



Risk Assessment for Emergency Shelter Planning

UN-Habitat, IFRC, ProVention Consortium Global Risk Identification Program (GRIP)
- Global Emergency Shelter Cluster -

Information needed for Pre-Disaster Planning



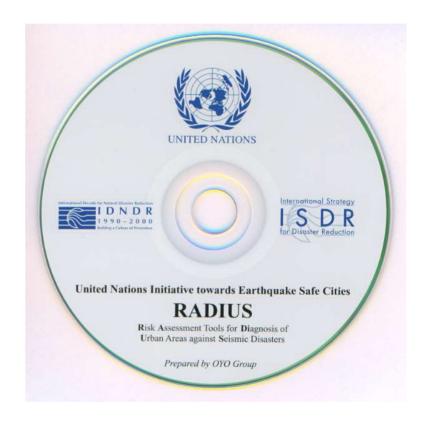
- How many killed people are expected?
- How many injured people are expected?
- How many hospital beds are available?
- How many displaced people are expected?
- What are the most affected areas?
- Where are the safer areas?
- How many shelter-buildings are available?

Simple Damage Estimation Software



RADIUS Tool

CD-ROM including
TOOLS and RADIUS city
reports. Distributed for
FREE to city
administrators of cities
worldwide by the UN and
RADIUS institutes.



Software Purposes

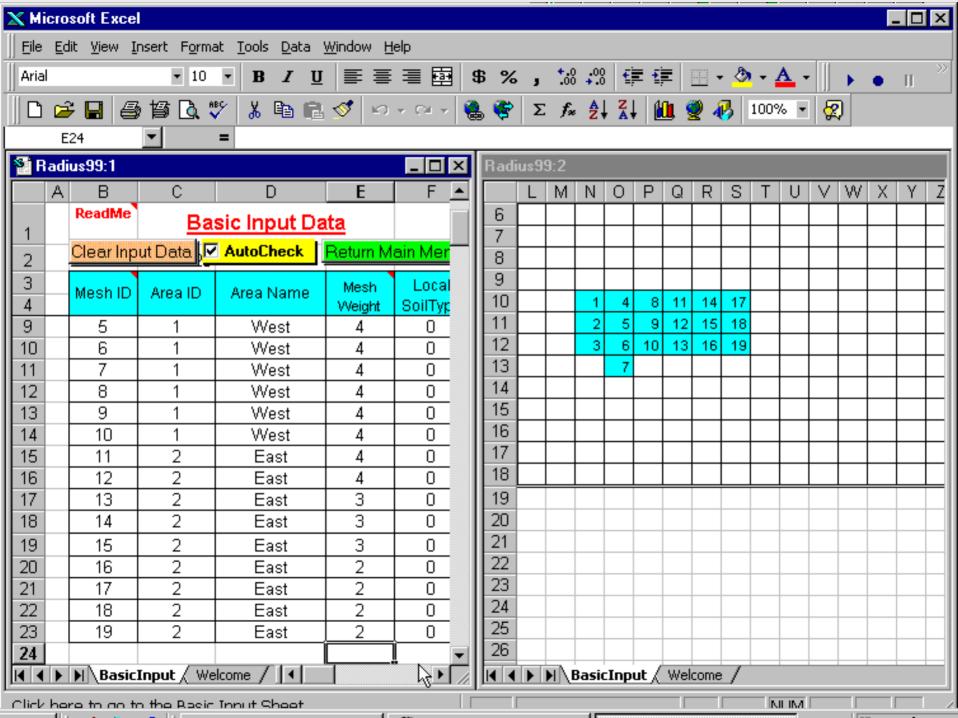


- To facilitate preliminary estimation of earthquake damage
- To be used by city administrators and general public, not for research purposes

To assist in decision making

 To raise awareness of earthquake risk







Program uses commonly available city information

- Shape of target region (entered as a grid)
- Population and its distribution
- Building Inventory and its distribution
- Ground Characteristics (Soil conditions)
- Lifelines information
- Choice of Scenario Earthquake and its parameters

Outputs



- Ground Shaking Distribution (PGA or MMI Intensity)
- Building damage
- Lifelines damage
- Human Impact (number of deaths and injuries)
- Summary Tables and Thematic Maps showing the results

Applications – Pre-Disaster Phase



- Shelter planning
 - Quantity
 - Location
- Legal and institutional agreements
 - Responsibilities at all levels
 - Inter-city agreements
- Revision of existing contingency plans
- Simulation exercises

