RESILIENT CITIES - AN EFFECTIVE WAY TO REDUCE DISASTERS

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SUMMARY:
The objective of this paper is to reduce loss of lives and properties in urban areas. The key strategy is to designate low and medium hazard sectors for population densification and city expansion, and to locate there essential facilities such as hospitals and develop lifelines such as water services, taking into consideration the influence of surface geology.
The hazard maps of Ica, Pisco, Chincha and Cañete affected by the Peru 2007 earthquake, developed in 2001-2002, agreed well with the real effect of that event. As one of the UN Millennium Development Goals (MDG) is to provide good quality water to at least half of the world's population, the damage to water and sewage of Pisco city was investigated.
As a member of the UNISDR Panel of the World Campaign 2010-2015 Making Cities Resilient. My city is Getting Ready, my intent in this paper is to provide some contribution to the campaign.

Keywords: resilient cities, risk reduction, hazard map, land use plan, water service.

1. INTRODUCTION

In view of the growing unplanned urban development taking place, which makes the cities in developing countries inefficient, hostile and risky, we proposed a desirable model city – one we would be happy to live in and hand down to future generations: a sustainable city (SC) – safe, orderly, healthy, attractive, efficient, environment-friendly, appreciative of its cultural-historic heritage and therefore, governable and competitive.

It was one of the main conclusions in Peru, at the mid-term of the International Decade for Natural Disaster Reduction (IDNDR) 1990-1999. So when the inundation maps of the cities of Tumbes, Piura, Talara and Paita affected by El Niño 1997-98 turned out to be practically carbon copies of those of the El Niño 1982-83, this became in a window of opportunity.

So a proposal was made –to the then Prime Minister of Peru, who was, at the same time, the Head of the El Niño 1997-98 Reconstruction Committee (CEREN) – to reconstruct those four cities, according to a Sustainable Cities Programme (SCP). The best argument to convince him, local authorities and the other stakeholders to reconstruct the cities affected by El Niño 1997-1998, implementing the SCP, was that these four cities, flooded by two extraordinary El Niño phenomena, had generated similar inundation maps on both occasions. It was decided to apply multihazard maps, which are a product of microzonation investigations and which include the effects of earthquakes, flooding, landslides, and soil liquefaction on the cities already built up and on foreseen city expansion areas. Thus the SCP was started in November 1998 and it has lasted up to present: the studies of more than 170 cities and towns with 7.5 million people have been developed.

At the time when the Ica Region or Pisco earthquake occurred on August 15, 2007, the Sustainable Cities Program 1st Step (SCP-1S) – focusing on its first attribute, its physical safety - had already completed the hazard maps of 130 Peruvian cities and towns, with 6.4 million inhabitants, including 16 cities located in the Ica Region or Pisco earthquake macroseismic area.

Quick field surveys made soon after the event have shown that the hazard maps of Ica, Chincha, Pisco and Cañete, capital cities of those provinces developed under the framework of SCP in 2001-2002, had good correlations with the actual seismic damage degree of the Pisco 2007 earthquake and its geographic distribution. It was therefore decided to expand and densify those cities, based on their updated validated hazard maps, which were completed in May 2008. There are now available validated or new hazard maps of 26 cities and towns, which are being applied in their safe urban development.

This paper focuses on the earthquake effects on the surface geology of the 2007 earthquake in the macroseismic area which caused –as expected– the worst effects in the cities of Pisco and Tambo de Mora, and along the Panamerican Highway, mainly due to soil liquefaction and lateral spread that occurred in those places.

This paper also includes damage caused to the water and sewage system (WSS) of Pisco city, the contribution of the World Bank project to protect the large investment being made in the country's WSS, and the impact in the country of the approval of "Disaster Risk Reduction" Management as Peru's 32nd State Policy on December 17, 2010.

Thanks to the technical and economic assistance of ECHO European Commission - Humanitarian Aid & Civil Protection, the project "Preparation for Seismic or Tsunami Disaster and Early Recovery of Lima and Callao" was executed from February 2010 to March 2011.

The summary of these activities leading to resilient cities are also presented in this paper.

