13th World Conference on Earthquake Engineering
Vancouver, B.C., Canada
August 1-6, 2004
Paper No. 2726

THE APPLICATION OF PERFORMANCE TARGETS TO PROMOTE EFFECTIVE EARTHQUAKE RISK REDUCTION STRATEGIES

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SUMMARY

Performance Targets are essential tools to measure the effectiveness of the elements in a seismic safety strategy. However, certain non-structural elements, such as public awareness and training, are neither integrated into a coherent risk reduction strategy nor are they assessed to gauge their level of attainment. The paper argues for 'trust' to be balanced with 'control' in developing targets. The management of performance indicators in other fields can provide useful models for measuring seismic protection. The concept of 'resilience' is explored, since this over-arching focus can be applied to the three phases of disaster management, and within each phase objective performance needs to be assessed.

INTRODUCTION

Standards, Targets and Benchmarks: Essential Control Tools or a Failure of Trust?

"I believe Red Tape, Bureaucracy, Regulation, Inspectorates, Commissions, Quangos, 'Czars', 'Units' and 'Targets' came to help and protect us, but now we need protection from them. Armies of interferers don't contribute to human happiness."

Michael Howard, [1].Conservative Leader of the Opposition,
The Times, Page 14 Friday January 2, 2004

We live in an age where political leaders and senior officials are intoxicated with a desire for indicators in every sector of life in order to secure targets or benchmarks to measure progress or attainment. Thus we have a plethora of indicators of hospital efficiency, success in finding criminals, road safety campaigns, levels or literacy, educational achievement etc. These indicators are often devised to measure the work of *others*, without their involvement in the process, rather than the performance of the originating or overseeing agency and this may be why indicators are often bitterly resented by those being measured.

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At best good indicators can be used to help any organisation understand where they have got to in relation to the goals they have been set. Indicators can also assist them in planning ahead to see where they need to progress in a given time frame of say two, five or ten years. However, the negative side is that indicators tend to be oversimplifications of highly complex variables that may even fail to recognise the essence of a given issue. They are also heavily biased towards what can be easily measured that can leave to one side critical, but intangible issues that may well be the most significant issues.

For example within the field of social vulnerability assessment it is relatively easy to develop indicators of say the extent to which all high risk social groups have been identified and catered for in disaster planning. Most societies with reasonably reliable census data and social services records know roughly where their elderly population live as well as their level of impairment / mobility. Such matters are fairly straight forward in developing vulnerability indicators. However, in moving into the field of mental attitudes such as the perception of risk, or behavioural change in response to enhanced risk awareness, it is a much harder task to establish reliable indicators given the intangible nature of social values, individual perceptions and behaviour. [2]

Within the UK, as within many other industrialized societies, successive governments have created regulatory environments that they perceive to be the most effective way to measure performance in order to raise standards in virtually all aspects of public life. Such performance indicators are symptoms of a 'mistrust in trust' demonstrating minimal confidence in the virtues of 'self regulation'. Thus standards of performance become an enforced contractual agreement between an agency and its regulating body or between an employee and employer. In this tough regime both 'sticks' and 'carrots' are vigorously wafted about. Extensive rewards for success may be offered, such as enhanced financial support, or financial grants may be reduced or denied as a punishment for failure, and such acts may precipitate a slow decline or even cause the death of an organisation. In this aggressive environment the performance of hospital administrators are judged by such indicators as the number of empty beds they fail to fill over a given period or the waiting time of patients needing surgery. Similarly, school teachers have targets set for the academic performance of their children that ultimately result in league tables being published of the relative strength or weakness of school in a given area. And all utility and transportation companies have targets set by their 'regulators' for the punctuality of train arrivals and departures.

However, after the virtually unstoppable growth in the development of a world of goals, targets and benchmarks, there are indications in the UK that the public as well as some of their leaders are now questioning the wisdom of this preoccupation. Do we really need objective measurable indicators, are there less bureaucratic alternatives, is 'trust' a possibility? These critics claim that there is a price to be paid for having such targets across the board, hence the quotation at the head of this section from Michael Howard, the Conservative Leader of the Opposition of the present British Government who has come to regard control measures as a vice we all need to be protected from. His platform of beliefs, including this contempt for the measuring and controlling state may well feature in the Conservative Manifesto for the next UK general election.

A further symptom of public and official disenchantment came in Wales in 2002 where the provincial government decided to abandon academic performance targets for Primary School Children on the grounds that these control measures were counter-productive and unnecessary, and were having a negative effect on overall educational performance. The education authorities replaced the targets by trusting their teachers to perform to their professional standards.

Conceptually, control is the opposite of trust and this is symbolized in Charles Handy's see-saw model.

