TECHNICAL DRAWING WITH ENGINEERING GRAPHICS & DESIGN IN PRACTICE: DEFINITIONS, IMPORTANCE, AND APPLICATIONS

SEPTEMBER 2019

Definition of Engineering Graphics; Definition of Graphical Engineering; What Engineering Graphics and Design is all About; Basic Components of Engineering Graphics—the Code of Practice; Importance of Engineering Graphics and Design; Uses/Applications of Engineering Graphics and Design

EDITED

BY IHAGH GODWIN

Motivation & Environment Presents

Technical Drawing with Engineering Graphics & Design in Practice: Definitions, Importance, and Applications

Content: Definition of Engineering Graphics; Definition of Graphical Engineering; What Engineering Graphics and Design is all About; Basic Components of Engineering Graphics—the Code of Practice; Importance of Engineering Graphics and Design; Uses/Applications of Engineering Graphics and Design

2019 Edition

Motivation & Environment

Edited by Ihagh G.

MSc (Water Resources & Environmental Eng.);

BSc (Civil Engineering), and 7 years of

university teaching experience

Editor, Motivation & Environment

Website: https://motivation-environment.com/

Email: godwinihagh@gmail.com

Table of Contents

1.0 Introduction

In the technologically advanced world of today, technical drawing with engineering graphics and design employs every important cognitive and manipulative skill in order to aid engineering graphical communication which uses lines, dimensions, scales, symbols and signs to illustrate how products, processes, services and systems look and work.

Technical drawing is applied in many fields, one of which is engineering graphics and design. Many students usually study technical drawing before gaining admission to read engineering and study engineering graphics which is just one out of many engineering subjects. The transition from technical drawing to engineering graphics and further study is usually much easier for students who have had past experience in technical drawing.

Although many people assume that technical drawing is the same as engineering graphics, there is actually a difference between the two: technical drawing is generally employed in producing diagrams and representations of object and shapes on paper, while engineering graphics is a technique used by engineers to produce engineering design drawings, including

pictorial representations of data in computer-aided design (CAD) and manufacture with the use of softwares.

Engineering graphics is somewhat an advanced type of technical drawing that clearly expresses the practical requirements for engineering forms or structures. Technical drawing goes hand in hand with engineering drafting graphics and design. Generally, whenever pencil and paper, or computer is used for drafting, it must be ensured that drafts are clear and visible enough to demonstrate how things work/would work.

The procedure, skill or actions often used to produce engineering graphics can be regarded as technical drawing or drafting. Note that technical drawing is also be applied in disciplines that are not usually regarded as fields of engineering; examples include landscaping, architecture, environmental health science, cabinet making, garment-making, etc.

Engineering graphics often combines many colors, various texts, and illustrations in order to communicate clearly and effectively using drawings, especially with people who understand the language of technical, or engineering drawing.

2.0 Definition of Engineering Graphics

Engineering graphics can be defined as a graphical language that gives precise pictorial expressions of engineering structures, and is used to make communication possible between designers and other people who might not necessarily be engineering professional. Engineering graphics, which usually provides details that cannot be derived from engineering calculations, helps to convey ideas to people, and convert concepts into reality if drafts, illustrations or drawing follow universally accepted codes, criteria, and conventions.

3.0 Definition of Graphical Engineering

Graphical engineering can be defined as the branch of engineering that deals with the study of computer-aided design (CAD) and imaging software aimed at creating digital sketches of engineering models, structures, plans, and projections for beneficial purposes.

In addition, graphical engineering combines the knowledge of technical drawing with engineering graphics, and computer software and hardware to illustrate and manipulate engineering

data/content for practical purposes. It is quite common for graphical engineering students to study programming language and 3-D maths, and use programming interfaces (API) to build 3-D engines, and rendering systems for 2-D and 3-D visuals.

4.0 What Engineering Graphics and Design is all About

Engineering graphics and design is a combined creative activity aimed at producing engineering structures or outcomes that are useful to people and society. The graphic description of any engineering structure has to be clear and presentable, and in such a form that can be easily understood and constructed or built without much assistance from the designer.

What is Engineering Design?

Engineering design is the type of design practiced by engineers. Engineering design is different from planning because in planning—unlike in engineering design—expressions or presentations are not sufficiently complete or detailed enough to be built like final and complete designs can.

