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Measures To Protect And Preserve Trees On Civil Engineering Construction Sites

BHOGENDRA KUMAR CHOUDHARY[1], RAKESH SAKALE[2], HIRENDRA PRATAP SINGH[3]
PG Student[1], HOD & Prof.[2], Asst. Prof.[3]
School of Research & Technology, People's University Bhopal (M.P.)

ABSTRACT
Particularly in the last few years, the construction development industry has experienced enormous expansion on a global scale. Environmental changes may result through the building of streets, sewer pipes, floors, and bridges. The climate will continue to change because of landscaping design and construction, which may include adding automatic sprinklers, seeding the lawn, and planting trees and tiny trees. In addition, many of these upgrades might be bad for the forest. In order to prevent rising tree destruction issues like dieback or destruction, appropriate infrastructural and environmental (compensation) measures are required throughout construction activity, which subjects trees to particular stress and damage. The paper discusses the divergent engineering techniques, such as the separation of the plant root region and staff training.
In a report that was released throughout this investigation, groups of 72 people (investigators, building development workers, and the public populace) were contacted to get their understanding and perspective of tree protection actions. According to the most recent qualified experts, significant portions of projects have not saved any trees at all. Nearly two thirds of specialists believe that less than 60% of the programmes in which they have participated have addressed plants on building project sites. In more than 60% of the projects where security was implemented, nearly half of the participants said it was insufficient. The main factor causing a loss of tree safety was a lack of resources, restrictions related to the building site's design, and incomplete awareness.
It is well recognized that the main sources and distribution channels for information on the safety of plants and trees are formal education, technical research, and the Internet. For this reason, comprehensive, up-to-date, and relevant information on tree security techniques will be presented in research seminars, relevant literature, and made freely available on company websites and distributed not only to experts but also to community members and real estate investors. Potential practitioners in related fields will have a human experience that includes awareness of tree security at construction sites. On the other hand, techniques for protecting trees and construction procedures are by far the most useful knowledge.
Keywords – *Redevelopment and construction firms, architecture, basic schooling, tree security, research.*

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I. INTRODUCTION

1.1 INTRODUCTION

The second-largest industry in the world, after agriculture, is the construction, development, and manufacturing sector. It significantly alters the economy of the nation and generates employment for a sizeable portion of its citizens. Construction operations are a crucial component of the company's infrastructure and construction expansion, and they are predicted to keep growing because of industrialization, population increase, technological advancements, and rising standards for a higher level of living. Including hospitals, universities, towns, businesses, homes, and other housing developments; municipal services (such as a source of drinking water, wastewater, and sewage); roads, bridges, docks, railroads, highways, and electrical systems; farming and forestry systems, telecommunications, and so forth. When it occurs, construction is the primary factor in the broad range of cultural and economic growth and development. The transportation industry's backbone is the building and construction industry. The nation's annual project budget is consumed by the building sector to the tune of 40 to 50 percent, and it contributes 20 percent to GDP. In fact, the construction sector supports the growth of other businesses by collaborating with them and generating substantial amounts of employment. For the sake of the nation's long-term strength, it is critical that such a vital operation be supported.

1.2 CLASSIFICATION OF CONSTRUCTION INDUSTRY

Companies mostly engaged in the building of housing or infrastructure projects make up the architecture sector (For example highways and service programs). Additional tasks, upgrades, adjustments, or replacements may also be included. The following lists the three main segments that make up the architecture industry:

a) The construction of new homes is the first (respectively commercial and common property).

b) The second category consists of large, structural infrastructure, such as specific water structures, property segregation, and roads, highways, and crossings. Industries in these two industries primarily engage in what are known as standard transactions, which are agreements that involve liability for specific aspects of specific programmes.

c) The third-most significant area of the construction industry entails the development of specialized professions that have mostly contributed to the growth of a certain task-related feature (for example, masonry, decoration, and building work). General contractors, engineers, or landowners may provide directions to consultants and contractors for businesses.

