PIROUZ KHANLOU

The construction explosion in downtown Baku creates extremely high density. Since there has not been adequate Urban Planning strategy, the infrastructure is vastly overburdened. October 2005.

undermine the strength of concrete and make buildings especially vulnerable to earthquakes. Unfortunately, Baku builders are often negligent with these tasks.

FAILURE TO "CURE" CONCRETE

Concrete must be poured when climatic conditions are neither too hot, too cold, too dry or too windy. Any of these conditions will cause the concrete to crack. In Baku the greatest concern is heat and wind. In such conditions, extreme care must be taken to cover the concrete to keep it moist and allow it to dry slowly—a process known as "curing". In hot weather—above 30C (86F)—or during high winds and low humidity, concrete can dry out easily. Particular care needs to be taken during the curing process.

This past summer, for example, temperatures often exceeded 40C (104 F). Yet many workers at construction sites kept on pouring concrete without curing it, and then they moved right on to the next level of construction before the lower level had a chance to dry adequately. Concrete must be cured properly in order to increase its strength, durability, water tightness, and resistance to wear.

DILUTING CONCRETE WITH WATER

The strength of concrete is determined by its ratio of sand, cement and aggregate to water. This becomes a critical issue in Baku when concrete must be pumped to the higher floors. Many contractors unscrupulously cut costs by diluting the concrete with additional water to make it thinner which makes it easier to pump to the higher elevations. Additional pumps should be used to provide the power to lift the heavy cement. Unfortunately, diluting the concrete causes the segregation of its components and severely compromises the strength of the concrete—a guarantee for disaster in earthquake regions.

