TRADITIONAL VS MODERN CONSTRUCTIUON PRACTICES

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Abstract.

Many structures currently in use have been built adopting traditional practices. In recent years, the role of intermediate construction technology has emerged, and this trend has led to the questioning of many traditional practices. At no time are such questions more pertinent than when traditional practices fail a community during an earthquake. Modern practices are then promoted to provide many answers for avoiding the worst impacts of hazards.

Modern practices must be managed to ensure all resources for construction; maintenance and operation are used effectively, efficiently and economically. Regulations must also deliver safe constructions. But all basic development issues underpin modern construction practices, and these promote the benefits of modern practices where traditional methods have failed.

Many countries have received developmental assistance during the last decade often leading to negative outcomes. Significant increases in poverty in Russia; major reversals in Africa; uncertainties in Asia etc have all been witnessed. Risks taken have resulted in social and political turmoil. The causes have been inadequate attention on priorities, sequencing and pacing in institutional development; reform; privatisation; and liberalization. If disasters are to be managed, modern practices cannot be imposed as a substitute for traditional construction methods without due consideration of all issues.

AN INTRODUCTORY OVERVIEW

The impact of disasters caused by natural hazards such as earthquakes can have serious consequences. Vulnerable populations are faced with unforeseen hardships, misery and death if their housing and buildings collapse and supporting infrastructure is severely damaged. Work programmes with a focus on developmental efforts are severely disrupted, accompanied by destructions of strategic infrastructure. Furthermore, all these events seriously limit the rate of progress in achieving desirable economic development and poverty reductions for vulnerable populations. Accordingly, many unfortunate people will continue to be faced with social setbacks until the worst outcomes of disasters can be addressed.

There are good reasons why these issues should be positively, vigorously and professionally addressed. Without new initiatives, any likely sustainable benefits that are being pursued for all people will be seriously undermined and the efforts of

governments to address the needs of the poor and vulnerable will continue to fail. Current poverty problems could therefore even rapidly expand on a global scale, and unless positively addressed, the roots of civil unrest could even continue to grow.

These problems are pertinent to many areas, where large and dense populations can face harsh environmental conditions, and severe natural hazards. Many reasons are often given for the wide differences in living standards enjoyed by populations throughout the world, and the speed at which economic development has been achieved (Landes, 2001). Yet over recent years many areas are starting to see and enjoy the benefits of developmental progress, but for the vulnerable living in potentially hazardous locations, there remains much to be done to alleviate the potential outcomes of dealing with disasters. New developmental initiatives should therefore be designed to accommodate complex cultural, social, economic, technical and political dimensions to ensure outcomes are sustainable. Every opportunity should also be taken to ensure good disaster management practices are included in future initiatives. This should set out to ensure the worst impacts of any hazards do not unduly influence progress in achieving the objectives of sustainability.

DISASTER MANAGEMENT: A PROFESSIONAL APPROACH

A professional management approach to disasters must address all elements in the disaster cycle. The management process must therefore cater for mitigation measures, all preparations prior to impact, as well as the needs of response and recovery phases following the impact of disaster. Emergency arrangements, short-term restoration measures and directions for long-term reconstruction/development strategies should all be considered. The effective management of disasters therefore requires a multidisciplinary approach, with a capability to address complex socio-economic and technical issues. This capability must have a capacity to realistically develop disaster management proposals based on a knowledge of construction standards adopted, and equally important, an appreciation of the likely performance of that construction to the hazard. Equally, there must also be an understanding at all times that disasters concern the people affected (Alexander, 2000).

Good planning is one essential requirement for effective management of disasters. This plan will be dependent on knowledge of available resources for an initial response to the emergency and subsequent restoration phases (Alexander, 2002). The detailed planning for longer-term reconstructions can often be conveniently merged with development plans. The critical emergency proposals should be prepared from vulnerability assessments of the hazards from which plans can be developed for the use of management. Such plans should recognise the importance of coordination between the public and private sectors, as well as the complex interaction between the various organisational services and the infrastructure they are all dependent on.