Architectural, electrical, transportation, and geotechnical sciences are all included in the broad field of construction management and civil engineering, which also includes a variety of specialized knowledge. Each specialty's knowledge and experience are often applied to jobs that are similar to those from some structural engineering backgrounds. For instance, as the airport is being developed, building specialists will work closely with transit engineers. Civil infrastructure comprises the planning, maintenance, and management of public facilities such homes, streets, freeways, highways, and reservoirs.

1.3 CONSTRUCTION INDUSTRY IN INDIA

Due to its essential infrastructure and extensive facilities, Madhya Pradesh, in particular, is particularly vulnerable to hazardous situations that could endanger the health of the entire project team as well as the business. As a result, there have been more mishaps, failures, and damages throughout time. It is obvious that India's building industries need to improve their reputation. Because people from different states and countries fill the majority of building positions, so many native Indians dislike working in the construction industry. People will also see damaged medical facilities on the ground and wounded there. In India, the building industry has long suffered from poor maintenance. However, there are frequently damaging factors affecting construction health in India, such as major dynamic tendering processes, employee age and experience, a lack of staff training, and the crucial factor of quality development with an ignorance of 16 health issues. One of the barriers to the expansion of the Indian construction industry has been health. The issue needs to be examined in light of improving building sector protection effectiveness.

1.4 TRESS AT CONSTRUCTION SITE

The benefits of plants to our living, operating, and working environments are enormous. Particularly, the proximity of trees to us may cause conflict when planning the development of land. A number of climatic changes may result from building roadways, floors, bridges, sewage pipes, and sewers. The climate would be further improved by garden design and construction, which would include particular indoor spreading sprinklers, spreading turf lawn, and growing vegetables and tiny trees. Some of these changes might be detrimental to plants.

Traditional building procedures include pressure washing, surface soil erosion, surface removal, and shading. In what is known as a "process of death," pressure from such activities progressively kills robust trees and plants for 1 to 10 years (Table 1). When one hazard causes the plant to become unstable and leaves the tree vulnerable to damage from another pressure that is not normally harmful, the steady decline begins. Therefore, when combined with building, deforestation and mammal/disease-yellowing leaves may be harmful. The facility would deteriorate further as pressure built up, and the spiral toward early death would continue. Before the quality deteriorates and the deterioration becomes obvious, the tree manager is typically aware that damage has occurred to the tree. Numerous restorative treatments fail when a dying tree has numerous dead leaves and tree branches. At this point, the risk of failure for emergency treatment and protection by a tree protection expert is considerable. Only trees that exhibit a reduction escape the death curve and survive. Destruction follows the downward trend in death rates, which is often a deadly concoction of systemic breakdown, environmental deterioration, and insect pandemic.

Table 1 Significant soil features and plant root systems manageable standards. The limits can differ with organisms and tree health overall

Soil Characteristics Important to Roots	Tolerable Limit	
	Minimum	Maximum
Air Pore Space	12 percent	----
Bulk Density Clay	----	1.4 g/cc
Sand	----	1.8 g/cc
Penetration Resistance1	0.01kPa	3,000 kPa
Oxygen in Soil Air for: (root survival)	2.5 percent	21 percent
(root growth)	5 percent	21 percent
(root initiation)	12 percent	21 percent
(efficient element adsorption)	15 percent	21 percent
Water Content	12 percent	40 percent
Temperature for Root Growth	40º F	94ºF
pH (wet soil)	3.5	8.2

1Resistance level kPa = 1,000 pascals of force; 1,000 kPa = 1 MPa or 1 million pascals of force = 10 bars = 145 psi or pounds per square inch.