Application of scientific principles is the major thing that distinguishes engineering design from the type of design practiced by other professions: the major difference between engineering graphics and design, and the type of design practiced by other disciplines/professions is that, prior to construction, engineers use the principles of science to prove or demonstrate to an appreciable extent whether designs will work.

With a great degree of accuracy, scientific principles can be used to predict the behaviour of physical systems—this is where engineering design comes in. When applying engineering design, planned systems do not have to be real; however, they may have to be clearly and precisely described in mathematical terms.

In many fields of engineering, one of the most important goals of design is to ensure that all structures (bridges, buildings, automobiles, and aircraft) are capable of carrying loads and forces without failing or collapsing.

In order to determine whether a given bridge or building can withstand forces without failing, existing mathematical models have to be employed in making checks and assessments—this is design. Loads are expressed in mathematical terms, and relevant

scientific principles (such as Newton's laws and Hooke's law) are used to estimate the stresses that would likely be produced in a structure whenever it is acted upon by various weights of loads or forces which could include human beings, chairs, tables, wind, etc.

By comparing the estimated stresses with the limiting values of the strengths of materials expected to be used, it can be determined whether or not any structure can perform certain functions. Engineering design is usually combined with engineering graphics in order to make important and precise descriptions for geometric and material properties of structures.

Without employing the principles of science, another way to determine whether a structure under design can perform its intended function, is to build it, test it, and hope for the best.

But in most cases, this is not a recommendable option because it doesn't follow any tested and trusted guidelines like the fields of engineering do. Generally, the principles of science have an upper hand when it comes to design because they are based on past research and proven theories.

Before introducing technical drawing with engineering graphics into the scheme of planned construction, engineering designs have to be carefully validated (proven that they are in accord with important and applicable design criteria) in order ensure that the most important concerns have been addressed, and intended structures will perform their functions after being built or constructed in accordance with design.

Application of Technical Drawing with Engineering Graphics in Engineering Design

Technical drawing with engineering graphics has two major roles in practical engineering design processes:

- To help communicate or pass on information in an easy and understandable way between participants of engineering design processes.
- To help designers create better ideas when validating design outcomes or decisions.

It is important to note that in engineering practice, all graphics/drawings remain just a means to an end—successful construction and operation of structures. Generally, engineering graphics are created to serve and support design processes,

which in turn assist in the construction of structures that serve greater purposes in society.

It is in this regard that engineering graphics is significantly different from artistic drawings that are created by artists. Unlike engineering drawing, the intention of most artistic drawings to create visually or aesthetically appealing effects.

In many cases, engineering designers do not build or construct their designs or works; for example, many engineering works are usually constructed or built by contractors who work independently of designers.

This implies that there is need to communicate effectively via drawings which can clearly and suitably describe what has been designed in order to be constructed or built. Due to the fact that engineering works are usually large and spacious, many objects are scaled down and graphically communicated in two- and three-dimensions respectively—i.e., in 2-D & 3-D.

Most times, the complete and final graphics of objects are issued at the end of engineering design processes, and provide complete descriptions of objects that would be constructed or built.

Engineering graphics can also be used to communicate internally within an organization that designs structures; for instance, communication can be from one designer to another, or from a designer to drafting staff.

Note

In order to effectively apply technical drawing with engineering graphics in any design process, engineers or students should be able to produce various types of drawing, formally, and informally. Generally, all drawings help the imagination to create and develop new ideas.

5.0 Basic Components of Engineering Graphics—the Code of Practice

Basic technical drawing is an essential component of all types of engineering graphics, nationally, and internationally. Within national and international trade, goods that are technical in nature almost always need to be accompanied by service diagrams or technical illustrations that express shapes, dimensions, and how components work whenever projections are assembled.

Examples of services could include consultancy work, design of a communication towers, installation procedure for technological inventions, or even instructions on how to assemble simple devices.

Whenever information is exchanged, especially between people who don't understand/use a common verbal language, technical drawings can give clarity, even when language barriers exist.

Before a unified approach was ever agreed on, IS:696: "Code of practice for general engineering drawing" was originally issued in 1955, and revised twice in 1960 and 1972 respectively.