In the past, infrastructure construction, covering the entire process of planning, design, construction, maintenance and operation required to deliver facilities, has

adopted a conventional approach with little consideration for the possible need of future disaster management consequential to the failure of such facilities. This is particularly pertinent to low cost housing and infrastructure upon which many of the vulnerable are highly dependent. Over recent years, disaster management has emerged to be a very important discipline for underpinning the values of a civilised world. The holistic approach to this discipline now covers capacity and capability building initiatives for institutional development in both public and private sectors. In respect to construction practices, it also entails developing an expertise in finance, manufacturing, contracting, services, training, education and research in addition to specific technical knowledge relating to the supply of high quality products and services. There is also a keen interest in achieving optimum delivery times in modern construction practices with materials that are required to provide a guaranteed standard of performance to facilitate predictability.

In certain areas, regions or countries, vulnerability assessments might indicate that large proportions of a population may be at risk from structural failures of traditional constructions. This could be mud housing, schools, hospitals, mosques, churches, commercial and municipal buildings as well as historic monuments. Many buildings may be ancient yet still fulfilling a daily function of providing basic shelter for families with limited regional resources. Such buildings normally satisfy a range of social, cultural, environmental, economic and religious parameters appropriate for meeting specific needs of local communities. The buildings may also satisfy basic technical parameters, even though these may be deficient and with major shortcomings. Typical communities involved might reside in countries with fragile regional economies and centralised institutions that possess technical expertise and practical skills to address a range of construction problems. However, the daily priorities for both the community and the centralised institutions might be so demanding that there is no time to consider the implications of localised vulnerability assessments.

In retrospect, it might now be argued that the people of Bam, Iran, were living in a comparable situation to this up until the disastrous earthquake of December 2003. The international response to this event has been this disaster was an accident waiting to happen: that Iranian authorities had been negligent in their approach to enforcing minimal building standards. Perhaps this may be the case? In hindsight, lessons might be learnt that could bring long term benefits to vulnerable populations through adopting good disaster management practices. This might include preventive measures, such as enforcing modern construction practices in the form of strengthening and upgrading initiatives in place of existing traditional methods, or alternatively, plans could be developed for an incremental introduction of a controlled phasing of affordable new constructions rather than planning for post-disaster reconstruction. However, the total resources, effort and time required to replace traditional with modern construction practices must never be underestimated: moreover, the development of effective disaster management plans should set out to fully address this issue in parallel with any emergency response proposals where earthquakes are identified to be high risk.

RECENT LESSONS IN THE DEVELOPED WORLD

The USA has a good reputation in their management record of domestic disasters, and further, recent experiences in California demonstrated that modern construction practices have responded well to earthquake intensities comparable to Bam. However, modern construction practices in Kobe, Japan, failed dramatically to the impact of earthquakes, but in hindsight, lessons have been learnt and technical explanations provided for failures. In addition, new initiatives have set out to address the response shortcomings and recovery efforts experienced in Japan. Such initiatives are seen to be adopting holistic approaches to disaster management.

Many institutions in the UK are also adopting a more professional approach to the effective management of potential domestic disasters (Abbott, 2002), even though this may not necessarily have a focus on the impact of major earthquakes. Historically, earthquake events in the UK have been relatively minor, but they do occur from time to time, and minor structural damage has taken place. In some areas, modern practices adopt ground movement design criteria, and nuclear power stations have in the past been designed to USA seismic standards. All these construction practices are currently supported by a wide range of disaster management initiatives that are setting out to address a wide range of issues, such as any emergencies following a terrorist attack or major transport accident; an economic/financial crisis resulting from a major incident with consequences to business continuity (Elliott, 2002); as well as to incidents caused by natural hazards such as floods and high winds. Clearly, the incidents of 11 September in the USA, followed by other global incidents such as in Bali, are strengthening the arguments that more resources should be devoted to disaster management. Speculative explanations on the vulnerability of tall buildings and related failure mechanisms of structures similar to the Twin Towers, New York, also continue to be debated.

However, it is probably wise to recognise that even in the USA the seismic design and modern construction practices have been revisited a number of times, and recent strengthening and upgrading of modern constructions on the west coast demonstrate some uncertainties. Clearly, the USA has the financial and technical resources to revisit modern constructions if there are questions on likely performance to the worst impacts of seismic effects. But how confident are the authorities on their technical decisions? 3D finite element analyses are a modern computerised technical tool for use in assessment appraisals of existing structures as well as in seismic designs for new buildings based on modern construction practices. But recent events in both Afghanistan and more recently Iraq clearly demonstrate that the implementation of modern construction practices is dependent of having in place either a domestic capability and capacity to deliver urgent plans or alternatively, resources must be plentiful to support external technical assistance. However, could this approach be realistically marketed to countries where traditional constructions remain in use yet resources are limited, even though vulnerability assessments identify large populations to be at risk from earthquake damage?

