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Support Action for Strengthening PAlestine capabilities for seismic Risk Mitigation

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مشروع تخفيف مخاطر الزلازل في فلسطين

(ساسبارم ٢)

2014 PROJECT FOR CIVIL PROTECTION FINANCIAL INSTRUMENT PREPAREDNESS AND PREVENTION SCHEME

Name الاسم

e-mail البريد الألكتروني

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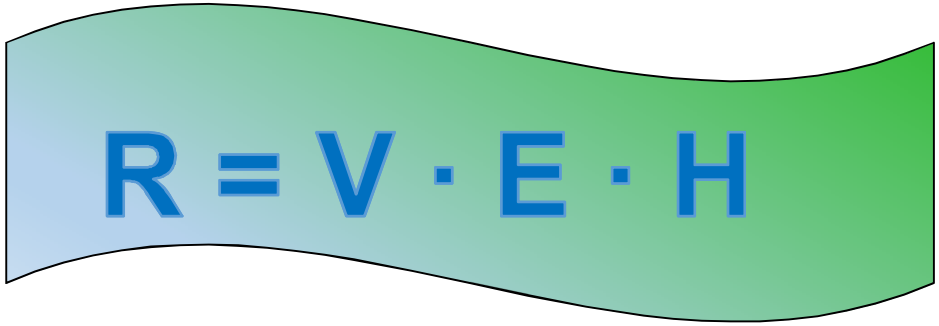
Risk Assessment تقييم المخاطر



R = **Risk**

V = **Vulnerability**: attitude of property present in a structure to undergo a certain level of damage as a result of a certain level of shaking

E = **Exposure**: distribution of the population and civil activities in seismic areas; it depends on the historical evolution of the settlements

H = **Hazard**: probability of exceeding a fixed level of shaking in a site, in a specific time period

[R] = [H] * [VUL]

Disaster Risk Mitigation / Seismic Risk Mitigation is a National responsibility and s Holistic Approach…

- تخفيف مخاطر الكوارث / تخفيف مخاطر الزلازل .... يعتبر مسئولية وطنية...

- نهج شامل....

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The Role of SASPARM 2 Project on Disaster Risk Reduction in Palestine

دور مشروع ساسبارم في الحد من مخاطر الكوارث في فلسطين

- Objectives
- Activities and Events,
- Tasks
- Expected outcomes

- الاهداف
- فعاليات المشروع
- اجزاء ومحاور المشروع
- النتائج المتوقعة

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Examples / Applications

Hazard Mapping

(Visualizing the Hazard)

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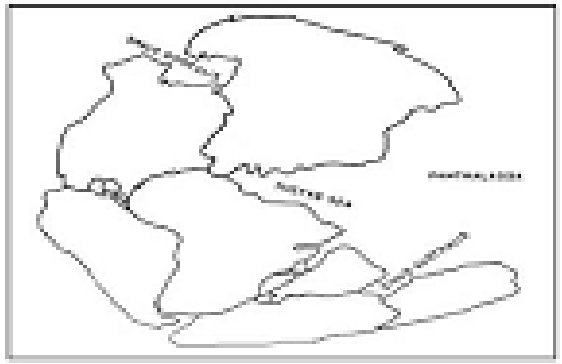
Crustal Movementحركة القشرة الأرضية

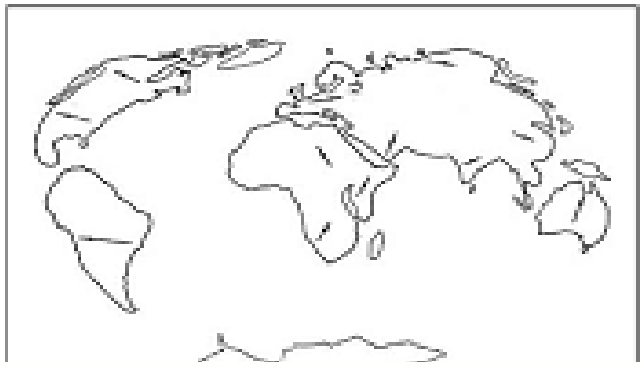
حركة الصفائح (القارات) في الكرة الأرصية



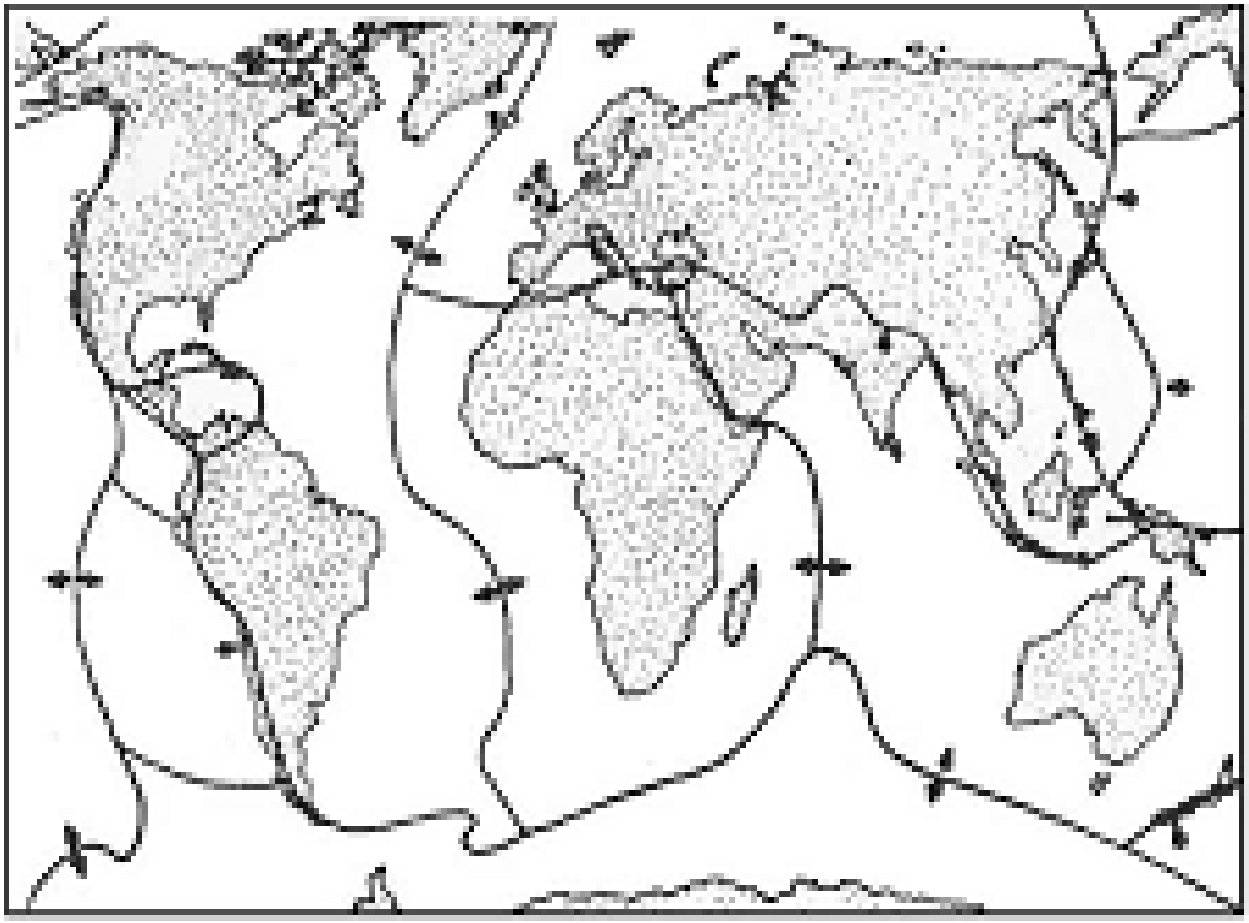
شكل الكرة الأرضية قبل 200 مليون سنة

شكل الكرة الأرضية قبل 65 مليون سنة

الوضع الحالي

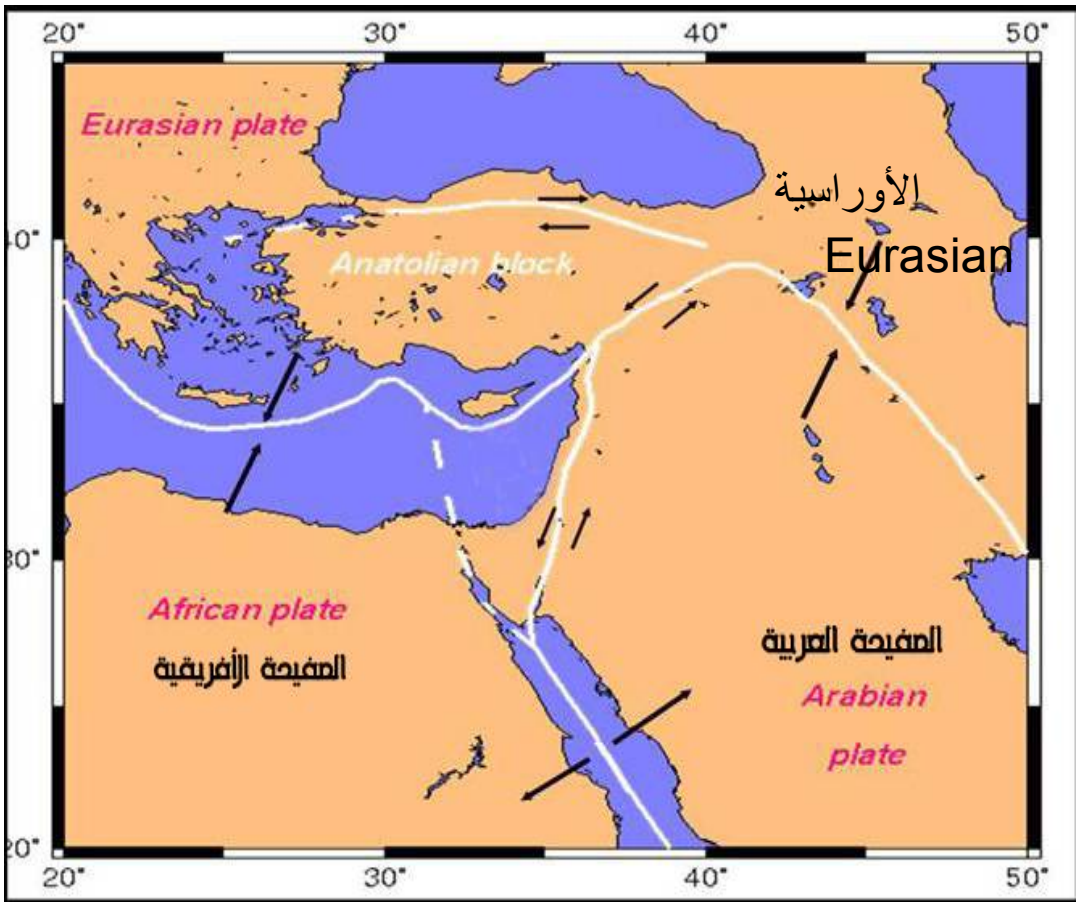


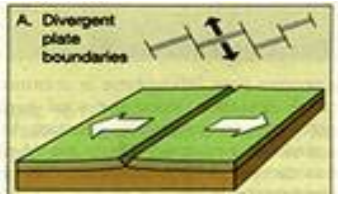
اتجاه الحركة النسبية لصفائح القشرة الأرضية بالاضافة إلى مواقع الفوالق القارية الرئيسية



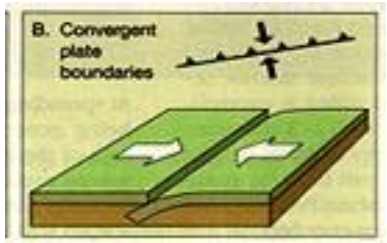
Jalal Al Dabbeek, An-Najah National University, Palestine

