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TIMBER STANDARDS AND QUALITY*

Prepared by

the UNIDO Secretariat

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TABLE OF CONTENTS

1. Introduction and Definitions

Most people would agree that standards are necessary in a progressive, industrialized society. Quality is also a characteristic that any reasonable person would agree is important. However, not only are these two terms widely misunderstood, but they are also very commonly neglected in practice. In general terms a standard is a definition used for measuring or evaluating whether a product has certain characteristics that will enable it to perform satisfactorily or as expected.

Obviously standards can vary from the quite simple to the extremely sophisticated and complicated; can be flexible or fixed and can serve several other uses aside from the original and generally understood one of objective evaluation.

This presentation is an attempt to clarify what is or should be understood by standards, codes, quality and performance; to put them into perspective in the context of building design; to analyze characteristics of good and bad standards; and to focus attention on practical measures to develop appropriate standards and procedures to ensure that they are not only applied reliably but also continually developed for the mutual benefit of the wood industry and its customers. Fig. 1.

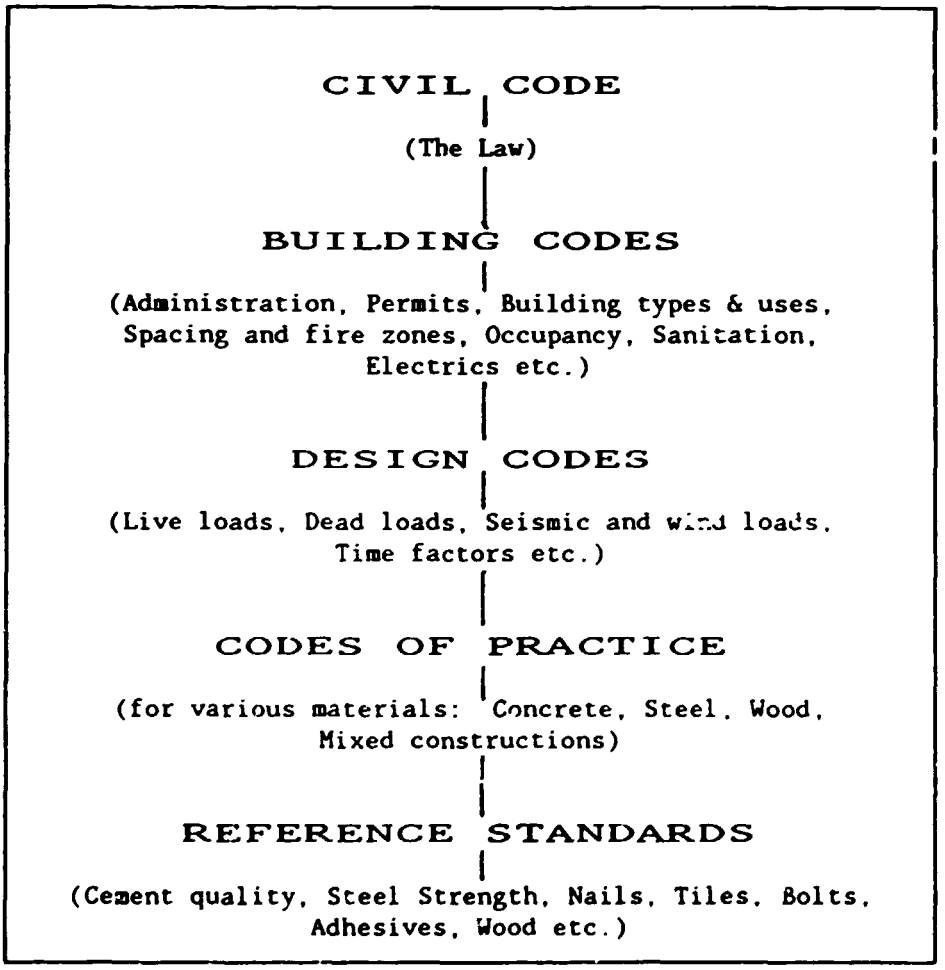

Fig.1: Codes and standards.

2. Why have standards?

Almost everywhere you look you will, if you think about it, be dealing with a standard of some sorts. You can be pretty sure that a bottle of beer contains one third or one half litre measured more accurately than you could possibly estimate. However, if you order a draught beer with a lot of foam do you wait till its settles to see of the liquid content is below full measure (or sub-standard) before you complain or do you wait until the next glass before saying something? Or, what if it tastes just a little bit off? How do you measure it against the commonly accepted standard for beer?

For the most part, standards have been developed in a haphazard sort of way and have been based on manufacturing or trade practice guided by customer tastes and requirements with no particular format in mind. In fact, **market** forces have probably had the strongest influence on development of standards with the objective of long term **trouble-free (claim-free) trading** in view. Usually when Governments try to impose standards, these are not conscientiously followed by the industry. I think it is safe to say that the only standards that are really paid attention to are those that are developed by those directly concerned in production and use working together with specialists from either universities or reputable institutions and involving, at the appropriate stages, government officials and their advisers.