Immediately after the disaster



- Very fast, accurate assessment of actual damages
- Total physical and human impact
- Most affected areas
- Identification of safe areas
- Shelter buildings that remain available
- Response facilities still working (hospitals, fire stations, police stations)
- Accessibility conditions

Immediately after the disaster



- Assessment of response capabilities
- Setting up response priorities
- Optimization of response resources
- Refinement of response strategy
- Monitoring of response implementation
- Coordination and updating of response process

Post-disaster phase



- Preparation of recovery scenarios to adjust shelter operations
- Preparation of recommendations for recovery planning
- Control for no risk re-creation
- Better coordination with early recovery activities
- Design of exit strategies

Methodology Development



- Pilot applications
 - Mozambique, Mexico, Nepal
- Training modules
 - Training for trainers
 - Self-teaching materials
- Large-scale implementation strategy
 - Recommendations

Methodology Development



In parallel

- Develop a new tool for floods risk
 - Urban areas Existing tool
 - Rural areas New tool
- Timeline
 - First phase
 - 3 Pilot applications July 2009
 - Training modules December 2009
 - New tool for Flood Risk August 2009
 - Second phase
 - Pilot applications of new tool December 2010

Long-term Implementation strategy



Users

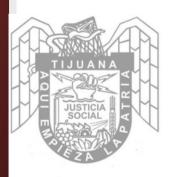
- Local emergency response organizations
- Local Red Cross → International organizations
- Time requirements
 - Training and installation: 2-3 weeks
 - Pre-Disaster Shelter plan: 6 months
- Geographic scope
 - High-risk Low-capacity countries
 - Medium and large cities (5/country)







Risk Mapping for Strategic Planning of Shelter Response in Tijuana, Baja California, México



Antonio Rosquillas and Luis Moreno

CICESE 35 ANIVERSARIO

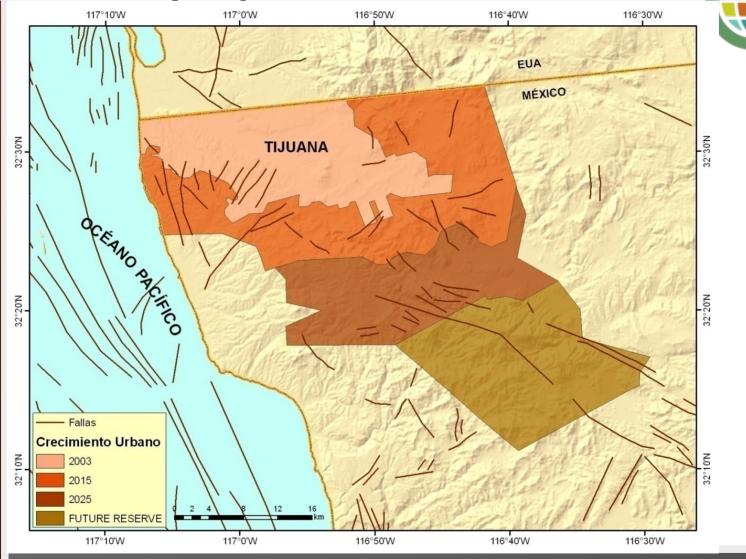
Municipio de Tijuana

H. AYUNTAMIENTO TIJUANA B.C.

June 2009

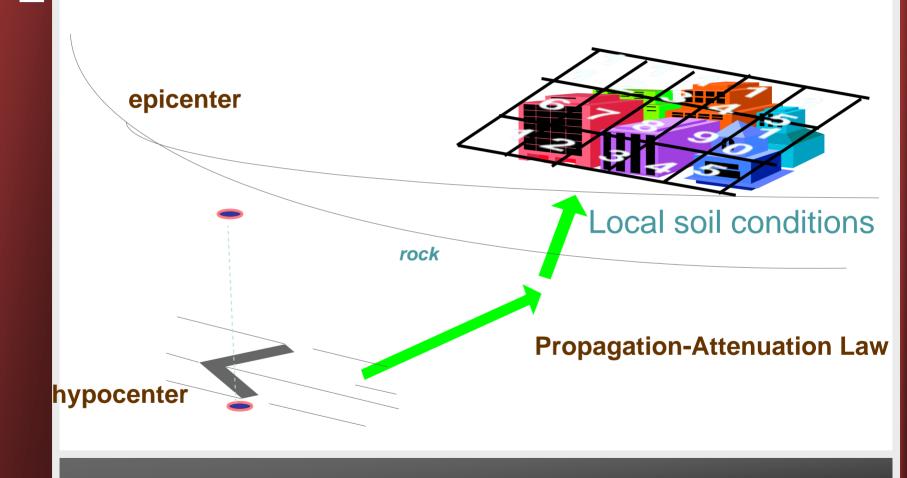
CENTRO DE INVESTIGACIÓN CIENTÍFICA Y DE EDUCACIÓN SUPERIOR DE ENSENADA.

Area of Study: Tijuana Urban Area



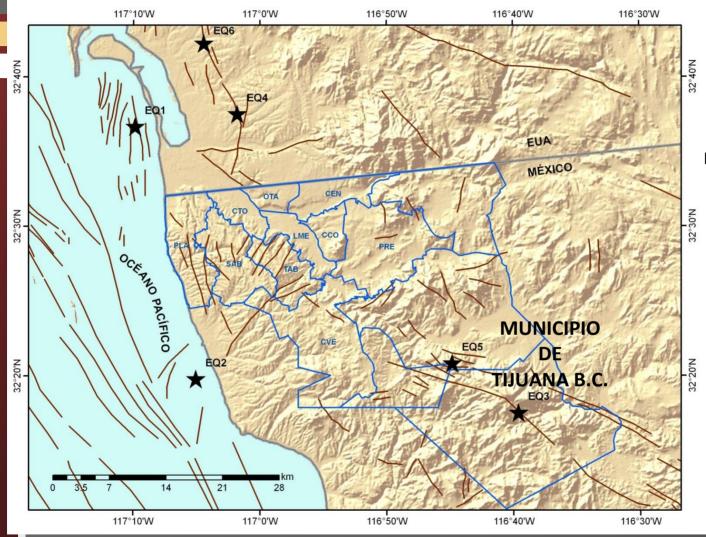
Components of EQ damage estimation





Plausible events





DELEGATIONS AND
EPICENTRAL
LOCATIONS (6) OF
EARTHQUAKE
SCENARIOS,
MAGNITUDE= 6.5

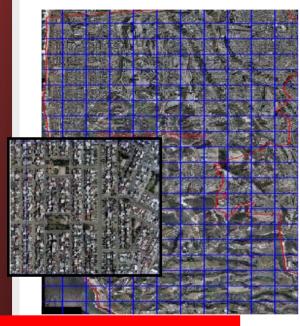
Mesh Generation (using aerial photos)



SAN ANTONIO BUENOS (SAB) DELEGATION

ORTOFOTO

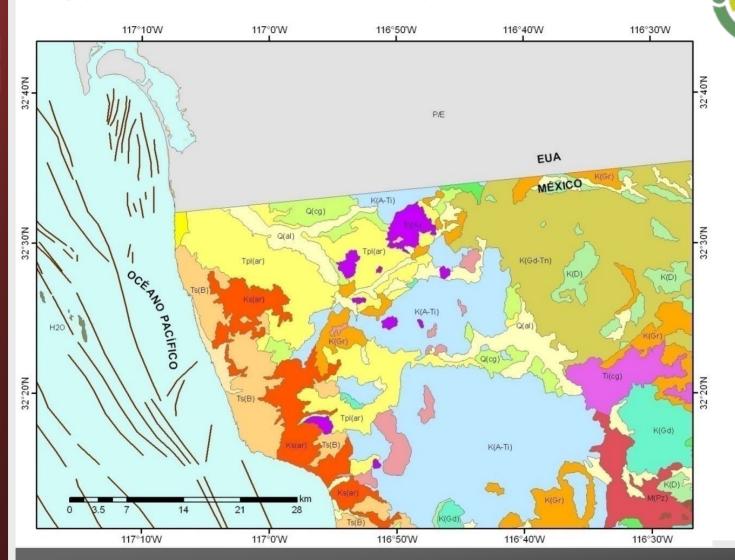




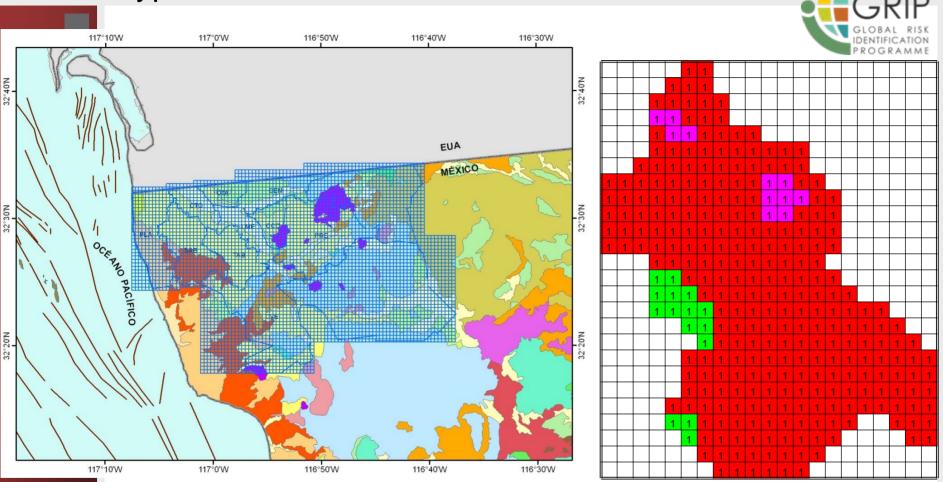
MESH 500X500 meters

| _ | 1 | | _ | | | | _ | | _ | | | | | | | | | | | _ |
|---|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | | | | 48 | 71 | | | | | | | | | | | | | | |
| | | | | 31 | 49 | 72 | | | | | | | | | | | | | | |
| | | | 17 | 32 | 50 | 73 | 96 | | | | | | | | | | | | | |
| | | | 18 | 33 | 51 | 74 | 97 | | | | | | | | | | | | | |
| | | | 19 | 34 | 52 | 75 | 98 | 120 | 142 | | | | | | | | | | | |
| | | | 20 | 35 | 53 | 76 | 99 | 121 | 143 | 164 | 185 | 206 | | | | | | | | |
| | | 11 | 21 | 36 | 54 | 77 | 100 | 122 | 144 | 165 | 186 | 207 | | | | | | | | |
| 1 | 6 | 12 | 22 | 37 | 55 | 78 | 101 | 123 | 145 | 166 | 187 | 208 | 227 | | | | | | | |
| 2 | 7 | 13 | 23 | 38 | 56 | 79 | 102 | 124 | 146 | 167 | 188 | 209 | 228 | 245 | | | | | | |
| 3 | 8 | 14 | 24 | 39 | 57 | 80 | 103 | 125 | 147 | 168 | 189 | 210 | 229 | 246 | | | | | | |
| 4 | 9 | 15 | 25 | 40 | 58 | 81 | 104 | 126 | 148 | 169 | 190 | 211 | 230 | 247 | | | | | | |
| 5 | 10 | 16 | | | 59 | 82 | 105 | 127 | 149 | 170 | 191 | 212 | 231 | 248 | | | | | | |
| | | | 27 | 42 | 60 | 83 | 106 | 128 | 150 | 171 | 192 | 213 | 232 | | | | | | | |
| | | | 28 | 43 | 61 | 84 | 107 | 129 | 151 | 172 | 193 | 214 | 233 | 249 | I | | | | | |
| | | | 29 | 44 | 62 | 85 | 108 | 130 | 152 | 173 | 194 | 215 | 234 | 250 | 260 | | | | | |
| | | | 30 | 45 | 63 | 86 | 109 | 131 | 153 | 174 | 195 | 216 | 235 | 251 | 261 | 269 | 276 | | | |
| | | | | | 64 | | | | | | | 217 | | | | | | | | |
| | | | | | | | | | | | | 218 | | | | | | | | |
| | | | | | 65 | | | | | | | 219 | | | | | | | | |
| | | | | | 66 | 90 | 113 | 135 | 157 | 178 | 199 | 220 | 239 | 255 | 265 | 273 | 280 | 286 | 292 | 298 |
| | | | | | 67 | | | | | | | 221 | | | | | | | | |
| | | | | 46 | 68 | | | | | | | 222 | | | | | | | | |
| | | | | 47 | 69 | | | | | | | 223 | | | | | | | 295 | |
| | | | | | 70 | | | | | | | 224 | | | | | | | 296 | |
| | | | | | | | | | | | | 225 | | | | | | | | |
| | | | | | | | | | | | | 226 | | | | | | | | |
| | | | | | | | 113 | 171 | 100 | 104 | 200 | | | | | | | | | |

Soil Types Distribution in Tijuana



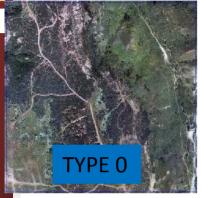
Soil Types Distribution



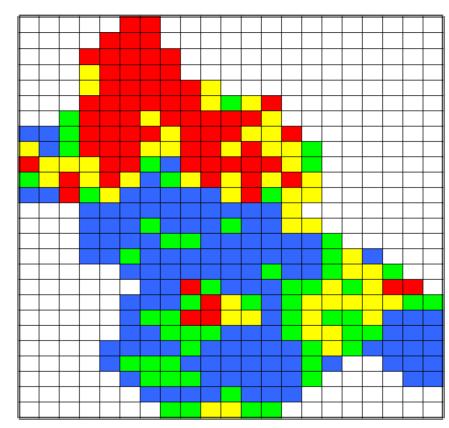
SUPERPOSITION OF MESH AND SOIL TYPES (TOPOGRAPHY INCLUDED)

Population Distribution







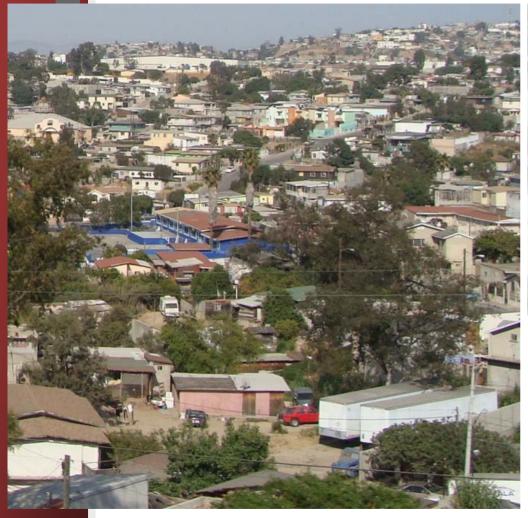






MESH WEIGHT BY POPULATION DENSITY using aerial photo

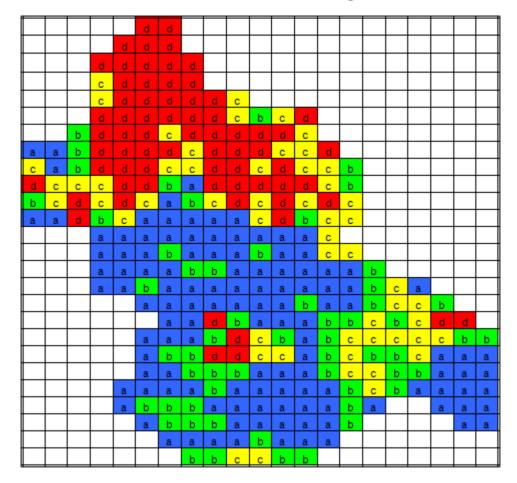
Building Types Distribution (SAB)





Building Distribution for SAB Delegation





| Aroa IF | Area | RES1 | RES2 | RES3 | RES4 | EDU1 | EDU2 | MED1 | MED2 | СОМ | IND | Sum |
|---------|------|------|------|------|------|------|------|------|------|-----|-----|-----|
| Area ID | Name | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) |
| 1 | SAB | 60 | 35 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |

Scenario Earthquake EQ6



| Read Me First | Scenario Earthquake I | nformation |
|---|---|-----------------------------|
| Scenario | | = |
| C H istorica | l Earthquak e | |
| Earthquake Information | | Attenuation Equation |
| Choose Scenario Earthquake | LANACION | Choose Attenuation Equation |
| Earthquak e Manitude | 6.5 Earthquake Depth (km) 8 | Joyner & Boore - 1981 |
| EQ Occurance Time (hrs) | 2 | |
| Reference | | |
| Enter Reference MeshID No | 280 Earthquake Epicentral distance (km) | |
| Choose EQ Direction relative from Ref. Mesh | North | OK & Return |
| relative from Ref. West | | |

MMI Intensity Distribution



| ı — | | | | | | | | 1 | i - | 1 | | | 1 | 1 | I | | 1 | 1 | _ | _ |
|-----|---|---|---|---|---|---|---|---|-----|---|---|---|---|---|----------|---|---|---|---|---|
| | | | | | d | d | | | | | | | | | | | | | | |
| | | | | d | d | d | | | | | | | | | | | | | | |
| | | | d | d | d | d | d | | | | | | | | | | | | | |
| | | | d | d | d | d | d | | | | | | | | | | | | | |
| | | | d | d | d | Ъ | d | d | d | | | | | | | | | | | |
| | | | d | d | d | d | d | d | d | d | d | d | | | | | | | | |
| | | С | С | С | С | d | d | d | d | d | d | d | | | | | | | | |
| С | С | С | С | С | С | С | С | С | С | d | d | С | С | | | | | | | |
| С | С | С | С | С | С | С | С | С | С | d | d | d | С | С | | | | | | |
| С | С | С | С | С | С | С | С | С | С | d | d | С | С | С | | | | | | |
| С | С | С | С | С | С | С | С | С | С | С | С | С | С | С | | | | | | |
| С | С | С | С | С | С | С | С | С | С | С | С | С | С | С | | | | | | |
| | | | С | С | С | С | С | С | С | С | С | С | С | | | | | | | |
| | | | а | а | С | С | С | С | С | С | С | С | С | С | | | | | | |
| | | | а | а | а | С | С | С | С | С | С | С | С | С | С | | | | | |
| | | | а | а | а | а | С | С | С | С | С | С | С | С | С | С | С | | | |
| | | | | | а | а | С | С | С | С | С | С | С | С | С | С | С | С | | |
| | | | | | | а | С | С | С | С | С | С | С | С | С | С | С | С | С | |
| | | | | | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С |
| | | | | | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С |
| | | | | | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С |
| | | | | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С | С |
| | | | | а | а | С | С | С | С | С | С | С | С | С | С | | | С | С | С |
| | | | | | а | b | С | С | С | С | С | С | С | С | | | | | С | С |
| | | | | | | b | b | b | b | b | b | b | b | | | | | | | |
| | | | | | | | b | b | b | b | b | b | | | | | | | | |

RADIUS calculates
PGA and then
Mercalli Modified
Intensities (MMI)

Building Damage Estimation (SAB)



| | | | | | С | С | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | С | С | C | | | | | | | | | | | | | | |
| | | | С | С | С | С | С | | | | | | | | | | | | | |
| | | | C | d | С | C | С | | | | | | | | | | | | | |
| | | | b | d | d | С | С | С | b | | | | | | | | | | | |
| | | | С | С | С | C | С | С | b | а | b | С | | | | | | | | |
| | | а | С | С | С | b | С | С | С | С | С | b | | | | | | | | |
| а | а | а | С | С | С | С | b | С | С | d | С | b | С | | | | | | | |
| b | а | а | C | С | С | Ь | b | С | С | С | d | С | b | а | | | | | | |
| С | b | b | b | С | С | а | а | С | С | d | d | С | b | а | | | | | | |
| а | b | С | b | С | b | а | а | b | С | b | С | b | С | b | | | | | | |
| а | а | b | а | b | а | а | а | а | а | b | С | а | b | b | | | | | | |
| | | | а | а | а | а | а | а | а | а | а | а | b | | | | | | | |
| | | | а | а | а | а | а | а | а | а | а | а | b | b | | | | | | |
| | | | а | а | а | а | а | а | а | а | а | а | а | а | а | | | | | |
| | | | а | а | а | а | а | а | а | а | а | а | а | а | а | b | а | | | |
| | | | | | а | а | а | а | а | а | а | а | а | а | а | b | b | а | | |
| | | | | | | а | а | b | а | а | а | а | а | а | b | а | b | b | b | |
| | | | | | а | а | а | а | b | b | а | а | а | b | b | b | b | b | а | а |
| | | | | | а | а | а | b | b | b | b | а | а | b | а | а | b | а | а | а |
| | | | | | а | а | а | а | а | а | а | а | а | b | b | а | а | а | а | а |
| | | | | а | а | а | а | а | а | а | а | а | а | а | b | Α | а | а | а | а |
| | | | | а | а | а | а | а | а | а | а | а | а | а | а | | | а | а | а |
| | | | | | а | а | а | а | а | а | а | а | а | а | | | | | а | а |
| | | | | | | а | а | а | а | а | а | а | а | | | | | | | |
| | | | | | | | а | а | а | а | а | а | | | | | | | | |

| Color | Automat | ic Range | Manual Range | | | | | | |
|-------|---------|----------|--------------|----|--|--|--|--|--|
| ID | From | То | From | То | | | | | |
| а | 0 | 18 | 0 | 18 | | | | | |
| Q | 18 | 35 | 18 | 35 | | | | | |
| C | 35 | 53 | 35 | 53 | | | | | |
| d | 53 | 70 | 53 | 70 | | | | | |

Shelter Needs Results

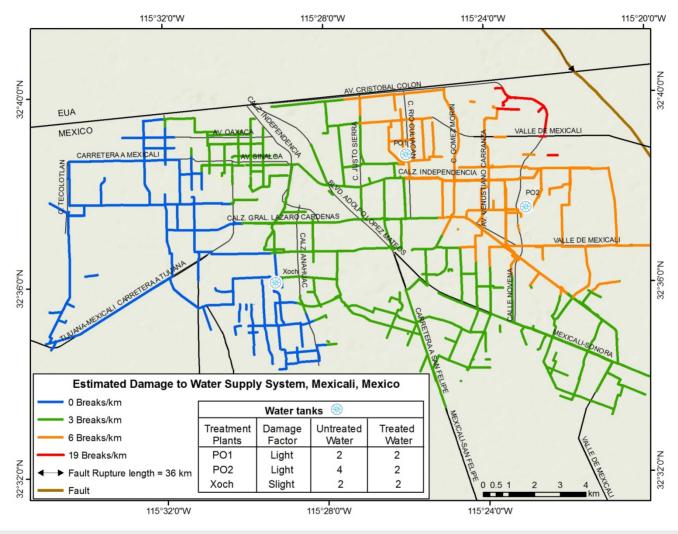


Number of people needing shelter for each of the six scenario earthquakes

| | SAB | CEN | СТО | ССО | CVE | LME | PRE | ОТА | PLA | TAB | Total |
|-----|--------|--------|--------|-------|-------|-------|--------|-------|-------|--------|--------|
| EQ1 | 10,000 | 4,622 | 8,917 | 3,282 | 1,226 | 5,839 | 7,276 | 4,497 | 6,372 | 6,246 | 58,277 |
| EQ2 | 12,392 | 4,593 | 6,853 | 3,661 | 3,184 | 7,012 | 8,576 | 3,341 | 5,335 | 9,503 | 64,449 |
| EQ3 | 3,025 | 2,792 | 1,942 | 2,400 | 1,360 | 2,751 | 8,457 | 1,266 | 947 | 3,648 | 28,588 |
| EQ4 | 12,465 | 10,140 | 11,085 | 6,676 | 1,703 | 9,942 | 15,133 | 7,984 | 6,019 | 10,169 | 91,316 |
| EQ5 | 4,986 | 4,504 | 2,900 | 4,289 | 2,581 | 5,317 | 16,561 | 1,993 | 1,456 | 6,338 | 50,925 |
| EQ6 | 6,411 | 6,063 | 5,761 | 3,581 | 1,032 | 4,979 | 8,437 | 3,985 | 3,216 | 4,979 | 48,444 |

Damage to lifelines







SHELTERS PLANNING

- GENERAL CRITERIA -

TEMPORAL SHELTERS IN MEXICO



- The National Defense Ministry is the first responsible office
- Schools are the first option for shelter
- For long-term dwelling rehabilitation, the arrangement of organized camps has been foreseen
- In Mexico, there is not any experience of temporal shelter provision in case of an earthquake.

Shelter deployment criteria



- Based on the damage scenario, schools located in areas of intensity less than VII, were chosen to be used.
 An average of 300 sheltered persons per school has been considered
- The open spaces (sport fields and parks bigger than 1000 m²) in the areas with intensity VII and up
- In the organized camps, local building materials will be used first and, if necessary, tents and camping houses

MMI Intensities for deployment criteria (EQ4) 117°10'W 117°0'W 116°50'W 116°40'W Earthquakes M = 6.5 Fault 32°40'N Political delegations **MMI Intensities EQ4** <7.0 7.0-7.5 7.5-7.9 >7.9 32°30'N 32°20'N 32°20'N 117°10'W 117°0'W 116°50'W 116°40'W

Institutional and legal frameworks



- The National Defense Ministry will apply the Plan DNIII created for natural disasters
- The local authority will use Project Sphere (IFRC) criteria for minimum requirements
- The local government, with the assistance of State and Federal governments, will provide the necessary supplies to all shelters
- Areas for supply centers and for foreign humanitarians teams are also identified

COORDINATION



Participants:

- Municipality
- State Government
- Federal Government
- National Defense Ministry.
- Marine Ministry
- Red Cross
- Volunteer Associations
- International Humanitarian Institutions and other countries

MORELOS PARK (open space) Area = 560 000 m² Shelter for 1000 people (42m2/person) Image @ 2008 Digital Globe S 505644.20 m E 3595651.01 m N Eye alt 1.11 km Feb 2006 Regional training on Risk Assessment, Dakar – November 25-27, 2009

ALAMAR RIVER (open space) Area = 924,638 m² Shelter for 20,000 people (risky in raining season)

GRIP - Global Risk Identification Programme, UNDP Bureau for Crisis Prevention and Recovery, +41 22 9178399, info@gripweb.org, www.gripweb.org

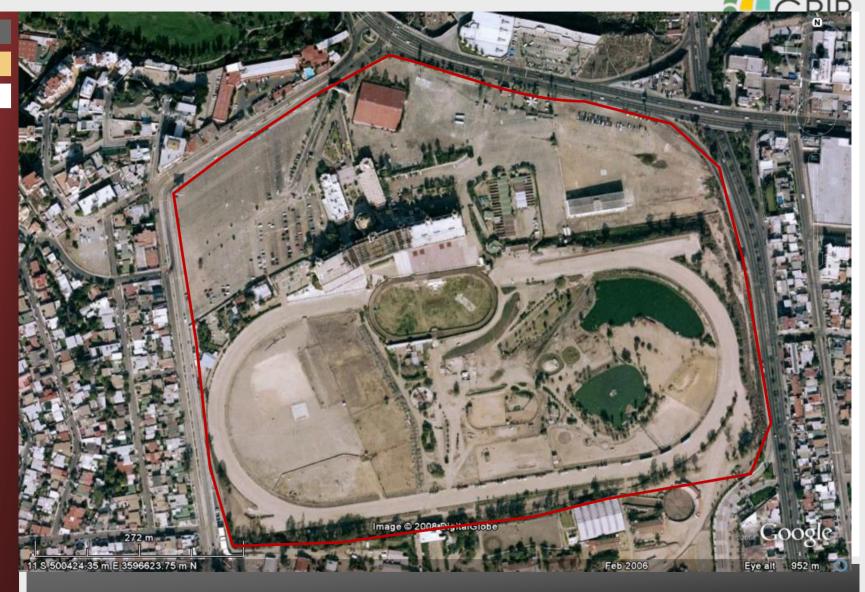
GOLF COURSE (open space) Area = 429,203 m² Shelter for 10,000 people (private) Image © 2008 Digital Globe Google Regional training on Risk Assessment, Dakar – November 25-27, 2009

AIRPORT (open space) Area = 593,234 m² External supplies reception



SPORT FIELDS Area = 358,115 m² Shelter for foreign teams (near airport)

RACE TRACK Area = 362,974 m² Shelter for 7,500 people (private)



MILITARY FIELD Area = 1,135,277 m² Supplies Image © 2008 DivitalGlobe Google 786 m Feb 2006 Eye alt 2.75 km 11 S 497812.53 m E 3592778.38 m N Regional training on Risk Assessment, Dakar – November 25-27, 2009

Shelter plan accessibility Coronado National City San Miguel More. < (7) Diego Bay (54) Chula Vista MORELOS Last Updated by Tijuana Earthquake Shelters on Jun Lemon Traffic More Мар Satellite Terrain Rancho **〈** ∜ **〉** San Diego SECUNDARIA GENERAL ESTATAL NUM. 115 Last Updated by Tijuana Earthquake Shelters on Jun San Diego Jamacha North Island NAS (125) /Halsey Field/ NOMBRE: SECUNDARIA GENERAL ESTATAL (54) National City INMUEBLES2: SECUNDARIA GENERAL ESTATAL NUM. 115 (54) Bonita DOMICILIO: CIRCUITO LOMA DORADA S/N CODPOST: 22214 Rancho Chula Vista TGRUPOS: 18 TALUMNOS: 653 SUPTERRENO: 4442 SUPCONSTRU: 1362 NUMEDIFIOS: 4 Imperial Beach 5 Get directions - Search nearby Naval Outlying Nestor Munici Zoom here - Send 905 Landing Field Tecate Tijuana Redondo Colonia Rancho Seco Regional training on Risk Assessment, Dakar – November 25-27, 2009

Simulation exercise (Sept. 18, 2009)