II. LITERATURE REVIEW

(Suchocka, Jankowski, et al., 2019) a sum of 128 Polish experts (dynamic and future planners, development representatives, and open authorities) was interrogated regarding their mindfulness and experience of tree assurance practice in a study directed during tree symptomatic instructional courses. As indicated by the accomplished experts, trees were not secured at all in a noteworthy extent of tasks. In the experience of almost 66% of experts, trees on building destinations were ensured in fewer than 60% of the tasks in which they were included. Half of the respondents assessed that in over 60% of the undertakings where any security was applied it was inadequate. Limitations identified with the state of the building site, absence of assets, and inadequate information were the primary elements prompting the absence of tree assurance. The primary purpose behind any tree insurance being set up was the legitimate guidelines. In spite of the fact that respondents didn't see the guidelines as a wellspring of information, they accepted that viable implementation of punishments could be one essential approach to secure trees on building destinations, close by professional help. As indicated by the aftereffects of the review, the consciousness of the estimation of trees didn't prompt tree safety assurance. Respondents appraised profoundly their insight about the impact of soil properties on tree endurance and advancement, the development and response of trees to harm, and tree security in development ventures, yet on the other hand conceded that they needed information on the specialized issues of tree insurance.

(Despot & Gerhold, 2003) two studies of people from three specialists instrumental in saving trees in project development ventures (experts identified with tree care, site plan, and development) uncovered their degree of information and utilization of tree conservation processes and recognized a portion of the motivations and obstructions to protecting trees. Various tree conservation processes has very low frequencies of utilization, regardless of the information that they are economical and powerful. A vast share of respondents accepted that clients would pay a premium for properties containing sound, develop trees. Manufacturers made some endeavor to protect trees on just 50% of their undertakings; arborists and constructer evidently had considerably very less chances. Numerous arborists remarked that they had been requested counsel past the point of no return in the development procedure. The Building with Trees workshops, supported by the National Arbor Day Foundation, obviously expanded information and utilization of tree safeguarding process. Familiarity with the estimation of trees to the completed task was the most significant motivation behind why tree protection processes were utilized. State and nearby laws were viewed as less significant, particularly by developers. Site imperatives were referred to as the significant boundary to tree conservation; however, these limitations were not explicitly distinguished. Arborists scored most remarkable and important on a scale that deliberate information on tree safeguarding rehearses. For manufacturers and architects, however frail relationship amongst information and utilization of tree conservation rehearses a positive. Instructive and advertising endeavors focused on landowners, site constructor, and development experts could build the number of solid trees that endure the development procedure.

(W. Grove & Morell, 1988) the urban trees will be covered and boosted by local and service companies that operate together. Rather than just directional drilling, the tree must be used for the protection of urban tree populations through a root area of trees with the Parkway Treatment Detail, formulated by Municipal Foresters in Northeast Illinois, for clearing battery powered transmission lines through using different cleaning methods apart from "topping".

(L. Mckinney, 2002) irregular changes in individual elements are generally significant in unadulterated and applied nature. This book presents segment and ecological stochasticity and represents measurable strategies for evaluating them from field information. The idea of the long-run development velocity of an individual is disclosed and stretched out to age-organized individuals. Dispersion approximations show how stochastic variables influence termination in single individuals and met populations. Deferred thickness reliance in individuals with discrete yearly propagation is evaluated from time arrangement of grown-up numbers joined with fundamental life history information. The spatial size of individuals' vacillations and neighborhood elimination hazard rely upon the sizes of spatial ecological autocorrelation and individual dispersal, and the quality of thickness reliance. Stochastic elements and factual vulnerability in populace parameters are fused in Population Viability Analysis and feasible reaping. Insights of species decent variety measures and species wealth circulations are portrayed, with suggestions for fast evaluations of biodiversity, and techniques are produced for dividing species assorted variety into parts. Investigation of stochastic network elements demonstrates that genuine networks are a long way from balanced.

(Weit & Miller, 1986) wooded fields are sometimes transformed into homes with surviving trees as the base of household ecosystems. Householders and construction companies know the architectural, economic, and practical qualities of tree lot, but do not appreciate the security of tree on the first day of development and operational tree counseling and installation. The goal is to provide this knowledge for homeowners and construction workers with rules and regulations for education programs.