The first objective must normally be to **define the quality** in the sense of characteristics, not so much as good or bad, to form the basis of contracts and legal liability. For a **valid sales contract**, there must be consideration (that is, payment or exchange of value of some kind) plus knowledge or understanding of the terms of the contract, which can be either written or verbal. For trade in commodities such as agriculture or forest products, many of these characteristics were established over a long period based on average crop qualities and yields. Then, no doubt, came the desire to differentiate between **bad, good and better qualities** and so to establish **price levels**. A more accurate description of this process would be to differentiate between **acceptable** quality and non-acceptable or reject quality, because in this more general sense, what is not acceptable at a high level of expectations might be acceptable and even a better value at a lower level and price. (Fig. 2)

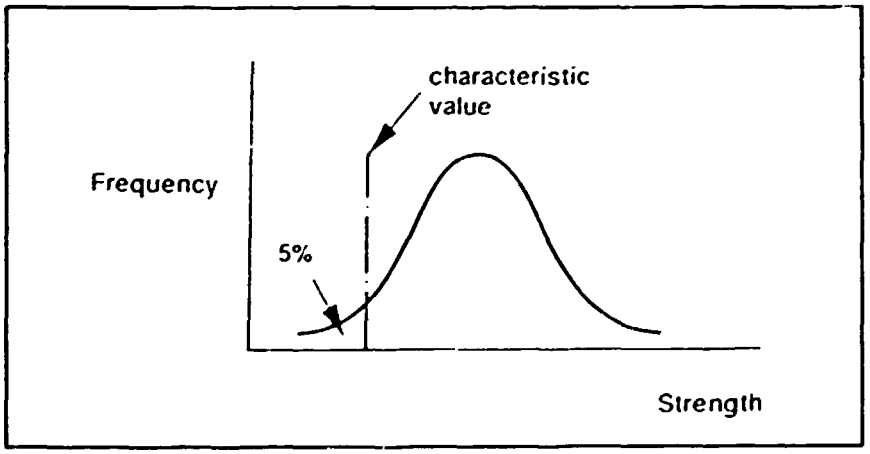

Fig.2: Illustration of characteristic value.

A quite different reason to have standards is either to **encourage** or **discourage trade**; normally for protectionist or political purposes.

A final reason for standards is that many people like living in an **orderly world** but, as with most things, a lot of other people prefer a **disorderly world** or at least one that allows a lot of flexibility of action and operation. Although this could be considered normal and reasonable for many commodities and products, in the field of construction most reasonable people would agree that standards, quality control and reliability are necessary if safe structures are to be built that are not too expensive to afford.

3. What makes a good standard?

First, to develop a good standard requires a **continuous process** of design, evaluation of performance and feedback to those responsible for it. (Fig. 3).

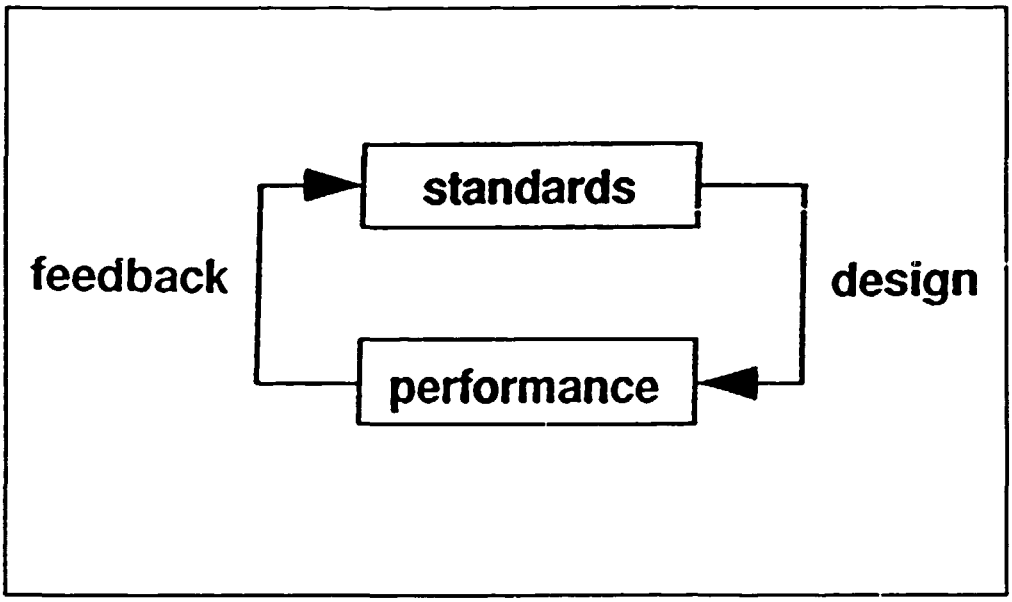

Fig.3: Relationship between standards and building performance.