Relative Plate Motion in the Easter Mediterranean

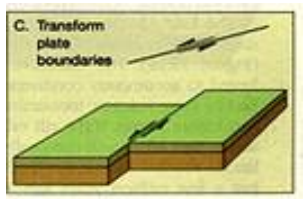




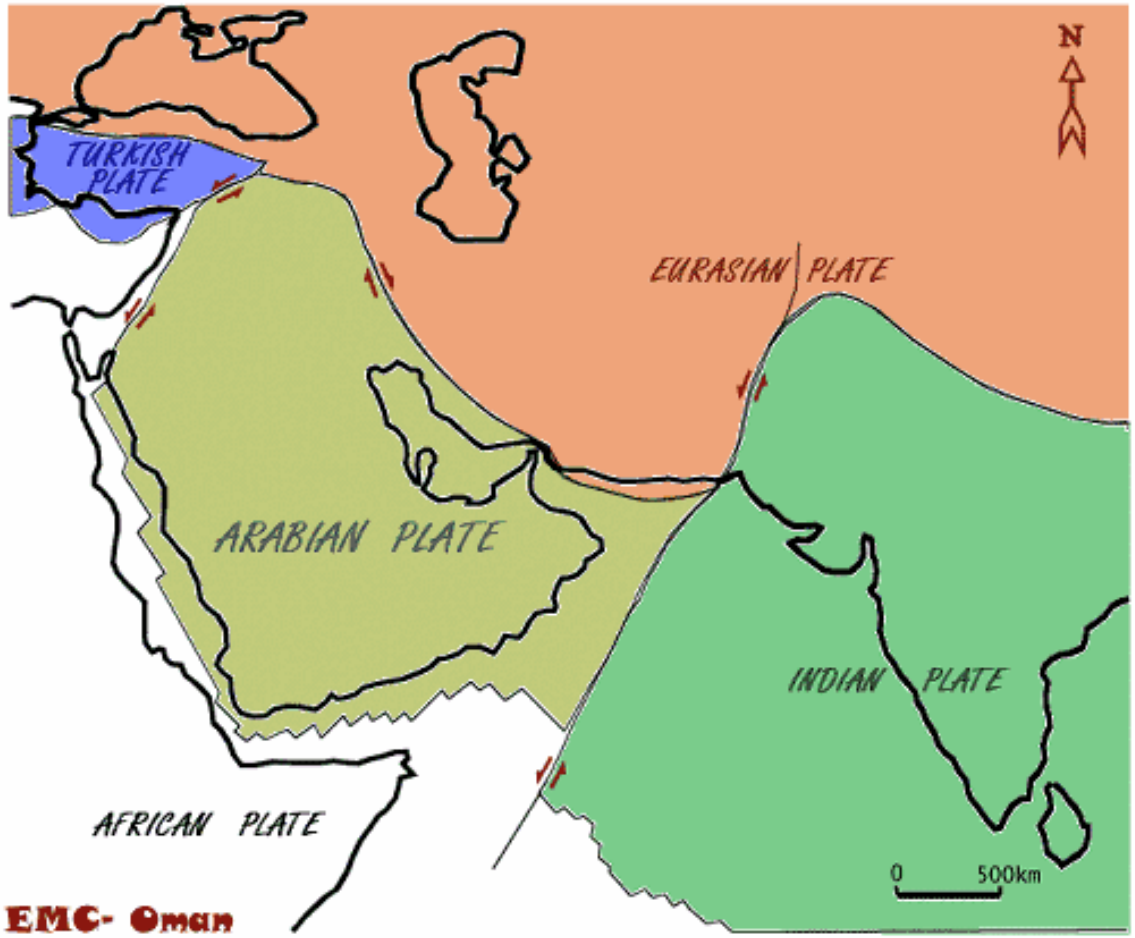
Divergence الأطراف المتباعدة



Convergence الأطراف المتقاربة



أطراف الصدع التحويلى



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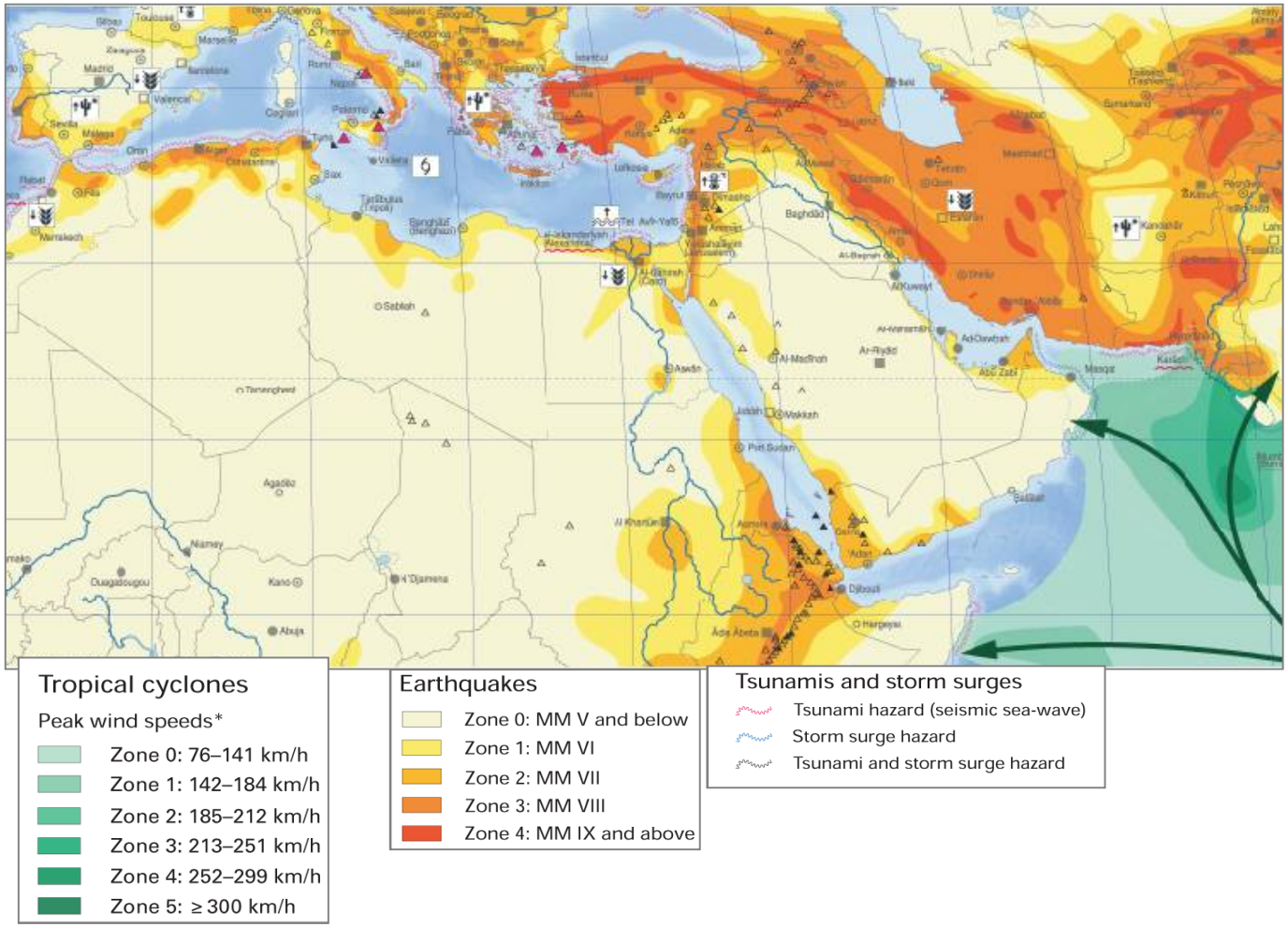
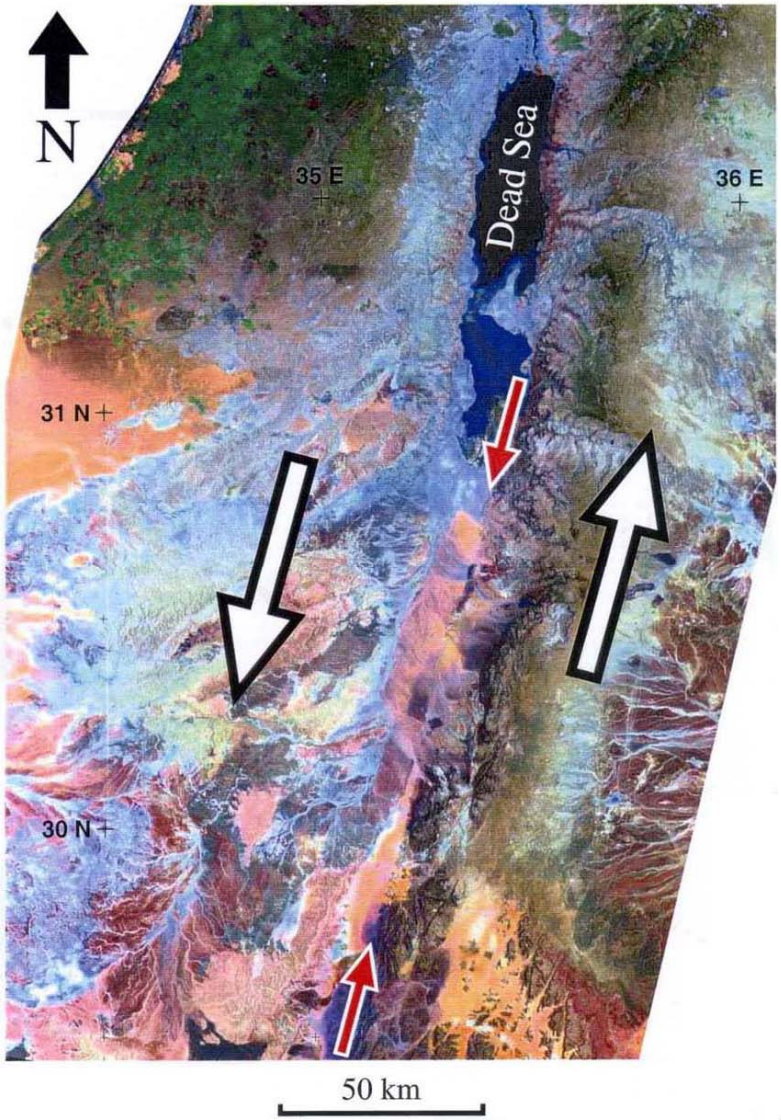


Source: Munich Re, 2009 - extract of world map of natural hazards



Transform Fault –
Relative movement between Jordan and Palestine.

اتجاه الحركة النسبية بين فلسطي والأردن

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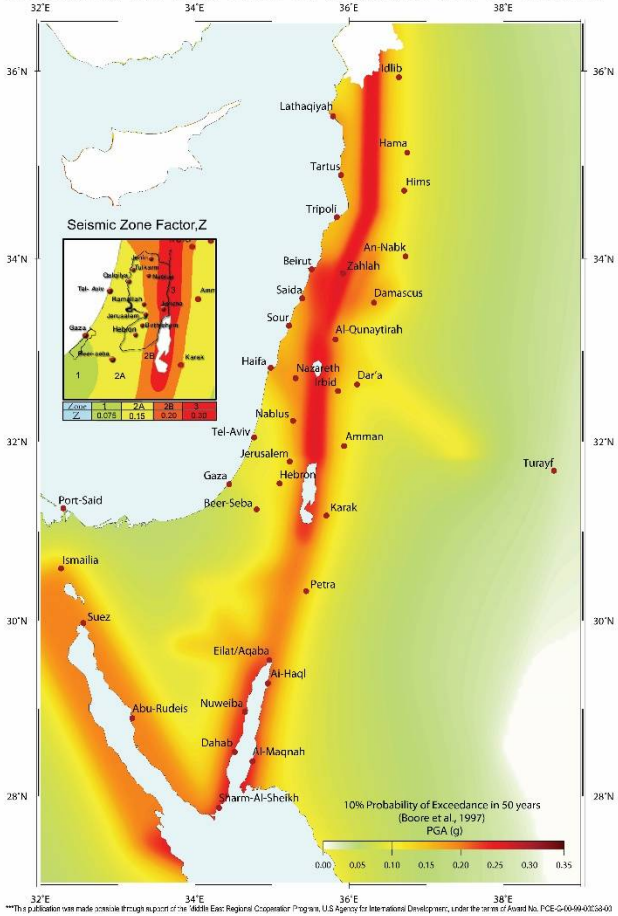
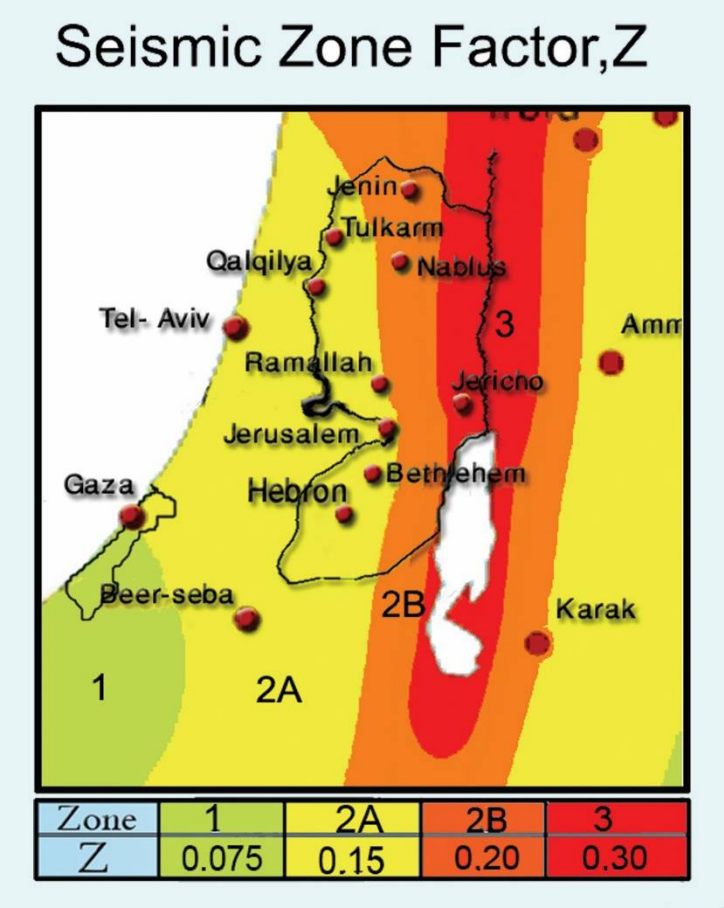
جامعة النجاح الوطنية
مركز علوم الأرض وهندسة الزلازل



***This publication was made possible through support of the Middle East Regional Cooperation Program, U.S. Agency for International Development, under the terms of Award No. PCE-G-00-99-00258-00

الخارطة الزلزالية



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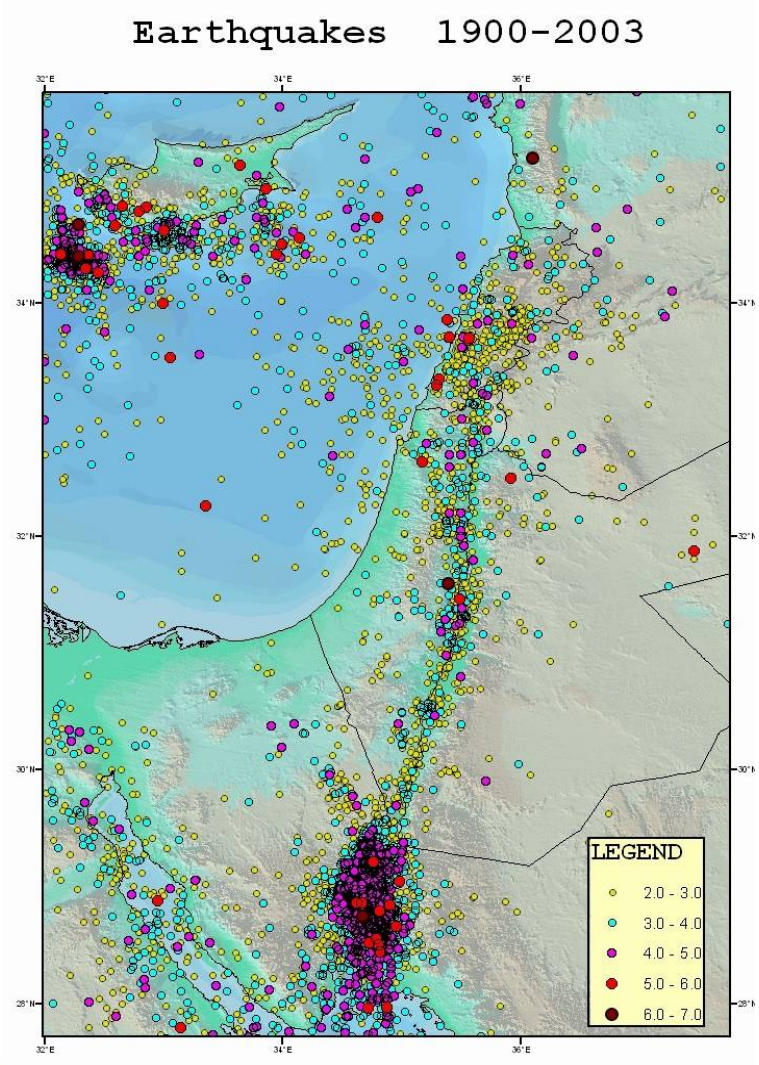

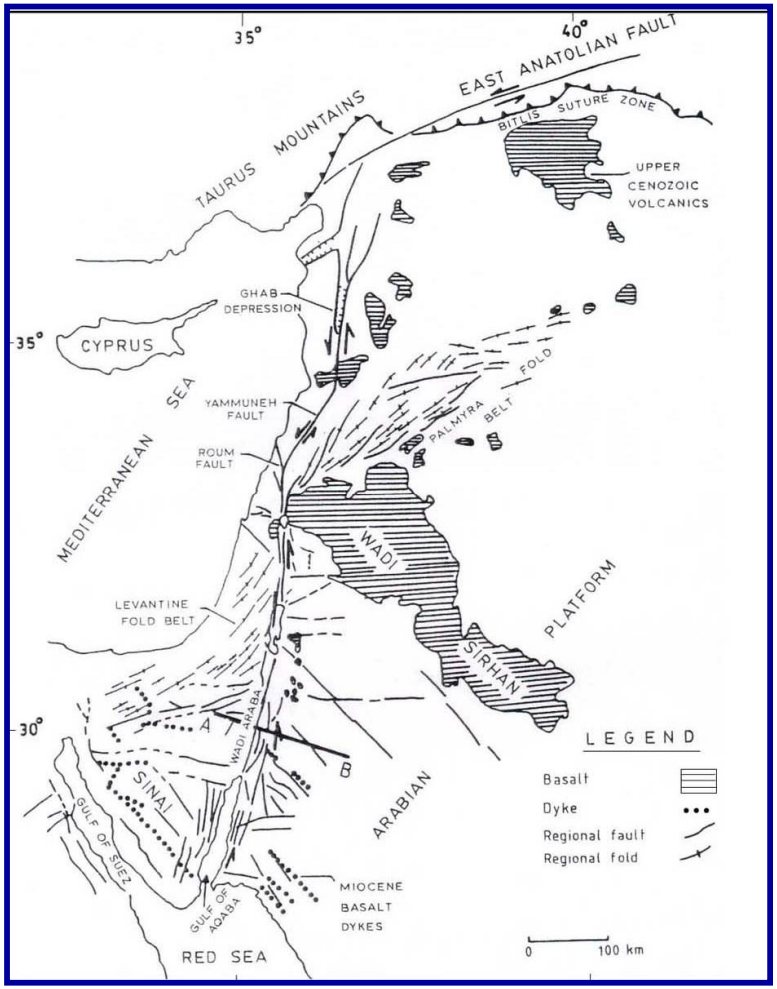

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النشاط الزلزالي في فلسطين

Seismicity of Palestine

✓ أهم تواريخ الزلازل التي تأثرت بها معظم المدن والمناطق الفلسطينية

{ ١٠٦٨ ـ ١٢٠٢ ـ ١٢١٢ ـ ١٣٣٩ ـ ١٤٠٢ ـ ١٥٤٦ ـ ١٦٥٦
١٦٦٦ ـ ١٧٥٩ ـ ١٨٣٤ ـ ١٨٥٤ ـ ١٨٥٩ ـ ١٨٧٢ ـ ١٨٧٣
١٨٩٦ ـ ١٩٠٠ ـ ١٩٠٣ ـ ١٩٢٣ ـ ١٩٢٧ ـ ١٩٥٤ ـ ١٩٩٦ }

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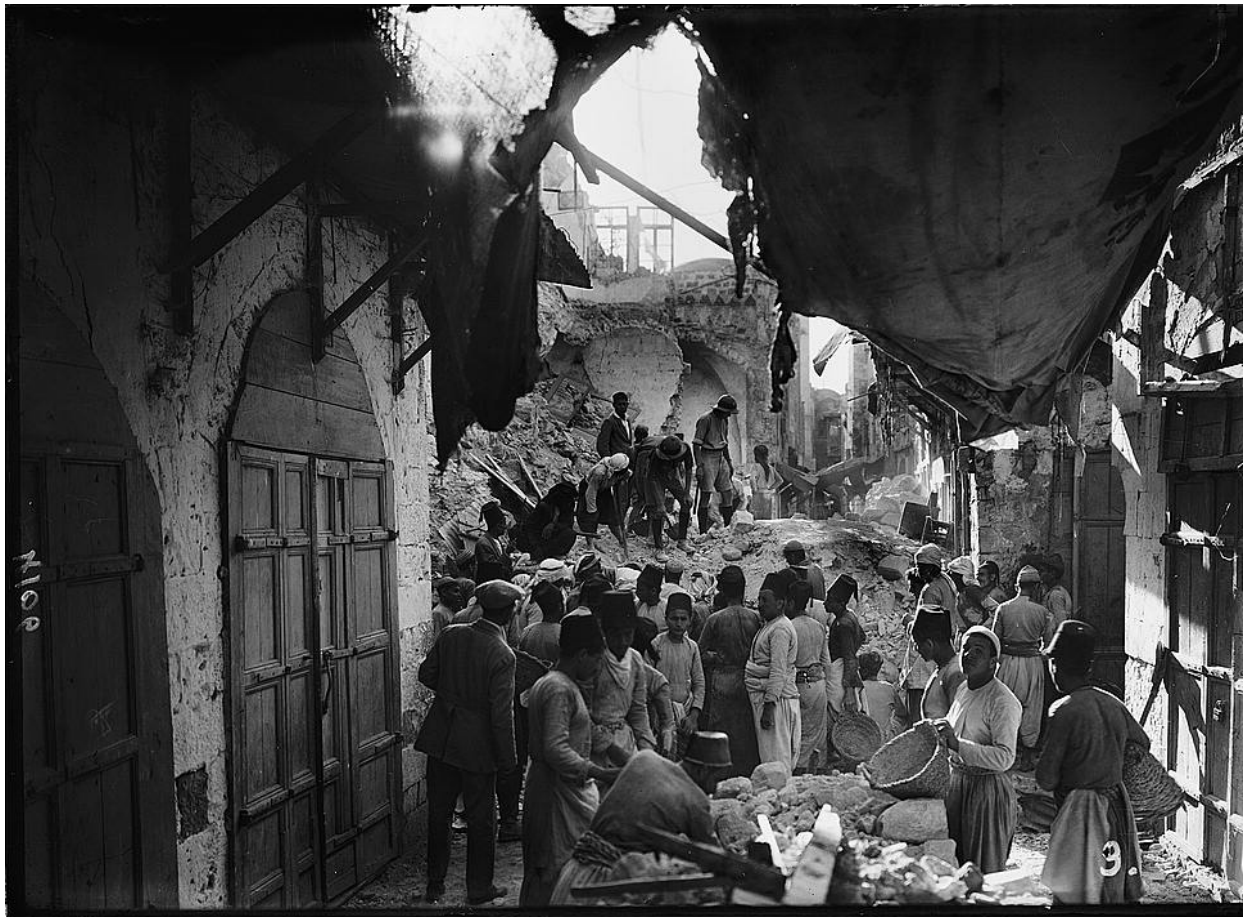
Historical Earthquakes زلازل تاريخية