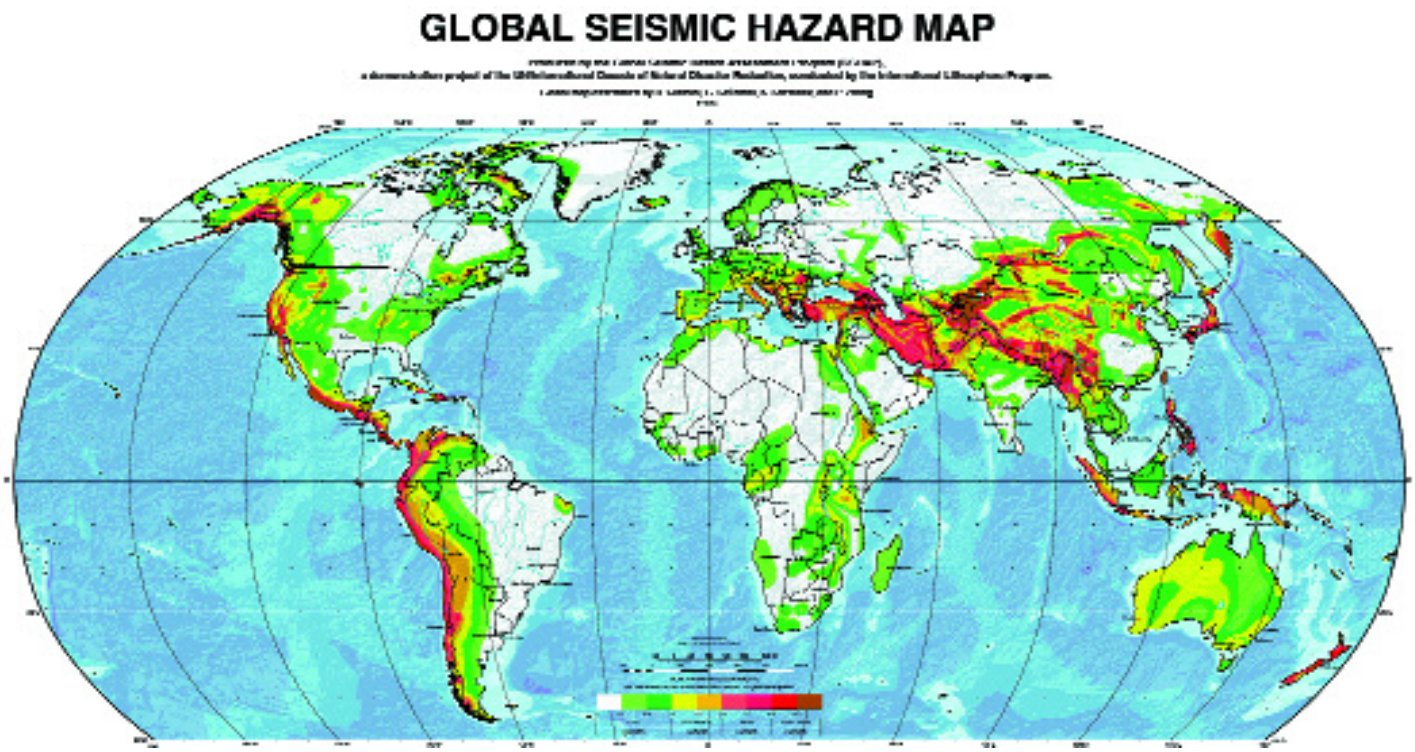
VIBRATION PROCESS

The correct use of vibrators is necessary in order to eliminate air pockets that may occur in the process of mixing concrete; otherwise, air pockets will remain in the construction of concrete beams, columns and slabs exposing the steel rebars. Again, this process weakens the concrete.

FAILING TO TEST CONCRETE

During the construction process, it is necessary to constantly monitor the strength of concrete. Concrete cubes should be made from the same ready-mixed concrete that is being used in the building. A test, known as "crash testing", is carried out in a laboratory to determine strength of the concrete. Unfortunately, many construction sites in Baku do not conduct such tests and, therefore, do not actually know the quality and strength of the concrete they are using. Since there is no official National Azerbaijani Standardization entity to determine the basic standards for the quality of construction materials such as cement and steel, low quality sub-standard grades and even defective materials are being dumped on the market in Azerbaijan. Some of these products are being manufactured within the country, others are imported.

Garadagh Cement, a Swiss-Azerbaijani joint venture, is extremely concerned about the quality of cement being used in construction throughout the country. At a press conference on October 4, 2005,



UNHAZARD ASSESSMENT PROGRAM IMAGE: COURTESY: ANDREW ALDEN AT: GEOLOGY.ABOUT.COM.

The World Global Seismic Hazard Map is a triumph of science, as the whole world has been mapped in terms of its earthquake hazard. The resulting map is the Global Seismic Hazard Assessment Project (GSHAP) to which 500 scientists contributed over a period of seven years.

Chairman of the Board Uve Kohler warned about serious problems in the building sector in Azerbaijan and predicted that most of newly constructed buildings would collapse in an earthquake—even of weak magnitude.

While Kohler vouched for the integrity of the Garadagh cement, he claimed that 50,000 tons of defective cement are being sold and used in construction in Azerbaijan on an annual basis.

SOIL AND GEOLOGICAL REPORTS

In earthquake prone regions, soil and geological reports must be conducted and seriously studied prior to doing any structural design and calculations. This is critically important in the preparation of the foundations and footings in buildings. Problems occur when soils of certain consistencies "liquefy" when the ground shakes, causing buildings to collapse—especially those with small footprints. Unfortunately, many developers do not bother to carry out soil and geological testing. Again, this is a recipe for disaster.

Not only are towers at risk, many of the older buildings that stand within their shadows, would be in jeopardy should any high rise building collapse above them. Although these lower buildings may have survived during moderate earthquakes in the past, today they may be at risk, not through any negligence of their own.

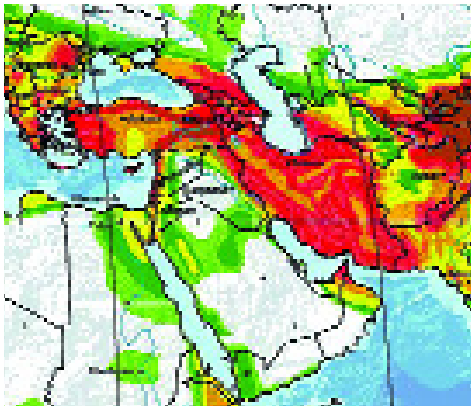
LANDSLIDES

Some areas in Baku—especially near the coast—do not have stable soil and geological conditions, making them prone to landslides. This is another reason why scientific analysis should be mandatory prior to any construction. There have been several recent devastating landslides that resulted in widespread destruction and even death. In the spring of 2000, a vast expanse of hillside in the south of the city, above the highway leading out of the city towards the Bayil district gave way to a massive land slide. More than 70 houses and shops were completely destroyed.

Another serious settlement took place in 2004 as a result of faulty engineering of a high-rise project under construction. Wide cracks suddenly appeared in the asphalt in the road north of the Cabinet of Ministers. Developers had not properly built a retaining wall. Residents from nearby apartments had to be evacuated and the avenue was closed for six months. This resulted in the closure of one of the main thoroughfares between the north and south ends of the city and further congested traffic in other parts of the city.

SAFETY GLASS

Glass is one of the most prominent features of these high-rise towers. However, even in a mild earthquake,



This map insert shows that Azerbaijan and neighboring countries, such as Iran, Turkey, Armenia and Georgia, are situated in one of the most seismically active zones in the world according to the World Global Seismic Hazard Map organized by the United Nations.

glass could instantly shatter, flying through the air—like thousands of daggers. Residents inside the apartments would be at risk, as would those living in adjacent low-rise buildings and pedestrians and passengers in cars in the streets below.

Tempered (toughened) glass drastically reduces such risk. When tempered glass breaks (and it certainly could even in an quake of low magnitude), it shatters into many small, cube-like pieces that are relatively harmless.

Another type of safety glass, known as laminated glass, has a transparent plastic sheeting sandwiched

BLAIR

Ornate stone carving on the facade of the Mitronoff Residence built during Baku's Oil Boom at the beginning of the 20th century. Buildings of that period are often highly decorative, inside and out. Many such buildings are being demolished and replaced with skyrise towers.

inside the glass. This prevents the glass from shattering and flying out. Unfortunately, it is extremely rare for contractors in Baku to use any of these types of manufactured safety glass in construction.

FIRES

In many parts of the world, the greatest damage from earthquakes comes from fires caused by gas explosions when gas mains or pipes break. California Building Code addresses this issue by requiring every building, old or new, to be equipped with automatic shut-off gas valves. This simple and relatively cheap device (less than $50) can prevent catastrophic fires and loss of life. Such basic equipment is not even known in Azerbaijan!

But if a fire were to break out in most of these towers, few of them are equipped to handle them. Most towers do not meet Western Standard Fire Codes. Many lack standard code fire alarm systems and don't offer sufficient fire emergency escape routes. Few have back-up, battery-operated emergency lighting to indicate where the exits are should the electricity suddenly be cut off.

Few buildings have been constructed using fire-rated materials of low combustibility, which retard the spread of fire. In addition, many buildings have used electrical systems manufactured from substandard cheap materials, which have no certified code approval from any recognized standard authority. Therefore, their safety value is not known and may not be reliable.

Then there is the question of the capability of the city even to fight fires successfully. When fires break out, traffic is likely to impede emergency vehicles from arriving at the scene of the fire in those first critical moments. In 1996, the British government donated fire-fighting equipment to Azerbaijan—80 Green Goddesses[10] (as the green fire trucks are called in the UK). These vehicles provided twice the pumping capacity of any fire equipment that existed in Azerbaijan at the time.

Intensive courses were provided so that Azerbaijani firefighters could train on the new equipment. But the current status of maintenance and training is not known. In addition, there were no high-rise towers in Baku a decade ago and so the question remains whether the existing fire fighting equipment could extinguish a fire that breaks out on the top floors of these 15-25 story buildings.

SHORT-TERM SOLUTIONS

The problems related to construction and development in Baku are so complex that they cannot be resolved quickly. It will take years of hard work and determination to rectify these problems. However, the current situation cannot be ignored. It is so critical and so dangerous that it requires immediate attention.

The best strategy would be to identify both short-term as well long-term solutions. Temporary stopgap measures would give the city a chance to "buy some time" during the transitional period to more permanent fundamental solutions. Here are a few preliminary steps that could be implemented quickly without considerable investment of time or money. Even these small steps could profoundly impact the city in a significant way.

1. HALT CONSTRUCTION PROJECTS

The first major step—fundamental to all decisions—would be to immediately freeze all construction projects on a temporary basis. No Building Permits should be issued at this time. Such a decision might seem radical, but it would be the best way to seriously begin to address construction issues to minimize future catastrophes and loss of life.

2. CONSERVATION AND RESTORATION COMMISSION

Baku desperately needs an active Commission for the Conservation and Restoration of the Architectural Heritage of the city. Some might argue that such a commission already exists, but if it were truly functioning as it