The public and private sectors have different roles to play since **industry standards** should be aimed at continual product development and improvement and the control of the production process itself to ensure compliance with the desired standard, whereas **public standards** could be considered as "downstream standards" which deal with the procedures for product acceptance and continuous verification or checking that the process control of industry is consistently carried out. (Fig. 4).

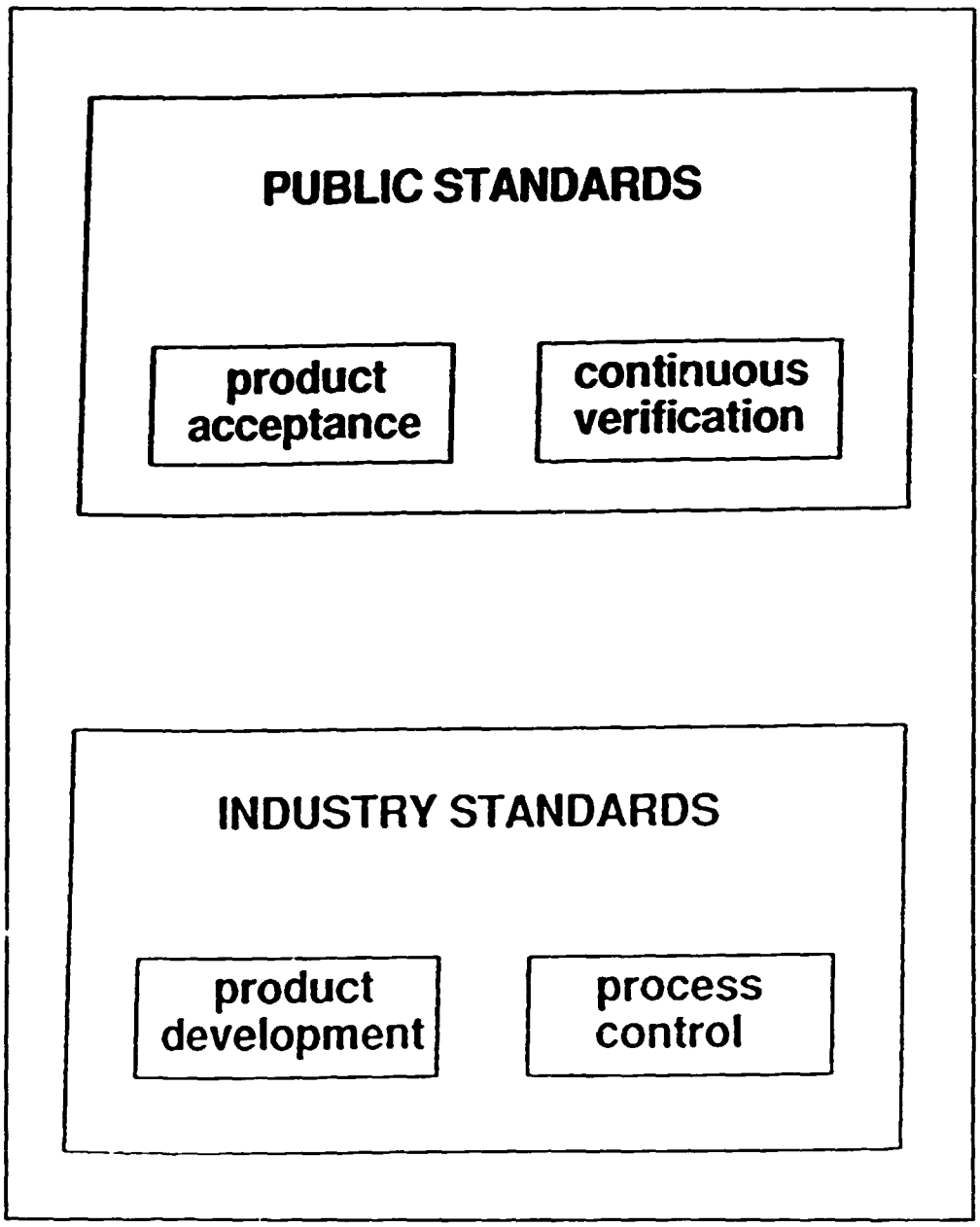

Fig.4: Basic types of public and industry Standards.

Both types of standards should be **simple and easy to check**, which implies that **training** of operators and inspectors should be reasonably straightforward; but they must also be sufficient in scope and details to meet the requirements of **full understanding** on the part of both the producer and user for contract purposes.

In this competitive age the question of **cost** must also be a main consideration. Obviously there are many aspects of costs but in general terms it must not cost more to create nor to enforce than it is worth in terms of ensuring harmonious trade or safe structures.

A good standard should also contribute to **production efficiency** and should be such as to **help rather** than hinder the **development** of better products. In this respect such a standard must be flexible with respect to production processes that could be used and not be restrictive. The way must be left open for **innovation and development** of new processes and materials. Therefore, a standard that **prescribes** what must be done or what components must be used is a **barrier to development** as opposed to a standard which defines the **performance required** and leaves open the way of achieving this performance.