2. SURFACE GEOLOGY INFLUENCE OF THE PISCO EARTHQUAKE DAMAGE ON BUILDINGS AND INFRASTRUCTURES

2.1. Development of Hazard Map in Peru

It was very fortunate that in the 1970's and 1980´s, it was possible in Peru to reach state-of-the-art in technology to investigate geologic hazards focused on seismic effects on soils, buildings and infrastructures.

Following the Ancash Peru 1970 earthquake, microzonation multihazard investigations of the Chimbote area were carried out by the Japan Scientific Mission headed by Dr. Ryohei Morimoto, at the time director of the Earthquake Engineering Research Institute (ERI) of the University of Tokyo (U of T). Key members of the mission were Japan's top seismologist, earthquake engineer, geologist, and geotechnical engineer from ERI, UoT and from the Building Research Institute (BRI), Ministry of Construction (MOC) Government of Japan. They spent over 4 months working very hard in the field investigation. Their assistants were former Peruvian students at the International Institute of Seismology and Earthquake Engineering (IISEE). They had the opportunity to apply in the field what they had studied in theory at the IISEE, Japan, and at the California Institute of Technology, Caltech, Pasadena, CA. USA.

During the 1980´s the site investigation for the location of a small research nuclear reactor, north of Lima. Peru, was carried out according to the regulations of the UN International Atomic Energy Agency (IAEA), Vienna, Austria. The site investigation plan, the field works and the results were reviewed and approved by Taylor & Woodrow, the largest general construction corporation of the U.K.

The whole mining town of Morococha of 5,000 inhabitants needed to be moved from its former

location to a new one, because of an open pit mining operation at its former location. A systematic and rational plan was developed by Knight Piésold Consulting (KPC) which operates worldwide. The seismicity was investigated by Montgomery Watson Harza MWH and reviewed by Golder Associates, to select the most adequate location for the new city, in a mountainous area 4,200-4,500 m.a.s.l. It was not an easy task. In this area, moderate slopes or flat areas are scarce, and wet, soft soils predominate.
An extensive area was investigated, which included environmental impact investigations. From the general area, 122 ha was selected and purchased. Of this land, the useful area for urban occupation is only an elongated area with a moderate slope and relatively compact and dry soil, which was considered to be the most adequate for the New Morococha town. With easy access from Peru's important Central Highway, it is going to be the urban integrating center for small surrounding towns and villages and the rural population. The urban development planning was made by GMI Consulting Engineers, Lima, Peru.

A review of the whole report was requested by Chinalco Peru S.A., subsidiary of Aluminium Corporation of China and this was done by a working group headed by the authors of this paper in 2010-2011. With great satisfaction, we are able to declare that the multihazard investigation methods, geophysical equipment used, and data processing applied in Peru coincide practically 100% with those used in Morococha by three internationally well known consulting companies.

The microzonation studies of the city of Pisco following the 2007 earthquake were performed by CISMID, National University of Engineering (UNI) Lima, Peru applying internationally accepted methods very similar to those used for the new city of Morococha; and also using the practical simplified method used by the Sustainable Cities Program INDECI/UNDP (SCP). Except for two small spots with very high hazard, that were not identified by the simplified method, more than 90% of sectorization of the hazard map for the city of Pisco was coincident in both results. From 1998 to 2011, more than 170 Peruvian cities with 7.5 million inhabitants developed their hazard maps and land-use plan under the framework of SCP INDECI/UNDP and these can be applied for the development of resilient cities in earthquake-prone countries.

2.2. Building damage

The damage caused by the Pisco earthquake, Mw 8.0 USGS of August 15, 2007 on buildings in the cities of Pisco and Tambo de Mora and damage to water and sewage services of Pisco and along the Panamerican Highway are included. In these cases, the influence of the local soil characteristics, as well as the geology and topography, were very strong on the damage degree and its geographic distribution.

In Pisco and Tambo de Mora –as the SCP 2001-2002 investigations had indicated, these places had very-high-hazard sectors – – many building collapsed from the heavy damage they suffered because of soil liquefaction and high intensity, up to VIII MMI in Pisco; and IX MMI in Tambo de Mora.

In Pisco, the worst damage occurred in a strip parallel to the seashore where soil liquefaction and tsunami inundation were expected, consistent with the hazard that was graded very high in the 2001/2002 hazard map. In fact, there the intensity was VIII MMI, moderate liquefaction occurred, and 2.5 to 3.0 m tsunami waves inundated the area; the damage was very severe there. In downtown Pisco, the hazard degree was high, but the high vulnerability of adobe constructions which predominated there made the seismic risk very high. There, practically 100% of the adobe houses collapsed, and reinforced concrete buildings with poor design and low construction quality collapsed or were also severely damaged.

The southeast sector of Pisco was qualified as being of medium hazard in the 2001/2002 hazard map. The building damage was clearly less severe there than in the other two sectors already described. In a roundtable session held at "El Comercio", Peru´s main newspaper, 10 days after the event, the author recommended that the city of Pisco should be expanded in that direction.

From October 2007 to May 2008, the validation of the Pisco hazard map was developed under the framework of SCP INDECI/UNDP. The fund was provided by the U.K. Department for International Development DFID. This was useful to validate the hazard maps of the other provincial capitals and to investigate the hazards of a few new towns.

In the validated map of Pisco (see Fig. 1), it was found that in general the boundaries between the very high, high and medium hazard sectors were accurate. Few correction were made, but in the validated map the limits between sectors were made along the axes of avenues and streets, so as not to cut properties, because of the legal implications of the municipal ordinance approving the hazard map and land-use plan.

Almost at the same time, at the end of 2007 and in early 2008, CISMID FIC/UNI also developed the Pisco hazard map funded by the Inter-American Development Bank-IDB, which was essentially coincident with the 2001/2002, hazard map and the validated hazard map developed under the framework of the SCP INDECI/UNDP Programme.

At the request of the Ministry of Housing Construction and Sanitation, in November/December 2011, the author compatibilized both hazard maps. Some changes were necessary, for example in downtown Pisco, there are two relatively small spots with very high hazard not identified by the SCP INDECI/UNDP map, but clearly indicated in the CISMID report, and this contribution was included in the final Pisco hazard map.

The sector northwest from downtown Pisco had been considered in the CISMID FIC/UNI map as low/medium hazard; however, in the final version, it was considered with high hazard, because the sewage treatment plant is located there, which moistens the area. The area is also contaminated by bad smell from the sewage and the presence of mosquitoes and sea birds that increase the contamination, so it was graded as high hazard. In the Pisco Municipality land-use plan, this sector is designated as recreational green areas, which was accepted by all the stakeholders.

In the case of Tambo de Mora (see Fig. 2), the microzonation effect was very clear. General liquefaction occurred there in the loose water-saturated fine sand. There, rows of brick houses settled as much as 0.90 m, and reinforced concrete tilted and sunk a few decimeters. At the Tambo de Mora, Chincha, Provincial Jail, some of buildings sunk over 0.50 m and fences moved along the wall axis about a meter and forward, some 0.70 m, opening a “new door” from the original one inch (1”) construction joint.

Two and a half blocks from the Tambo de Mora main square (Plaza de Armas) an Evangelical church built with 4.20 m high and long adobe walls, with no reinforcement, nor any confinement at their top edge, did not suffer any damage. Something similar happened with a 3.80 m high adobe fence. The church and the fence were constructed on a hard, dry soil, resulting from a cut made to a small elevation. See Fig. 3

2.3. Damage to Infrastructure Caused by the Pisco August 15, 2007 Earthquake

This paper focuses on two cases:
- Damage to the Panamerican Highway, an investigation performed by the author following the Pisco 2007 and also the Arequipa 2001 earthquakes, with funds provided, in both cases, by UNDP/Peru.
- Damage to water and sewage system (WSS) of the city of Pisco, a case study of the World Bank in an effort to reduce losses in such systems in Peru.

Why? Because in both cases, the damage observed was closely related to the influence of the surface geology.