(Suchocka & Kostrzewa, 2019) the number of choices allowing the expulsion of trees in urban areas is expanding each year, which recommends a long period of carelessness, or rather inadequate assets for appropriate administration of urban backwoods. The absence of proper instruments causes challenges in the dynamic procedure. This issue is particularly significant in a circumstance of expanded weight applied by inhabitants to abandon trees, mostly because of the wellbeing reasons. A fundamental component in keeping up the best possible tree the executives in a city is to improve management frameworks by applying far-reaching strategies and devices. Hence, numerous techniques are utilized to help the stock and recognizable proof of hazardous trees. The introduced look into is a reaction to the requirement for the unification of the board frameworks dependent on the best and demonstrated strategies for characterizing the asset, wellbeing and static condition, esteem, appraisal of tree future, or tree harm. Such a joint methodology can improve the security and the board of urban backwoods. The consequences of the introduced examinations prompted the detailing of target rules for the urban tree the executive's measures.

(Spellerberg & Green, 2008) the general point of this examination was to survey the general rules for the choice of trees for urban conditions and city situations. The purpose behind this exploration was to evaluate the degree to which rules for tree determination can add to nature protection in urban areas. We led a broad survey of the writing, searching for distributions about the determination rules. Specifically, we searched for any past distributed audits of the rules. Concerning the models utilized in New Zealand, we embraced an unstructured survey of the practices received in many urban communities. A survey of the writing uncovered numerous distributions about various models however just a single distribution in which there was a general audit of the standards utilized for choosing trees for urban situations. By the method of differentiation, arrangements of tree species considered to be reasonable (or unsatisfactory) for urban planting are broadly accessible, and some incorporate data about determination measures, yet frequently with little foundation clarification. Around the world, normally utilized rules included business accessibility of species, the similarity with urban situations, scene configuration, low support, shirking of aggravation factors, and authentic practice. The most well-known standards are worried about the idea of picking species perfect with nearby atmosphere and soils. Narrative proof recommends that an ever-increasing number of urban communities are utilizing a blend of standards including those that may add to preservation and reclamation of local biota. We propose that there need to be more prominent utilization of biological, hereditary and biogeographically rules to address the issues of natural protection in New Zealand urban areas.

III. METHODOLOGY

3.1 INTRODUCTION

This section discusses the research technique and design. This comprises the selection method, data collection techniques, review and delivery of the study, as well as its idea and design. In this chapter, the chosen framework for achieving the predetermined study aim and objectives is addressed and assessed. As particular recommendations to be put into practice for the protection of trees, this study also mentions many procedures, criteria, and activities for safety and security and planning of trees at building sites.

3.2 RESEARCH DESIGN

We planned and chose to use a questionnaire study conducted by knowledgeable, skilled, new, local communities, and property owners to assess tree health and safety performance at the construction work sites of projects and professional awareness among the professionals polled. The methodologies employed in this study are founded on a number of principles: (1) determine whether tree preservation is a common practice; (2) perform a technical analysis of the major reasons for the implementation of tree conservation and its failure at the project level; and (3) determine whether current legal restrictions and awareness of the value of trees are among the justifications for tree protection of the tree and its safety; (4) The degree to which nearby residents are aware of the need to protect trees during development; (5) Solutions and strategies for doing so; and.

3.3 RESPONDENTS

90 candidates received questionnaires, and 72 of them were returned, yielding a response rate of 80 percent. Some construction industry professionals, a small number of students studying construction and the environment, as well as citizens living near the construction site, participated in the poll. 68 of the responses were chosen for analysis of the survey and knowledge of various responses because the study's focus was on tree protection on building sites. Consequently, 68 surveys form the basis of the study and analysis. A variety of questions are chosen to be posed to the residents with the primary goal of examining only their level of awareness regarding this issue.

3.4 QUESTIONNAIRE

The research study comprised a number of socio-demographic issues pertaining to the traits of the participants and respondents, as well as 21 structured questionnaires with a variety of complications and ramifications, divided into three portions.

The initial round of inquiries focused on the subjects' age, class, educational and professional history, abilities, and sociodemographic factors.

