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Tools and Equipment Used In Civil Engineering

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ABSTRACT: - Tools are an essential asset of any engineer and especially when it comes to civil engineering where it involves a lot of fieldwork, civil engineering tools play a major role. Understanding these civil engineering tools can keep you at the edge over others and can boost your confidence as most of the learning is done when you start understanding the various civil engineering tools.

For you to gain that confidence, we came up with this article where a varied range of civil engineering tools is explained in detail. So, without wasting any time, let's get started.

I. INFORMATION

Using civil engineering tools offers numerous benefits that enhance the effectiveness, safety, and efficiency of construction and infrastructure projects. Here are some of the key advantages of using these tools:

Improved Accuracy: Civil engineering tools, such as surveying equipment and computer-aided design (CAD) software, enable engineers to achieve high levels of precision in their work. This accuracy ensures that structures are built according to specifications and minimizes errors that can lead to costly rework.

Enhanced Productivity: Heavy machinery and construction equipment increase the speed and efficiency of construction processes. This reduces project timelines and labor costs while improving overall project productivity.

Cost Control: Tools for cost estimation, project management, and resource allocation help project managers and engineers monitor and control project expenses. This prevents cost overruns and helps projects stay within budget

Safety: Safety equipment and monitoring instruments protect workers and the public from potential hazards on construction sites. This includes personal protective gear, safety barriers, and environmental monitoring tools.

Optimized Design: CAD and simulation software enable engineers to test and refine designs before construction begins. This reduces design flaws and ensures that structures are both safe and functional.

Efficient Resource Management: Tools for scheduling and resource allocation help project managers optimize the use of materials, equipment, and labor. This minimizes waste and maximizes resource efficiency.

Environmental Considerations: Monitoring equipment allows engineers to track and mitigate the environmental impact of construction projects. This is essential for complying with environmental regulations and minimizing harm to ecosystems.

Data-Driven Decision-Making: Instruments like data loggers and sensors provide valuable data on the performance of structures and materials. This data helps engineers make informed decisions about maintenance and repairs, extending the lifespan of infrastructure.

Quality Assurance: Material testing machines and inspection tools ensure that construction materials meet the required quality standards. This leads to durable and safe structures that require fewer repairs and maintenance.

II. METHODOLOGY

Cone Penetrometer: Imagine it as a probe that gently pokes into the ground like a finger. It tells engineers how soft or

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firm the soil is, which is crucial for knowing if the ground can support heavy structures.

Soil Sampler: Think of this as a scoop that collects soil samples from different depths underground. It's like taking soil samples from different layers of a cake to understand its ingredients and quality.

Sieves: These are like special sifters for soil. Engineers pour soil through them to separate it into different-sized particles. It's a bit like sorting marbles by size.

Proctor Compaction Test Apparatus: This device helps engineers figure out how densely they can pack the soil. It's similar to squishing sand to see how tightly it can be packed in a bucket.

Compression Testing Machine: This is like a giant strength tester for concrete. Engineers take a small piece of concrete and squeeze it to see how much force it can handle. It's similar to testing how strong a material like a rubber band is by stretching it until it breaks.

Concrete Mixers: Imagine a big kitchen mixer, but instead of baking, engineers use it to mix the ingredients for concrete – like cement, sand, and water – to create a consistent and strong mixture.

Rebar Locators: These are like metal detectors for concrete. They help engineers find the hidden steel bars (rebar) inside concrete structures to ensure they're placed correctly and won't cause problems later.

Tape Measure: Think of it as a handy measuring tool, like the one you might use when hanging a picture at home. Engineers use it to make sure things are the right size and in the correct position.

Levels: These tools are like the bubble levels you might use for hanging shelves or pictures. They help make sure surfaces are flat and things are straight. Imagine making sure a bookshelf is perfectly horizontal – that's what levels do but on a larger scale.

Laser Distance Measurers: These are like magic wands that quickly measure distances accurately with a laser beam. It's as if you could point your finger and instantly know how far away something is.

II. LITERATURE REVIEW

Taylor et al. (1923) stated that depreciation charges should be apportioned over the period the machine is to be used so that the book value of the machine (defined, in any year, as the purchase price less the total depreciation charged in previous years) is the value of the machine to the business that owns it.

Taylor et al. (1923) published the paper that forms the nucleus of most modern-day economic replacement theory. He defined the useful (economic) life of a machine as the period that minimizes the unit cost of production for that machine. If a machine is sold before or after the period has expired, the average unit cost of production will be greater than the optimum unit cost.

Terborgh et al. (1949) described the classic model for equipment costs is the average cost minimization model. This model uses machine age as its abscissa and average cost as its ordinate.

Terborgh et al. (1949) recognized that the relationship between repair costs and accumulated hours of use was not a straight line.

Douglas et al. (1975) concluded that economic models for equipment management typically take the form of either cost minimization or profit maximization models.

Nichols et al. (1976) proposed a method of estimating repair costs that consisted of multiplying a number of factors times a multiple of the initial purchase price of a machine. These factors took into account the type of equipment, total hours of use, years of useful life, temperature, work conditions, maintenance, quality, type of use, operator style, equipment quality, pace of work, and luck. In Nichols's model, repair costs increased with the use of the machine.

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The specific problem of estimating equipment repair costs is a challenging one. Over the years, many methods have been used to help practitioners with this problem. The most simplistic and easy-to-implement models employ a constant repair cost over the life of the machine. These have varied from expressing repair costs per hour as a percentage of straight-line depreciation (Nichols 1976) or as a percentage of the purchase price (Peurifoy et al. 1996; Cox 1971).

Nunnally et al. (1977) described that equipment selection is a critical factor in the execution of many construction projects. This is much more critical in heavy construction projects where the equipment fleet plays a vital role in performing the work. In this type of project, the equipment fleet may represent the largest portion of the bid price.

Nunnally et al. (1977) described that the economic analysis of construction equipment is mainly focused on determining the owning and operating costs as well as the economic life for each type of equipment. To properly complete the equipment economical analysis, all costs associated with the selected equipment must be considered.

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