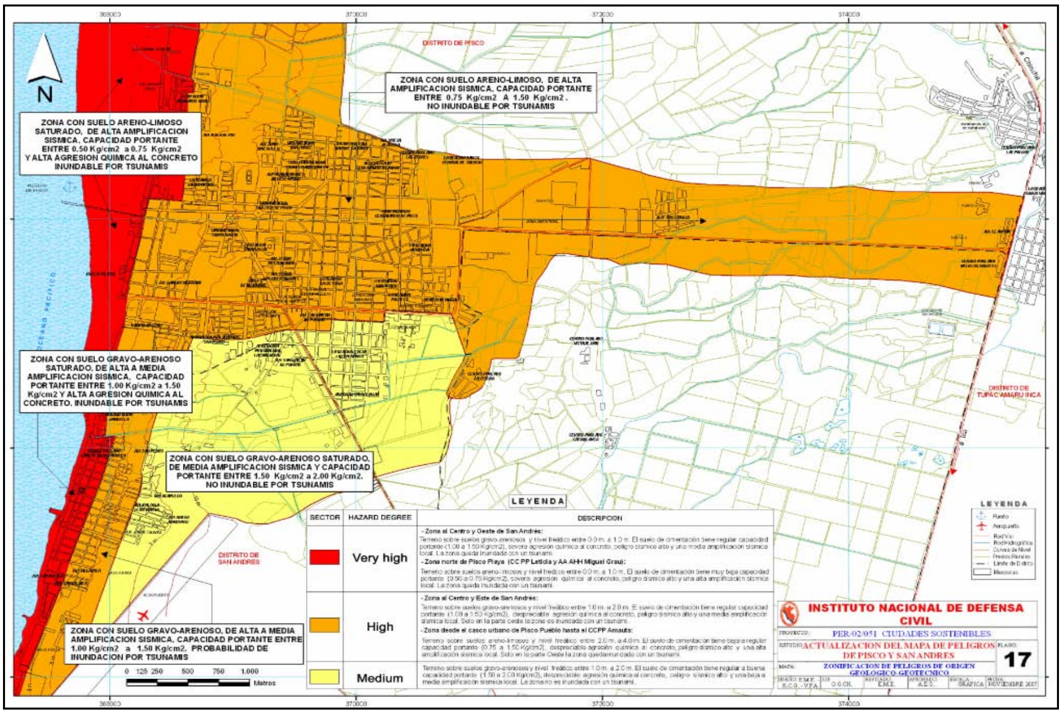

Fig. 1. Final Hazard map of Pisco. Results of compatibilization of the CISMID UNI and SPC INDECI/UNDP hazard maps. Reported to the Peru Ministry of Housing, Construction and Sanitation and to the Municipality of Pisco, in December 2011

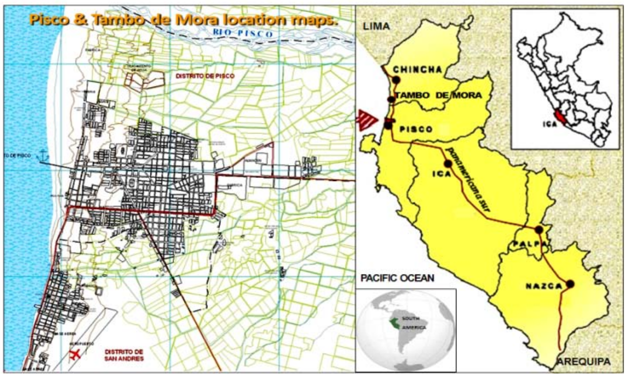

Fig. 2. Location of Pisco and Tambo de Mora.

Fig. 3. MICROZONATION EFFECTS IN TAMBO DE MORA

1). Volcano of soil liquefaction. 2). Lateral spread. A “door was opened”. 3). Settlement of 0.80m 1.00m. 4). Settlement of bearing walls and broken concrete floor. 5). Undamaged adobe church and 6). adobe fence, only 200 m from the Tambo de Mora main square (Plaza de Armas) where generalized soil liquefaction occurred. 7). Large and abundant cracks were opened north of Tambo de Mora, where also a 3 km long and 0.6 km wide block was displaced a few meters toward the ocean.

2.3.1. Damage to the Panamerican Highway

Damage to the Panamerican Highway caused by the Pisco 2007 and Arequipa 2001 earthquake was clearly influenced by the presence of water underneath the pavement, near to the soil surface. This is particularly important because the macroseismic areas of both earthquakes are one of the world's driest regions: a northerly continuation of the Atacama Desert.