Nablus, 13:04, July 11, 1927



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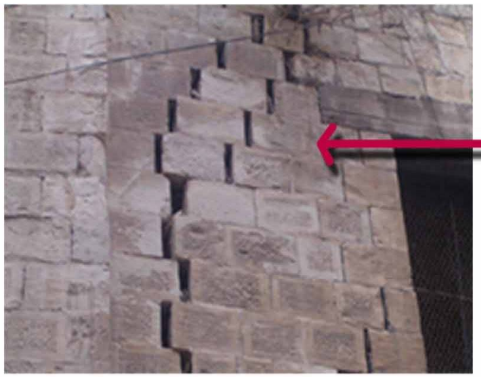
Dead Sea Earthquake 11- 2 - 2004

Old Masonary Building



E

D

Corner Detachment of Building

F

G

Location: Old town of NABLUS city
Structural System: Cross Vault's
Use: Soap Factory

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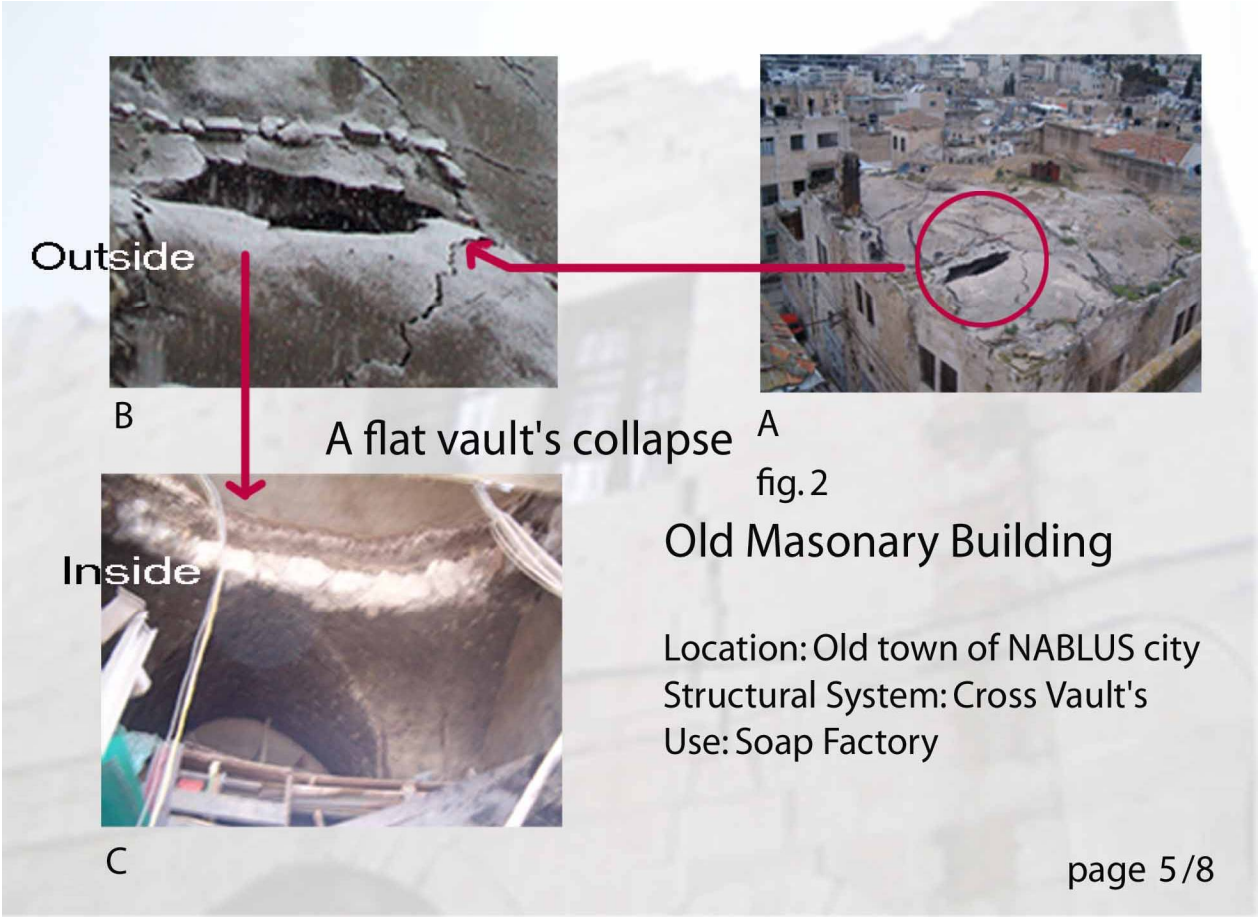
Dead Sea Earthquake 11- 2 - 2004



Dead Sea Earthquake 11- 2 - 2004

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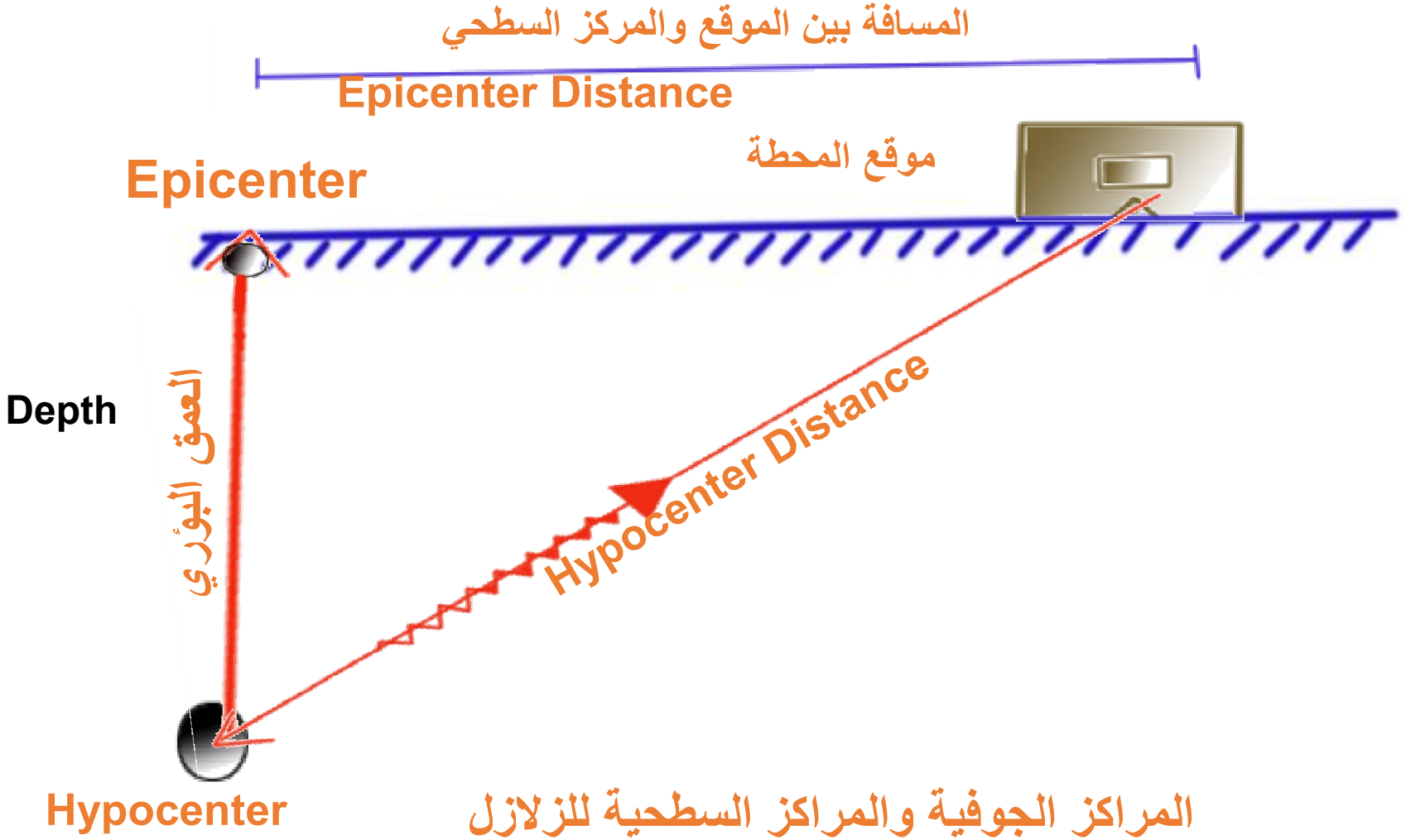

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Expected Earthquakes احتمال حصول زلازل في المستقبل

$$M_{max} = 6.5$$

$$7 > M > 6$$

Where is the problem: المشكلة الحقيقية

- ✓ **The Earthquake Magnitude ??** قوة الزلزال المتوقع ... ؟ !
- ✓ **The Readiness / Preparedness** ام الجاهزية .. !! ؟

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عامل تأثير الموقع
Local Site Effect

- أنظمة الصدوع الأرضية

Faulting Systems

- أثر التربة (تربة الموقع):

- التضخيم الزلزالي Amplification
- الانزلاقات الأرضية Landslides
- تميؤ التربة Liquefaction

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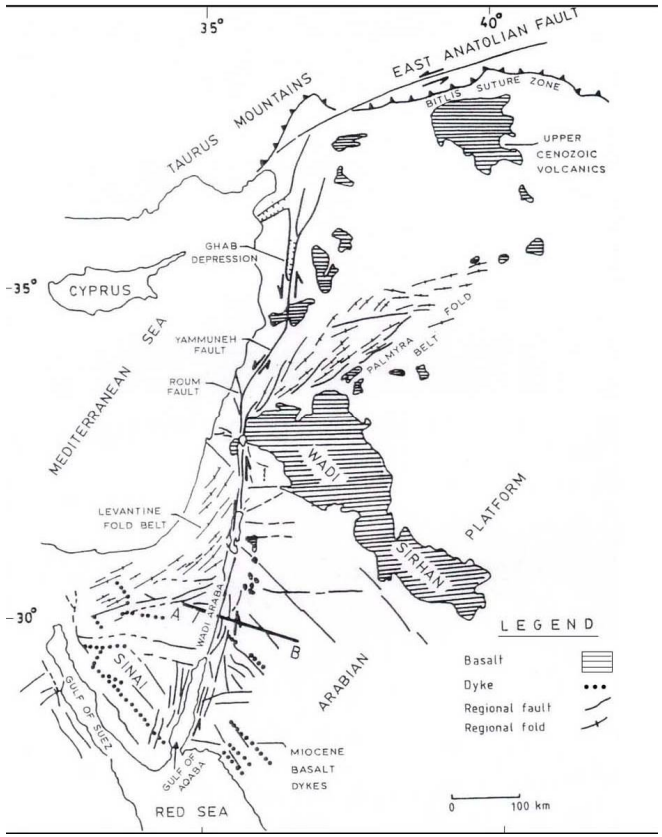
أنظمة الصدوع الأرضية



Main Faults and Tectonic Map

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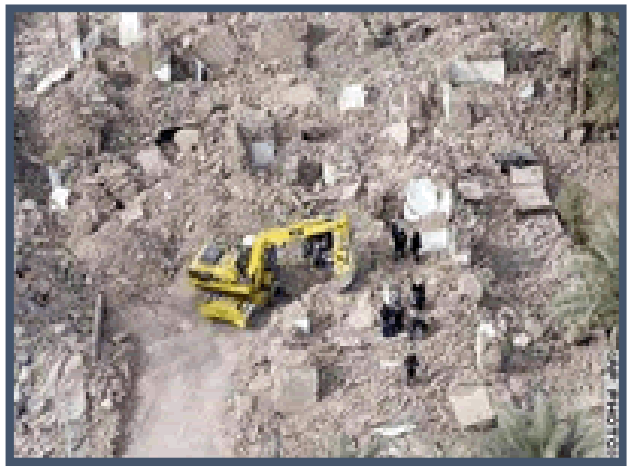
General Views of Bam after Earthquake

التضخيم الزلزالي



No collapse, Partial collapse, Total collapse

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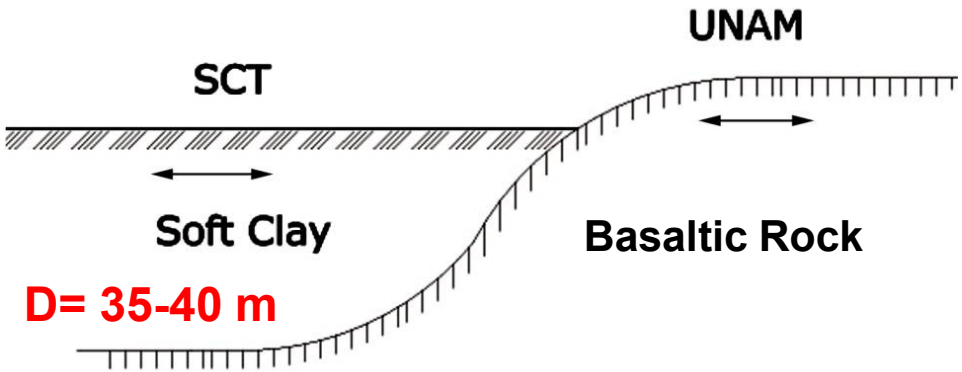
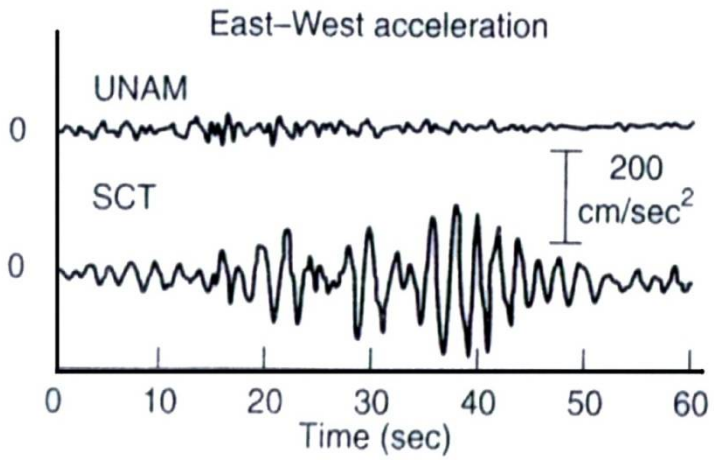
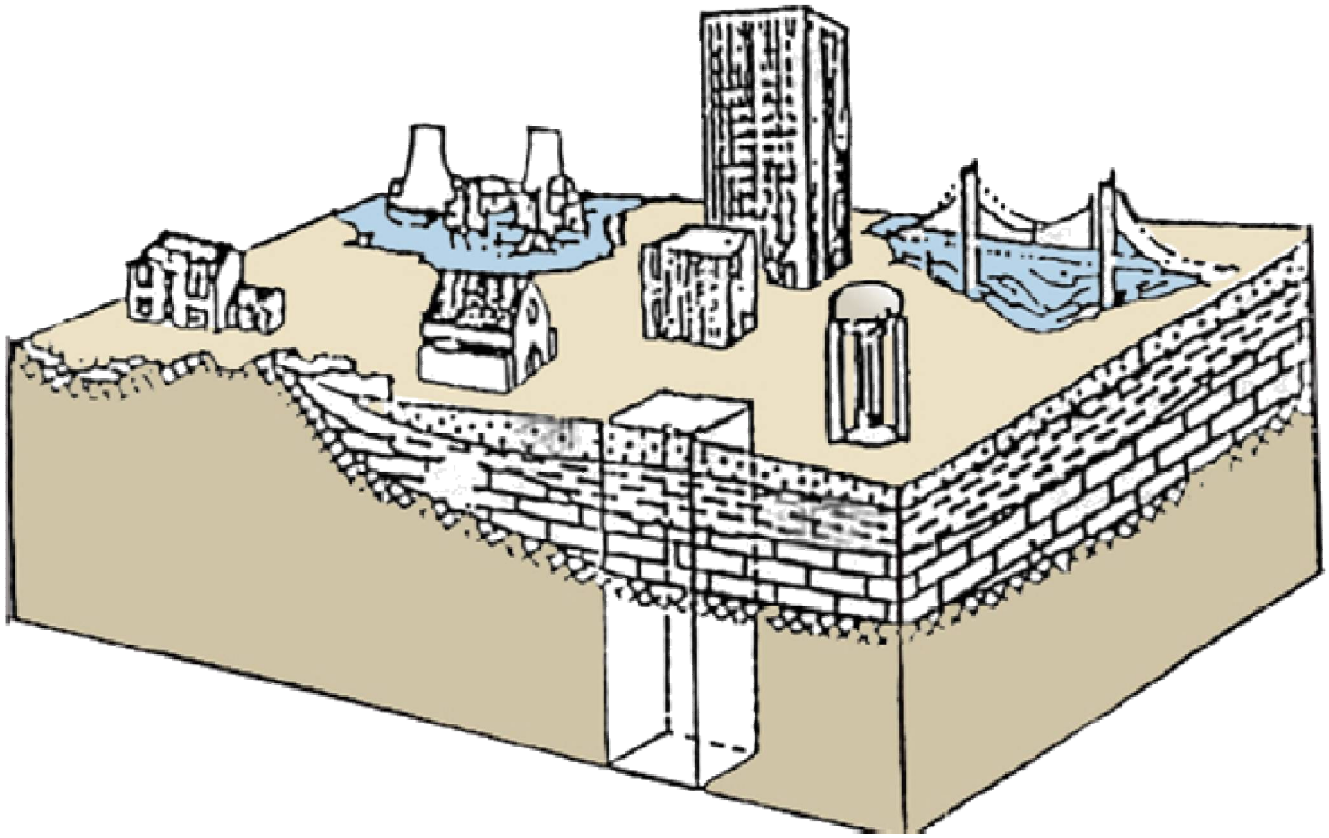
زلزال المكسيك، 1985 كانت درجته M=8.1

Mexico City Earthquake, 1985







رسم توضيحي يظهر المجموعات المختلفة للمنشأ وطبقات تربة الموقع وفقاً لقيم الاهتزاز المسيطر لها.