"*The principle of 'balance' keeps cropping up in life. There seems to be a reciprocal 'balancing' relationship between trust and control, so that where trust is increased control diminishes, and if you increase your control the perceived trust is decreased, as on a balance.*" [3]

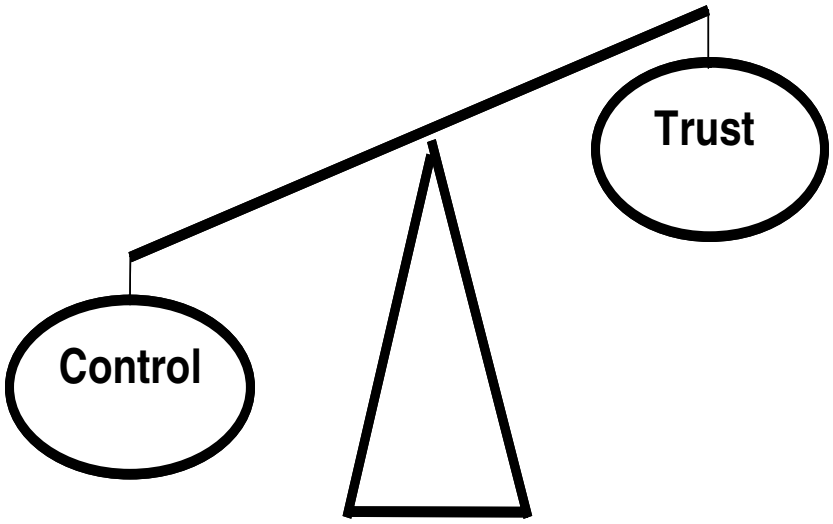

Figure 1. Control and Trust out of Balance

PERFORMANCE TARGETS FOR EARTHQUAKE RISK REDUCTION

Controls and Trust in relation to Earthquake Risk Reduction Measures

While performance standards are obviously implicit elements in all structural design codes they are not yet present in many of the non-structural safety measures. This is the central theme of this paper; do we need systems of controls in relation to such elements as the training of builders, public awareness programmes, and higher education of related professions: engineers, architects, and physical planners? The unequivocal answers to these questions must be positive since lives depend on seismic safety and it follows that it is essential to devise measurable indicators for all safety elements to ensure that standards of performance are met, and thus they need to be objectively measured.

The following model of a linked chain of seismic safety elements was introduced in a Keynote Presentation in the 12th European Conference on Earthquake Engineering in London in 2002 [4]