Experience in the UK certainly indicates the design/construction specialists are capable of displaying a high degree of confidence on these issues, and yet the outcome of constructions of the Millennium Dome and the Bridge, London, both prestigious projects, perhaps demonstrates this confidence to be questionable. Clearly, whatever decisions are taken in promoting the benefits of modern construction practices in lieu of traditional ones, careful consideration must always be taken in identifying the most cost effective and practical solutions given all the constraints. This would need to address all institutional, economic, technical and manpower issues as well as the absorptive capacity of the vulnerable populations. Furthermore, given the uncertainties and durations for construction, a full range of adequate disaster management provisions must also be given equal attention.

NATURAL HAZARDS AND VULNERABLE POPULATIONS

Although there are locations that have enjoyed the benefits of development and economic growth over recent years, even where setbacks have occurred, there are other areas that face difficult problems as a consequence of their unique geographical locations. There are certainly regions faced with a range of potentially severe natural hazards. Some regions support large populations, and often people have very limited resources. Living conditions can also be harsh for people who have to contend with a debilitating climate and limited infrastructure. Many people regularly face the consequences of disasters, the outcome of which brings ill-health to the vulnerable (Walker, 2000) and constrains the pace of potential development.

Earthquakes are one hazard that impose severe problems to vulnerable populations in both low-cost urban areas as well as remote rural regions (Blaikie, 2000). In comparison to normal experiences, the scale of these hazards can be extensive as well as intense. The outcome of structural failures of traditional buildings with heavy un-reinforced roofs, weak walls and limited column connections can certainly be catastrophic to occupants. Strategic low cost infrastructure serving the rural and urban poor can also often be either destroyed or put beyond repair, thereby restricting hard-won progress in achieving any desirable economic development. The available domestic resources to address the consequences of these events are often very limited. Accordingly, external assistance has frequently been sought from the international community for relief and survival followed by restoration and reconstruction. But is this approach sustainable (Smith, 1996)?

Whereas humanitarian assistance can often be justified for basic needs in disaster prone areas, it can be short-lived, and even very limited in scope (Eade, 1998). In such situations, difficulties can also be experienced in moving through the disaster cycle from response and relief to development. Furthermore, the resources for such an approach can be considerable. It is thus reasonable to question whether better use could be made of a small proportion of these resources for future preparedness and mitigation measures. This would be particularly pertinent to a wide range of typical engineering works and necessary budgetary commitments. Perhaps better use could be made of the national resources adopting good disaster management

practices, with a focus on building up capacities and capabilities under training programmes for the implementation of planning, mitigation, preparedness, response and relief measures at the times of national emergencies? A key component in such an initiative would be the inclusion of realistic provisions for the training and institutional development of technical personnel charged with responsibilities of reviewing traditional construction practices; realistic application of regulatory new frameworks; and adoption of modern/intermediate practices for upgradings and new works (Yahya, 2001). The philosophy to adopting such an approach is that disasters primarily concern the people affected, and therefore are one component of the development process.

DEVELOPMENT INITIATIVES

Early Initiatives, Strategy Changes, Employment and Appropriate Technology

The management of development initiatives has generally followed strategies that are now accepted practices (Thompson, 1994). Institutions therefore recognise the need for continuing review and change based on an awareness of original targets set and achievements attained. Early initiatives on construction activities in support of development set out to build strategic infrastructure in anticipation this should bring benefits to populations and economic growth for the country. This has been achieved either directly from the initiatives taken by domestic governments or with support from the international community. Many people have benefited from success, but the benefits for many of the poor and vulnerable have been, if at all, minimal. It cannot therefore be said that benefits have materialised for everybody.

It has taken time to recognise that growth and prosperity do not alone flow from the construction of national infrastructure and housing. For instance, foreign consultants and contractors were often used with little involvement of domestic resources. Few lessons have been learnt. The currents situations in Afghanistan and Iraq clearly demonstrate the shortcomings in this approach if gauged against experience gained over many years of developmental initiatives. In all these cases, there is little local benefit from the construction process other than from the final built product. Furthermore, it has become very clear that it can never be assumed that once infrastructure is successfully built there will be a national capacity and capability to automatically take over the critical operation and maintenance of the finished works. Moreover, the financial resources required for desirable levels of maintenance have often not been available. The benefits from new works were often never realised, and infrastructure often fell rapidly into disrepair. This observation is very relevant to low cost constructions that were frequently provided for the least developed areas.

