

Reducing urban and natural risks in Mexico City

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The director of Mexico City's incredible housing reconstruction effort after the earthquake of 1985 describes what happens when artificially induced ecological changes heighten a city's natural vulnerability. He calls for a reorientation of urban development — a qualitative long-term change to close the gap between the city's urbanization pattern and degree of vulnerability. He stresses the need for community development over the continuing development of a metropolitan program vast beyond reason.

In this last decade of the twentieth century, Mexico City — located more than 2,000 meters high, on an enormous lakebed — has become one of the largest metropolises in the world. Risk and disaster have always been part of life in the nation's capital. Home to more than 15 million Mexicans (about 19 percent of the country's population) who live in the Federal District and 17 surrounding municipalities, the city is a disjointed assembly of mixed urban habitats.

These habitats — located in the Valley of Mexico, surrounded by volcanos and mountain chains — differ in their subsoil, altitude, and degree of modernization. Their major infrastructure and service systems are not integrated, and a complex network of regulations and overlapping administrative jurisdictions operate in isolation, with no sense of metropolitan unity. The metropolitan area now covers nearly 1,500 square kilometers.

Economic, political, and cultural factors have all played a part in Mexico City's current problems. The period of fastest urban growth in the valley was from about 1955 to 1982, when expansion averaged 3 percent yearly. This period coincided with a general agricultural crisis in Mexico and the adoption of a development model based on a strong concentration of industry and services. At present, nearly 30 million industrial plants are located in the Federal District alone, which covers 55 percent of the metropolitan area. Although rural migration to the city has fallen off in the last five years, it

remains high, with about 300,000 new arrivals each year. Improvements in the Federal District's demographic policy have reduced the annual rate to 1.2 percent, but the same is not true of outlying areas in the State of Mexico, such as Chalco, in the Northeast of the metropolitan region, where the population is growing more than 5 percent a year.

The city's size, artificially induced ecological changes, and constant changes in the use and allocation of urban land have clearly heightened the city's vulnerability. When urbanization pushes the rate of expansion beyond a certain point, risk and vulnerability increase and become a constant factor that must be considered in the design and implementation of urban development policies. The city now lives with permanent risks of earthquake, landslides, floods, severe traffic congestion, and interruptions of the water and power supply to certain critical regions.

We live in an urban complex that began to deteriorate ecologically more than 400 years ago, when the Spanish *conquistadors* began the prolonged drainage of Lake Texcoco. This was completed only at the start of this century, but the consequences of this action are still at the root of many of our problems. In our time we have seen a city rapidly modernizing but as a result it is a victim of bold architecture that sometimes defies the swampy and geological nature of the basin of Mexico.

Its residents are aware of overexposure to contingencies of varied nature and magnitude. But not until the 1985 earthquakes did we become fully aware of our profound vulnerability as an urban commu-

nity. The painful experience of the 1985 earthquakes illustrates the vulnerability we live with daily and the community's ability to organize quickly in response to devastation from natural disasters.

The earthquake on September 9, 1985, reached 8.1 on the Richter scale. In parts of the city with soft and humid subsoils, or because of amplification, the intensity topped 10. The effects of the seismic waves caused the death of more than 5,000 people and damaged buildings more than eight stories high located in the epicenter, the central-eastern part of the city. Similarly, the duration of the earthquake destroyed older neighborhoods, multifamily dwellings, and such strategic service networks as the water supply, drainage, and main roads and avenues — thus delaying rescue operations.

But as a witness and actor in this period in the history of our capital, as head of the Popular Housing Reconstruction program, I can state that the emergency and subsequent reconstruction were times of unforgettable solidarity and human effort. Few countries and cities have gotten back on their feet in so short a time. Reconstruction was overwhelmingly successful. For example, 48,000 dwellings in the hardest hit areas were raised from the rubble — in the poor but well-serviced center of the city — within 18 months. Virtually all of the city's infrastructure and service systems were restored in only three months.

The terrible lesson of the earthquakes has resulted in increased

community awareness of not only the constant risks but also vulnerability caused by so-called overurbanization. The first step in reducing the vulnerability of the Federal District was the redesign and implementation of an integrated civil protection system. The second was a reorientation of the urbanization process and the city's development model

MODERNIZING THE FEDERAL DISTRICT'S CIVIL PROTECTION SYSTEM

The first task was to identify the most vulnerable zones and regions, especially the nature and scope of risks in the central and northeastern part of the city which, because of its soil and structures, is most likely to be affected by geological phenomena. The belt of gullies, depressions, and ravines that crosses the city from west to southeast has the highest risk of cave-ins and land faults, as well as flooding because of intense annual rainfall and inadequate storm drainage. The basic purpose of the civil protection system in the Federal District is to guarantee an organized, speedy, and efficient government and community response to any emergency and to coordinate joint efforts to restore normalcy in services and the rhythm of daily life.

The project to modernize civil protection has five strategic guidelines.

- Fostering solidarity.
- Local, decentralized responses to emergencies.
- Adequate training for each

population group by zone and type of activity.