Prescriptive standards are generally simpler and therefore quite common. Unless the industry or an enlightened Government is very supportive of change and innovation, very few firms are willing or in a position to bear the expense of sponsoring a change in a standard that would permit their newly developed and improved product to be accepted. This underlines the importance of **joint industry action** to point out deficiencies in standards which have become barriers to profitable trade or building activities and to work together to improve the standard and convince the Government of the importance of doing so. Otherwise, it often takes a **natural disaster** or **serious accident** to draw attention to such deficiencies and so stimulate all parties concerned to change the standards or trade practices.

Finally, **normal market forces** usually prevail ultimately, provided the public as consumers or users have the opportunity of making their **opinions known**. Again, the value of joint industry action is evident so that, before the sector as a whole gets a bad reputation, action can be taken to improve its public image. The **risk or consequence of inaction** is that competing materials will take an increasing share of the market.

However, in order for public opinion to be made known, a complaint threshold must be defined and in most cases quantified. (Fig. 5).

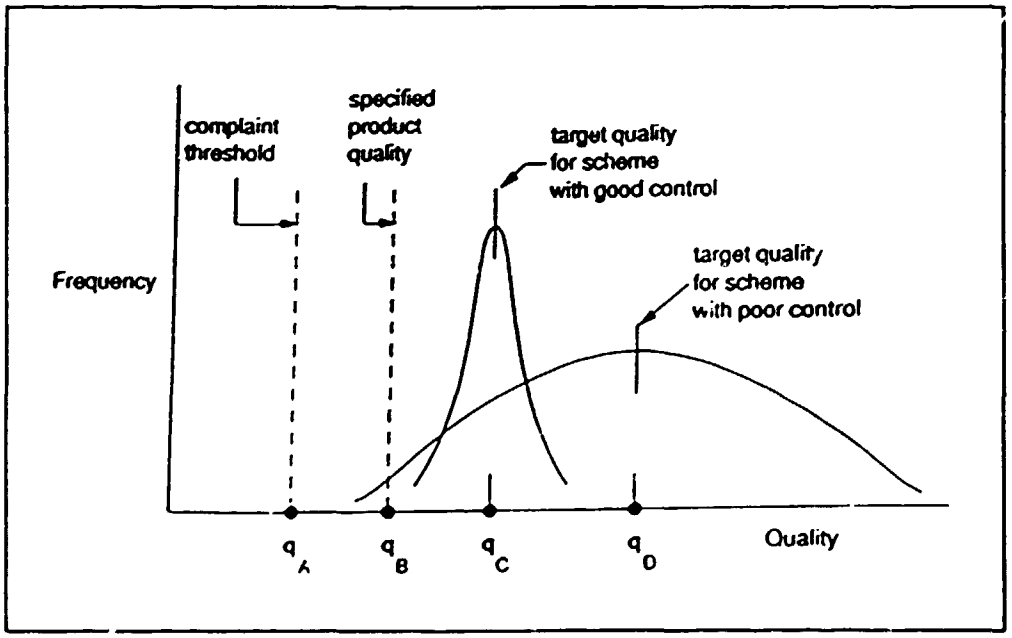

Fig.5: Effect of control on the required target quality.

4. Control mechanisms

This figure also serves to illustrate the effect of control on the required target quality and introduces the problems associated with control schemes and inspection procedures. The first question a firm should ask is whether they want to control their process continuously or to have it controlled through customer complaints and loss of business. In situations where the risk of failure or the cost of its consequences is not high, such as in the case of slightly off beer, the Government is usually not very concerned. However, in the case of a public building such as a cinema or stadium, the Government has a very strong interest in ensuring that the risk of failure is minimal.

Unfortunately many things are difficult to measure. How do you prove in law that something is not serviceable when the characteristics are subjectively evaluated rather than quantitatively measured or even estimated? Is it possible to say that a product is 95% or 99% serviceable? What is the time period over which it must serve the purpose intended? The question of guarantee terms and duration is very difficult and it includes such aspects as the period of time during which a customer has the right to notify of a fault.

Owing to the commercial or monetary interests of all parties concerned, the question of costs not only of the products but also of the control mechanism becomes very important. Although cost is probably the one principle factor, the following control mechanism also exert influence on the performance of products, commonly referred to as quality.

Standards,
Litigation,
Market forces,
Education.

Standards are intended to set an ideal or target quality whereas litigation could be considered as a check or control of how people react to standards.

Market forces act on individuals and firms in the short term but over the long term influence the standards themselves.

Investment in education through all parties concerned is probably the most cost-effective means of improving quality and performance of products and a long term trend towards development and improvement.

Figure (6) illustrates the relationship between the effective cost of a product (or structure) as it varies with reliability. It should be obvious that the incidence and therefore cost of failures decreases as the reliability increases and that the cost of a structure increases with reliability. Conceptually speaking, an optimum reliability could be defined that would minimize the cost to consumers.