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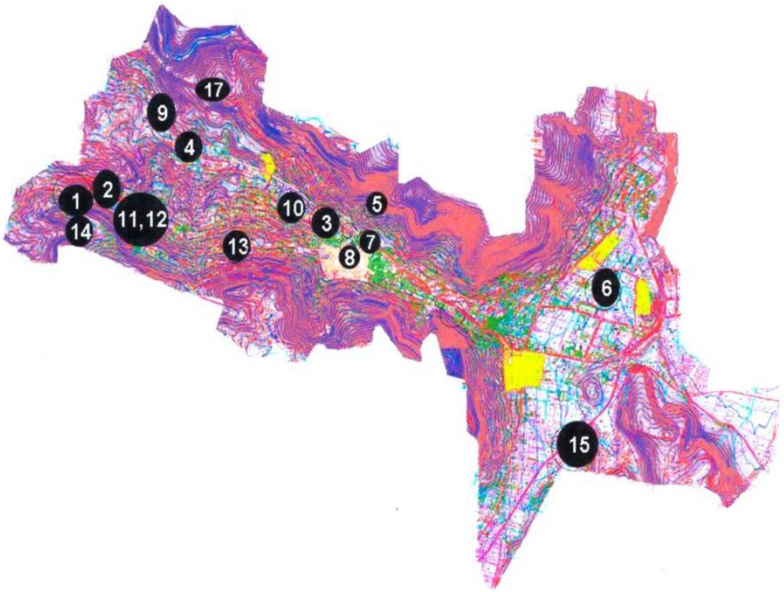
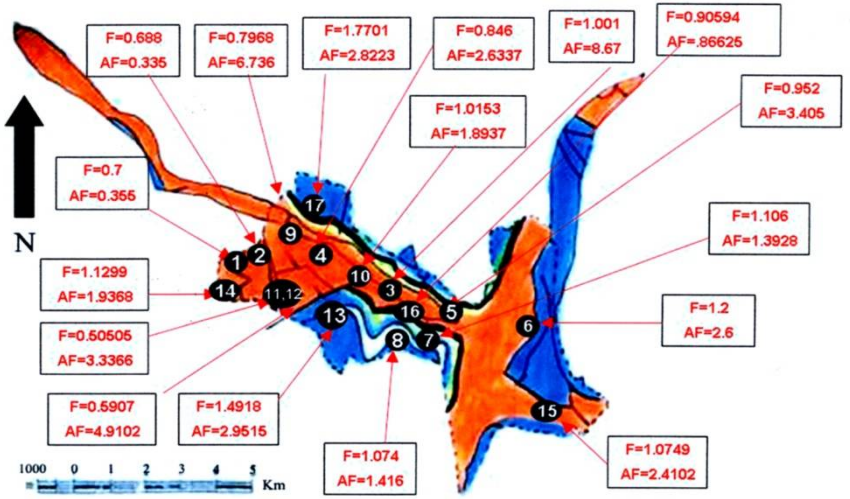


locations of measured sites in Nablus City.



Values of dominant frequencies (DF) and amplification factors (AF) at all measured sites in Nablus City.

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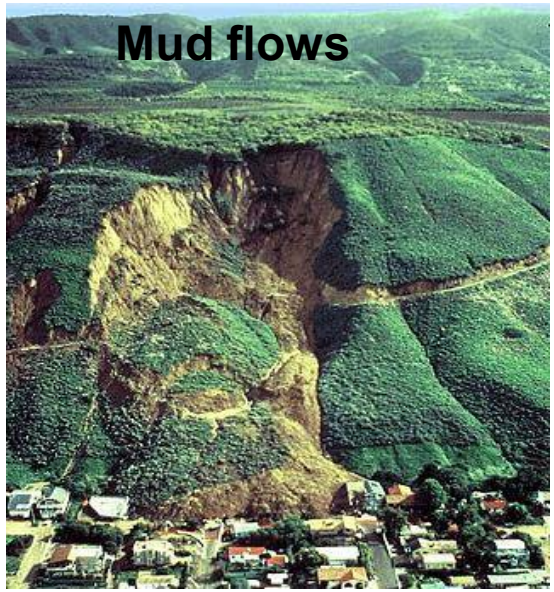
LAND SLIDES

الانزلاقات الأرضية

Slides Slope failures



Mud flows

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Site Effect: Landslides الانزلاقات الارضية

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Landslides - Palestine

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A'arrabeh – Jenin, 2012

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LIQUIFACTION

تميؤ التربة

Liquefaction

تميؤ التربة

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To avoid the site effect….??

الحلّ ... !!!

Land Use سياسة استخدام الأراضي

- وجود سياسة وطنية لاستخدامات الاراضي
- التخطيط لاستخدامات الاراضي
- خرائط استخدامات الاراضي.

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Seismic Vulnerability of Palestinian Common Buildings

قابلية الاصابة الزلزالية لانماط المباني الدارجة محليّا

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العوامل التي تؤثر على قابلية الإصابة الزلزالية للمباني

Factors Affecting the seismic Vulnerability of Buildings

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Old Masonry Buildings: Cross Volts and Barrel Systems

Non Reinforced Concrete Bearing Walls

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أنواع المباني وفئات قابلية الإصابة [مصدر (E4)].

نوع المبنى	النظام الإنشائي	فئات قابلية الإصابة Vulnerability Class A	B	C	D	E	F
مبني من الطوب (masonry)	مباني من الحجارة (دبش قطع غير مصقولة) Rubble stone, Fieldstone	○					
	مباني طينية (من اللبن) adobe (earth brick)	○	⊣				
	مباني من الحجارة البسيطة (أشكالها غير معقدة) simple stone	⊢	○				
	مباني من الحجارة الكبيرة قوية متماسكة massive stone		⊢	○	⊣		
	مباني غير مسلحة (حجارة مصنعة) unreinforced, with manufactured stone units.	⊢	○	⊣			
	مباني غير مسلحة (لكن البلاطات مسلحة) unreinforced, with RC floors		⊢	○	⊣		
	مباني من الطوب المسلح reinforced or confined			⊢	○	⊣	
مبني من الخرسانة المسلحة (Reinforced Concrete RC)	إطارات غير مصممة لمقاومة الزلازل frame without ERD	⊢	———	○	⊣		
	إطارات مصممة تصميم متوسط لمقاومة الزلازل frame with moderate level of ERD		⊢	———	○	⊣	
	إطارات مصممة تصميم جيد لمقاومة الزلازل frame with high level of ERD			⊢	———	○	⊣
	جدران مسلحة غير مصممة لمقاومة الزلازل walls without ERD		⊢	○	⊣		
	جدران مسلحة مصممة تصميم متوسط لمقاومة الزلازل walls with moderate level of ERD			⊢	○	⊣	
	جدران مسلحة مصممة تصميم جيد لمقاومة الزلازل walls with high level of ERD				⊢	○	⊣
Steel	منشآت معدنية steel structures			⊢	———	○	⊣
Wood	منشآت خشبية timber structures		⊢	———	○	⊣	

○ تشير إلى فئة قابلية الإصابة التي يقع فيها المبنى

——— احتمالية انتقال المبنى إلى الفئة الأخرى

..... احتمالية أقل لانتقال المبنى إلى الفئة الأخرى

ERD : التصميم المقاوم للزلازل (Earthquake Resistant Design)

النظام الانشائي وقابلية الاصابة

Structural Systems and Seismic Vulnerability

يعتبر النظام الانشائي للمباني من اهم العوامل التي تؤثر على قابليتها للإصابة الزلزالية وبالتالي على السلوك الزلزالي المتوقع لهذه المباني ويمكن تصنيف المباني من حيث قابليتها للإصابة كما هو موّضح في الجدول التالي :

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Seismic Vulnerability of Palestinian Common Buildings

قابلية الاصابة الزلزالية لانماط المباني الدارجة محليّا

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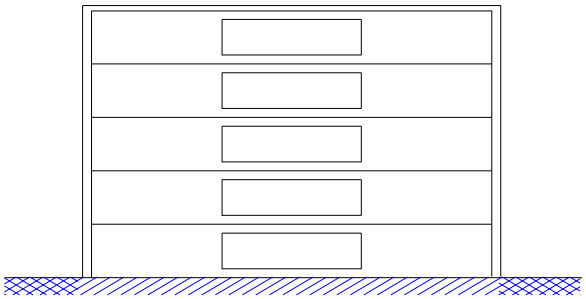
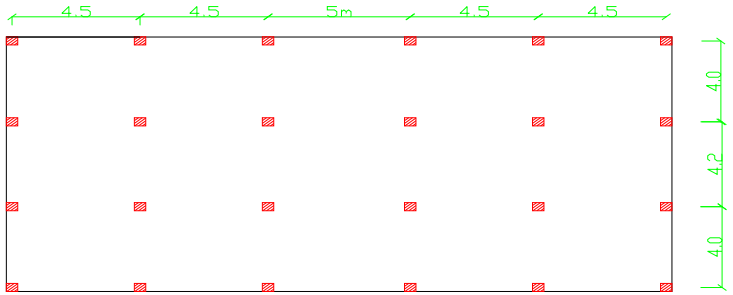
التعرف على أشكال المساقط
Plans and Elevations



مســـــــقط جـــــانبي أو رأســـــــي

Elevation - Side view



مســـــقط أفقـــي

Plan

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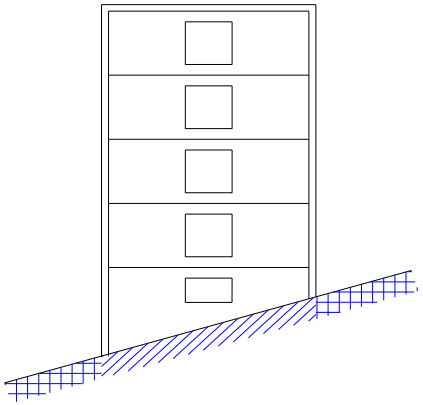
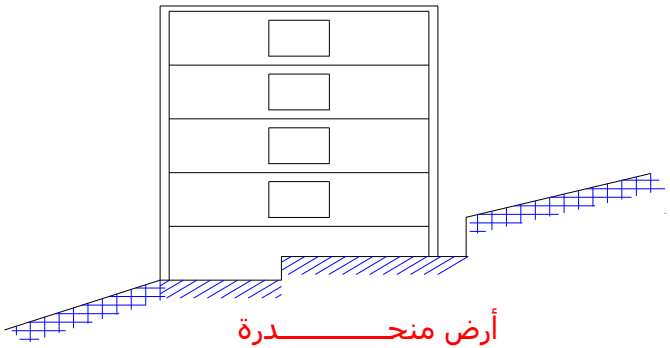
عامل انحدار الموقع
Site slop factor



أرض منحـدرة

(صخرية-صـلبة)

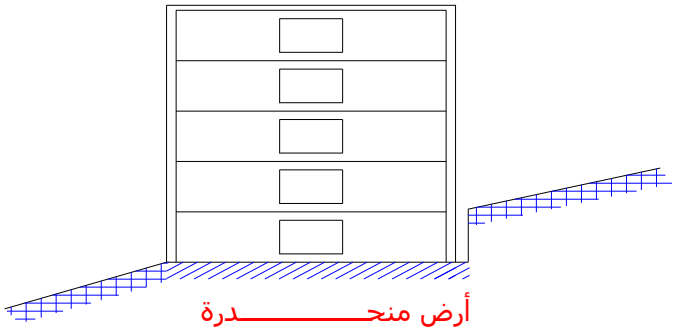
الأفضل زلزاليـاً



أرض منحـــــــــدرة

(صخرية-صـــــــلبة)

Site with slop and hard rock



أرض منحـــــــــدرة

(صخرية-صـــــــلبة)

Site with slop and hard rock

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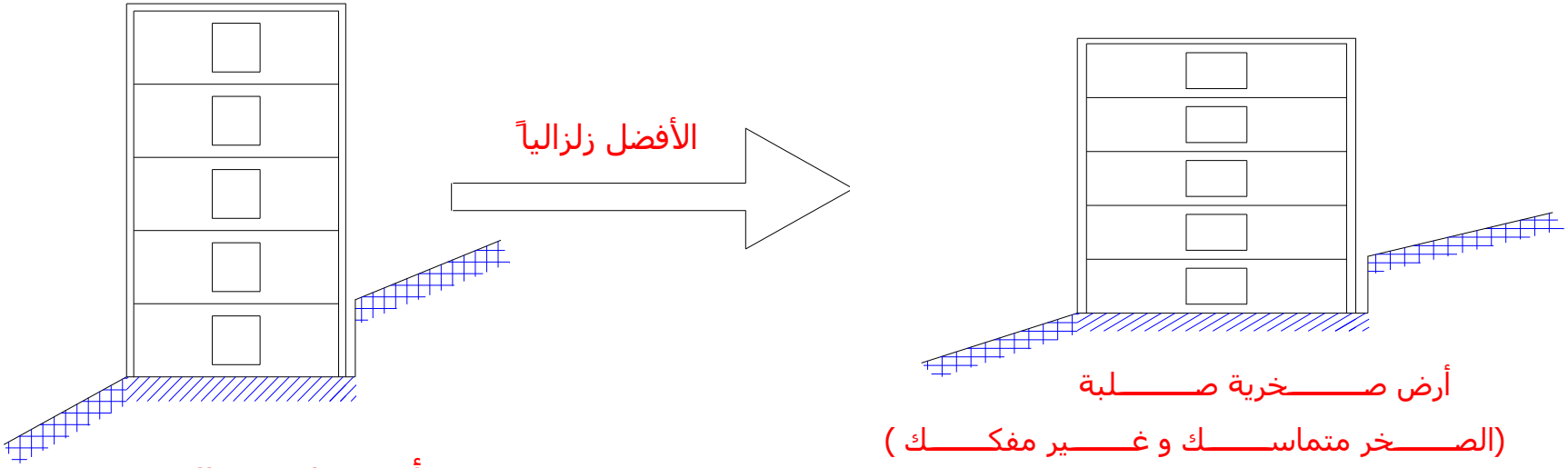
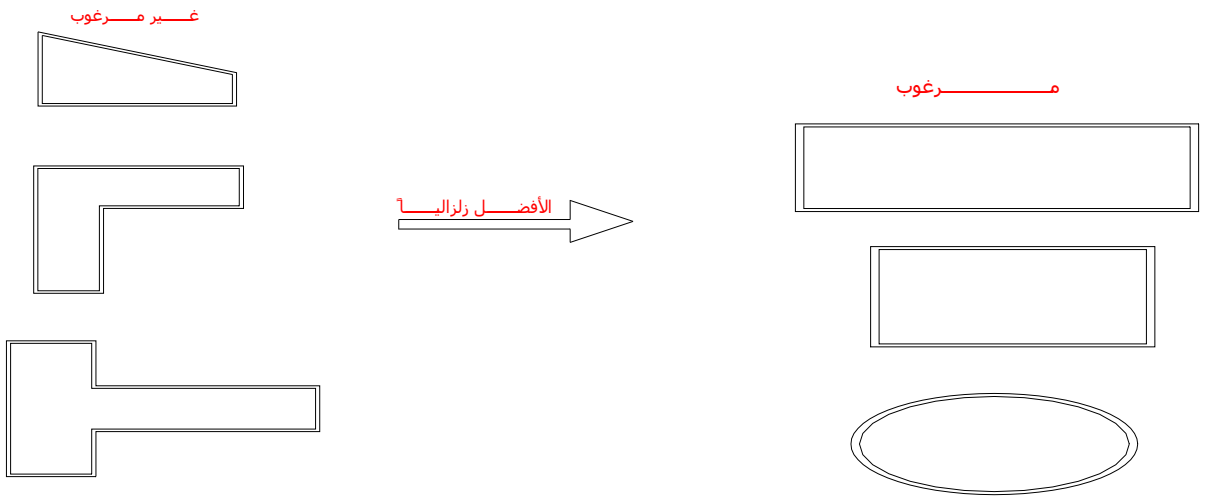
المنحدرات وظروف الموقع
Slopes and site conditions



أشكال المساقط الأفقية للمباني
Forms of horizontal plans of the buildings



Undesirable

Desirable

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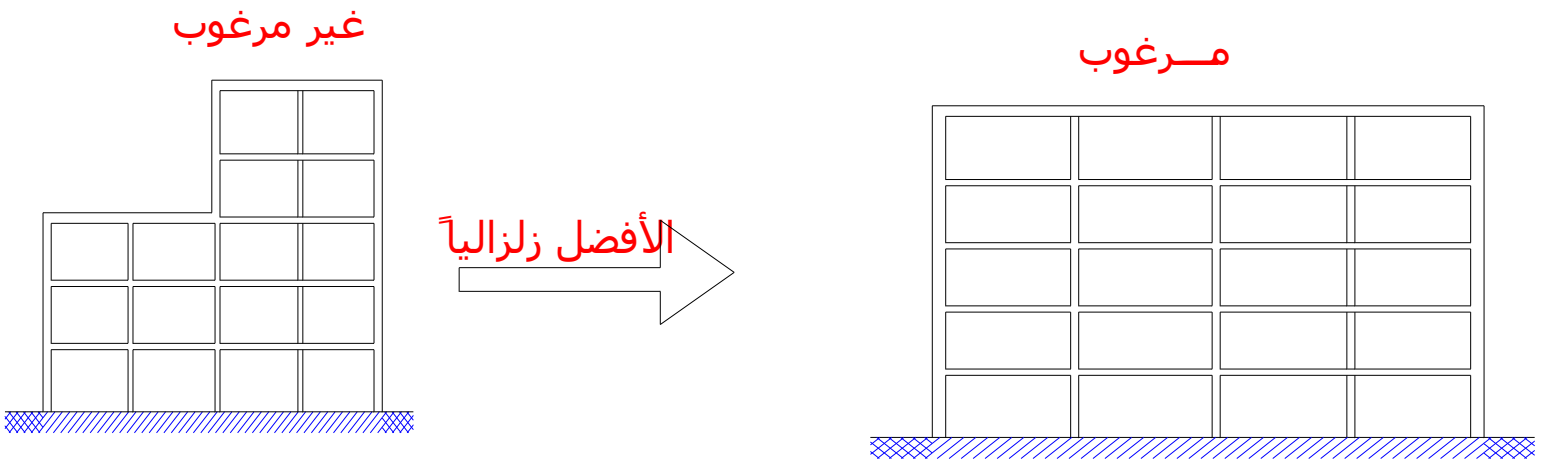
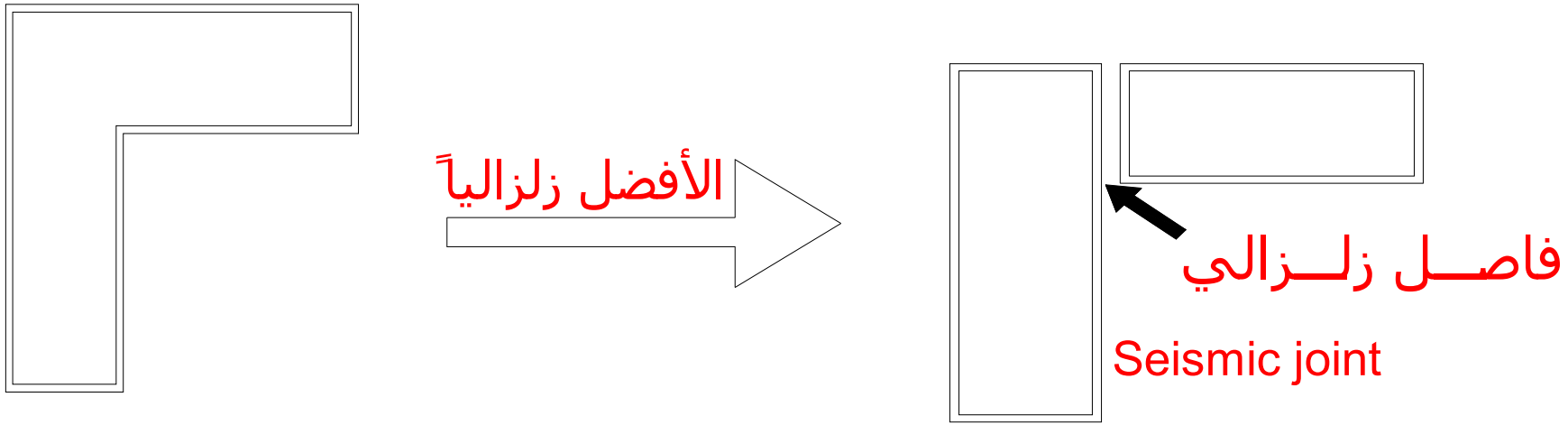
عدم التماثل و الإنتظام في المساقط الجانبية
Lack of Symmetry and regularity in the elevations



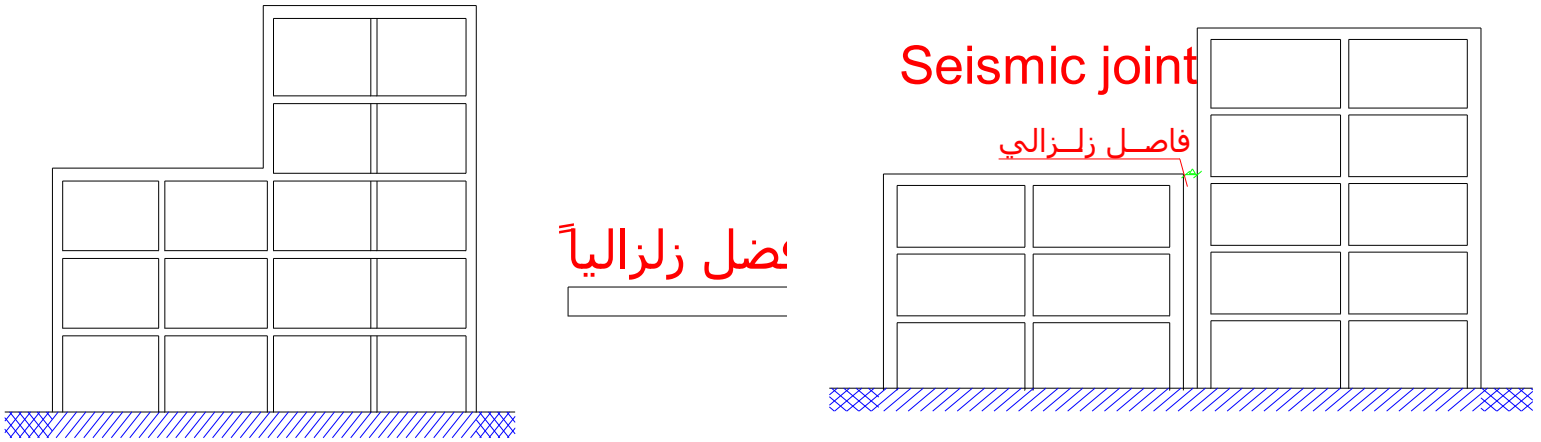
Undesirable

Desirable

استخدام الفواصل الزلزالية لتحقيق التماثل
Using the seismic joints to achieve symmetry

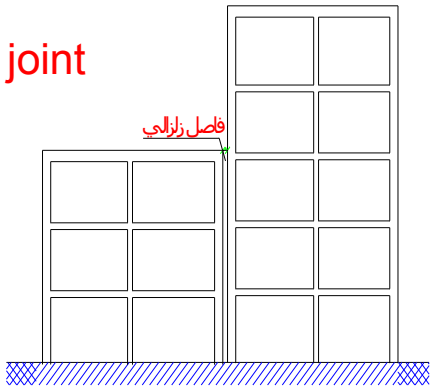


استخدام الفواصل الزلزالية لتحقيق التماثل
Using the seismic joints to achieve symmetry



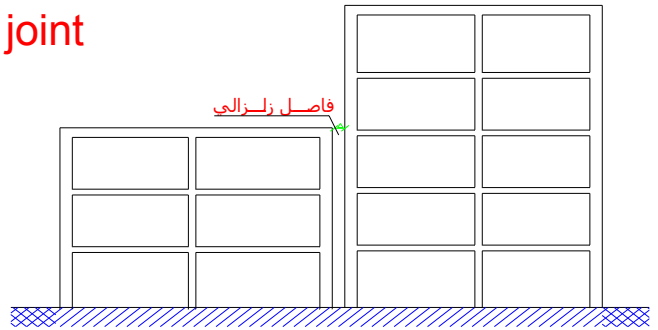
عرض الفاصل الزلزالي
The width of seismic joint

Seismic joint

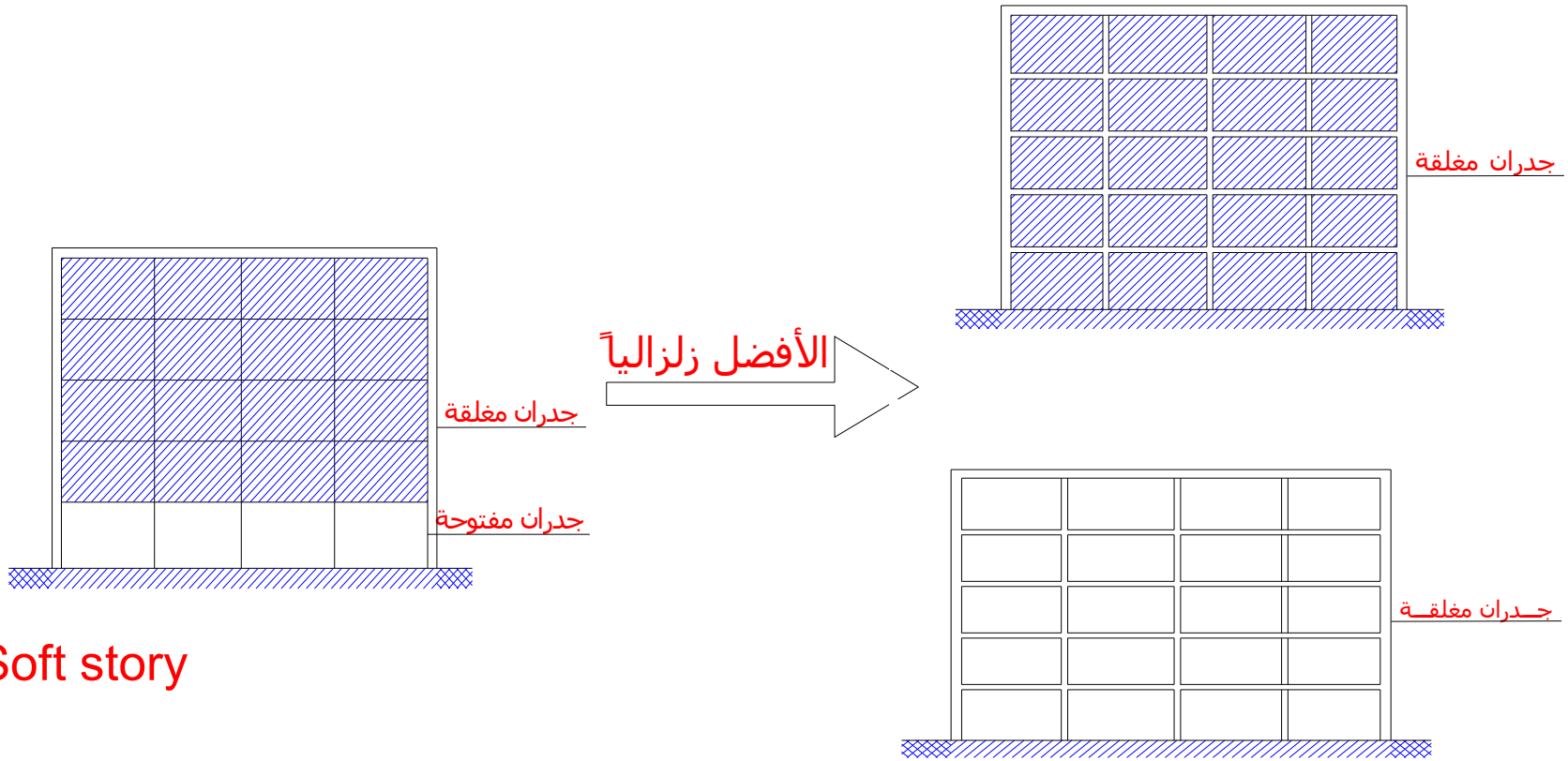


الأفضل زلزالياً

Seismic joint

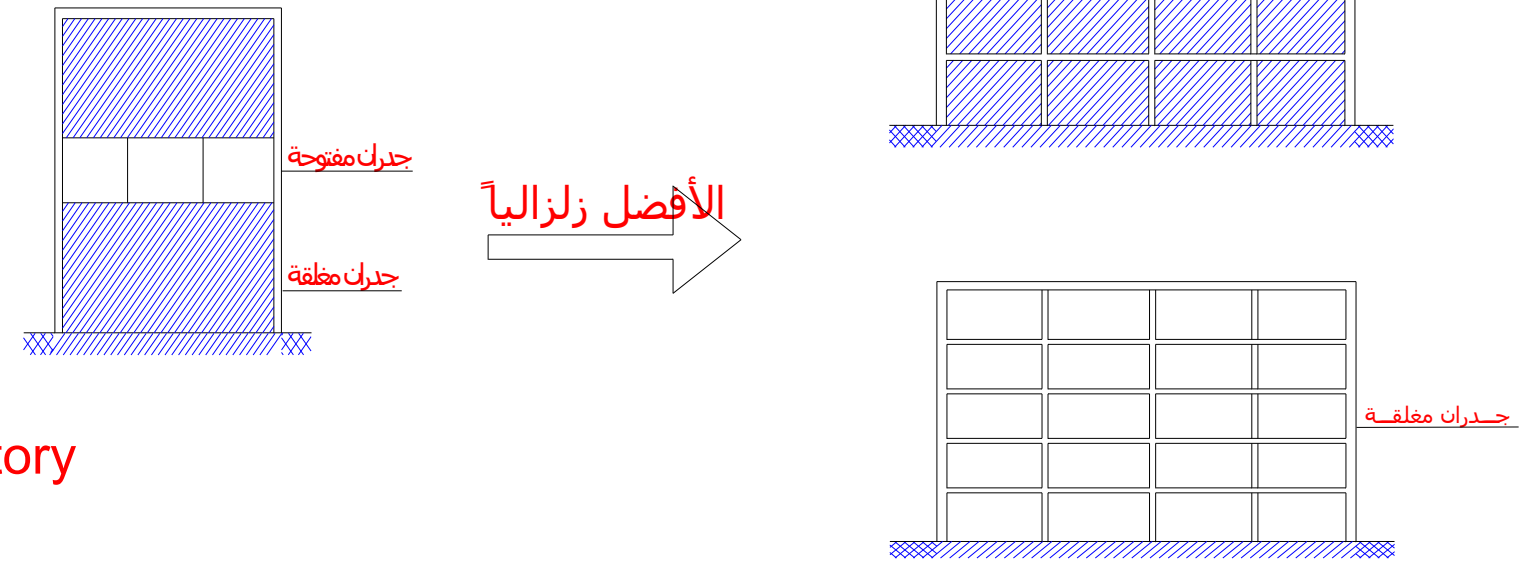


الطابق الرخو(الضعيف) Soft or weak story



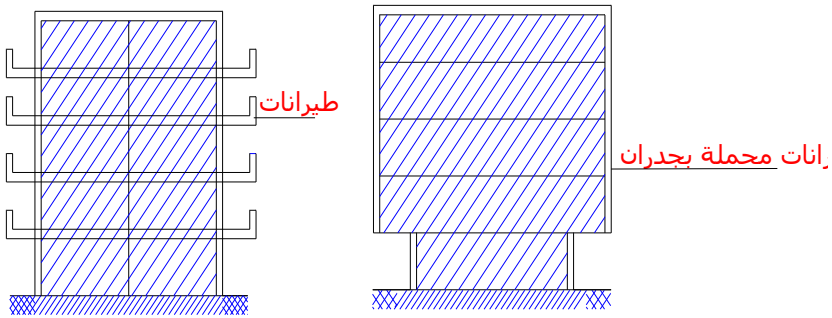
Soft story

Soft or weak storyالطابق الرخو(الضعيف)