- Coordination of the public agencies and the community to give the rescue effort a sense of unity and balance.

- An international exchange of experiences to introduce Mexico City to advanced technologies for the prevention of, and response to, disasters.

The spirit behind these strategies is solidarity and grassroots participation. All of our equipment and trained personnel are useless in a catastrophe if we cannot incorporate the solidarity, civic-mindedness, and the responsibility demonstrated by the millions of anonymous citizens who saved Mexico City in 1985. Specialized teams of volunteers must work with groups in the community, contributing their resources and personnel to promote more collective security. By the end of 1989, neighborhood organizing efforts in the Federal District had attracted 16,000 volunteers to the civil protection system. The second phase will tap the imagination and talent of these volunteers for tasks of such magnitude and importance that we must all join in.

REORIENTING URBAN DEVELOPMENT

Mexico City has reached a stage in its development that requires medium- and long-term qualitative changes to close the gap between the city's urbanization pattern and degree of vulnerability. We cannot say that Mexico City will stop growing or that its vast problems of pollution and vulnerability will cease to exist or continue to increase if we

reduce urban growth. But the urbanization pattern must be reoriented to stabilize the pollution and vulnerability indices, so that we can gradually make overall improvement and restore environmental quality.

For many years, urban growth meant that most investments went to expand such major infrastructure systems as the water supply, storm drainage, and the subway. Improvements were virtually the exclusive preserve of the modern microregions of the city, to the detriment of the poorer, deteriorated areas. True, many of the major infrastructure systems must continue to provide a centralized service that serves the urban whole. But most government action — whether to reduce pollution, improve the urban space, or diminish the uncertainty of foreseeable risks — should be a local, decentralized response to the priority demands of specific, localized social entities.

In the future, most investments in Mexico City must be made in mixed urban habitats. If they are to be integrated in a just and fair manner, community development must be stressed over the continuing growth of vast metropolitan programs. Aggregate demand must yield to priority demand — which should be met primarily by use of local resources.

Through group representation, communities must participate directly in managing everything that bears on their daily lives. This is the true meaning of democracy and the only real way for social justice to prevail in one of the largest cities in the world.

would have to be rebuilt. Rehousing on the expropriated sites was initially set at 46,700 dwellings, of which 23,200 (half) were to be rebuilt, 14,900 (32 percent) rehabilitated, and 8,600 (18 percent) improved by minor repairs. Exposing the structural elements revealed that many buildings slated for rehabilitation had to be replaced. So the number of reconstructed dwellings increased to 35,900.

The technical staff, together with architectural consulting firms, selected three prototype designs for reconstruction. RHP had to take a pragmatic approach to unit size, rebuilding for

an average family of 4-6 persons. Each dwelling unit has a minimum net area of 40 square meters, a kitchen/living/dining room with hot water, two bedrooms, a complete bathroom with shower, and a small laundry patio or balcony. The structures are all earthquake-resistant.

The architects and planners were ingenious in providing a diversity of building shapes and heights with a striking use of color and texture. Most buildings are three stories high, with grade beams of 20 x 40 centimeters, load-bearing walls, and reinforced concrete slabs. The structural beams on each floor are tied to the columns to

provide a rigid structural frame. The common walls serve as shear walls to provide added rigidity. Many of the sites had such poor (highly compressible, saturated) soil conditions that as much as 1.2 meters had to be excavated and replaced with compacted crushed stone.

2. INTENSE CONSTRUCTION AND SOCIAL ORGANIZING

The bureaucratic procedures for plan approvals, construction, modification, and completion of each building were streamlined between RHP, the Low-Income Housing Fund (FONHAPO), the office of the Federal District (DDF), and the National Bank of Works and Public Services (BANOBRAS). Plans and construction contracts for more than 3,000 sites had to be approved, so it was imperative to reduce approval time to days instead of months. Close daily supervision by zonal offices, community groups, and future condominium owners kept the construction on schedule. A technical team from FONHAPO helped RHP administer the loans. The average cost of the dwellings on the first group of sites was US\$4,030, so repayment was based on a down payment of 10 percent and the rest, US\$3,630, was amortized over 5.5 to 8.5 years, depending on the purchaser's ability to pay. Monthly payments were set at 20 percent to 30 percent of one minimum wage indexed to inflation. The payments were adjusted once a year using a computerized formula. A special municipal trust was activated to receive the monthly payments and maintain the loan portfolios. As construction expanded to hundreds of sites, construction management teams had to streamline their daily accounting and budgeting systems, which quickly reached a peak expenditure of US\$1 million a day. Auditors from the National Chamber of Deputies periodically reviewed the financial accounts. Their reports were published for public commentary — which was continually favorable.

Procurement

Under the emergency act to expedite procedures, in July 1986 RHP called for tenders on delivery of 12,000 toilets and 32,000 wash basins, kitchen sinks, and water heaters. The government and World Bank procurement guidelines on local and international competitive bidding were fully respected but early approval of

documents and down payments ensured on-time delivery. Savings of about US\$1.5 million were achieved by the bulk purchase, despite the difficulty of storing such quantities of goods.