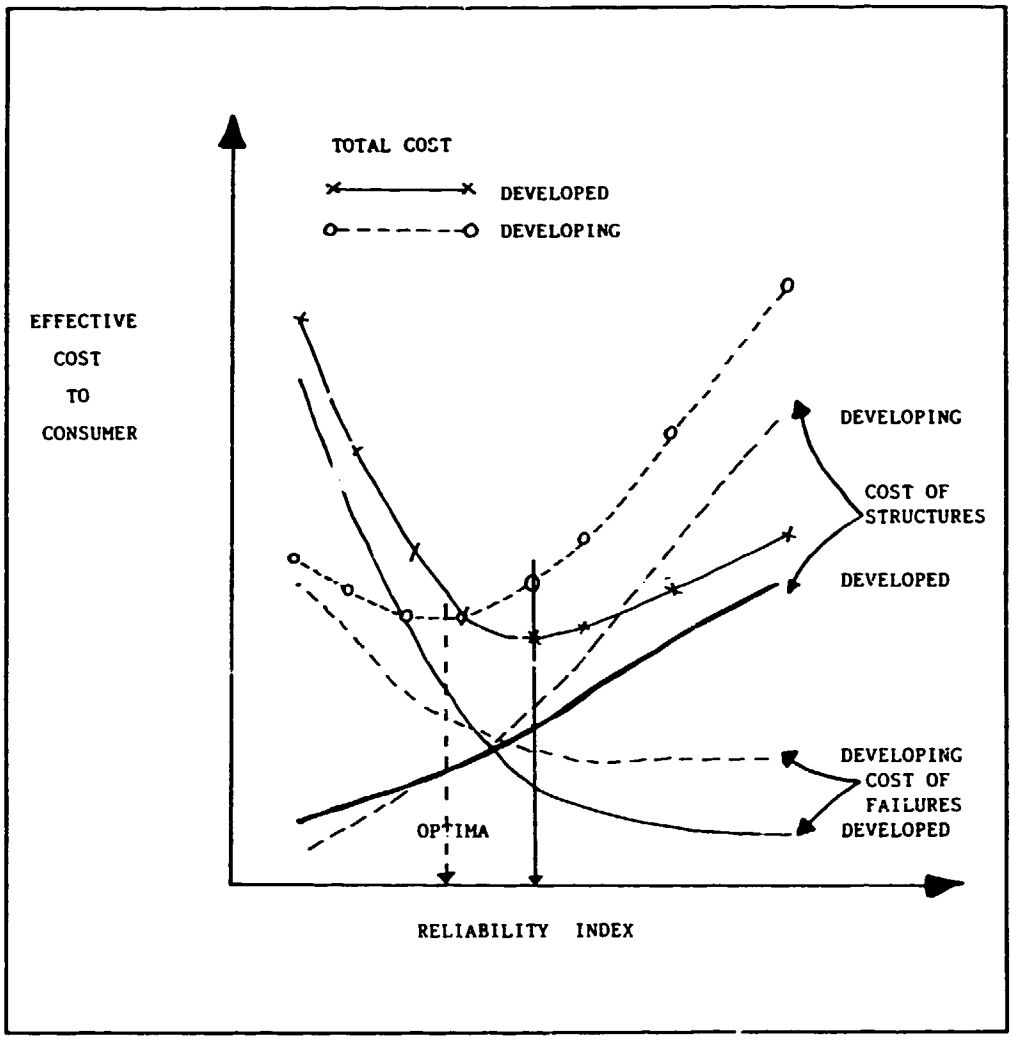

Fig.6: Cost versus reliability of structures.

This relationship could be used to consider how **reliable different structures should be** and also whether this reliability should be different from country to country.

I would suggest that the acceptable reliability for developing countries is lower than for developed countries owing to the lower initial cost of failures at low reliability but possibly higher cost or incidence despite higher reliability owing to external factors. Probably more important however, is the higher cost involved in making structures more reliable given the greater expense of importing unobtainable or expensive materials and the scarcity of highly qualified professionals and in general, the rarity of highly reliable structures. Is this a reasonable supposition?

5. Applications to timber structures

The presentation so far has been in general terms but has included mention of structures. Within the general understanding of standards are design codes which are in fact a special type of standard which define acceptable procedures which should result in "reasonably safe" structures. In other words, "copy this and it will be OK". They are special because they rely themselves on a whole series of related standards. For timber construction, the following hierarchy of standards describes the situation. (Fig. 7).

