

# **A Critical Study on Various Demolition Equipments and Techniques and Assessing the Usage of Thermal Energy for Demolition of Steel Structures**

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**ABSTRACT:** Many of the structures in India have already passed their design life. For safety purpose, the old - structures has to be demolished properly and replaced by new structures. Small structures can be demolished by manual methods. For bigger structures, advanced techniques and machinery are required for demolition. A detailed study on demolition technique using thermal energy was done. When compared with conventional methods of demolition, Thermal demolition technique has more advantages like less noise, low cost, low vibration and the work can be completed in short duration. This procedure is ideal for demolition where vibration and noises are unacceptable or where high work speed is desired. This project deals about the various methods in which thermal demolition technique is used. This project is an initiation to try and implement the thermal demolition technique in our country which is vaguely used here. Assessment is being done to find out how to incorporate thermal demolition technique as replacement for other conventional methods of demolition.

**KEYWORDS:** Thermal demolition, Thermal energy, conventional method.

## **I. INTRODUCTION**

Many of the structures in India have already passed their design life and need to be reconstructed for safety and operational requirements. For this purpose, the old structures need to be demolished for replacement by new structures. Small structures can be demolished by manual methods but machinery and advanced techniques are required for demolition of bigger structures. Advanced techniques are also required for faster demolition and demolition in confined areas.

Demolition means dismantling, destroying or wrecking any building or structure or any part therefore by pre-planned and controlled methods. Demolition methods can vary depending on the area where it will be held on, time available, the building material, the purpose of the demolition and the way that debris is going to be disposed. time saving methods are more expensive than slower ones. if noise, dust, and vibration are to be restricted, it will add to the cost of demolition.

This project deals with the various demolition equipment and techniques and assessing the usage of thermal energy for demolition of steel structures. Implementation of thermal technique for demolition in hilly region is adoptable when compared to normal conventional methods. Depending upon the noise, dust, cost, time and the materials are recycled. Questionnaire survey has been conducted in leading companies in Tamil Nadu regarding the thermal energy for demolition in construction industry.

The project covers the methods commonly used in demolition of structures giving attention to the detailed studies of each technique and reducing the cost and time in construction. The questionnaire survey has been

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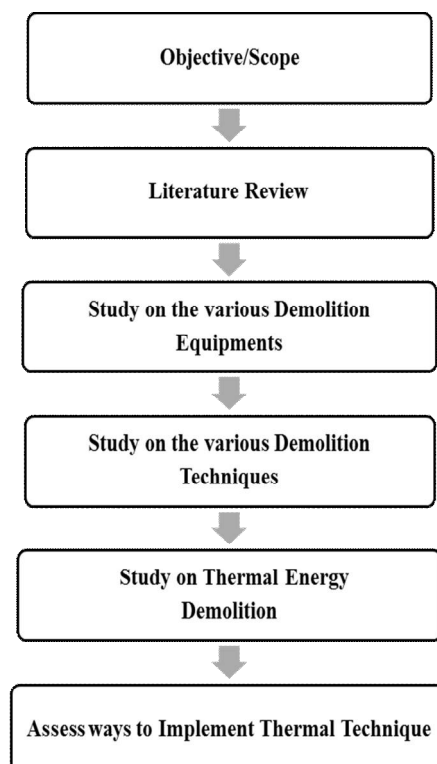
conducted on various companies and it has been analysed to find the weight age of each questions and their performances in the industry. This survey will be helpful in the construction industry for selecting the most appropriate technique for demolition work.

This project used questionnaire survey as the method for capturing the expert knowledge to establish to general industry wide perspective on demolition. A questionnaire can be defined as "a list or grouping of written question which a respondent answers "and it also known as a "manual expert driven system "or "expert's self-report". it can be collected using mail survey through postal services or internet survey through web and email. The questionnaire needs to be designed to ensure the largest possible return, which enables meaningful analysis. The recommendations include the following:

- The question must be clear, not ambiguous and easy to answer
- The question should be brief
- The language used for writing the questions should be simple
- The questionnaire should be designed attractively and should be uncluttered
- The questionnaire must be designed so that the analysis of results is easy and
- Biased terms should be avoided in order to get a real view from the respondents.

There are two types of questions that can be used in the questionnaire survey. closed questions and open-ended questions. closed questions limit respondents 'answers to the survey. The respondents are allowed to choose from either a pre-existing set of answers, such as yes/no, true/false, or multiple choice with an option for "other" to be filled in, or ranking scale response options. open-ended questions do not give respondents are encouraged to explain their answers and reactions to the question with a sentence, a paragraph or even a page or more, depending on the survey. In some questions, a space was provided as an option for respondents to give additional information.