Growing international cooperation and exportation of technology has necessitated the development of an internationally unified format that consists of components, rules, codes, conventions and symbols that illustrate the language of technical drawing with engineering graphics.

Since the publication of the code of practice, many countries have made a lot of progress in standardizing the components of technical drawing with engineering graphics because of their adherence to the mutual agreement on the use of codes in, and between countries.

The basic components of the code of practice used in technical drawing with engineering graphics include:

- List of drawing tools and items.
- Sizes/layout of drawing sheets.
- Folding of drawing sheets: how to fold drawing sheets.
- Assembly drawings.
- 2-D and 3-D views.
- Methods of dimensioning.
- Methods of sectioning.
- Cross-sectional views.
- Half-sections.
- Method for indicating surface texture.
- General principles for dimensioning.
- General principles of presentation: how to present drawings.
- Linear and angular boundaries/tolerances for engineering and technical drawings.
- Drawings for welding and metal work.
- General scales used in drawing.
- Lines: thicknesses, spacing, and proportional dimensions.
- Lettering: dimensions and recommended sizes.

6.0 Importance of Engineering Graphics and Design

Just to mention a few, the importance of engineering graphics and design include (but are not limited to) the following:

- Engineering graphics and design is important because it provides engineering and technology students with knowledge of techniques and standard practices generally employed worldwide in engineering graphics and design. This makes it easier or possible for design ideas to be adequately communicated, produced and used in many countries.
- Engineering graphics and design is important because it sharpens the imagination, and helps engineering professionals solve more advanced technological problems related to engineering graphics and design.

7.0 Uses/Applications of Engineering Graphics and Design

Although engineering graphics and design has many uses or applications, discussions will be limited to the following:

- Engineering graphics and design can be used to produce "layout drawings" of completely designed end products; it can also be used in geometric studies to develop the movement of mechanical linkages, clearances, or arrangements.
- Engineering graphics and design can be used to produce "mono-detail drawing" which is very important because it gives details and maximum clarity about any part of an engineering structure without having to view a whole structure.
- Engineering graphics and design can be used to produce "assembly drawings" for 2-D projections that have to be joined together in order to form an "assembly" which gives clear and precise overview of structures.
- Engineering graphics and design can be used to produce "installation drawings" in order to provide technical

information regarding the proper way to position and install items. Installation drawings could also include dimensional data, hardware descriptions, and information regarding general configuration on installation sites where control systems, electrical systems, hydraulic systems, and other types of systems exist.

- Engineering graphics and design can be used to produce “modification drawings” in order to alter characteristics of items that have been purchased in bulk; examples include hinges, extrusions, channel nuts, semi-processed items as electronic equipment drawers, castings, blank panels, castings, etc. Drafts for altered items are usually prepared whenever it becomes necessary to alter existing items.
- Engineering graphics and design can be used to produce “procurement control drawings” which provide criteria on performance, and identification of supplier items that list the engineering design characteristics required to ensure control of interfaces, and repeatability of performance according to design. In the commercial realm of engineering practice, procurement control drawings can be prepared for item identification, purchased items, alteration to

purchased items, selection from purchased items, and development/qualification of new items.

- Engineering graphics and design can be used to produce "mechanical systematic diagrams" whenever general operating principles cannot be promptly determined after studying assembly drawings. Generally, mechanical schematic diagrams clearly illustrate design information for hydraulic or pneumatic systems, and complex mechanical systems such as the complex arrangement of gears, cams, linkages, clutches, linkages, etc.
- Engineering graphics and design can be used to produce "electrical & electronic diagrams" (in accordance with ANSI Y14.15 or ANSI/IEEE STD 991) in order to clearly describe the elements and functions of electrical or electronic tools/equipment in accordance with ANSI/IEEE STD 91 and 315.
- Engineering graphics and design can be used produce "functional block diagrams" in order to clearly illustrate the relationship between the functions of major elements in a system, or an assembly of various systems.

For regular updates on technical and engineering drawing topics, subscribe: enter your email address & subscribe for new articles at top or bottom of the right sidebar of any web page on https://motivation-environment.com/.

Interested in starting and building a website?

If you are interested in starting and building a website on WordPress.com, then sign up by clicking here. Moreover, if you would like to know the important reasons why WordPress.com is the best platform, especially in terms of the advanced level security it offers, then click here and read a very enlightening article on the subject.