Damage to the Panamerican Highway and other paved main roads in Peru's southwestern (SW) region caused by the 2001 Arequipa earthquake was clearly influenced by the site's natural characteristics. Damage to the Panamerican Highway occurred only at its intersections with narrow irrigated valleys where the soil is humid all year around, in spite of the fact that only a small volume of surface water runs from January to March each year. Damage on the highway also occurred to the unconfined sides of thick filled platforms of more than 4.00 m in average.

During the 2007 Pisco earthquake, the worst damage along the Panamerican Highway occurred where the soil is wet. At the point marked km 190 from Lima, one side of the platform is unconfined for more than 13 feet (4.0 m) high. Under this portion of the Panamerican Highway runs the Chillon gully that usually carries water only from January to March, but the humidity is maintained all the year round. There, the embankment collapsed and shear failure of the three-cell concrete box culvert occurred (O´Connor et al., 2007). At the low, wet south approach to the Huamaní bridge that crosses the Pisco River, cracks on the pavement occurred. The north side of the approach is high and the soil is compact and dry, so no noticeable damage occurred there.

Visible cracks with lateral spreading were observed on the highway pavement from km 182 to km 188. The validated Chincha hazard map (Kuroiwa and Salas, 2008) showed that irrigation-by inundation project is located in the upper plain, hundreds of feet east of the Panamerican Highway, from where water is infiltrated.

As far as 95 miles (150 km.) from the earthquake epicenter, there was also damage, with cracks in the pavements, at the south entrance to Lima in Villa. A comprehensive report of damage to roads and bridges in the macroseismic area of the August 15, 2007 earthquake was released on December 10, 2007 by J. O´Connor, L. Mesa and M. Nykamp, and a number of pictures of the damage sustained are also included in their report.

This information may be useful to foresee the different effects of earthquakes in very dry regions and others where humid soil predominates.

2.3.2. Damage to the Pisco city water and sewage service (WSS)

On the occasion of the 50th anniversary of the Fukui, Japan 1948 earthquake a special session of a full half day of the World Conference on Earthquakes in Urban Areas 1998, was dedicated for protecting WSS from intense earthquakes. An invitation from the mayor of Fukui city and Dr. Ichiro Tanahashi, chairman of the Organizing Committee of that conference –to whom the author expresses his gratitude– was critical for initiating, in 1998, a systematic investigation of how to protect WSS from earthquakes, flooding, and landslides. One of its products is included in Kuroiwa J. (2004) pp. 73-84.

At the time when the World Bank decided to investigate the effect of the 15.Aug.2007 event on the WSS of Pisco, the soil characteristics of the built-up area of Pisco city were known, because of the existing results of the SCP INDECI/UNDP. The WB provided an assistant, a top graduating student from the Department of Environmental Engineering of the National University of Engineering (UNI) Lima/Peru, in the specialty of Sanitary Engineering, who developed his assistantship activities as a professional thesis for his academic department at UNI, Huaman A. (2011) which facilitates investigations. However, the soil characteristics of the trunk water pipe from Cabeza de Toro, the water source, to the water tanks in Pisco needed to be studied. The pipe crosses fine water-saturated agricultural soil. Extensive soil liquefaction occurred along the pipeline, which was broken at several points, and a great volume of water was lost, inundating the agricultural land. In the built-up area of Pisco, both the water and the sewage system failed at many points and were put out of service. The soil is fine sand with the ground water table very close to the surface, and at these points partial liquefaction and high seismic intensity occurred.

In general, in the whole Pisco earthquake macroseismic area, elevated water tanks, supported on complicated reinforced concrete columns and beam structural systems, failed at their extremes, near the joints, because of stress concentration caused by the seismic moment and shear by inverted pendulums with a great mass of water concentrated at the top of the structure. The concrete cover was broken or cracked there, and caused steel bar corrosion, making the elevated tanks seismically unsafe. Elevated tanks with solid R.C. cylinders, behaved much better than the former, and no damage was observed in this type of elevated tanks. The tendency in Peru is now to build elevated water tanks with R.C. solid cylinders. Pisco water tank N° 2 supported directly on compact and dry soil, over a small cut elevation, did not suffer structural damage, but the connecting pipes to the outside systems were broken.

3. EXPERIENCES OF PROTECTING WSS OF KOBE, JAPAN AND LOS ANGELES, CA. – LESSONS LEARNT

The Hanshin, Japan 1995 (M 7.2 Richter) and Northridge, CA 1994 (Mw 6.7) earthquakes caused extensive and severe damage to WSS of two important cities: Kobe, Japan and Los Angeles, CA, USA. In both cases the influence of the surface geology on the degree of damage and its location was very clear.

The WB project to reduce losses caused by extreme events: earthquakes, flooding and landslides included technical visits to the Kobe Water Department (KWD), the Metropolitan Water District of Southern California (MWDSC) and Los Angeles Department of Water and Power (LADWP).

In Japan and California the world’s most advanced technology is applied to supply water during emergencies following large earthquakes for controlling fires and to supply drinking watering in emergency situations. In the case of Kobe, the 1995 earthquake produced the most adverse scenario, an extreme case.

The objectives of the technical meetings in Kobe and Los Angeles were focused to take direct knowledge of how the emergencies were faced and their lessons learned, especially for planning future actions to rationally reduce losses to WSS, useful to other countries located in earthquake-prone regions.

In order to have a complete but simplified vision of the Kobe and LA experiences, summaries of both cases are included.

3.1. The Kobe lessons to protect WSS from extreme earthquakes

The great earthquake and fire of Hanshin-Kobe 1995 earthquake (M 7.2 Richter) had the maximum intensity of 7.0 in the Japan Meteorological Agencies JMA scale, equivalent to XI MMI. In the Kobe 1995 earthquake, fire was the most devastating event, as tsunami was in the Tohoku, Japan 2011 earthquake.

The Kobe 1995 earthquake had shown a clear influence of the local physical characteristics on the seismic intensity and the damage caused. The intensity was particularly high in a 0.4 km narrow strip, contact zone between the soft damp soil and the solid rocks of the Rocko Mountain, showing soil edge effects. There was widespread damage in the macroseismic area to water, gas and sewage systems. Most of the damage to water systems occurred in the water distribution pipes system: pipes were broken at 1757 points, and connections to private users in 89,584 out of 650,000 existing services, which accounted for 55% of the total repairing cost. The main cause of damage to pipes was permanent soil deformation, together with lack of ductility of the pipes, and non-seismic-resistant pipe joints.

The 6th floor of the Kobe Municipal Building collapsed. The KWD headquarters were located there. . Important documents of the WSS, including pipe maps, were lost. Telemetric control of water reservoirs was effective, useful during water system restoration work, and also to save 43,000 m3 of water following the earthquake, which provided emergency drinking water to 1.5 million people for 9 days.

The KWD master plan following the 1995 earthquake was:
- Emergency system to provide drinking water
- Earthquake-resistant water pipes and joints
- Special design of large diameter pipes
- The goals established for the water system temporary rehabilitation in less than four weeks, limit of the Japanese tolerance, known by a survey
- Gradual increase of drinking water supply
- Mutual collaboration between nearby water service companies
- Improve the fire water control and collection of public and hospitals' solid waste

3.2. The 1994 Northridge CA earthquake and damage to Los Angeles water systems

In this paper only the most interesting topics on water component damage related directly to the surface geology to WSS are included. For example, the Jensen water treatment plant (550 million gallons of water/day) that suffered only minor structural damage due to water sloshing, which was repaired without reducing the plant's productivity; however, there was damage to trunk untreated water lines as well as large treated water pipes connecting to the city's supply system, which were broken and out of service for several days.

It is interesting to remember that the Jensen WTP suffered severe damage during the San Fernando 1971 earthquake (M 6.6 Richter) with its epicenter some 24 miles NE from the Northridge earthquake (Mw 6.7). The Van Norman earth dam almost collapsed. The San Fernando Valley Section of MWDSC implemented important improvement measures, such as the construction of 1000 gravel columns to reduce water pore pressure and soil liquefaction at the Jensen WTP; and a new Van Norman dam was built.

During the 1994 Northridge earthquake no significant damage was reported at the Jensen WTP, only partial soil liquefaction occurred there and the new Van Norman dam was undamaged.

According to T.D. O´Rourke (1999), during the 1994 Northridge earthquake most of the damage in pipes of different material and qualities, occurred in:
- Soft clay deposits susceptible to lateral movement and lurching
- Sand and interbedded clay and silt susceptible to liquefaction
- Saturated sand and clay deposits susceptible to site amplification
- Steep slopes with soils and fills susceptible to slumping and landslides

If the repair contour intervals with 0.1 r/km for cast iron are drawn, the most severe damage overlaps almost perfectly over sectors with the above described soil characteristics, indicating that the pipe damage was concentrated where the soil suffered important permanent deformation or the seismic waves suffered important amplification or slopes were unstable. The most important lessons from the technical meetings with engineers of the MWDSC and LADWP in March 2010, were that one effective way to protect WSS from future earthquakes is to foresee possible scenarios as to what type of damage is likely to occur, and where, in the WSS, and accordingly upgrade the seismic resistance of identified critical points; and to have a good maintenance program, which is not usual in earthquake-prone developing countries.

Los Angeles is the world's largest city located in a desert area. The water-saving program for LA may be very useful to cities with a water crisis, such as the urban areas located along the Peruvian coast, where 60% of the country's 30 million inhabitant live but have only 2% of the country's fresh water.

4. CONCLUDING REMARKS

Making the Latin American and Caribbean (LAC) cities resilient needs to be a medium- and long-term inevitable goal, in order to ensure the sustainable socioeconomic development of their nations, as urbanization in this sub-region is one of the world's most active.

There are useful tools to reduce the risk of disasters of natural origin in urban areas developed in Mexico, Colombia, Chile and Costa Rica. Even in Brazil a non-seismic area, Curitiba is a good example to be imitated as a resilient city. However in this paper only the case of Peru is summarized because of the direct, local experience.

The first attribute of a resilient city is its physical safety. People and properties need to be protected from damaging natural and man-generated disasters.
Some of the existing tools, useful to attain resilient cities are:

- Simplified low-cost multihazard microzonation method. If population is densified and city expansions are made in sectors with low and medium hazards, future losses will be drastically reduced. However, this is a very difficult task, because most local authorities, in general, are not aware and do not understand the problem well.
- Low-cost housing needs to be protected from earthquakes, flooding, and landslides. For example, homes built with adobe, need to be in low-hazard areas and the adobe reinforcement methods developed at Peru's Catholic University need to be applied there

  Confined Masonry (CM) housing was developed in the Chimbote area in 1970-74 by former UNI students. It was tested in the Pisco 2007 earthquake with good results. According to a special session on the matter, during the 14th World Conference on Earthquake Engineering, Beijing, 2008, the conclusion was that CM is one of the most effective and cheapest methods to take seismic loads, and it is easy to build, as brick construction is very popular globally.

  A prefabricated modular quincha house, because of its small mass, is able to take "G" horizontally. The late professor emeritus Joseph Penzien at the UC Berkeley, was requested by China to offer a lecture there on the Peruvian quincha.

  In general wooden and bamboo houses, because of their light weight, are adequate for soft soil, that greatly amplifies the seismic waves and high seismic intensity is expected there.
- Reinforced concrete buildings designed with seismic codes from the 1990´s to date are safe in general; however, new problems arose from the experiences of the Northridge, CA 1994 and Kobe, Japan, 1995 earthquakes. Damage to non-structural elements and contents accounts for over 80% of losses in buildings. In the case of hospitals in Kobe, the structural damage was only 8% of the damage, and 92% was due to damage to non-structural elements and contents.
- The practical Guide (PG) to reduce earthquake, flooding, and landslide damage to water and sewage systems, developed by the World Bank, taking as a study case the effects of Peru 2007 on WSS of Pisco city, may be useful to protect water supply systems to comply with the Millennium Development Goals to halve the number of people who not have access to clean drinking water by 2015.

As a university professor, some self-criticism is necessary in the sense that the Peruvian universities are not producing the professionals that the country needs for disaster risk reduction. For example, not only in civil engineering and architecture, in which the course contents are already obsolete, but also in social sciences, education, and the police academy, professionals who are in direct contact with the communities, their participation in risk reduction planning and executions is very important. It is to be hoped that in the long term, local authorities may have the necessary knowledge in disaster risk reduction.

As a member of the UNISDR Advisory Panel of the World Disaster Campaign 2010-2015 Making Cities Resilient My City is Getting Ready, I apologize for not doing enough. This paper intends to provide some contribution.

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