## II. METHODOLOGY



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The objective of the project is studied in detail. A brief knowledge on literatures is gained by making note of all the journals published earlier on demolition processes, especially thermal demolition. A vast survey is made on the demolition equipments used in present day scenario, how technology has been improved in demolition techniques and why using latest technology has been a horse horn in India. Finally knowledge has to be fed to demolition companies about using thermal demolition as a conventional process.

## DEMOLITION TECHNIQUE

When selecting the most suitable method of demolition, the knowledge of the site should be applied and the interdependency of elements and the nature of the structure should be taken into account. Each of the basic principles of structural demolition, i.e. progressive, deliberate collapse or deliberate removal should be considered. The strategic use of inherent forces should be considered as an aid to efficient demolition. These same principles should be applied whether there is full or partial demolition or where structural alterations are to be carried out.

## TYPES OF DEMOLITION EQUIPMENTS AND TECHNIQUES

- Manual method,
- Saw Cutting method,
- Water-Jet method,
- Wrecking Ball method,
- Deliberate collapse method,
- Wire rope pulling method,
- Using grapples & shears,
- High reach demolition excavators,
- Explosive method,
- Implosive method,
- Non-Explosive demolition agent,

## III. CASE STUDY

A case study is made by creating questionnaire and circulating it to around 25 companies. After the response is got from the companies, a result is arrived by gathering the data and a final verdict is passed with the prepared questionnaire.

- This study will give an idea about the various techniques available for demolition and the most appropriate demolition technique for various types of buildings
- This study will give the survey details about most appropriate demolition technique which can be used for buildings.
- To compare analysis of conventional demolition methods and thermal energy demolition methods.
- Assessing for thermal energy usage for demolition of steel structures.
- This study will help to reduce the cost, time, noise and vibration on during demolition process and also increasing the reuse of materials.

## DEMOLITION BY USING THERMAL ENERGY

- Demolition by Thermal Lance
- Demolition by laser beam.

### Demolition by Thermal Lance

The thermal lance is capable of processing by thermal cutting high melting materials and at high functioning temperature is capable to cut virtually any material. Thermal lancing is made from low-carbon steel tube, consumable by oxygen burning in which we can introduce wires with same diameter made from a low-carbon steel. Through this

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method it is possible to cut carbon alloyed steel and high alloyed steel, cast irons and non metallic materials such as bricks, concretes etc. with no vibrations and noises. this procedure is ideal for demolitions where vibrations and noises are unacceptable or where is desired a high work speed. Thermic lance is a tool that heats and melts steel in the presence of pressurized oxygen to create very high temperature required for cutting. Sometime mixed with aluminium rocks to increase the heat output. Concrete melts at 1800-2500°C. Steel less than 1500°C. Combination of metal and concrete are notoriously difficult to cut. Since the technique for metal, a thermal lance will cut through both materials with ease at the same time.

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## Demolition By Laser Beam

In the thermal cutting processes with beams, only the laser is used as the jet generator for cutting. The various methods in laser beam cutting are,

### Laser Beam Combustion Cutting

The process sequences in laser beam combustion cutting is comparable to oxygen cutting. The material is heated to the ignition temperature and subsequently burnt in the oxygen stream. Due to the concentrated energy input almost all metals in the plate thickness range of upto approximate 2 mm may be cut. In addition , it is possible to achieve very good cutting qualities for stainless steels (thickness of upto approximate 8mm) and for structured steels (thickness of upto 12mm). Very narrow and parallel cutting are characteristics for laser beam cutting of structural steels.

### Laser Beam Fusion Cutting

In the laser beam fusion cutting remains the reflexion on the molten materials, at more than 90% the absorption factor of the laser light in dependence on the temperature. this factor mainly depends on the wave length of the used laser light. when the melting point of the material has been reached, the absorption factor increases unevenly and reaches values of more than 80%..

## REFERENCES

- [1] Slottman, G. V., and Roper, E. H. 1951. Oxygen Cutting. New York: McGraw-Hill.
- [2] Brandenburger, E. 1975. New oxygen wire core lances. Metal Construction. 617.
- [3] Davies, I. L., Fleischer, C. C., and Paton, A. A. 1987. Developing techniques for removing activated concrete. Nuclear Engineering International 32 (392): 45.
- [4] Brower, J. S. 1978. Underwater cutting rod. U.S. patent no. 4,069,407.
- [5] Sweetman, W. G. 1958. Chemical cutting method and apparatus. U.S. patent no. 2,918,125.
- [6] Paaso, C., Cariello, B., and Palumbo, A. 1991. Cutting electrode for underwater and land use. U.S. patent no. 5,043,552.
- [7] Moore, P. E., Strohl, R. L., and Soisson, L. R. 1985. Coated exothermic cutting. U.S. patent no. 4,544,139. 8. Hirano, T., Sato, K., and Sato, Y. 1983. Prediction of metal fire spread in high pressure oxygen. Combustion Science and Technology 32:137-159.