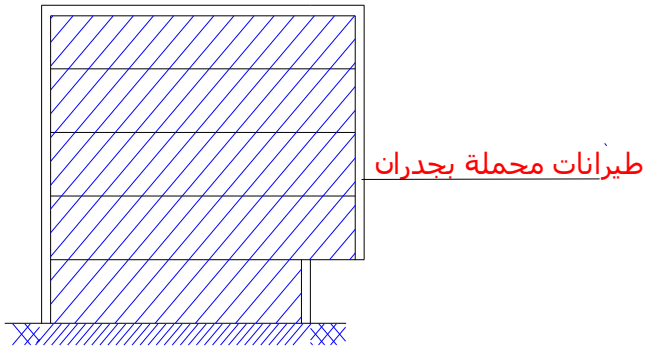


Soft story

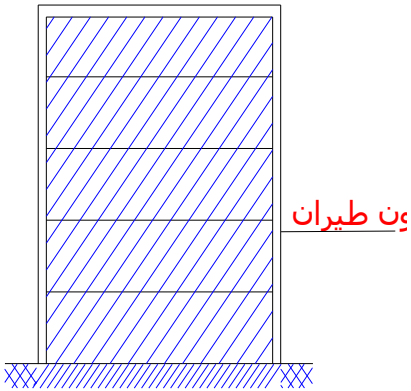
انظمة الطيرانات
Cantilever Systems



With cantilever systems



الأفضل زلزالياً



Without cantilever

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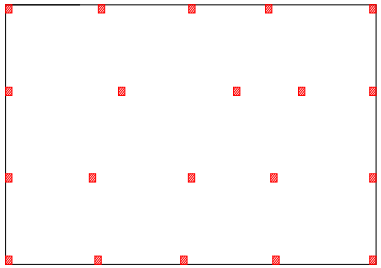
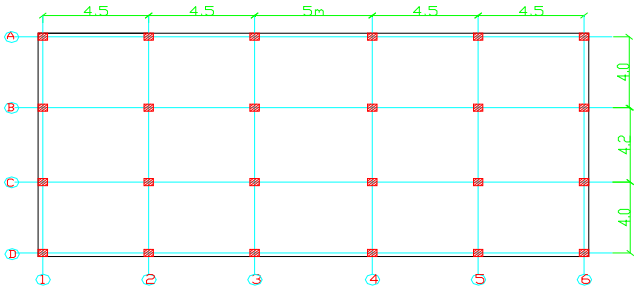
وضع الأعمدة بشكل شبكة (متماثل)
Symmetry distributions of structural systems

غير مرغوب



الأفضل زلزالياً

مـــرغوب

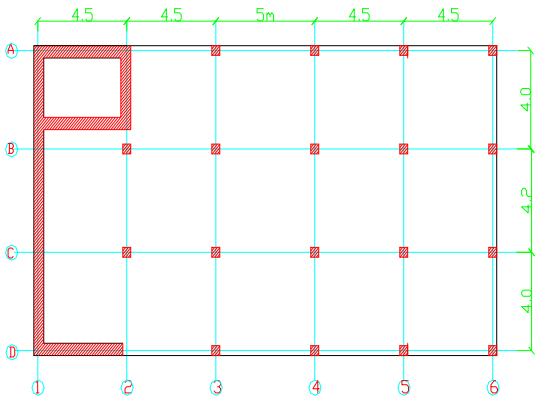


Undesirable

Desirable

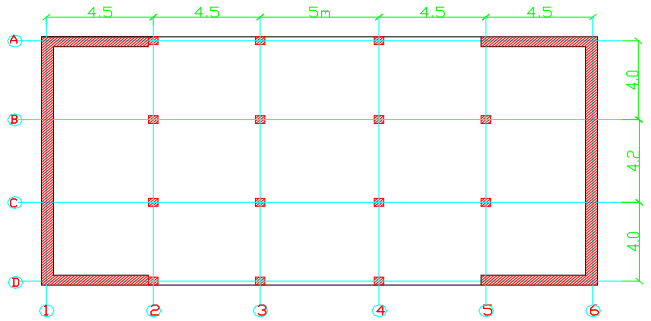
توزيع جدران القص
Distribution of shear walls

غير مرغوب



الأفضل زلزالياً

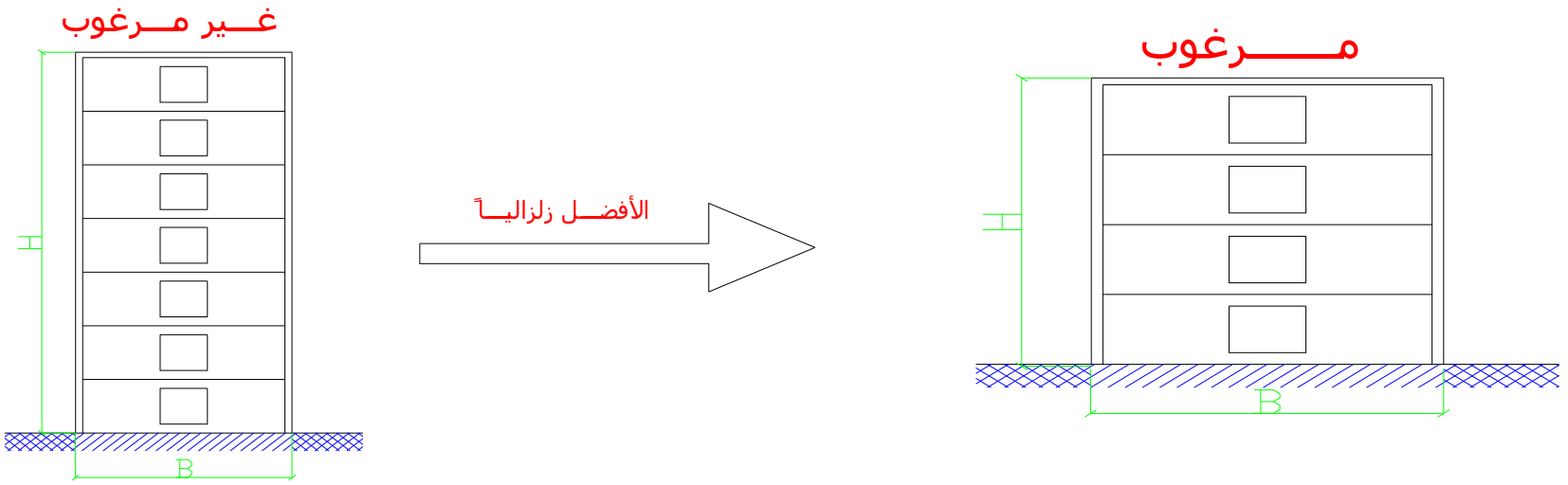
مـــرغوب



Undesirable

Desirable

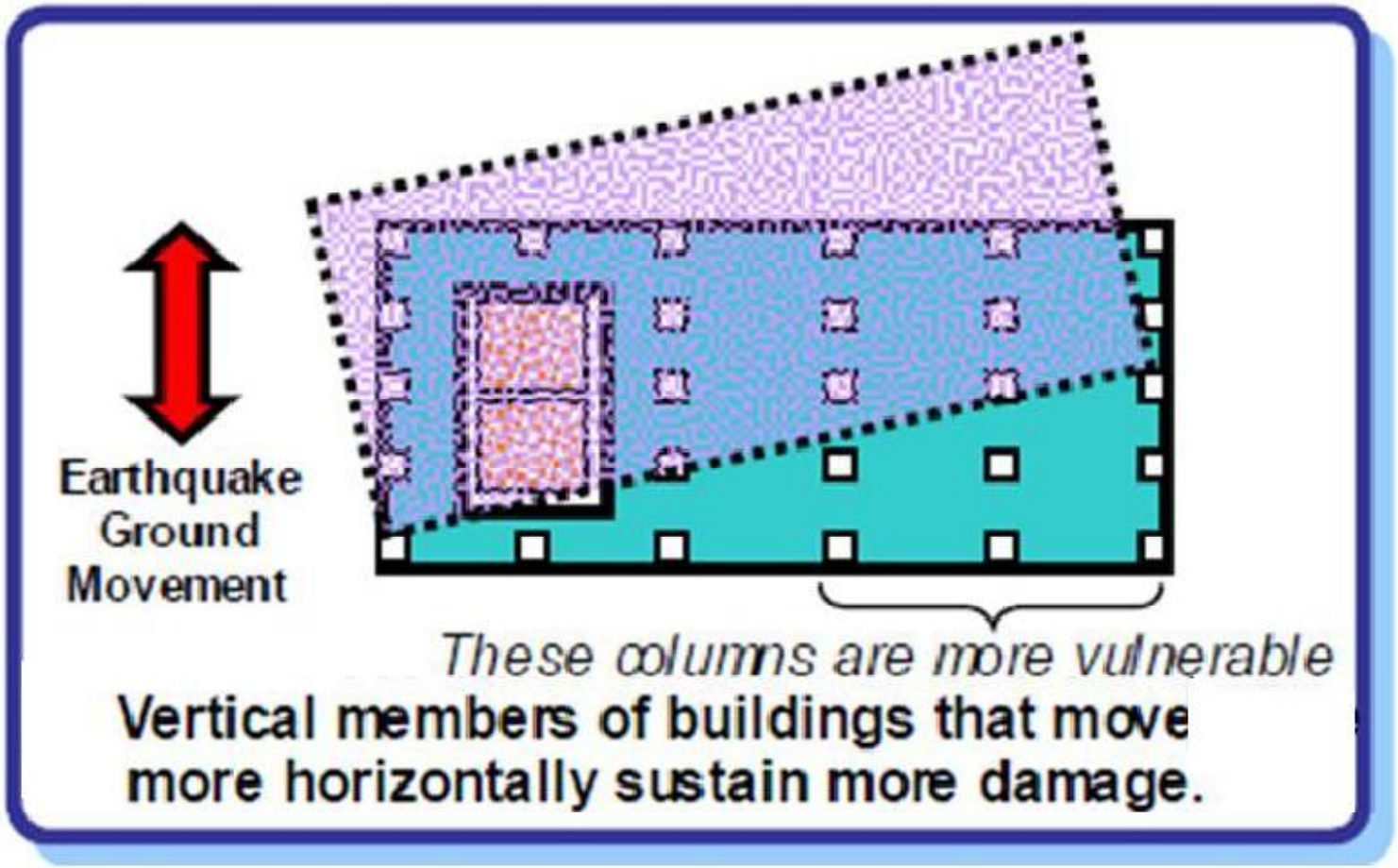
Slenderness ratioنسبة النحافة



Undesirable

Desirable

تتطلب تصميم زلزالي خاص بالمباني البرجية (H/B>4)تنويه: المباني النحيفة


Earthquake
Ground
Movement
These columns are more vulnerable
Vertical members of buildings that move
more horizontally sustain more damage.

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Examples and Case Studies

امثلة وحالات دراسية

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Irregularity انعدام الانتظام والتماثل

Irregularity انعدام الانتظام والتماثل

Slenderness ratio نسبة النحافة

انعدام الانتظام والتماثل

Irregularity

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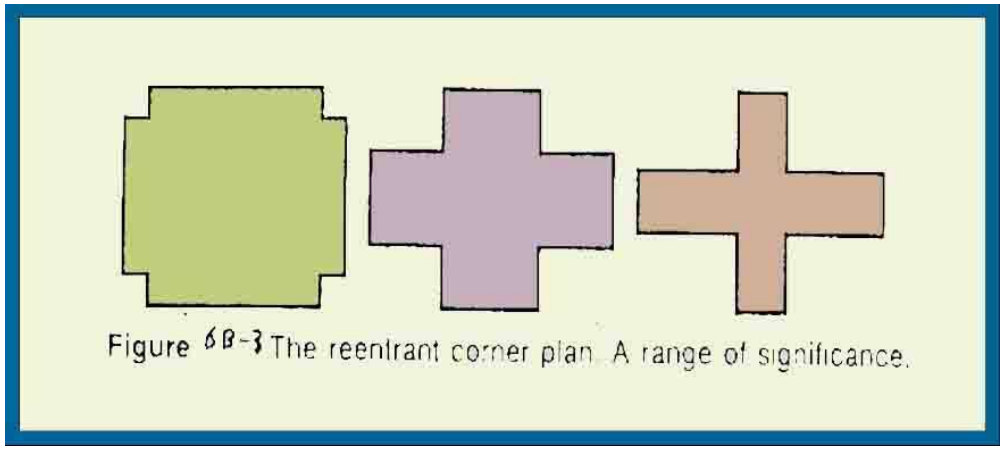
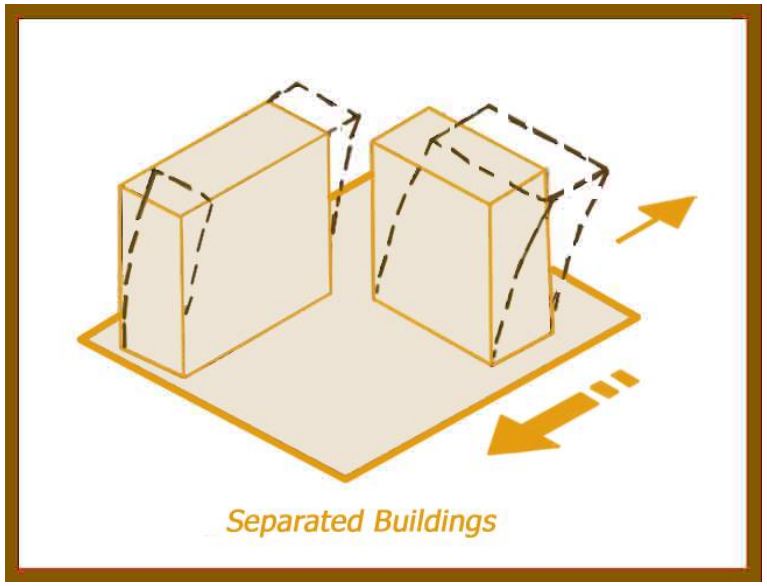
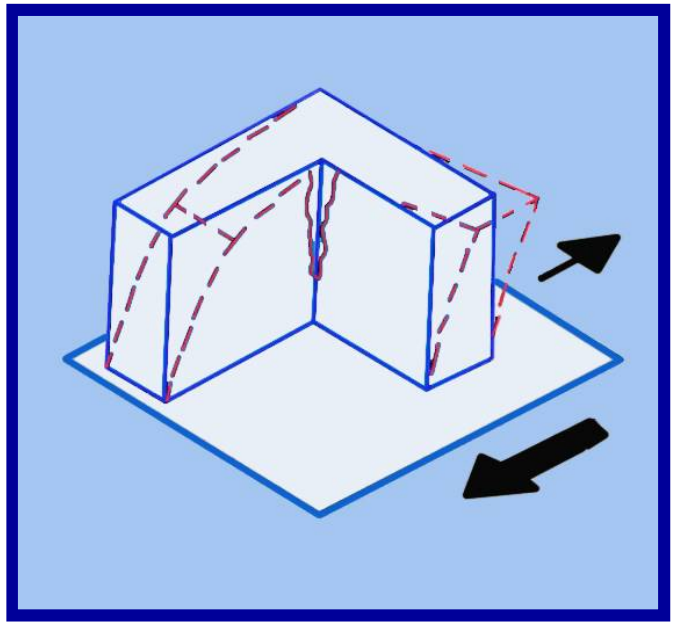
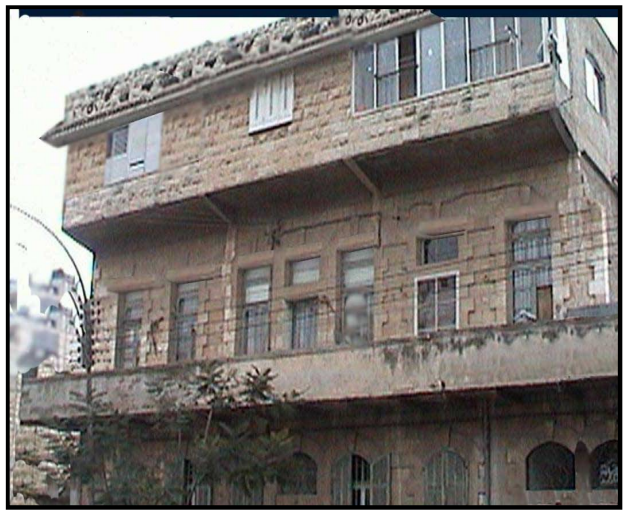


Figure 6B-3 The reentrant corner plan. A range of significance.





Irregularity انعدام الانتظام والتماثل



Cantilever systems

الطيرانات

Cantilever systems

الطيرانات

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Cantilever systems

الطيرانات

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Soft Story at the first floor

الطابق الرخو

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Soft Story

الطابق الرخو او الضعيف وانماط المباني الدارجة محلياً

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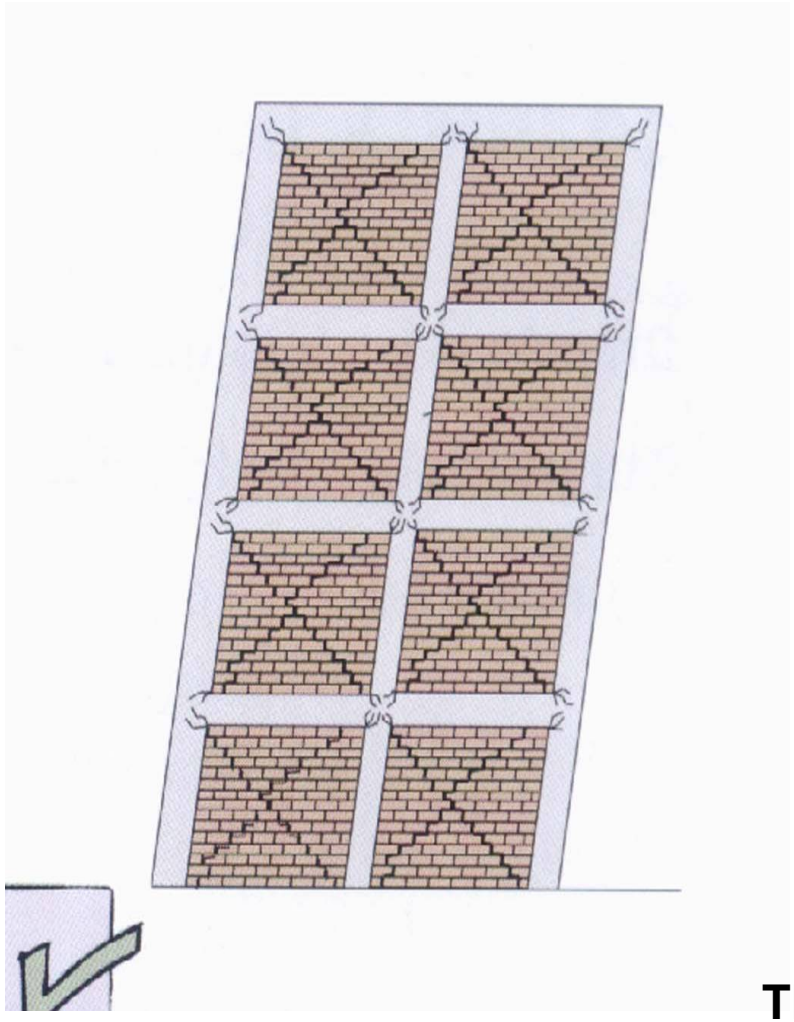

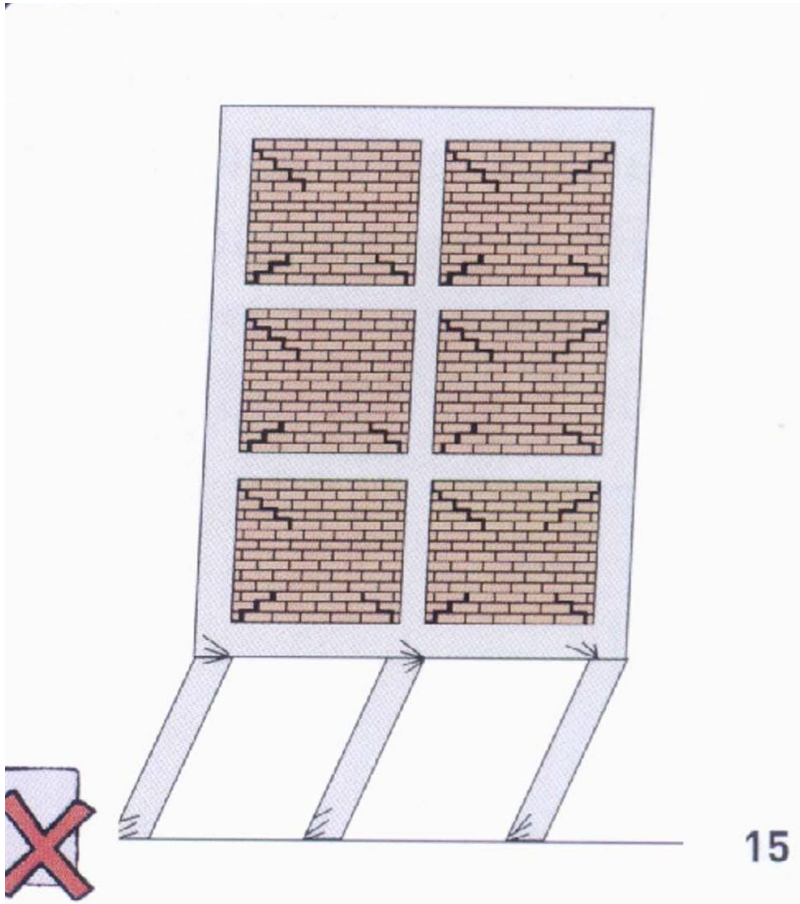

The soft story and the strong columns - weak beams concept.

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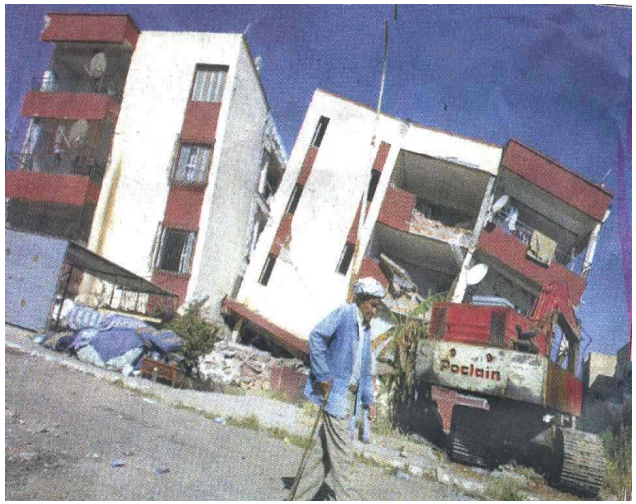

Soft Story

Soft Story

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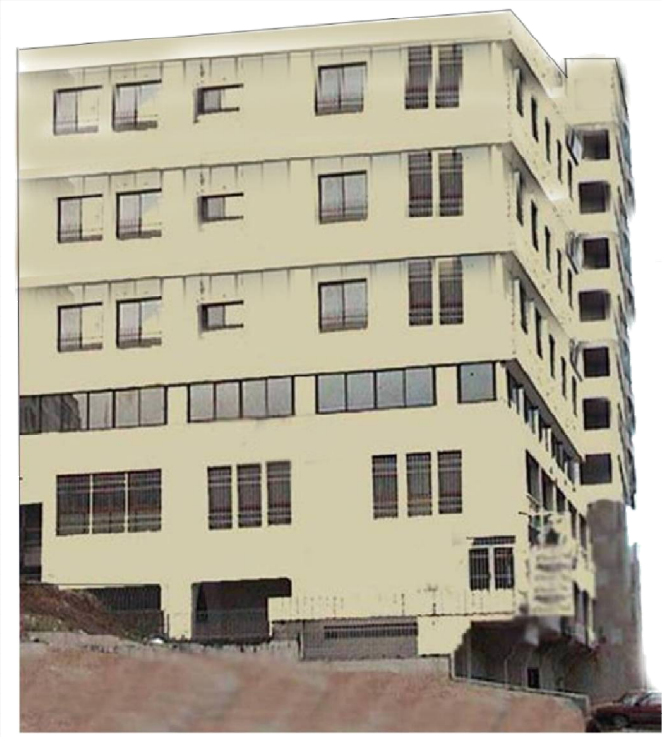

بعض أنماط المباني الدارجة محلياً ووجود طابق/ أو طوابق رخوة
في الطوابق الوسطية أو المتكررة.

Soft Story

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Soft Story

زلزال تركيا 1999

تشكيل الطابق الرخو في الطوابق الوسطية

زلزال الهند 2001

تشكيل الطابق الرخو في الطوابق الوسطية

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Slenderness ratio نسبة النحافة

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انقلاب مبنى نحيف زلزال كوبي، اليابان 1995

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- Adjacent to other building.

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الفواصل الزلزالية-

الفواصل الانشائيّة

Seismic Joints

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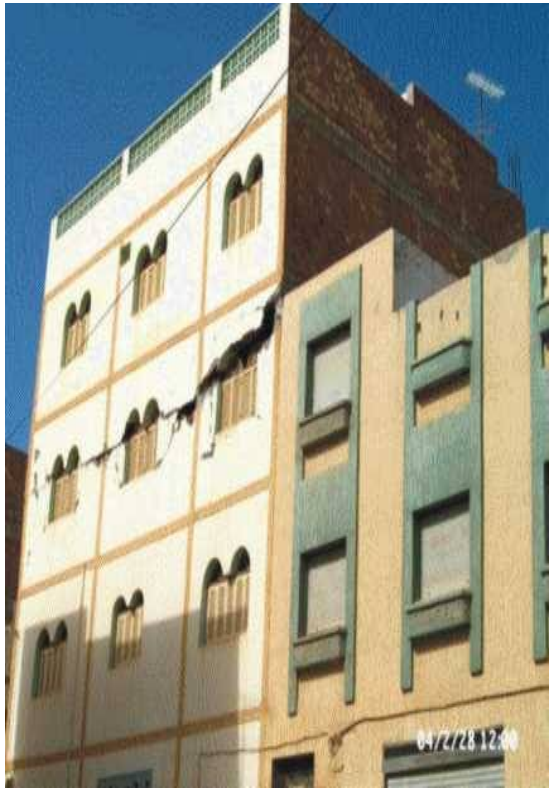
- Adjacent to other building.



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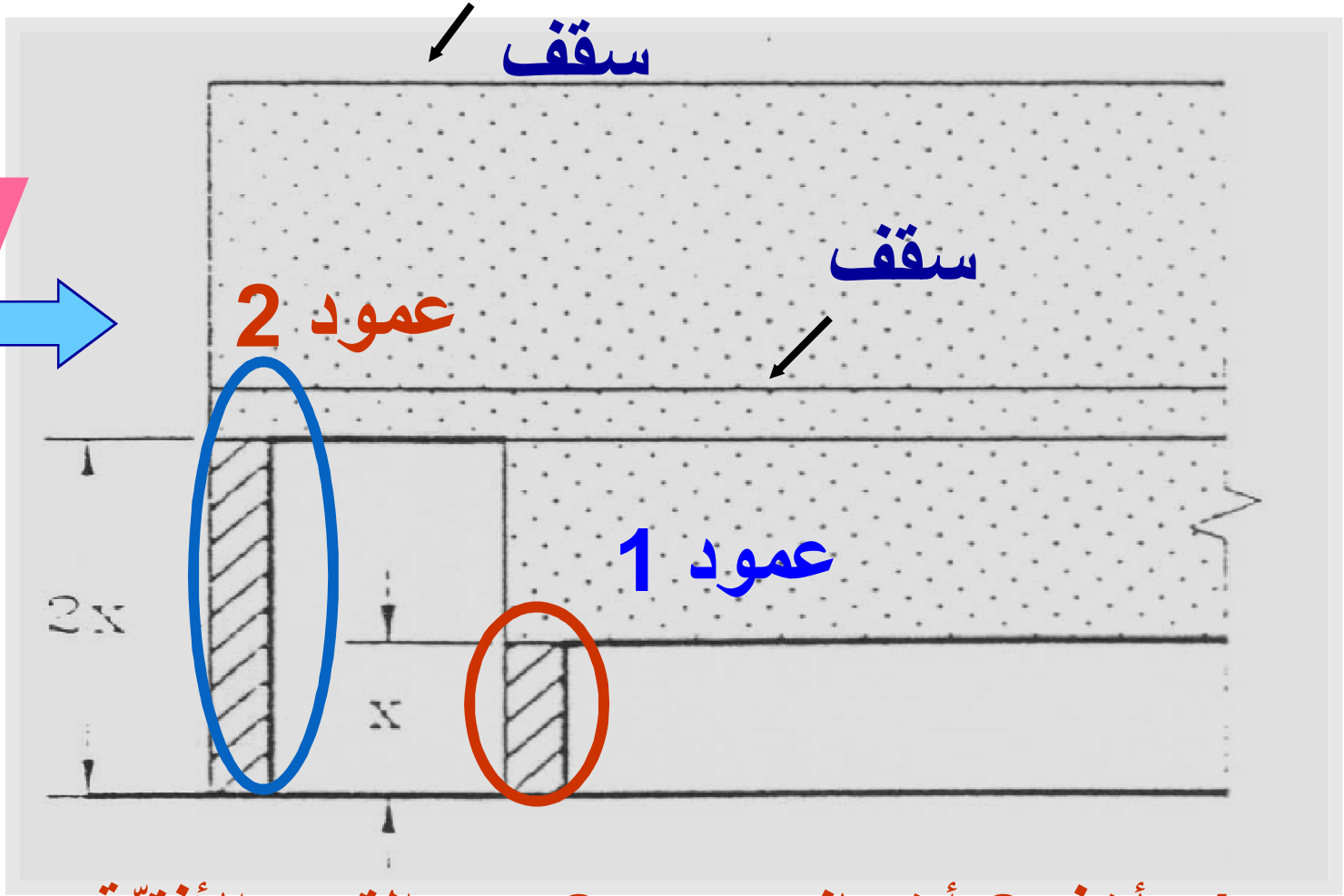

عمود1 يأخذ 8 أضعاف عمود 2 من القوى الأفقيّة

$$K = nEI / L^3$$

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Short column

Nonductile Concrete Buildings

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البناء القديم... البناء فوق قائم قديم؟؟

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Urban Planning and Disaster Risk Reduction Center/Earthquake Engineering Unit

Number	Category / code	Building Type	ERD and seismic details	slop- site	Soil type	Building Mat. Condition	Slenderness Ratio	Plan unsymmetry	Elevation unsymmetry	Position (Seismic Join	Soft Story	Short columns	Cantilever system	Main Entrance	DBSNS	Important Factor	Seismic Vulnerability			
																	D	C	B	A

Page 1

S_A: Hard Rock.
S_B: Rock.
S_C: Very dense soil and soft rock.
R.C.Mas: Reinforced concrete beams and columns with exterior decorative masonry walls.
R.C-Brick: Reinforced concrete brick
DBSNS:details between structural and nonstructural elements

I= 1, Normal, Residential Buildings.
I=1.2, Hazardous Buildings, Schools, Hospitals.
I= 1.5, Essential Buildings, Power-Generating stations,All structures with occupancy grater than 500 Persons.
(-): Not applied or no effect for the mentioned factor.

E: Excellent
V.G: Very Good
G: Good
B: Bad
V.B: Very Bad

L: Low
M: Moderate
H: High
W_L: Low weight
W_M: Moderate weight
W_H: Heavy weight

ERD: Earthquake Resistance Design

Table (1): Seismic Vulnerability Of Selected Buildings

Jalal Al-Dabbeek

مركز التخطيط الحضري والحد من مخاطر الكوارث/ وحدة هندسة الزلازل

الرقم	عوامل / رمز المبنى	نوع البناء	التصميم الزلزالي	انحدار الموقع	نوع التربة	حالة المبنى (المواد)	نسبة التحاك	عدم تماثل افقي	عدم تماثل عمودي	نواصل زلزالية	وجود طابق رخو	وجود اعمدة قصيرة	وجود الطوب الطيران	تشكيل المدخل الرئيسي	ربط العناصر غير الإنشائية	معامل الأهمية (I)	فئة قابلية الإصابة			
																	A	B	C	D

Page 1

L: Low	E: Excellent	I= 1, Normal, Residential Buildings.	S_A: Hard Rock.
M: Moderate	V.G: Very Good	I=1.2, Hazardous Buildings, Schools, Hospitals.	S_B: Rock.
H: High	G: Good	I= 1.5, Essential Buildings, Power-Generating stations,All structures with occupancy grater than 500 Persons.	S_C: Very dense soil and soft rock.
W_L: Low weight	B: Bad		R.C.Mas: Reinforced concrete beams and columns with exterior decorative masonry walls.
W_M: Moderate weight	V.B: Very Bad		
W_H: Heavy weight			
ERD: Earthquake Resistance Design		(-): Not applied or no effect for the mentioned factor.	

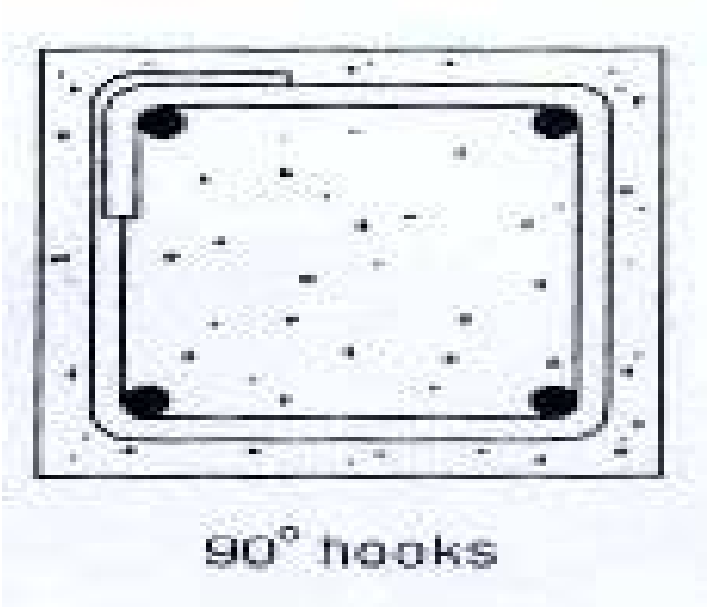
جدول (١): التقييم الميداني السريع وقابلية الإصابة الزلزالية لأنماط المباني الدارجة محليا.