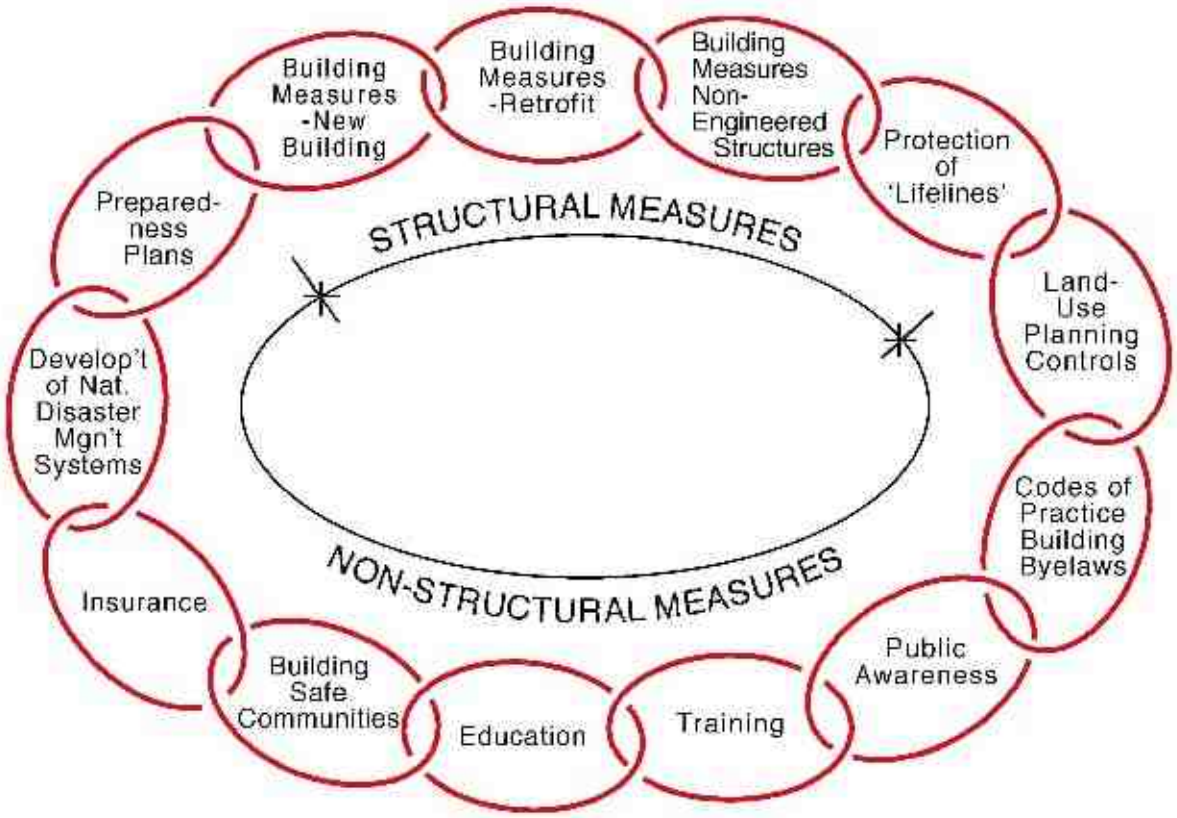

Figure 2. The Seismic Safety Chain

The imagery may be particularly appropriate for earthquake engineers with its similarity to a ring-beam. Each link in the chain can represent an element within an integrated risk reduction strategy. Individual Links need to include:

Structural Protection Measures*:*

- building measures: new buildings and infrastructure
- building measures: existing buildings and infrastructure (retrofit)
- protection of non-engineered structures
- protection of lifelines/critical facilities (including disaster plans for each facility)

Non-Structural Mitigation:

legislative framework:

- land use planning controls
- codes of practice/ building bye laws

human resource development (HRD):

- public awareness
- training
- education

public-private partnerships:

- building safe communities (this refers to the initiative within the USA developed by the Federal Emergency Management Agency (FEMA) now called 'Project Impact'
- insurance

risk reduction planning:

- development of national disaster management systems
- preparedness plans

Each element in the chain has to be strong, since much is demanded from it to contribute to the demanding function of protecting lives, livelihoods and property. A single weak element in a risk reduction strategy, such as a poorly devised and weakly enforced building code, can constitute a major source of failure. In the catch-phrase of a popular TV quiz show a chain is *'only as strong as its weakest link'*.

Each link in the chain model needs to be connected to another to symbolise their interdependence. Furthermore, a strategy comprising a number of elements, or links, is a sensible 'fail-safe' approach with in-built redundancy. Switching the metaphor, this is the time honoured expedient of *'not putting all your eggs in one basket'*. Thus if one measure fails, others may be strong enough to compensate to reduce risks. For example, even if the building codes in a given situation are below standard, a good training programme for builders can result in better-constructed buildings, which will have a stronger chance of withstanding an earthquake than shoddy construction. Another example of the need for a multi-element strategy is when a community has learned how to prepare for, as well as behave during and after an earthquake. If such preparedness has taken place they will stand a better chance of survival even if their buildings fail to withstand seismic forces.

When this model was presented in 2002 no attempt was made to relate the various 'chain links' to performance targets. However, within recent years it has become increasingly important to introduce these indicators in all sectors that are currently lacking in performance indicators, (such as Training, aspects of Higher Education and Public Awareness). The ideal initiator of such indicators will be National Governments as part of their National Disaster Management System or as an integral element in their seismic safety system. But in the light of the earlier discussion they need to be developed with full consent and cooperation of relevant parties to avoid an unproductive adversarial situation developing between the regulators and the regulated. The overriding issue is to balance 'trust' with 'control' measures.

Alan Lavell has summarized the essential elements needed for a risk reduction strategy, and the indicators required to measure their performance. Lavell's list is repeated on Figure 2 'The Safety Chain Model', but he introduces important additional criteria such as the wider need for good governance [5].

> **"***Experience would show that the following factors or contexts are necessary prerequisites for the instrumentation of adequate risk management strategies and procedures. Some or all of these may be used in constructing management capacity indicators*
>
> - *The existence of well tried and strong democratic government with adequate checks and balances and decentralized government structures and political and administrative procedures.*
> - *Significant and sustained advances in poverty reduction and wide ranging social safety networks and support mechanisms.*
> - *Comprehensive risk management institutional frameworks and mechanisms that incorporate sectorial and territorial development agencies and broad civil society representations.*
> - *Comprehensive legal and normative frameworks on risk reduction and representations.*
> - *Well tried and functioning land use and territorial planning mechanisms*
> - *Comprehensive insurance coverage for the productive and social sectors*
> - *Educational coverage on the topic and undergraduate and post graduate professional formation and training opportunities*

Omar Cardona and his research team working on the Development of 'Indicators for Disaster Risk Management' have noted the challenge presented in addressing this task, given the complexity of the subject:

> *"Efforts to measure risk and the effectiveness of risk management when faced with natural phenomena, using a system of transparent, robust, representative, replicable, nationally comparable, and easily understood indicators is a major challenge from the conceptual, scientific, technical and numerical perspective*" [6]

To be effective these performance indicators need to be *'SMART' (sustainable/ measurable/ achievable/ relevant and time framed)* with certain additional criteria:

- **sustainable** over time,
- **measurable**, with defined criteria for success and specific benchmarks,
- **achievable** within the time frame that governments set, (this may extend over months or years depending on available resources and national priorities)
- **relevant,** to satisfy varied national situations (related to national hazards, vulnerabilities and capacities and set within national governmental structures)
- related to carefully **timed** targets, with both short and long term goals being defined,
- **transparent,** so that all stakeholders are aware of the full picture without hidden elements,
- **robust,** sufficiently strong to cope with complex and demanding variables,
- **representative,** to cover all key sectors of protection and key phases of intervention: risk reduction, emergency management and recovery management,
- clearly **defined**,
- **replicable,** so that the indicators can be reused in differing contexts,
- **flexible,** to enable 'on course corrections' to be made,
- **nationally comparable,** to enable essential comparative studies to be undertaken between countries,
- **adaptable** to suit changing needs and perceptions,
- well **integrated** between sectors, line ministries or departments and between fields or disciplines,
- **accepted and understood** by all contributing bodies both inside and outside governments,
- **based on international experience** from countries that have succeeded in creating effective mitigation and preparedness strategies and indicators to measure performance levels,
- **tested in pilot studies** before they are widely implemented

It should be emphasised that performance targets are needed by ***all*** disaster prone societies, whether they have advanced economies or not. As a working principle, the more limited the resources of a country may be, the more important it will be to fix achievable targets to avoid a costly dissipation of national effort.

The above 'shopping list' is extensive and may seem intimidating in its scale and scope but this demonstrates the need to spend time and effort field testing any system of indicators rigorously before proposing them for widespread application.

One example from the chain model, 'Training' has been examined in a worked example of possible performance targets. (see Appendix) This example has considered these targets within a Matrix format with three columns: Guiding Principles, Performance Targets and Benchmarks-Criteria to Measure. This model could be developed to include a five stage performance rating scheme on the lines of the illustrated example of the dissemination of cyclone warnings as described in the next section of the paper.

Performance Targets in Safety Management

Before turning the context of performance targets for seismic safety it may be useful to look at two areas of public safety where performance targets are routinely applied to see if either can provide useful ideas for replication in the seismic safety field. These are in Road Safety and The Dissemination of Cyclone Warnings

Road Safety Targets

Within the UK, specific targets form the basis of road design and traffic management. These relate to 'Casualty Reduction Targets' that are expressed in specific targets on a year by year basis as well as over a ten year period. For example the UK governments is committed to a 40% reduction in fatal and serious injuries in the UK within a ten year period, a 50% reduction in fatal and serious injuries to children and in some regions to a 10% reduction in all injuries to cyclists and pedestrians. Then in response to these targets realistic 'Action Plans' are drawn up in the fields of Education, Training, Publicity, Enforcement and Engineering. These measures embrace school education campaigns, the re-design of roads in locations where there has been a succession of accidents, pedestrian crossings, speed management measures, traffic restrictions, pedestrianisation etc. A key factor in determining the action plan is the existence and maintenance of reliable data concerning accidents. For example the government checked the accuracy of police reports of fatal accidents against hospital records and found that nationally just 2.76 percent of all deaths on the roads were missing from police reports. [7].

In this road safety context it is difficult to conceive of any alternative other than the 'three stage system' that exists to:

1. monitor road safety by collecting reliable data concerning safety measures as well as the nature and location of all accidents involving serious injury or fatalities,
2. fix both short term as well as longer term targets for risk reduction to all road users, that are linked to:
3. realistic action plans that embrace structural and non structural measures

This is clearly an example of public safety where a fully integrated system of safety has to be maintained at all times. This presents an important lesson for the seismic safety community concerning integration. In the road safety field there are not only performance standards for the various elements but there are also targets that relate to full integration of structural and non-structural measures. The link between the assessment system and the development of action plans is particularly important. Thus it is a sensible concern to identify targets that *link* the various elements on the 'Seismic Safety Chain' described in Figure 2.

Flood and Cyclone Warning Dissemination Targets

Dennis Parker and his colleagues within the Flood Hazard Centre in Middlesex University in the UK have spent the past thirty years developing tools for flood and cyclone management both in the UK and internationally. One of these tools, called a Criteria-Development Matrix (CDM) has been developed over the past ten years to measure and compare flood warning dissemination schemes in various European countries.[8] The concept is certainly not unique, in the UK the Higher Education Council uses a similar qualitative rating scale to assess the quality of both learning and research.

The team devising this system has progressively added to the list of criteria and now has a matrix with twenty seven criteria that has been applied to cyclones as well as floods. They include such topics as 'public awareness raising concerning cyclones', 'availability of hazard information', 'performance targets

set and monitored' 'arrangements for warning procedures for groups with special needs' etc. The criteria matrix adopts a five part rating scale, indicating stages of development from 1 (basic) to 5 (optimum).

The following pair of examples chosen at random from their twenty seven topics indicate how the matrix works for cyclone warning dissemination.

Development Stages

Characteristics or criteria	**Stage 1.**	**Stage 2.**	**Stage 3.**	**Stage 4.**	**Stage 5.**
Attitudes towards freedom of hazard information	Highly restricted and secretive	Quite restrictive and secretive	Mixed. More openness developing but in practice confidentiality looms large.	Generally more open in policy and practice.	Fully open in policy and practice
Organizational culture	No evidence of a disaster culture (i.e. organizations internalizing mitigation arrangements)	Evidence of disaster culture in a minority of organizations; competition between organisations	A disaster culture exists in many organizations with evidence of collaborative agreements, competition between organisations	A disaster culture exists in many organizations; evidence of internal cyclone preparedness plans; some evidence of widespread collaborative agreements; some competition detectable:	A well-developed disaster culture exists among most internal organizations, internal cyclone preparedness plans are widespread; evidence of widespread collaborative agreements and disaster mitigation

The obvious strengths of these criteria rating system is that qualitative comparisons can be made between differing situations and differing safety elements. In addition the system can provide government officials with specific and measurable targets in all the elements that collectively form a 'safety system' to achieve by x or y date.

Performance Indicators to Measure Resilience in Three Disaster Contexts

In writing this section I am grateful for two primary sources of data and creative insights. Firstly, to the vital contribution of a distinguished multi-disciplinary team of researchers: Michel Bruneau, Stephanie Chang, Ronald Eguchi, George Lee, Andrei Reinhorn, Masanobu Shinozuka, Kathleen Tierney, William Wallace and Detlof von Winterfeldt working within the Earthquake Engineering Research Centre Program of the National Science Foundation. Their pioneering research fills a major gap in our understanding of ways to assess and enhance the seismic resilience of communities, and I have adapted one of their models in the following section. [9]

Secondly, I am indebted for all the rich insights gained from participating in the ongoing ambitious international programme of study being undertaken on 'Indicators for Disaster Risk Management'. This ground breaking research is being conducted on behalf of the Inter-American Development Bank by the Universidad Nacional de Colombia- Sede Manizales Instituto de Astudios Ambientales (IDEA) under the leadership of Omar Cardona. This programme is already leading to the development of a sophisticated assessment methodology to measure key elements in a country's vulnerability to natural hazards as well as measuring the performance of different risk management polices and tools. [6]

A striking feature of progress within the disaster risk reduction field in recent years has been in the conceptualization of disaster management as well as in expanding its scope and contribution to the development of sustainable communities.

The first of these changes has been the belated recognition that it is neither organisationally logical nor prudent to regard disaster management as consisting of isolated or loosely connected entities. Thus up to about 1995 the literature often described three components of disaster planning that were all too frequently independent entities. First, mitigation and preparedness planning, second emergency management (or the 'relief phase') and third the recovery/ rehabilitation phase. Gradually this dangerous conceptualization is being replaced by the concept of 'Disaster Management', embracing the three elements within an integrated and interdependent system. Thus in the development of National Disaster planning in Afghanistan, where there is little in the way of existing disaster planning entities or traditions the intention is to create a unified system of the three elements as indicated on the triangle below.

Figure 3. Disaster Management embracing three components.

The second positive development has been to place hazard mitigation in a wider socio-environmental framework. Dennis Mileti articulated the shape of the new paradigm in 1999:

> *"The goal of this new sustainable hazards mitigation is not just to reduce losses but also to build sustainable local communities, with an eye towards expanding that resiliency to nationwide and international spheres. Under this framework, actions to reduce losses would be taken only when they are consistent with the other principles of sustainability. Sustainable hazards mitigation has six essential components: environmental quality, quality of life, disaster resiliency, economic vitality, inter-and intragenerational equity, and a participatory process".*[10]

Mileti includes the concept 'disaster resiliency' in the new framework. This idea, entering the disaster management from the engineering field has provided the key ingredients for an advanced, integrated approach. I will now seek to summarise how resiliency is expressed in the three key elements of disaster management: Risk Reduction, Emergency Management and Recovery Management and this discussion will then proceed to a series of suggestions concerning indicators to measure progress within each element.

Defining Resiliency

> *"Vulnerability is intimately related to social processes in disaster prone areas and is usually related to the* ***fragility, susceptibility or lack of resilience of the population*** *when faced with different hazards"* A..Lavell [5]

> *"Local resiliency with regard to disasters means that a locale is able to* ***withstand an extreme natural event*** *without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community"*
>
> Dennis Mileti [10]

> *"the ability of a system to* ***withstand stresses****"*
>
> J.F.Horne and J.E.Orr [11]

> *"The capacity to cope with unanticipated dangers after they have become manifest, learning to* ***bounce back****"* A..Wildavsky[12]

> *"The* ***capacity to adapt*** *existing resources and skills to new systems and operating conditions"*
>
> Louise Comfort [13]

> *"The ability of an actor to* ***cope with or adapt to*** *hazard stress. It is a product of the degree of planned preparation undertaken in the light of a potential hazard, and of spontaneous or premeditated adjustments made in response to felt hazard, including relief and rescue. The most important policy options available to enhance resilience are those that shape formal or informal insurance mechanisms. Insurance is a key tool for use in spreading the economic costs of disasters across society and over time."*
>
> Mark Pelling [14]

This collection of definitions is stated to emphasise the diverse aspects of a resilient disaster management system that:

- withstands, or absorbs abnormal pressures or stresses *(risk reduction),*
- has the ability to cope with the disaster forces and bounces back *(emergency management),*
- is adaptive, and makes adjustments *(risk reduction, emergency management and recovery management)*

A resilient system demonstrates three 'values' for a community:

1. **Reduced failure probabilities**, *(through risk reduction actions)*

- Performance Indicators are needed to cover all the elements identified in Figure 2. 'The Seismic Safety Chain Model'. In addition a system of performance indicators is needed to measure success in integrating these elements. The performance targets to reduce disaster risk will need to be integrated and harmonised with non-disaster targets for sustainable development, environmental protection etc.
- The audience of the disaster performance targets for reduced seismic failure probabilities will need to include related professions, such as engineers, architects, physical planners, economists, social workers, educationalists etc. In addition risk reduction targets will relate to all relevant governmental departments and the NGO community. Finally, the targets will need to be developed with full public participation, so that they are understood and accepted by the communities 'at risk' of a future disaster.

2. **Reduced consequences from failure**, in terms of fewer injuries, fewer lives lost and reduced direct and indirect damage, *(through emergency management actions)*

- Performance Indicators are needed to cover the range of roles functions and relationships of the emergency management community. These targets will inevitably also need to include specific preparedness measures. (See the Appendix for suggestions for Performance Indicators for the training of national Disaster Management Staff)
- The audience of the disaster performance targets for reduced consequences from seismic failure will need to include related professions, such as medical professionals, social services staff, the police, emergency services staff, civil defence officials etc. In addition risk reduction targets will relate to all relevant governmental departments and the NGO community. Finally, the targets will need to be developed with full public participation, so that they are understood and accepted by the communities 'at risk' of a future disaster, who need to know how to reduce the consequences of sudden failure.

3. **Reduced time for recovery** in terms of restoration to 'normal' conditions or to higher level of protection. However it is essential to recognise that returning to 100%, (pre-disaster levels) will not be adequate in conditions where there is acute vulnerability, in such situations it will be essential to rise above previous 'normality' levels. *(through recovery management actions)*

- Performance Indicators are needed to cover the state of progress in recovery. This will not be difficult in measuring economic or physical recovery actions; however it will be much more difficult to devise measurement indicators to measure the psycho-social recovery of the affected community. These indicators also need to address risk reduction measures that are introduced within the recovery process.
- The audience of the disaster performance targets for reduced time for recovery following the disaster will need to include related professions, such as engineers, architects, physical planners, economists, social workers, educationalists, development workers etc. In addition risk reduction targets will relate to all relevant governmental departments and the NGO community. Finally, the targets will need to be developed with full public participation, so that they are understood and accepted by the communities 'at risk' of a future disaster, who need to know how to reduce their recovery time.

These three 'values' of a resilient system can best be understood by considering a series of graphs that are set out below with a horizontal coordinate representing the duration of time, say 2000-2010 and a vertical coordinate representing the overall 'quality' of an environment or stage of development that will include the level attained in building a 'safety culture' This coordinate starts at the base as zero quality rising to the optimum level of 100% quality or stage of development.

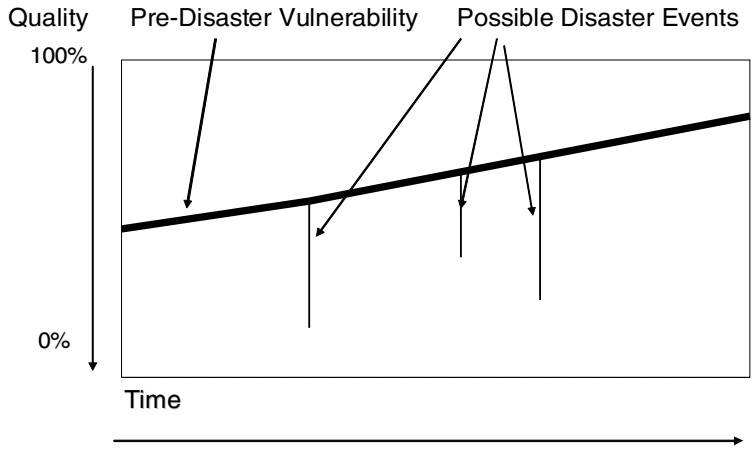

Figure 4 The Expectation of National Development.

Figure 4 describes the situation before a disaster occurs. The rising line represents development, thus it is not horizontal since this would imply a static development over time, rather it rises to express growing wealth and high expectations of the society to prosper and improve in overall quality. The starting point of this line is at a stage of about 50% quality or stage of development. In this diagram the quality level may represent a condition of vulnerability. This would be characteristic of many developing country contexts, whilst California would be somewhere near the top of the quality scale, say at about 80%. There are a number of vertical lines dropping from the rising development line. These represent possible future disasters that pose serious threats to the steady progress of development and the general quality of life.

