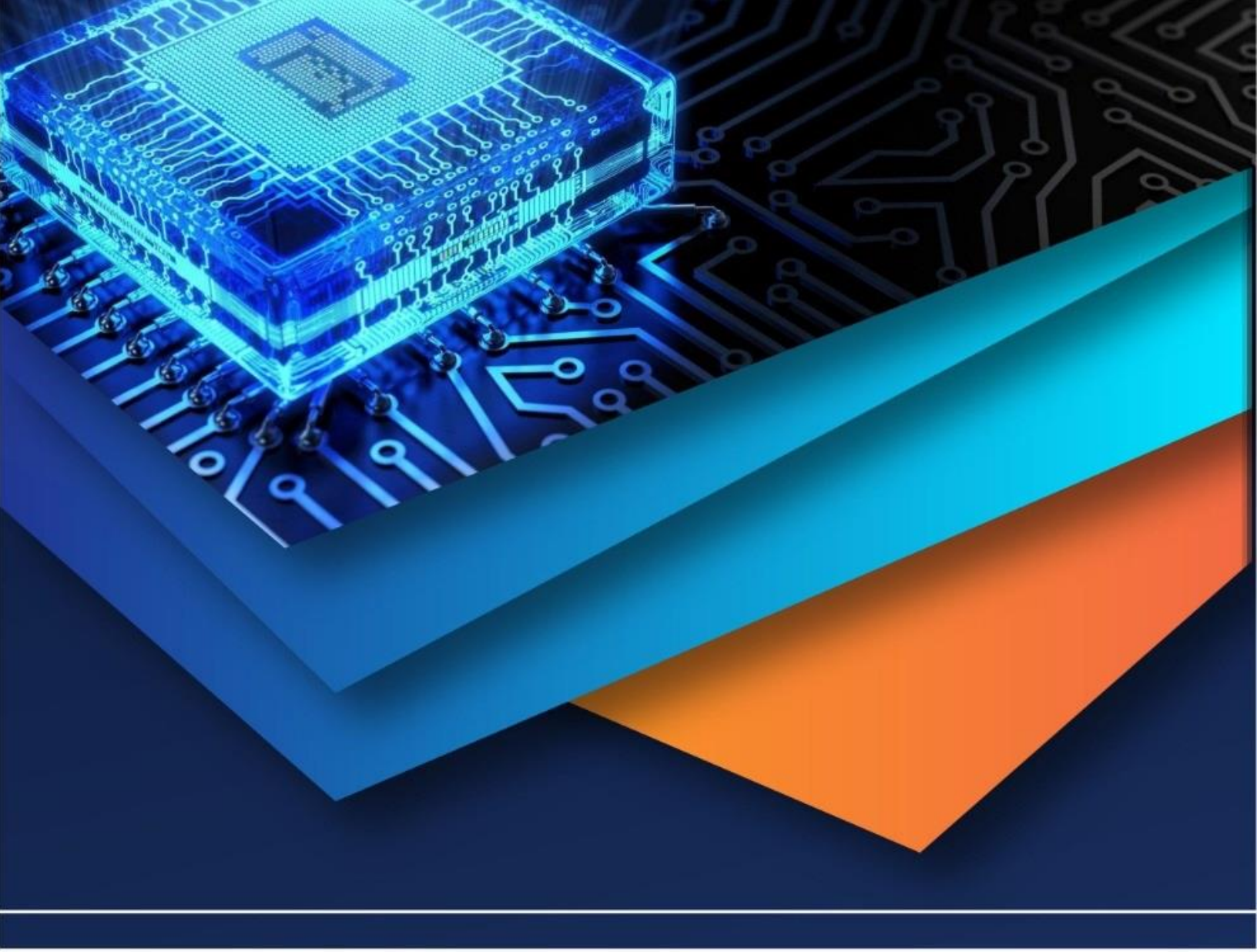
1) Construction work zone safety has been focused for safety of workers and road users during highway construction and maintenance.
2) Various measures have been taken to maximize driver attention to work zones warning signs.
3) Identification and rectification of accidental blackspot on national highways have been done.

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Despite the major contributions of studies, India has not yet implemented work zone safety and effective management of work zone activities during blackspot improvement. In order to close this research gap and enhance work zone safety, this research is aimed to implement and develop guidelines for corridor approach of work zone activities management during black spot rectification and use it as an alternate to traditional approach of work zone management. Corridor approach of work zone management mainly focuses on ensuring safety on work zones by efficiently managing activities involved.

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