By mid-1986, RHP had been asked to rehabilitate or restore more than 100 buildings considered to be of historic value, providing residential living space, security, and adequate sanitation within the program's budget. Project designers from the National Institute of Anthropology of History helped identify buildings that were candidates for restoration and conversion to residential use. In many of these old "mesones," densities before the earthquake were one family per room, so many families had to be relocated. The decision of *whom* to move was left to the group. Residents on the alternative site had accepted the move of those who were relocated. On acceptance, final sales prices and plans — including the date construction was to start, the date people were to move to temporary shelters, and the agreement to receive monthly rent during reconstruction — had to be ratified by all partners.

Help from social and community groups and universities was essential. Interdisciplinary groups of students of medicine, psychology, sociology, architecture, and engineering — coordinated by RHP social services — provided the much-needed social services in the temporary shelters, while RHP paid for utilities and provided security, fumigation, and maintenance and repairs to the sanitary installations. As a rule, the beneficiaries were willing to accept the rules of the reconstruction program.

Demand for temporary shelters increased and it was difficult to build more of them in the streets, so in May 1986 SEDUE acquired 28 hectares next to the airport on which to build 1,200 prefabricated dwellings. These were occupied initially by one family per room. When reconstruction was complete, they were modified back to one family per four rooms of about 48 square meters and sold to the beneficiaries. A total of 20,000 temporary dwellings were built. As a complementary measure, rent assistance was increased to significantly reduce the demand for temporary shelters.

By mid-December RHP technical and administrative teams were so immersed in construction management, with many sites operating around the clock, that they chose to work through their normal Christmas holiday to advance the program. In the first eight months of construc-

tion. RHP's construction management team maintained its output at the rate of more than 2,600 dwellings a month — a remarkable achievement. By the end of December 1986 (the end of Stage 2), 21,200 dwellings had been completed and 10,437 of them were already occupied. Dwellings were finished and assigned so quickly that it was necessary to speed up removal of the temporary camps — first those on the streets, then those on expropriated lots.

3. ALLOCATION OF DWELLINGS, REGISTRATION OF DEEDS

In January 1987, RHP began to restore the streets and parks that had been occupied by the temporary shelters. Sidewalks were repaired and the area was cleaned up, gardened, and repaved. On February 6th the International Union of Architects announced that RHP had won an international architectural award, the Sir Robert Matthew Gold Medal award. The reconstruction program was considered by the Architect's Union "the best piece of work on human settlements carried out internationally in the previous three years."

During this period, the Legal Department was verifying the massive data the notaries needed to legalize the transfer of deeds to the new owners and to register them in the Public Registry of Properties. This involved deeds for permanent housing on 2,870 lots constituted as condominiums, along with 46,720 individual deeds for each dwelling or commercial outlet. In addition, the 1,200 prefabricated dwellings near the airport were divided into 11 lots for deed registration. The Social Development Department undertook the problem of verifying the technical and social historical data on each lot. Each site development lot required a complete technical-social file. There were external problems as well. Many of the lots were unregistered and the Cadastral Office of Deeds had incomplete or no data. The Public Register of Properties was not equipped to handle this enormous load, so RHP had to send its personnel and computer data equipment to help check out the background information of the register in the Treasury, the Legal Department of the City Government, and the Tribunals. By the end of March 1987, they had distributed 1,807 deeds for individual dwellings and 188 condominium deeds. Construction was virtually complete, but on March 31 the President of the Republic

authorized that "closure" activities continue until the end of September 1987, that the Low Income Housing Loan Trust Fund (FIDERE) would recover the loans, and that the City Government would take over all of RHP's rights and obligations on RHP's demise.

4. COMPLETION OF PROGRAM

By July 1987 the reconstruction of 45,100 dwellings was completed. It had taken 14 months, with an average 3,220 dwellings a month. During the peak period of February-April 1987, RHP was completing more than 120 dwellings a day. To process final payments to the more than 700 construction contractors, on the more than 10,000 contracts of supplies and services, RHP developed a computer program that indexed construction costs to inflation and completion schedules. Final estimates were reviewed by building control personnel who sent them to finance personnel for verification. Contractors who owed money to RHP completed payment by certified check. If payments were due the contractor, a final balance sheet was sent to the financial department for final payment. RHP would return bond security on the advanced payment, leaving the bond covering construction warranties.

By the end of September, the rent payment assistance program was closed. It had benefited 19,900 families with an average of 364,704 pesos (US\$750) a family. Rent assistance, which lasted an average eight months per family, included payments for moving furniture and personal possessions twice. The loan portfolio for recovering the loans for 42,000 dwellings and commercial outlets and 2,745 lots (or 94 percent of the total) — together with the hardware and software used to administer the system — was handed over to the financial trust, FIDERE. By September 1987, the gross repayment (monthly payments, advance payments, and insurance) had reached about US\$10 million.

5. DIAGNOSTIC HISTORY

With the help of personnel from the General Archives of the Nation, RHP began analyzing the documentation for the whole program. The structure and content of the General Archives were designed so data could be retrieved for research. A building was rehabilitated to store: