Earth Sciences & Seismic Engineering Center

An-Najah National University

جامعة النجاح الوطنية
مركز علوم الأرض وهندسة الزلزال
Urban Risks in the Arab Region
(case study: Urban Risks in Palestine)

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(Earth Sciences & Seismic Engineering Center)

Regional Workshop on Urban Risk Reduction

Damascus, Syria, November 4. – 5. 2009
Contents

- Introduction: Natural Disasters and Climate Change in MENA
  - Frequency and Intensity of ND are increasing

- Risk assessment and the implementation strategies Of risk reduction programs

- Seismic vulnerability of buildings and infrastructures in Palestine (Buildings, site effect and urban planning)

- Urban planning and risk maps

- Conclusions and recommendations.
Increasing frequency and intensity of natural disasters pose serious challenges to the sustainability of development investments and the stability of economic growth in the MENA region.
The implementation strategies
Of risk reduction programs

Stop increasing the risk for new construction and infrastructures

Start decreasing the unacceptable risk for existing constructions and infrastructures

Continue preparing for the consequences of expected hazards
Five priorities for action

1. **Governance:** ensure that disaster risk reduction is a national and local priority with strong institutional basis for implementation.

2. **Risk identification:** identify, assess and monitor disaster risk and enhance early warning

3. **Knowledge:** use knowledge, innovation and education to build a culture of safety and resilience at all levels

4. **Reducing the underlying risk factors in various sectors** (environment, health, construction, etc.)

5. **Strengthen disaster preparedness for effective Response**
RISK ASSESSMENT

HAZARD MAPS
INVENTORY
VULNERABILITY
LOCATION

DATA BASES AND INFORMATION

RISK MANAGEMENT

- MITIGATION
- PREPAREDNESS
- EMERGENCY RESPONSE
- RECOVERY AND RECONSTRUCTION

ACCEPTABLE RISK

UNACCEPTABLE RISK

مخطات مقبولة (يمكن تحملها)
مخطات غير مقبولة (لا يمكن تحملها)

خريطة الأخطار
الجرد
قابلية الإصابة
الموقع

RISks:
GROUND SHAKING
GROUND FAILURE
SURFACE FAULTING
TECTONIC DEFORMATION
TSUNAMI RUN UP
AFTershocks

إدارة أخطاع

تخفيض
إستعداد
الاستجابة للطوارئ
الاستشراق
 وإعادة البناء
Risk Assessment

Risk = Hazard * Vulnerability

المخاطر = مصدر الخطر * قابلية الإصابة

القدرة

Jalal Al Dabbeek
Seismically information including historic and prehistoric data indicate that major destructive earthquake have occurred in the Jordan-Dead-Sea region, caused in several cases severe devastation and many hundreds and sometimes thousands of fatal casualties.
USAID-MERC Project, report 2004
Microzonation Maps

Liquefaction Map for M7.1

Study Area
Hayward Fault

Percent of area predicted to liquefy for M=7.1

- 73%
- 38%
- 3%
- < 1%
- 0%
- Water

2000 0 2000 Meters
Impact of 2003 Floods, Algiers.

Impact of 2008 Floods, Yemen

Between October 23-25, 2008, Yemen witnessed heavy sustained rains as a result of a level-three tropical storm that hit the country. The storm caused widespread flooding in several locations.
Case Study
Seismic vulnerability of Palestinian Common buildings
(Rapid Assessment)

European Macro Seismic Scale
(EMS-98)
Factors Affecting the seismic Vulnerability of Buildings:

- Building type
- Quality and workmanship
- State of preservation
- Regularity
- Ductility
- Position…..(Pounding)
- Strengthening
- Earthquake resistant design (ERD)
- Site conditions

The high vulnerability to damages and losses in the buildings and infrastructures in oPt, considered as a direct result of high percentage of weak buildings and infrastructures that do not comply with seismic resistant requirements

Jalal Al Dabbeek

Vulnerability Classes and Building Type
The high vulnerability to damages and losses in the buildings and infrastructures in oPt, considered as a direct result of high percentage of weak buildings and infrastructures that do not comply with seismic resistant requirements.
The high vulnerability to damages and losses in the buildings and infrastructures in oPt, considered as a direct result of high percentage of weak buildings and infrastructures that do not comply with seismic resistant requirements.
Palestinian Common Buildings – Architectural and Structural Configurations
Slenderness ratio

Palestinian Common Buildings – Architectural and Structural Configurations

1995 Japan
- Construction over existing old building.
Architectural Configurations
Nonstructural Damages
(learning from earthquakes)

Jalal Al Dabbeek
Figure 7: Formation of plastic hinge in the column near the beam-column joint in a hospital building in Manshera.
Dead Sea Earthquake of 11 February 2004, Mb 5.1 - Hospital
learning from earthquakes
### Table: Assigning the Vulnerability class.

<table>
<thead>
<tr>
<th>Category Code</th>
<th>Building Type</th>
<th>ERD</th>
<th>Slope</th>
<th>Position (seismic Joints)</th>
<th>Plan unsymmetry</th>
<th>Elevation</th>
<th>Slenderness</th>
<th>Short columns</th>
<th>Cantilever system</th>
<th>Soil Type</th>
<th>Building condition</th>
<th>Main Entrance</th>
<th>Importance</th>
<th>Vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nablus/Z210</td>
<td>R.C</td>
<td>Without</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>H-W&lt;sub&gt;H&lt;/sub&gt;</td>
<td>S4</td>
<td>G</td>
<td>?</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Nablus/Z211</td>
<td>R.C</td>
<td>Without</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>L</td>
<td>&lt;3</td>
<td>L-W&lt;sub&gt;L&lt;/sub&gt;</td>
<td>S1</td>
<td>E</td>
<td>-</td>
<td>1</td>
<td>!</td>
<td></td>
</tr>
<tr>
<td>Nablus/Z242</td>
<td>Masonry</td>
<td>Without</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>M</td>
<td>&lt;3</td>
<td>M-W&lt;sub&gt;L&lt;/sub&gt;</td>
<td>S2</td>
<td>G</td>
<td>?</td>
<td>1</td>
<td>!</td>
<td></td>
</tr>
<tr>
<td>Nablus/Z263</td>
<td>Masonry</td>
<td>Without</td>
<td>M</td>
<td>H</td>
<td>&lt;3</td>
<td>L</td>
<td>L-M-W&lt;sub&gt;M&lt;/sub&gt;</td>
<td>S4</td>
<td>B</td>
<td>-</td>
<td>1</td>
<td></td>
<td>!</td>
<td></td>
</tr>
<tr>
<td>Nablus/Z275</td>
<td>Old Masonry</td>
<td>Without</td>
<td>L</td>
<td>d=1cm</td>
<td>M</td>
<td>&lt;3</td>
<td>-</td>
<td>-</td>
<td>S4</td>
<td>V.G</td>
<td>?</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ERD: Earthquake Resistance Design

- **L**: Low
- **M**: Moderate
- **H**: High
- **V.G**: Very Good
- **G**: Good
- **W**: Without
- **L**: Low weight
- **B**: Bad
- **M**: Moderate weight
- **V.B**: Very Bad
- **W**: High weight

If a cell is blank, it indicates the information is not applicable or available.
Based on data collected and the analysis done according to EMS 98, the following vulnerability classes have been obtained.

<table>
<thead>
<tr>
<th>City</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>No.of buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nablus</td>
<td>35.5 %</td>
<td>42%</td>
<td>18%</td>
<td>4.5%</td>
<td>700</td>
</tr>
<tr>
<td>Ramallah &amp; Abudis</td>
<td>32%</td>
<td>39%</td>
<td>22%</td>
<td>7%</td>
<td>120</td>
</tr>
<tr>
<td>Hebron</td>
<td>43%</td>
<td>31%</td>
<td>26%</td>
<td>---</td>
<td>120</td>
</tr>
<tr>
<td>Jenin</td>
<td>45%</td>
<td>43%</td>
<td>12%</td>
<td>0%</td>
<td>100</td>
</tr>
<tr>
<td>Qalqilia</td>
<td>34%</td>
<td>45%</td>
<td>21%</td>
<td>0%</td>
<td>100</td>
</tr>
<tr>
<td>Tulkarim</td>
<td>41%</td>
<td>37%</td>
<td>19%</td>
<td>3%</td>
<td>80</td>
</tr>
<tr>
<td>Bethlahim</td>
<td>42%</td>
<td>39%</td>
<td>19%</td>
<td>0%</td>
<td>100</td>
</tr>
</tbody>
</table>
Site Effect

- Landslides
- Site Amplification
- Liquefaction
- Fault Rupture

Local site effect (landslides, liquefaction, amplification and faulting systems) play an important role on the intensity of earthquakes.
learning from earthquakes - Liquefaction
Due to its geology and location the Gaza Strip is expected to face Liquefaction phenomena in several areas if a strong earthquake occurred in the region in the future.
Fault Rupture

learning from earthquakes
Site Amplification
(Local Geology)
learning from earthquakes – Mexico City 1985,
Site effect Studies in Nablus City - Amplification
Dead Sea Earthquake of 11 February 2004, Mb 5.1

February 11 /2004
Dead Sea Earthquake of 11 February 2004, Mb 5.1
locations of measured sites in Nablus City.
Values of dominant frequencies (DF) and amplification factors (AF) at all measured sites in Nablus City.
<table>
<thead>
<tr>
<th>Site</th>
<th>Dominant Frequency Hz</th>
<th>Amplification Factor</th>
<th>Natural period Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.700</td>
<td>0.355</td>
<td>1.429</td>
</tr>
<tr>
<td>2.</td>
<td>0.688</td>
<td>0.335</td>
<td>1.453</td>
</tr>
<tr>
<td>3.</td>
<td>1.001</td>
<td>8.67</td>
<td>.999</td>
</tr>
<tr>
<td>4.</td>
<td>0.846</td>
<td>2.6337</td>
<td>1.182</td>
</tr>
<tr>
<td>5.</td>
<td>0.952</td>
<td>3.405</td>
<td>1.050</td>
</tr>
<tr>
<td>6.</td>
<td>1.2</td>
<td>2.6</td>
<td>0.833</td>
</tr>
<tr>
<td>7.</td>
<td>1.106</td>
<td>1.3928</td>
<td>0.904</td>
</tr>
<tr>
<td>8.</td>
<td>1.074</td>
<td>1.416</td>
<td>0.931</td>
</tr>
<tr>
<td>9.</td>
<td>0.7968</td>
<td>6.736</td>
<td>1.255</td>
</tr>
<tr>
<td>10.</td>
<td>1.0153</td>
<td>1.8937</td>
<td>0.984</td>
</tr>
<tr>
<td>11.</td>
<td>0.50505</td>
<td>3.3366</td>
<td>1.980</td>
</tr>
<tr>
<td>12.</td>
<td>0.5907</td>
<td>4.9102</td>
<td>1.693</td>
</tr>
<tr>
<td>13.</td>
<td>1.4918</td>
<td>2.9515</td>
<td>0.6703</td>
</tr>
<tr>
<td>14.</td>
<td>1.1299</td>
<td>1.9368</td>
<td>0.769</td>
</tr>
<tr>
<td>15.</td>
<td>1.0749</td>
<td>2.4102</td>
<td>0.930</td>
</tr>
<tr>
<td>16.</td>
<td>0.90594</td>
<td>.86625</td>
<td>1.103</td>
</tr>
<tr>
<td>17.</td>
<td>1.7701</td>
<td>2.8223</td>
<td>0.565</td>
</tr>
</tbody>
</table>
Fig. 6 space frame model of 4 story building in SAP2000

Fig. 21 ten story perimeter walls building - model
<table>
<thead>
<tr>
<th>Building type</th>
<th>Load Ton/m²</th>
<th>Period, T For Exterior frame</th>
<th>Period, T For Interior frame</th>
<th>Period, T For Space frame</th>
<th>Period, T Using UBC C97</th>
</tr>
</thead>
<tbody>
<tr>
<td>4_story frames</td>
<td>0.95</td>
<td>0.5</td>
<td>0.71</td>
<td>0.71</td>
<td>0.63</td>
</tr>
<tr>
<td>4_story frames</td>
<td>0.75</td>
<td>0.447</td>
<td>0.63</td>
<td>0.632</td>
<td>0.56</td>
</tr>
<tr>
<td>4_story perimeter walls</td>
<td>0.95</td>
<td>0.15</td>
<td>0.152</td>
<td>0.77</td>
<td>1.09</td>
</tr>
<tr>
<td>4_story perimeter walls</td>
<td>0.75</td>
<td>0.14</td>
<td>0.143</td>
<td>0.7</td>
<td>0.988</td>
</tr>
<tr>
<td>10_story frames</td>
<td>0.95</td>
<td>1.06</td>
<td>1.571</td>
<td>1.5</td>
<td>2.22</td>
</tr>
<tr>
<td>10_story frames</td>
<td>0.75</td>
<td>0.947</td>
<td>1.406</td>
<td>1.339</td>
<td>1.987</td>
</tr>
<tr>
<td>10_story perimeter walls</td>
<td>0.95</td>
<td>0.386</td>
<td>0.389</td>
<td>1.619</td>
<td>2.404</td>
</tr>
<tr>
<td>10_story perimeter walls</td>
<td>0.75</td>
<td>0.365</td>
<td>0.368</td>
<td>1.474</td>
<td>2.188</td>
</tr>
</tbody>
</table>
Landslides
learning from earthquakes
Site Effects ????

- Land Use Policy
Jalal Al Dabbeek
Seismic vulnerability – Nablus city

Jalal Al Dabbeek
Seismic vulnerability – Nablus city

Urban Risks and Risk Map

Jalal Al Dabbeek
NABLUS CITY
Classification of areas for survey purposes
(ROADS)
Jafal Al Dabbeek

Case study – Amman City
Conclusion and Recommendations

Conclusions

The earthquakes, floods, landslides, droughts and desertification are the main natural hazards in Palestine as well as Arab region. Based on data obtained from local and international statistical reports and scientific research studies, important comprehensive conclusions about the following main topics could be concluded:

- Regional cooperation and International initiative
- Training and awareness
- Institutional structure and capacity
- National policy, legislation and strategies
- Disaster Profile and risk assessment
The conclusions are:

- National and local capacities for disaster risk reduction are generally very weak at all levels.
- Legal frameworks for disaster risk reduction are very limited. The disaster risk reduction agenda is driven by response activities, whereas prevention or mitigation is missing.
- Absence of clear and comprehensive national plan for disaster management and focal national office for disaster risk management.
- Weaknesses of national programmes and public policies on preparedness, mitigation, and emergency response.
- Weak institutional capacities and training in disaster management and rescue operations.
- Weakness of awareness by citizens as well as capacity of professionals, engineers, and decision makers.
- Lack of coordination between central and the local level authorities in disaster management activities.
- Disaster risk management system as it is outlined in the Hyogo Framework for Action is not yet regulated.
- National and local disaster management and emergency response plans do not actually exist.
- Absence of clear and comprehensive national plan for disaster risk reduction and focal national office for disaster risk management.
- Lack of adequate coordination among different governmental and non-governmental organizations and the private sector as well. This will result in the reduction of the emergency support operations.
- Absence of well equipped operations central rooms on the national levels covering different governorates.
- Few national bodies are key players in disaster risk reduction, but all of them are facing considerable capacity gaps. Also, public responsibilities in disaster risk management are not allocated to one specific relevant authority, but they are shared among different bodies.
- The role of the private sector in disaster reduction is also not adequate.
- The vulnerability of buildings and infrastructures to earthquakes is very high.
- Absence of codes, rules and regulations which emphasize on the safety requirements in the buildings.
- Absence of land use policy (planning).

However, it is observed that there is a lack of coordinated efforts among various departments, coordination between centers and local administrative bodies and clear definition of the roles and responsibilities towards disaster reduction and management.
Comprehensive recommendations about the following main topics:

- National Policies, legislation and enforcement
- Disaster risk reduction database and risk modeling
- The National Disaster Management Plan
- Non Governmental Organizations
- Political Consensus
- Approach towards disaster risk management
- Regional cooperation
- Links from the Center to Local Government
- Links between Policy and Operations
Based on this fact and considering the importance of earthquake risk reduction, ESSEC managed to contact and talk with different members and groups of the society including citizens, professionals and decision makers, by adopting a comprehensive methodology, these include:
- Conducting a number of academic courses for both graduate and undergraduate students at the faculty of engineering and also some elective course of engineering type for all other students at the university.

- Conducting and organizing many training courses in most of Palestinian cities to support the continuous education among engineers and planners.
- Publishing periodical essays and dissertations in engineering magazines.

- Organizing many conferences, symposiums, workshops and lectures.

- Publishing awareness bulletins and wrote many essays in local magazines and news papers., in addition to public awareness through available local media (To change the methodology of thinking among citizens)
- Supplying the decision makers in related ministries with updated regulations and guidelines in codes of practices and recommendations of international engineering organizations.
Thanks

- GFZ, SDC, UNDP, USAID, etc
- UN ISDR
THANKS

شكراً لحسن اصياغكم