This graph represents one possible context to introduce measures to improve resilience by coping with the stresses and shocks from hazards. This 'pre-disaster' context is where effective risk reduction actions should occur, in part as a key strategy to ensure that the potential set backs from major disasters are reduced.

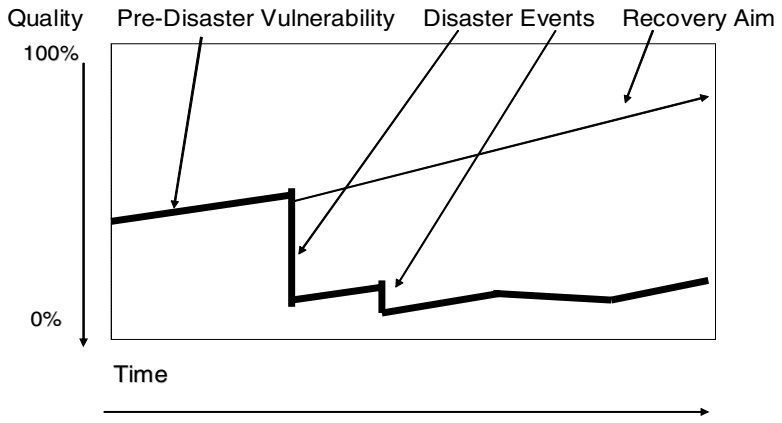

Figure 5. Resilience expressed in three Disaster Phases
Pessimistic Model of failure to recover to the
Pre-Disaster Level

Figure 5 pictures a post disaster situation where he anticipated development was brutally interrupted by a severe, sudden onset disaster such as an earthquake, represented by the vertical line. The society then began to pick up the pieces in their recovery process only to suffer another disaster shock. The result has been a failure to recover to even the pre-disaster level that implied a state of vulnerability. In this highly pessimistic, (yet not unusual) scenario, the disasters have weakened an already fragile society that may never fully recover.

This graph represents three possible contexts for measures to improve resilience:

- The pre-disaster opportunity to reduce risks
- The immediate disaster situation when there is the opportunity to reduce the drop of the vertical line through effective actions to improve emergency management in order to help this society to 'bounce back'
- The erratic recovery phase when the society may seek to firstly- shorten the recovery time and secondly - recover above the pre-disaster norm that gave rise to the disaster.

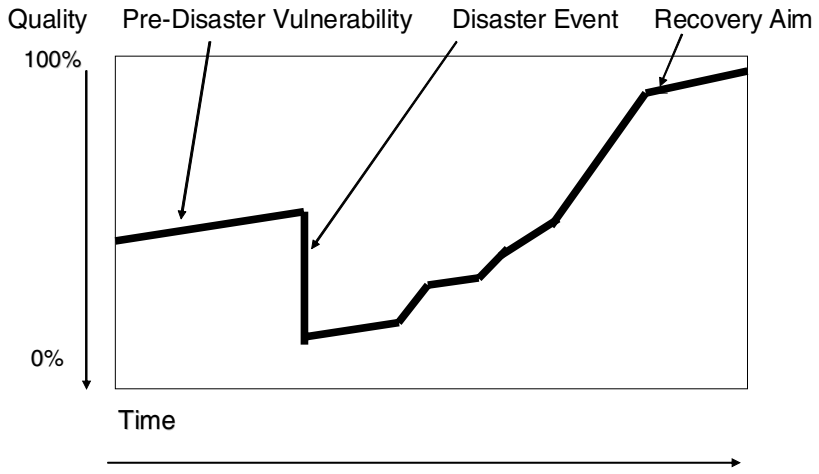

Figure 6. Resilience expressed in three Disaster Phases
Optimistic Model of recovery above Pre-Disaster Level

Figure 6 pictures a post disaster situation where he anticipated development was interrupted by a severe, sudden onset disaster, represented by the vertical line. The society then began a rapid recovery process that has taken it well above the pre-disaster vulnerable norm. The result has been a double success story with a rapid recovery process as well as the reconstruction of high quality building and infrastructure. It is labeled 'optimistic' since this recovery pattern would be rare event.

The issues raised by this diagram vividly remind me of a Disaster Management Training Course I led in 1982. A Red Cross official was making a presentation on Disaster Recovery and he stated that the key principle must be to **'restore normality'** This prompted an exclamation from a perceptive Jamaican nutritionist who was sitting in the back row. *"I am afraid you are wrong"* she shouted, *"..in my country we have people who live in cardboard boxes, that is their normality, so are you suggesting that in the recovery plan we put them back in these boxes? No our 'normality' is the same as 'vulnerability' and in recovery planning you must surely aim to reach a higher standard than the pre- disaster norm"*

This graph represents three possible contexts for measures to improve resilience:

- The pre-disaster opportunity to reduce risks
- The immediate disaster situation when there is the opportunity to reduce the length of the vertical line through effective actions to improve emergency management and to strengthen community coping mechanisms in order to help this society to 'bounce back'
- The positive recovery phase when the society has shortened the recovery time and secondly – recovered well above the pre disaster vulnerable norm, that gave rise to the disaster.

