COMMENTS ON THE HISTORY OF EARTHQUAKE CASUALTY ESTIMATION

Karl V. Steinbrugge
Consulting Structural Engineer

It is a pleasure to have this opportunity to give my comments on the history and background of earthquake casualty estimation. It is also an opportunity to meet again with some of the persons who have been actively engaged in these endeavors for about 20 years.

Earthquake Casualties and Vulnerability Studies

To my knowledge, the first major report which included estimated earthquake casualties was prepared by NOAA for the Office of Emergency Preparedness in 1972 under the title of "A Study of Earthquake Losses in the San Francisco Bay Area: Data and Analysis." Consultants to this study who are also invited participants to this workshop include Frank McClure and Henry Lagorio. Robert Olson was the project officer for the Office of Emergency Preparedness, now known as FEMA.

I well recall the beginnings at a meeting in Santa Rosa, California, where some of the consultants met with Bob and his boss, Mr. O'Callaghan (who later became Governor of Nevada). These were primeval days in vulnerability studies. For example, high officials of one public utility exerted considerable pressure on us to remove all statements regarding possible damage to their facilities since their designs were earthquake resistive. The need for death and injury estimates were a necessary component of this and subsequent vulnerability studies, but persons with this kind of experience were unknown. The casualty estimates were developed principally by the design professionals, that is, persons such as structural engineers and architects.

About 90 pages of the 1972 study were devoted to earthquake casualties, impacts on hospitals, nursing homes, blood banks, and health care professionals. The available data and methodology development for quantifying the losses and their impacts were stated in that report. As head of the consulting group, I can say that the casualty estimates were the best available, but certainly very far

from good For example regarding the number of injuries as a ratio of the number of deaths, I quote from page 118 of the NOAA study:

> It will be assumed for planning purposes that a 4:1 ratio applies for "serious" injuries to deaths, with "serious" injuries being defined as those requiring hospitalization, however brief For non-serious injuries, the ratio will be taken as 30:1.

"Serious" is not broken down by type of injuries. There was insufficient hard data to support the ratio of injuries to deaths. Such was the state of the art at that time. It remained essentially unchanged in governmentally supported vulnerability studies for years to come. As a matter of fact, the quality of casualty estimates has decreased in recent years since available funds for recent studies have not allowed improvements in the source data.

National Public Policy

I now would like to turn to national public policy matters relating to casualty estimation. All of us at this workshop have been affected by the National Earthquake Hazards Reduction Program (NEHRP). This program was the result of the earthquake Hazards reduction Act of 1977 (Public Law 95-124) Charles Thiel attending this Workshop had a major role in its passage.

My first significant exposure with national earthquake hazard reduction public policy came in 1970. Then, as chairman of the Task Force on Earthquake Hazard Reduction in the Office of Science and Technology in the Executive Office of the President, we issued a report on earthquake "Program Priorities." This was one of the studies leading to the aforementioned 1977 law. In 1978, the Working Group on Earthquake Hazards Reduction in the successor Office of Science and Technology Policy issued the report "Earthquake Hazards Reduction: Issues for an Implementation Plan." Subsequently, many reports were published on the scientific and engineering needs, funding requirements, and responsibilities of the four Federal NEHRP agencies.

Vagaries of the budget process did not often satisfy expectations. Governmental support for NEHRP has varied, certainly influenced by some ambiguity in the enabling law. Despite that, all NEHRP agencies took their roles seriously In my view, the accomplishments to date have been quite satisfactory but, of course, not as great as everyone may have wished.

As I review the past, the various public policy studies, as well as Public Law 95-124, have spoken almost exclusively to agencies oriented towards the physical sciences and their engineering Public Law 95-124 states in its findings "...Earthquakes have caused, and can cause in the future, enormous loss of life, injury,..... " All public policy studies, scientific research, engineering progress in building design, and those of other related disciplines have hazard reduction as their goal. Certainly, it can't be otherwise.

But let us reflect on the required decades before there are major reductions in potential casualties. Casualties arise directly from man-made construction. Hazardous structures are found in the very large inventory of existing construction. Each year, new construction changes the total American building inventory by only a few percent. This means that the potential number of casualties is reduced by only a very small percentage each year In the next few decades, despite any great breakthroughs in science and engineering, expected casualties in a great earthquake will be reduced from "enormous loss of life," to probably "great loss of life" in much of the United States Precautions taken in response to short-term earthquake predictions could greatly lower the number, but current expectations for such predictions are not high.

Reducing the number of casualties has been accelerated in a few states by retrofitting hazardous buildings to a standard less than that for new earthquake resistive buildings. Retrofitting hazardous structures certainly reduces the life hazard, but not to the same degree as that for new construction.

Curiously, the medical and health care sciences and professions are little mentioned in almost all public policy studies, despite the expected casualties after a disaster. Admittedly, these disciplines are deeply involved in disaster response planning. On the other hand, they are not an integral part of the NEHRP process.

History and the Future

I don t believe that I should be here reciting history if the experience doesn't have meaning towards this workshop's goal. I strongly support the stated goal to "prepare the best casualty estimation model which we can" in the next 12 months. It will be a moving target, but well worth pursuing.

From my perspective of having been involved in 10 major vulnerability studies throughout the United States, certain kinds of multidisciplinary information after earthquakes will greatly improve the quality of future vulnerability studies.

As I see it, there is a significant need for improved scientific - engineering - medical interdisciplinary efforts. Data collected by one discipline often is of a kind which is incomplete and only partially useable by other disciplines. For example, for disaster response planning there is a need to know not only the breakdown of types and treatments of the injured, but their number. This is not possible without knowing the building classes, occupant loads, and expected injuries by type. An adequate, but not burdensome, multidisciplinary paper trail needs to be developed and used after each event. Research grants should acknowledge this need. Examples of these kinds of problems and needs were discussed in the U.S.G.S. Open File 90-244, "A Meeting of the U.S. Ad Hoc Working Group on 'Earthquake Related Casualties'," July 13, 1989, Baltimore. Other recent and forthcoming conferences have and will also relate to these issues. The opportunities for this workshop are evident and excellent, but not necessarily easy to achieve.

I would like to pose a problem for your consideration. Quite reasonably, medical researchers could obtain only the data necessary for their study. However, this does not satisfy any of the needs for disaster response planning since incomplete data will not provide best aggregate death and injury projections for future events. Immediately after a great emergency, record keeping takes a reduced priority, as it should. Thereby, a relevant multidisciplinary paper trail regarding details on casualties (auto, home, brick parapet onto sidewalk, kind of building and its occupant load at risk, etc) becomes more difficult. Hospitals and others will not have the resources or patience to have several researchers

working with their files for differing purposes. Experience shows that they prefer one person. I suggest that you examine mechanisms which should be developed to obtain the multidisciplinary information.

Seismologists have a variant of the problem. For example, seismic records may come from instrumental networks paid for by the USGS, but operated by a private university. A reasonable compromise is worked out on the timing of the release of these data paid for by government to become available to anyone who asks.

I would like to leave you with a second thought Has not the time arrived to add an agency to the NEHRP group which will represent the medical and health care disciplines? The recent Armenian earthquake has shown the intensely growing interest in earthquakes by epidemiologists, and excellent work has been done by them. In my view, this time has arrived

I do hope that the experience from history will be of assistance in your deliberations.

Thank you.