Historically, the focus therefore shifted to the building up of domestic capabilities in manpower training as well as capacities in institutional development programmes. However, this initiative was overtaken by new management trends in many developed countries. The new focus concerned the introduction of competition as a

means to stimulate motivation and achieve higher performance, thereby driving up standards of efficiency and effectiveness. The purported benefits of privatisation, and the re-organisation of the public sector, were changes that continue to be introduced in developed, and more recently developing countries, adopting a range of models. It has been applied to the water industry, the railways, road transport, building hospitals etc. Such new initiatives have also been promoted globally in the hope ultimate development objectives might be accelerated (World Bank, 1994). However, the benefits of privatisation have yet to be conclusively proven, and recent UK experience is indicative of problems that can be faced by the railways and the water industry. Furthermore, there have been dramatic failures on a global scale over the last decade from which lessons are being learnt on the importance of giving adequate attention to priorities, sequencing and pacing of institutional development initiatives (Stiglitz, 2002). Lessons from past developmental experiences must be clearly recognised and long term initiatives for adopting holistic approaches to disaster management must be based on extensive lateral thinking (Emmott, 2003).

Some parties have argued that many development construction initiatives were not strictly appropriate for the least developed and economically poor locations. Intermediate and appropriate technological constructions were therefore introduced thereby bringing development opportunities and jobs for the poor and unemployed. Constructions were built to appropriate standards, a technology was developed, and the work force gained new skills in the implementation of civil engineering/building works. Clearly, some problems were encountered in the management of these works, such as in the organisation, administration and supervision of many scattered small construction projects. These issues continue to be positively addressed.

Planning, Design, Construction, Maintenance and Operation of Constructions

The setting of appropriate standards for infrastructure/buildings, including the acceptance criteria whilst in service, can poise many problems to decision makers. Clearly, it is desirable to set standards that will provide an appropriate level of service for the user. The actual performance should also be predictable as well as safe for the user. These ideal provisions may often be compromised in situations where resources are limited or the environment in which the infrastructure/building is required to perform poises hazards of unpredictable magnitude and timing. It can be argued that technological advances continue to provide civilisation with most of the answers to construction problems. There are, however, inevitable difficulties in applying these answers to areas where resource allocations are limited; or unrealistic regulations are applied; or regulations are unenforceable under weak institutional frameworks. Many of these issues are relevant to locations where large populations continue to be vulnerable when faced with potentially difficult hazards such as earthquakes. The poor and their representative governments do not normally have the resources for providing high cost solutions in deprived areas nor can government realistically enforce such solutions on the least developed areas.

Accordingly, planning, design, construction, maintenance and operational criteria for infrastructure/building provisions in all developmental initiatives have been, and will continue to be, constrained by economic circumstances. Engineers have taken decisions on the interpretation of a host of requirements: some based on client instructions; some on regulations; some on standards; and others on the latest technical knowledge. The ultimate decisions taken will set out to best satisfy the economic constraints, and will deliver structures that perform somewhere near expectations. It is in this context that engineers are frequently commissioned to identify and deliver solutions for constructions where there might be current or future problems for people in specific locations. The solutions are invariably conditioned by funding constraints; a lack of ideal information; irrational design parameters and the need to set standards for a specific situation. This approach necessitates careful consideration and difficult decision-making. It is therefore not surprising that constructed infrastructure might not always deliver the service envisaged.

Sustainable Development, Poverty Alleviation and Disaster Management.

There has been a recent shift in the emphasis of development priorities. There is currently a concern for the protection of the natural environment, with a closer focus on sustainable development. These new development objectives set out to protect opportunities for future generations, whilst addressing, inter alia, the needs of current populations who face extreme poverty and deprivation. Clearly, this objective must clearly focus on all vulnerable people at risk from disaster. The poor must therefore be the highest priority. Fortunately, appropriate technology work activities sit very comfortably with all the goals of sustainable development. The work can provide desirable infrastructure/housing required for basic needs. It also provides productive job opportunities for the unskilled and unemployed facing poverty. It does not compromise the status of the natural environment. It also has a role to play in disaster management, and specifically, future mitigation, preparedness, response and recovery measures when faced with the potential impact of earthquakes.