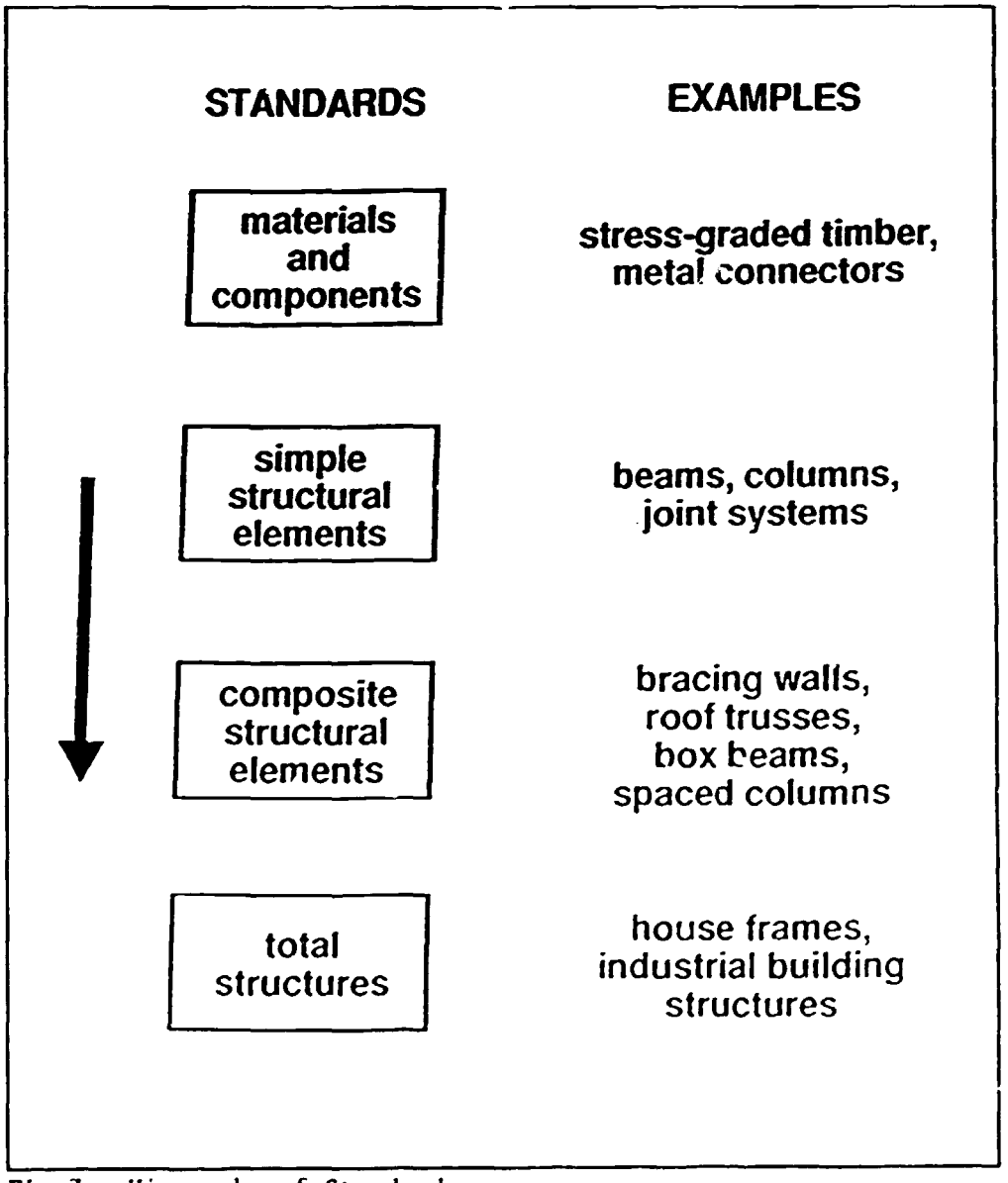

Fig.7: Hierarchy of Standards.

It should be obvious that the whole process must be integrated, linked with a wide range of related material standards and accepted by producers and

users (industrial) with a confidence inspiring series of control procedures for credibility.

Looking back at Fig. 2 which exemplifies the concept of **"characteristic value"**, the range of materials used in construction is very large. It includes not only timber which should be stress graded but also **metal connectors** (including **nails** which can show a surprising variation in performance or quality), **preservative treated wood components, cement, sand, roofing paper, water pipes, electric components** etc. which have many different characteristics to account for. Some of these rely on **close process control in manufacture** and to the end-user many are considered simply as **standard products**. In other words the process control and continuous verification procedures are assumed to have been properly done and the expected performance is also taken for granted. Usually these processes are too complex for sub-standard products to be introduced from unlicensed or uncontrolled producers.

Unfortunately in many countries **timber has not reached this stage**. In what could be called more simpler times, fine straight-grained and defect-free wood was available in a good range of sizes and was cheap enough to be over-dimensioned and even wasted by today's standards. A skilled carpenter knew from trial and error that certain species in certain sizes were safe and "reliable enough" for the purpose. Even animal **barns** were made with great skill and care and many have lasted for many hundreds of years. This is even more true for the great houses and cathedrals or temples of Europe and Asia particularly.

The situation today is much different and an **industrialized society** requires that **all materials** and components be **properly classified** and **certified** to be of a certain quality level that will meet the performance requirements of the structure. It is this factor that I was referring to earlier in Fig. 6 that showed the relationship between effective cost and reliability of structures. In fact, **without reliably** certified materials, the risk and therefore implied **cost of failure** of a structure is **extremely high** since **insurance companies** will **not assume the risk** at all. This in fact probably defines the **lower limit of reliability** since the structure would not likely be built. This brings up the regrettable state of affairs in many developing countries where, for **lack** of an appropriately integrated and accepted **hierarchy of standards** timber construction is severely restrained.