The second round of questions focused on the respondents' viewpoints and inquired about their personal experiences with tree protection during construction and development projects. The primary cause and motivation for including tree protection in construction projects were then elicited (only if safety and security were applied to these projects). The third party also questioned the following fundamental justifications for not protecting or providing adequate security for trees in building projects in this section: (with respect to just certain projects in which trees have not been covered or tree protection inadequate). Respondents were asked to express their opinions in terms of percentages of agreement and disagreement. According to the poll, there is complete disagreement among 0–19% of respondents, and among 20–39% of respondents, there is disagreement but not a strong agreement. People's responses to questions are neutral between 40 and 59 percent of the time, which suggests there may be misunderstanding or that they see both sides as equal. People respond to the question with agreement or strong agreement in the percentages of 60–79% and 80–100%, respectively.

The understanding and familiarity of all 68 survey respondents with cutting-edge techniques applied on construction sites was taken into consideration and examined in the third section. Ten incredibly specific tree protection techniques have been chosen and chosen. Five approaches are very helpful in protecting tree species, whereas five are very harmful. The most commonly applied guidelines for the safety and security of trees at building projects are those resulting from the five positive activities and behaviours. The remaining five phases and procedures cannot be carried out on construction sites due to the permanent soil compaction, root destruction, or, in the case of damp soil, severe injury to root conditions and soil quality caused by the operation of heavy machinery and construction equipment. When necessary, temporary pathways should be utilised or should work correctly on frozen or dry land. In the following instances, research should not be done in the area that protects trees and ensures their safety. Participants in the study indicated and scored their level of understanding of the methods listed on a discrete scale from 1 (“I don't know at all”) to 5 (“I know very well”), as well as their influence on trees on a scale from 0 (“no impact”) to 2 (“extremely positive”) and -2 (“very harmful”).

In this final section of the questionnaire, many approaches for encouraging tree safeguards during building projects were effectively posed to respondents (Question 10). Seven different strategies were suggested, and the effectiveness of each was scored on a discrete scale from 1 ('not effective') to 5 ('extremely efficient').

To simplify communication and the capacity to understand the results, the responses and feedback of the participants were divided into three categories—low, medium, and high—in particular analysis methods and evaluations. The topics of auto-estimation of information on the conservation of trees, the quantity of sources of knowledge, and information on procedures for the conservation and protection of trees were all examined in this study.

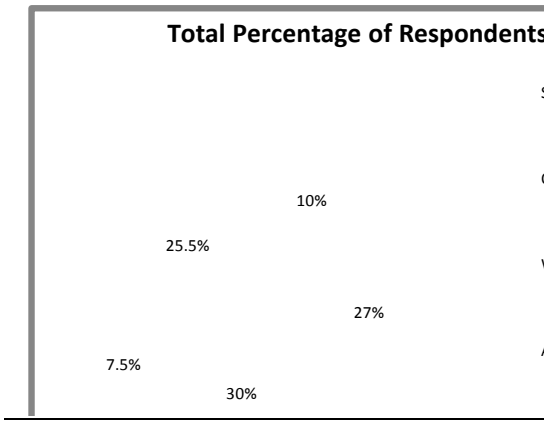
IV. RESULTS

4.1 INTRODUCTION

This chapter presents the findings of the survey. Descriptive statistics is used for facilitating meaningful analysis.

4.2 RESPONDENTS

Four randomly selected building construction sites of publicly sponsored projects in the Bhopal district were used to select respondents for this study. The 68 individuals who were chosen were 20 residents of the construction project, 10 participants in construction management, and 38 professional tree conservation administrators from building projects. There were 68 participants in the study. By their area of employment and career specialization, the officers, contractors, designers, and arborists have been further divided and classified as experts and professionals. Students (10%) and experienced people (52.5%), including cops (25.5%), employment contractors (30%) and arborists (7.5%), were among the 68 people interviewed. Because the participants' occupations could not be identified and characterized prior to the decision to return the survey questionnaire, the actual response rates for each occupation could not be determined. Only three arborists took part in the research study, hence this profession was excluded from statistical techniques and analysis when they were applied to analyze the study participants in various vocations. In numerous more case scenarios, the arborists provided feedback for the statistical analysis.