THE WAY FORWARD : BETTER PREPAREDNESS FOR NATURAL DISASTERS

Lessons learnt from past experiences in many areas identify that changes are now necessary to current disaster management practices. The current approach is certainly not sustainable. In the past, too much emphasis has been placed on response and short-term restoration measures. The opportunity should now to be taken to introduce new initiatives for future management of disasters focusing on appropriate mitigation measures and levels of preparedness, and these measures should be fully integrated into construction work. Plans should be developed from vulnerability assessments of natural hazards, and training for disaster management should in the future be incorporated in development work programmes. Moreover, many countries now have good reputations for an expertise gained in implementing appropriate technology work practices. This technology has been applied to rural small-scale construction projects and there is scope to extend this further in the

upgrading of existing buildings, and in the modification of traditional practices with modern construction practices for future new works within a framework of good disaster management practices.

Training programmes could initially focus on vulnerable urban and rural populations so that they are given the opportunity to manage the potential outcomes of local disasters caused by natural hazards such as earthquakes. Experiences learnt from appropriate technological work programmes indicate that this approach should be feasible. The benefits of appropriate technology as practiced in the past are improved constructions as well as an improved understanding, knowledge and management skills in getting a job done on time, and with limited local resources.

The problems associated with providing a guaranteed performance of all important constructions throughout its working life has been identified. Whereas hazards and associated risks to construction works are nowadays identified for the building of most new infrastructure, this is rarely extended to the longer term, and specifically the maintenance and operational phases, unless it is for some strategic feature like a large dam or power-plant. Clearly, it would be difficult to justify these measures when considering all constructions, and particular, elements such as low-cost housing and infrastructure for all basic public services (Smutniak, 2003). However, there is a strong case to extend this line of work, and to undertake vulnerability assessments, even if generic, for all the forms of infrastructure that the public are dependent on when faced with the outcome of a potential disaster consequential to a major hazard.

The purpose of this approach would be to identify the actions to be taken up by the public who, with the support of government, would set out to address the desirable needs of any mitigation work opportunities using available resources. It would address the preparedness, the response and the recovery proposals. The approach would also identify the line of actions to be taken consequential to inadequate or failed infrastructure. The decisions taken would be based on risk reduction appraisals and assessments of the likely performance of the prevention measures built under development work programmes.

The implementation of effective disaster management practices is dependent on wise decision-making and an assessment of the risks. A great deal can be learnt from experiences gained from past disasters (Toft, 1994). Management charged with responsibilities for new initiatives should therefore take careful stock of the situation. This could start with a comprehensive review of the extensive information available to all organisations with responsibilities for the maintenance and operations of all buildings and infrastructure on a national scale. The review would assess both the performance in service as well as the shortcomings of existing provisions. It could be usefully supported with information obtained from desk research. Based on the outcome of this review, a comprehensive vulnerability assessment for the entire population can be undertaken upon which an action plan can be developed. The action plan would set out to jointly involve all communities in future disaster management proposals. The launch and expansion of the action plan should be incremental, and would start from pilot schemes. A key element to the

implementation of the plan would be the training programme, including the training of trainers to ensure extension to communities, and in particular, the most vulnerable.

Government institutions in many countries often have limited means to deal with disasters. Budgetary resources can be small, whereas manpower resources at national level are often large. Clearly, there are circumstances where the magnitude and scale of the impact of natural hazards seriously weaken the potential capacities and capabilities of such populations to respond to a disaster, and in such cases, the international community should provide specialised assistance upon receipt of reasonable requests from the host government. In the future, however, government should ensure vulnerability assessments of the hazards are undertaken, and that plans are prepared for the effective management of any future disasters. Community leaders and representatives of the public should be trained by government, donors, and specialised NGOs conversant with disaster management practices. The purpose of the training would be to develop a capability to undertake a phased work plan to both upgrade traditional constructions to be more responsive to hazards such as earthquakes and to impose an appropriate regulatory framework for any new works. The pace of this reform would be geared to available resources (Backhouse, 2002) and the absorptive capacity for training and institutional development (Dyer, 2003).

CONCLUSIONS

An outline approach has been developed for many difficult areas where local populations could effectively manage future disasters caused by a wide range of hazards. Although not yet fully proven, an attraction to the approach is that it is sustainable, as it affords local populations an opportunity to gain maximum benefits from their own efforts when they are involved in the protection of their own development initiatives. It is recommended that the approach could be adopted in pilot schemes prior to full-scale implementation. It would, however, be wise to remember that the cause of many disasters in the past has been consequential to weak management practices (Turner, 1994).

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