Regrettable too is the fact that **research** to obtain reliable estimates of strength (or other characteristics of products) is **expensive**. Expensive too is the travel and collaboration needed to harmonize research and development between countries. Even such an apparently simply problem as measuring **average strength of beams** is open to different approaches and results (Figures 8 and 9).

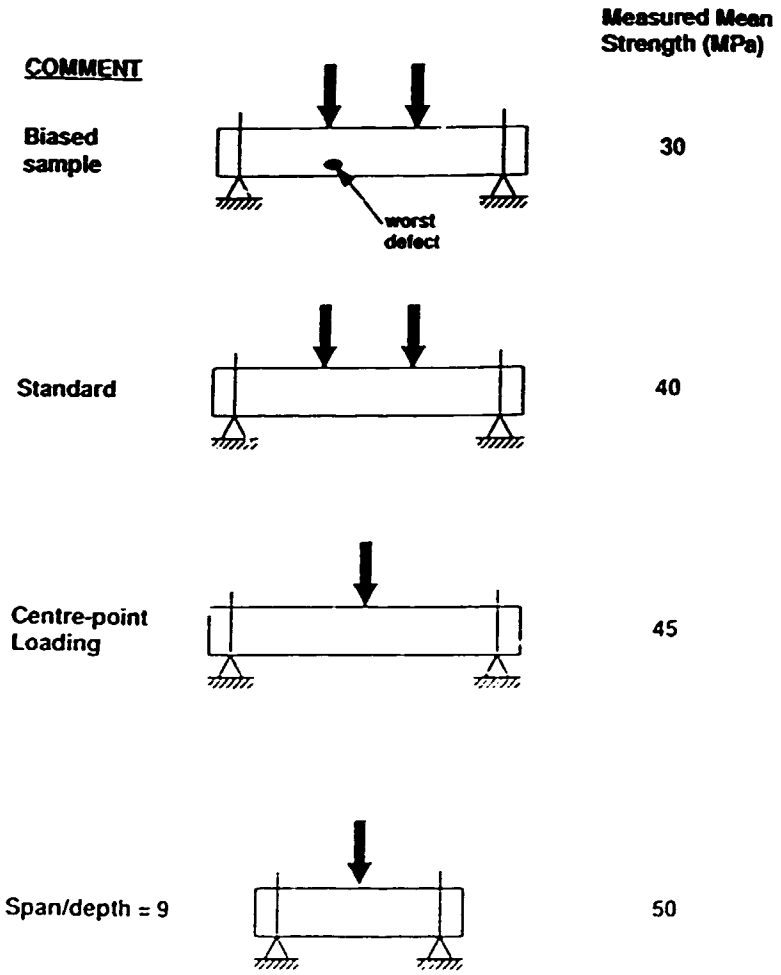

Fig.8: Effect of loading method on measured strength of F5 radiata pine.