An example of a Performance Target for Seismic Risk Reduction

Bruneau et al. [7] identify four dimensions of resilience:

- **Robustness** (strength of elements to withstand stress without loosing their function

- **Redundancy** (the extent to which elements continue to function in the event of a disaster)
- **Resourcefulness** (capacity to identify problems and mobilize resources)
- **Rapidity** (capacity to meet priorities and achieve goals in order to contain losses and avoid future disruption)

From these features of a resilient system a series of performance indicators can be identified. For example one of the elements in the disaster chain in Figure 2 was that of 'Training'. This is needed for numerous groups involved in a disaster risk reduction strategy that include builders, building code enforcement officers, building managers, managers of critical facilities and for public officials working in National Disaster Management Offices. The constraints of space in this paper do not allow for indicators to be developed for each group, therefore a single example has been developed in outline form that relates to performance targets for the training of disaster managers with general responsibility for overall disaster management and with specific responsibility for emergency management and aspects of risk reduction. [See Appendix]

CONCLUSIONS

1. This paper has argued for performance indicators to be developed for all seismic reduction elements, with a particular and urgent emphasis on the development of indicators for non-structural elements in a risk reduction strategy, such as training and public awareness.
2. In addition to the need for performance targets for individual safety elements, there is a further need for the measurement of the integration of safety elements in the manner of the Road Safety example cited in this paper.
3. The performance indicators, as 'control' measures need to be balanced with 'trust' so that all stakeholders recognize their value and are fully involved in the measurement process.
4. An extensive 'shopping list' is provided that lists the demanding requirements for effective and accepted performance targets.
5. The examples of performance indicators drawn from the road safety and cyclone warning dissemination provide useful models that may be helpful in developing performance indicators to measure seismic risk reduction. The road safety model has a vital ink between performance assessment and the development of action plans, a strategy that could be usefully replicated
6. The concept of 'resilience' is important since this provides a comprehensive environment to integrate three phases of disaster management: risk reduction, emergency management and recovery management. Each of these phases can be effectively be strengthened by the use of performance indicators. However performance targets for seismic safety will need to be integrated with general performance targets set for such 'normal' concerns as sustainable development or environmental protection.
7. Figure 6. graphically posed the greatest challenge set out within this paper. It raises one of the most important demands facing the global earthquake community. The question concerns how a developing country, with limited resources and subject to severe seismic risks can recover rapidly, yet in a safe manner ABOVE the pre-disaster vulnerable norm in order to withstand future disaster impact?
8. Finally, emphasis is given throughout the paper to the importance of developing measurable indicators for ALL safety elements in recognition of the threat posed to lives by the failure to develop a comprehensive system of seismic protection. The paper reports on some good progress being made to develop the necessary performance indicators to help realize this noble aim.

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APPENDIX

Staff Training within National Disaster Management Centres (DMC)

Elements:	Guiding Principles:	Performance Target:	Benchmarks –Criteria to Measure:
Overall status of training and Human Resource Development (HRD) within the National Disaster Management System	Incorporate training and HRD in the structure of national disaster planning with full legislative support	Secure a rolling budget for training and HRD for a minimum of 5 years All staff to have their training requirement built into job specifications within 12 months	Evaluation of the effectiveness of the DMC Training System and HRD in financial accounting terms as well as cost-effectiveness studies.
Task Analysis of Staff in the Disaster management system	Training course developments and training materials to be related to a task analysis of staff to be trained All training materials to be revised every two years	Over a 12 month period conduct a task analysis for all senior staff.	Using qualitative interviews with trained staff evaluate the practical relevance of training, following the task analysis.
Relevance and applicability of training	Make training relate as close as possible to actual DM experience. All key decision makers will be regularly trained in 'on the job' disaster simulation exercises. All staff to have induction training in DM to suit their roles and specific levels of responsibility Training will involve multi-agency emergency management teams to familiarize staff with their colleagues and inter agency operating procedures. Develop individual training packages with the Internet.	Produce detailed case studies of disaster or major crisis situations experienced within the area where staff are trained. Produce two per annum, so that there are always up to date examples available for learning purposes. Design, test and implement the earthquake simulation exercise every year (as well as for other assessed natural and human made threats) Create a small high level training cadre from senior operational staff within one year.	Aim for a 20% reduction of property losses and 20% reduction in deaths and serious injuries over a five year period as a result of effective emergency management. to monitor their performance following training. Review the performance of the trainers and the training programme by conducting in- house and out- house evaluations of the performance of staff under simulation conditions. Measure enhanced performance by staff that have been trained.