Graph 1 Distribution of respondents

The survey's respondents were split roughly 70 percent female and 30 percent male. Large percentages of students under the age of 30 made approximately 90% of the student body. The age range of the bulk of seasoned practitioners (55%) was between 30 and 45; 25% were beyond 45; and 20% were under 30. 90% of skilled professionals had postsecondary education, compared to 10% who only had it. The bulk of them had extensive experience in the industry; 35 percent of them had worked there for more than ten years, 47.5 percent had done so between the ages of four and ten, 12.5 percent had done so for one to three years, and only 5 percent had done so for less than a year. The local population's age distribution was as follows: 32.8 percent of persons were between the ages of 31 and 36, while the remaining 68.2 percent were between the ages of 23 and 30. The exact sociodemographic characteristics are listed in Table 1. There are two categories of data: one that contains students and the other that does not. The main cause of this segregation is that students are not held responsible for comprehending the next stages. It is advantageous if they are aware of it even though they are still in school and will have the opportunity to learn it shortly.

V. CONCLUSION AND FUTURE SCOPE

This study focuses on raising awareness of the need to protect trees and plan for their future in light of nearby construction. Numerous studies have been conducted on the procedures for caring for trees and their planning. These studies come from all across the world and concentrate on various difficulties.

There are several ways to put this into practice, as well as actions to take to safeguard trees on construction sites. In this case study, the main emphasis is on raising public awareness about tree protection at building sites and conducting a poll to see what experts, professionals, and students think about the topic.

The study's findings suggest that professional tree maintenance and management, which are required to deliver urban ecosystem services, call for significant institutional reform in Bhopal as well as more finance. There are three key reasons why the current state of tree protection is nowhere near enough:

1- In the first place, because potential homebuyers, builders, and other professionals involved in the development process are not sufficiently aware of the worth and advantages of trees.
2- Secondly, because there are few penalties for cutting down trees under general law.
3- Thirdly, because there is a shortage of technical expertise about tree protection on construction sites. It is important to emphasize that the management of urban forests is inconsistent. They frequently deal with circumstances where trees that were harmed by construction work years ago must be cut down for safety concerns.

These issues are becoming particularly significant in circumstances where experts say that using protection strategies is frequently necessary. Clients must insist that developers and builders heed their proposals and that they be expressed effectively. Implementing explicit protective elements, such as thresholds for root damage, trunk or canopy damage, or impassable tree protection zones, could improve communication (TPZ).

Formal education, specialized literature, and the Internet are thought to be the main sources of information about tree protection. As a result, thorough, thorough, and current information regarding tree protection methods should be included in study courses, relevant literature, and on openly accessible industry websites directed not just at experts but also at residents and homebuyers. Future professionals in linked disciplines should learn about tree protection on construction sites as part of their standard education. The fact that respondents do not currently have sufficient knowledge of the technical side of tree protection, despite their usage of several sources and their high level of confidence, demonstrates that the information provided by the sources is insufficient and unreliable. The most sought-after information, however, relates to design strategies and methods for protecting trees.

Only the internet and scholarly literature volumes fall into the unimportant category, as shown by Fisher's exact p value test, with values greater than 0.05. This indicates that, in the existing environment, the two sources are unable to raise public awareness about the need to conserve trees near construction sites. Studies, legislation and regulations, training, and information from other experts are regarded important in spreading the word and contribute significantly to the current level of awareness, which is still fairly low.

The only way to encourage tree protection that has various average scores from various occupations is through formal education. Students place the most value on this method of teaching about tree protection (mean score 4.17), whereas officials place the lowest value on it (3.41). There was no discernible difference between the mean scores of designers (3.74) and work contractors (3.50) and those of students or officials.

The average knowledge of each respondent was calculated in order to provide a summary of their understanding of the 10 techniques for protecting trees. The 68 respondents' combined average score was 3.18. The average of the respondents' knowledge of the five advantageous strategies was also determined for each survey participant. All respondents gave the helpful strategies an average score of 3.92. Regarding the study's potential scope, 68 respondents were used. By including more professionals and arborists, the number of respondents can be increased and the quality can be raised. In order to raise awareness and better analyse the current statistics, a larger number of students from professional studies and courses could be included.Similar to this, any government official survey can also be included in this to further improve understanding of the legislation.

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