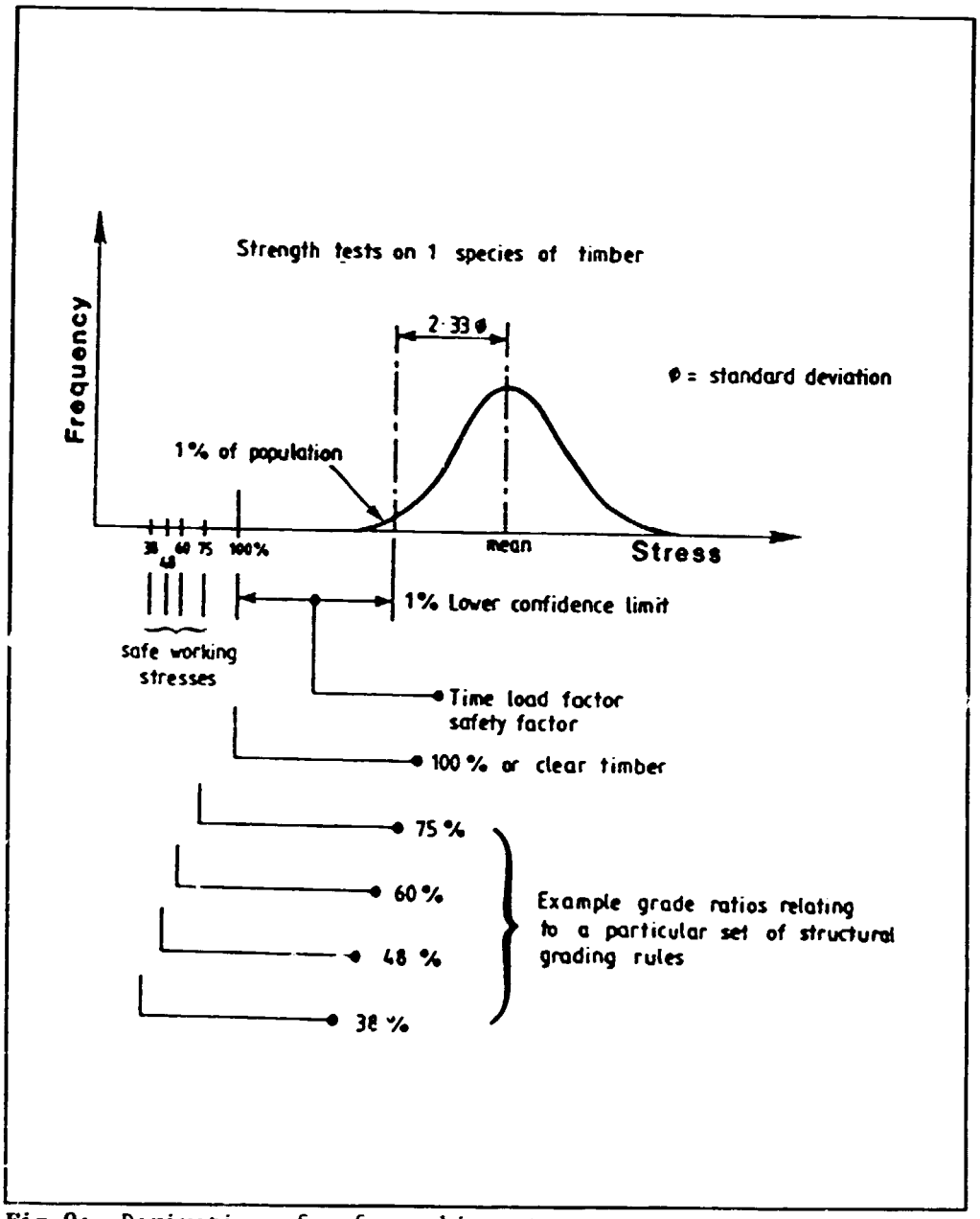

Fig.9: Derivation of safe working stresses.

On a more **positive note**, many countries are taking steps to introduce the appropriate range of standards and control mechanism but, in my view, a great deal of promotion must be carried out to **convince producers, fabricators** and **users** that this is to their **advantage**. Decisions must be taken at the policy levels within both government and industry as to what products and prccedures should be included and what standards need to be either revised or created. Management of industry must be **fully convinced** of the value of applying such standards and procedures and provision must be made to **train** staff and operators in producing enterprises in the exercise of quality control in production. This is an extremely important aspect since good quality control requires each person to be aware of **his or her role** in the

process and not just work with the attitude that it is somebody else's job to catch the defects.

Production management should also be continuously trying to improve processing techniques so as to produce better products and to reduce the variation in quality for each product.

But is it enough to rely only on process control and market forces to ensure that the required performance standards are maintained? Normally a "third party quality assurance (QA) scheme" is developed and maintained to verify continuously that the quality control procedures are being properly carried out. Here again the value of industry working together for their mutual benefit must be mentioned. A scheme developed voluntarily by the industry which has recognized the need for it is far better than a similar scheme imposed by Government officials on a reluctant industry which was unresponsive to claims of poor performance, unserviceability or even structural failures as seen by the public.

How does a quality assurance scheme become established? First there must be a perceived need to control the quality control of a certain product or range of related products. An independent third party is essential for credibility and the general rules or framework should be conceived by the third party in consultation with both producers and users.

At this stage the management must be convinced of the value of joining such a scheme in order to strengthen their marketing position, and a draft of the procedures including fees and costs must be circulated.

The second stage is for the QA specialist to make a first inspection of the production facilities to explain details of the scheme and to determine whether the production process is in control or could be brought under control with minor changes. In short, do they qualify to join the scheme? At this stage a commitment must be made by the management to support the QA scheme with sufficient funding to make it viable. This is often dependent upon at least a certain number of members joining. During this stage such details as quality stamps or labels, inspection procedures (announced or unannounced) as well as the necessary paper work and documentation can be sorted out.

The implementation stage involves periodic inspections to verify that the control procedures are in place, that appropriate documentation has been maintained, and that the products are still meeting the required standard.

6. Advantages

So why take the trouble to make all these standards and to develop an integrated system leading to reliable design codes fitting in with the national building codes?

The first answer is that timber producers and builders are likely to sell more wood and build more structures with more certain and profitable long term prospects. Secondly, promotion campaigns have a more solid basis and financing of expansion programmes or other investments becomes more possible. An enterprise that can claim that it produces or uses quality assured materials is more likely to attract both customers and credit for their activities.

A third advantage relates to the efficiency of production. A limited range of standard products should be more economical to produce, inventory costs are lower and production runs can be longer. According to company policy, special orders can still be accommodated but the majority of output should be of "standardized" items that can be quickly passed down the commercial distribution chain.

A fourth important advantage is that cooperation within the sector becomes possible. Joint promotion campaigns can be launched to protect markets against competing materials with the bonus that industry-wide campaigns have more credibility then those launched by individual enterprises.

7. Disadvantages

None.

Acknowledgement

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