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EARTHQUAKE RISK ASSESSMENT FOR INDUSTRIAL FACILITIES IN ISTANBUL

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GENERAL TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

Following the losses suffered during the two major earthquakes that struck Turkey in 1999, there has been a broad recognition among Turkey's governmental, non-governmental and academic organizations of the need for extensive response planning based on detailed risk analyses of likely seismic hazards in Turkey general and, Istanbul, in particular. One of the largest risks evidenced by the earthquake and partly assumed by the insurance sector has been associated with the industrial facilities.

This report is prepared by the Department of Earthquake Engineering of Boğaziçi University for Munich Reinsurance Company within the framework of the project entitled 'Earthquake Risk Analysis of Industrial Facilities in the Istanbul Metropolitan Area'.

The project starts with the assessment of the probabilistic and deterministic earthquake hazard in the region based on regional seismicity, tectonics, and appropriate attenuation relationships. Earthquake hazard assessments, conducted in connection with risk analysis are generally related to a scenario earthquake in a deterministic manner. For Istanbul a scenario earthquake is determined to take place on the Main Marmara Fault. Deterministic site-specific hazard maps constitute the products of this section. For the general inventory of industrial facilities digital data from Istanbul Metropolitan Municipality and Turk-Telekom analog maps are utilized. For the inventorizarion of large size industrial facilites and industrial parks helicopter flights and other special surveys are conducted. Damage to indusatrial facilities in past earthquakes in Turkey constitute an important part of the study. This study is supported by the comrehensive questionnaire survey carried out. The vulnerabilities of industrial facilities are investigated in on the basis of different sectors and also on the basis of main components of industry. The earthquake vulnerability relationships of most of the components of industrial facilities were essentially based on the observations acquired from past urban earthquakes and the regressions provided by US-Applied Technology Council, appropriately amended with domestic data. The study culminates with a general assessment of risk to industrial facilities in Istanbul and with general suggestions for the improvement of existing level of earthquake performance.

The study incorporates generic description of damage expected in industrial facilities depending on the earthquake intensity that they will be exposed in the case of the occurrence of the scenario earthquake. However, for the professional engineer, the report contains enough information and data to enable him/her to carry out a first order estimate of the specific earthquake risk to a given industrial facility.

A word of caution in interpreting these loss results would be appropriate for the end users. History has taught that the next major earthquake to affect a city (for that matter Istanbul) will likely be somewhat different from the "scenario earthquake" anticipated as part of an earthquake loss assessment investigation done here. The magnitude and location of the earthquake and the associated faulting, ground motions and soil failures will not be precisely what has been anticipated. Thus, the results should not be interpreted as a prediction but rather as an indication of what type of losses may take place. Istanbul has an enormous variety of industrial facilities with different sizes, shapes, and structural systems built with highly variable construction practices over long periods of time. To deal with this heterogeneity and complexity the loss methodology used in this study gross assumptions are made in their

groupings based upon key vulnerability characteristics. Under these uncertainties the estimated losses depend upon the "law of averages", in other words are applicable to a population of industries rather than individuals.

The scenario earthquake that has been selected qualifies for the so-called "Credible Worst Case Scenario", as such there exist a substantial possibility that a somewhat smaller earthquake(s) (Moment magnitude between 7.0 and 7.5) may take place. As such the losses should be regarded as upper bounds within their uncertainty. On the other hand in the deterministic hazard assessment we have used the median (50-percentile) of the attenuation relationships. Thus, statistically there exist a 50 % chance that the hazard results will less that or greater than the hazard value used in the loss assessments.

What will be needed, in the context or mitigation of the industrial losses, is the dissemination of the information contained in this report to technical personnel in charge of disaster planning and mitigation and to sensitize the CEO of the facilities. If this dissemination is not adequately conducted, the return of this study will only be marginal.