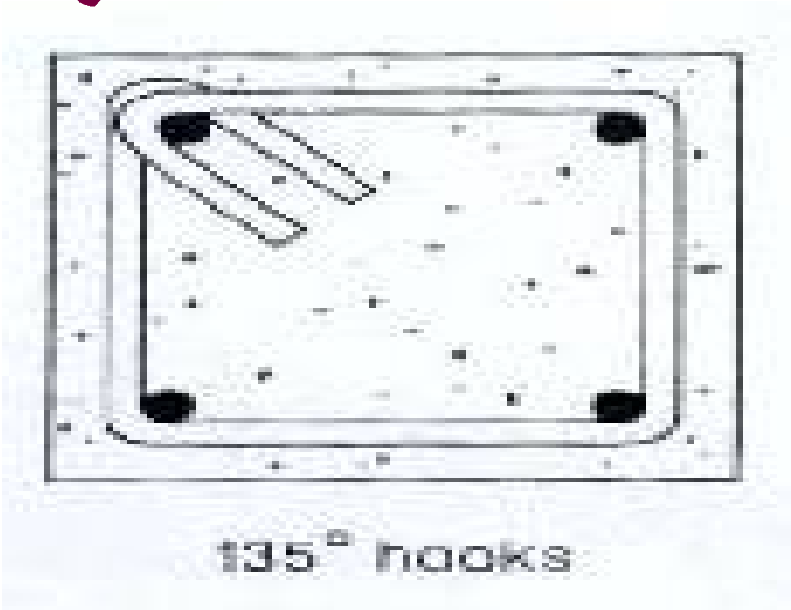
د.جلال الديبك

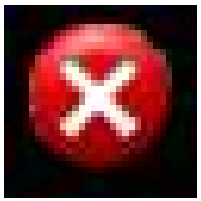
Quality and Workmanship

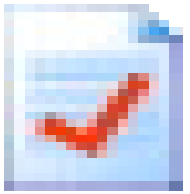
النوعية (المواد والتنفيذ)

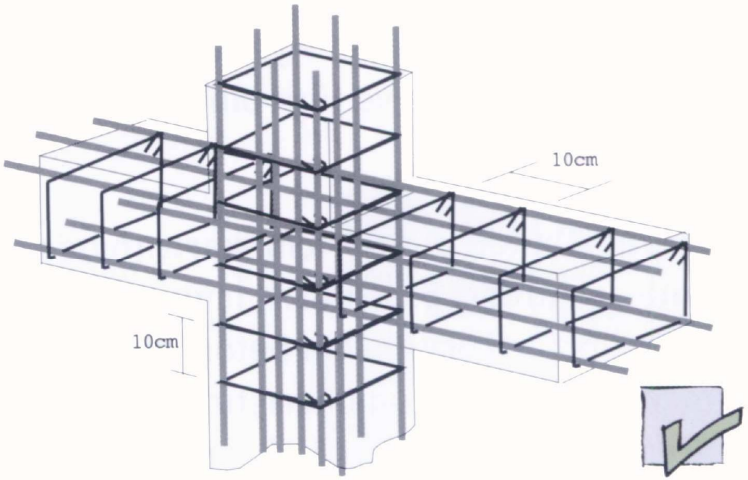
تفاصيل تسليح العناصر الانشائيّة

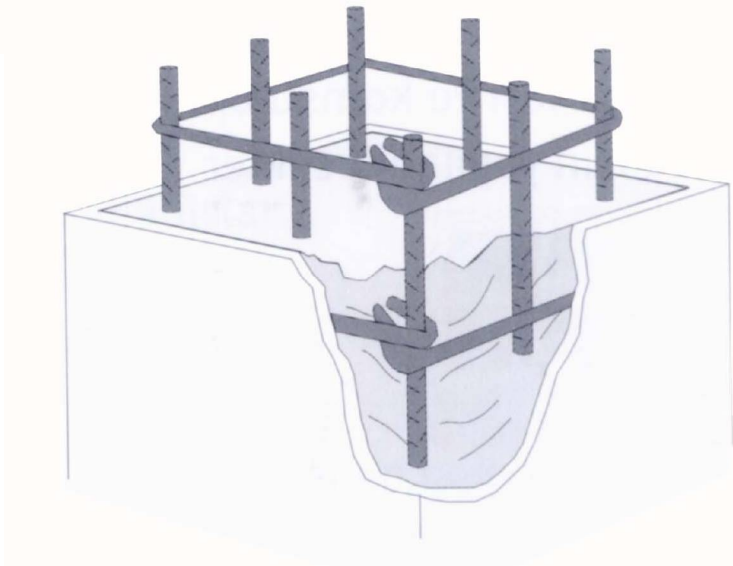









10cm
10cm



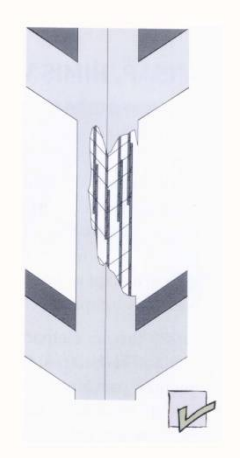


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Figure 7: Formation of plastic hinge in the column near the beam-column joint in a hospital building in Mansehra

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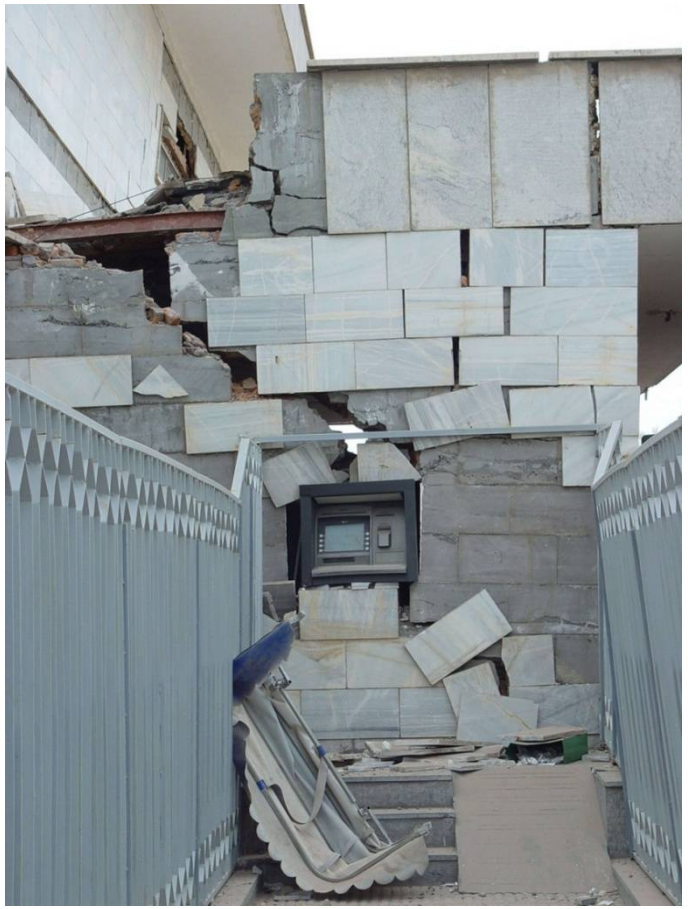
Non structural damages

الاضرار غير الانشائية



Non structural damages

الاضرار غير الانشائية

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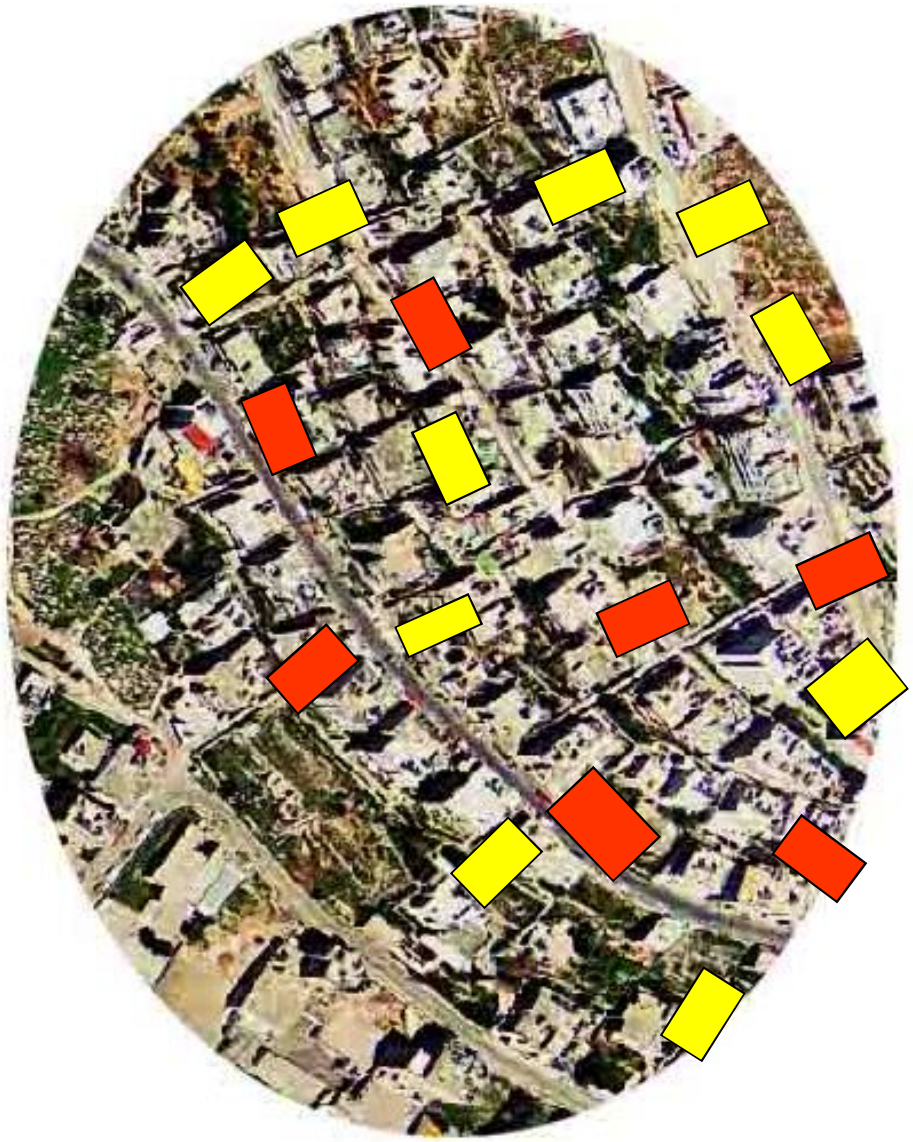

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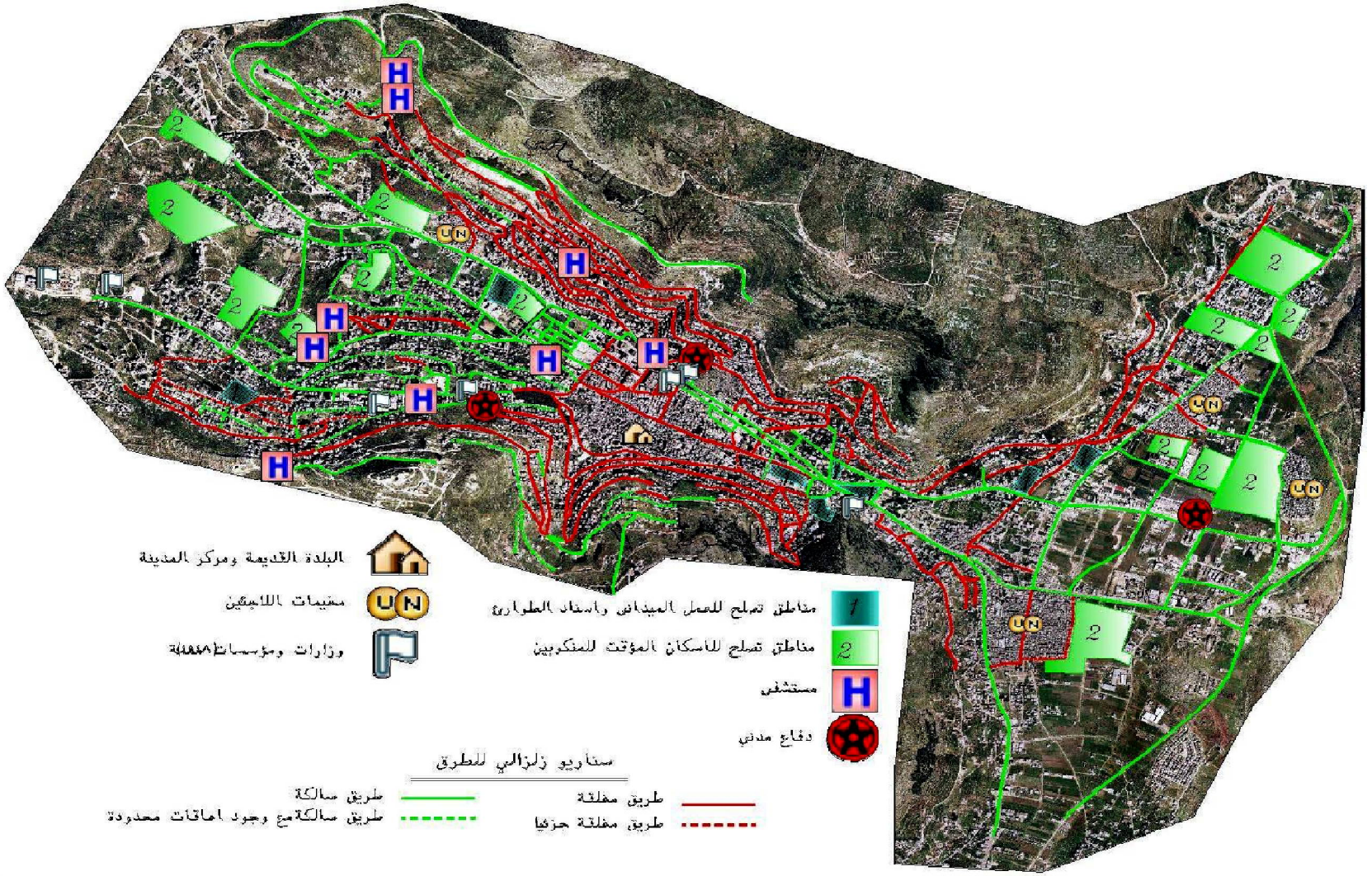

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5- Assess the safety of all schools and health facilities and upgrade these as necessary

٥. تقييم سلامة جميع المدارس والمرافق الصحية ورفع مستويات السلامة لهذه المرافق كلما احتاجت لذلك؟

نقاش:

- المدارس
- المستشفيات

What about the seismic vulnerability of non structural elements??? → Non structural damages….

What about the seismic vulnerability of non structural elements in the hospitals??? Non structural damages….

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The Integration Between SASPARM 2 Project and International Activities and Programs on Disaster Risk Mitigations

التكامل بين مشروع تخفيف مخاطر الزلازل في فلسطين والفعاليات والبرامج الدولية في مجال تخفيف مخاطر الكوارث

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Hyogo Framework for Action 2005 – 2015

إطار عمل هيوغو في الفترة ما بين (٢٠٠٥-٢٠١٥)

Buildings the resilience of Nations and Communities to disasters

بناء قدرة الأمم والمجتمعات على مواجهة الكوارث

Priorities Action

- **Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.**
- **Identify, assess and monitor disaster risks and enhance early warning.**
- **Use knowledge, innovation and education to build a culture of safety and resilience at all levels.**
- **Reduce the underlying risk factors**
- **Strengthen disaster preparedness for effective response at all levels.**

أولويات العمل

- ضمان إعتبار الحد من مخاطر الكوارث أولوية وطنية ومحلية قائمة على قاعدة مؤسسية صلبة التنفيذ
- تحديد مخاطر الكوارث وتقييمها ورصدها وتعزيز الإنذار المبكر
- الاستفادة من المعرفة والإبتكارات والتعليم لبناء ثقافة للسلامة والقدرة على مواجهة الكوارث على جميع المستويات
- الحد من عوامل المخاطر الأساسية
- تعزيز التأهب للكوارث بغية التصدي لها بفاعلية على جميع المستويات.

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تمكين المدن من مجابهة الكوارث:
مدينتي تستعد!

Making Cities Resilient:
My City is Getting Ready

الحملة العالمية للحد من الكوارث

World Disaster Reduction Campaign

هل مدينتك مستعدة؟

Is your city ready?

www.unisdr.org/campaign

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Priorities for action

أولويات العمل

Sindai Frame Work for Ation

Priority 1: Understanding disaster risk

الأولوية ١ - فهم مخاطر الكوارث

الأولوية ٢ - تعزيز [الحكم والمؤسسات/الترتيبات المؤسسية/الأطر التنظيمية والقانونية والسياسية] لإدارة مخاطر الكوارث

Priority 2: Strengthening governance to manage disaster risk

الأولوية ٣ - الاستثمار في مجال الحد من مخاطر الكوارث من أجل زيادة القدرة على مواجهتها

Priority 3: Investing in disaster risk reduction for resilience

الأولوية ٤ - تعزيز التأهب للكوارث بغية التصدي لها بفعالية و "إعادة البناء بشكل أفضل" في مرحلة التعافي والإصلاح وإعادة البناء

Priority 4: Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction

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Building the resilience of nations and communities to disasters

بناء قدرات الامم والمجتمعات لمواجهة الكوارث

ايجاد البنية الفعّالة و السّياسة الحكيمة و الجهاز القادر

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Thank you for your attention!

شكرا لحسن الإصغاء

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