
Building on Faults: the 1999 Turkey Earthquake



by
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Purdue University
March 31, 2006

Outline

- **Overview**
- **Shaking Damage**
- **Fault Rupture**
- **Near Fault Effects**
- **Rigid vs. Flexible Structures**
- **Conclusions**

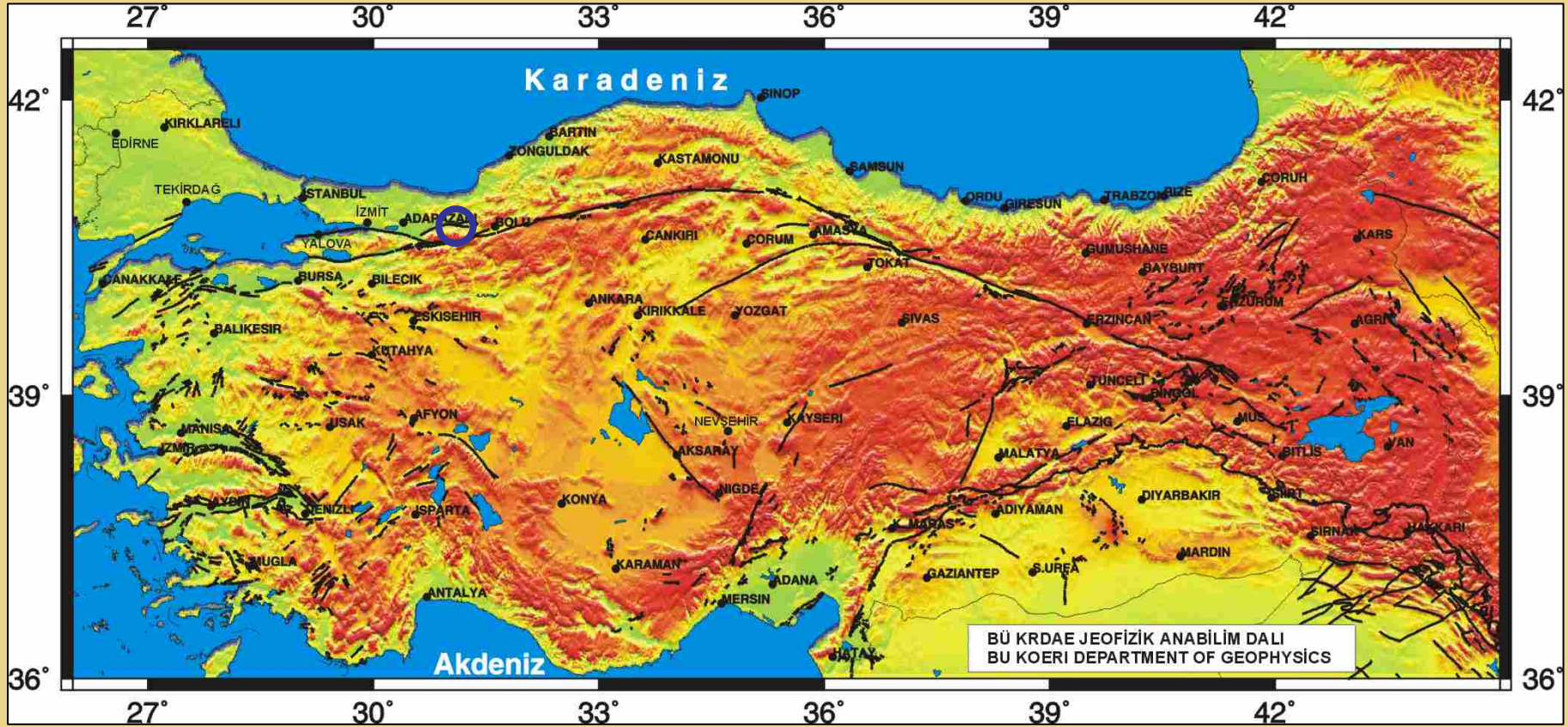


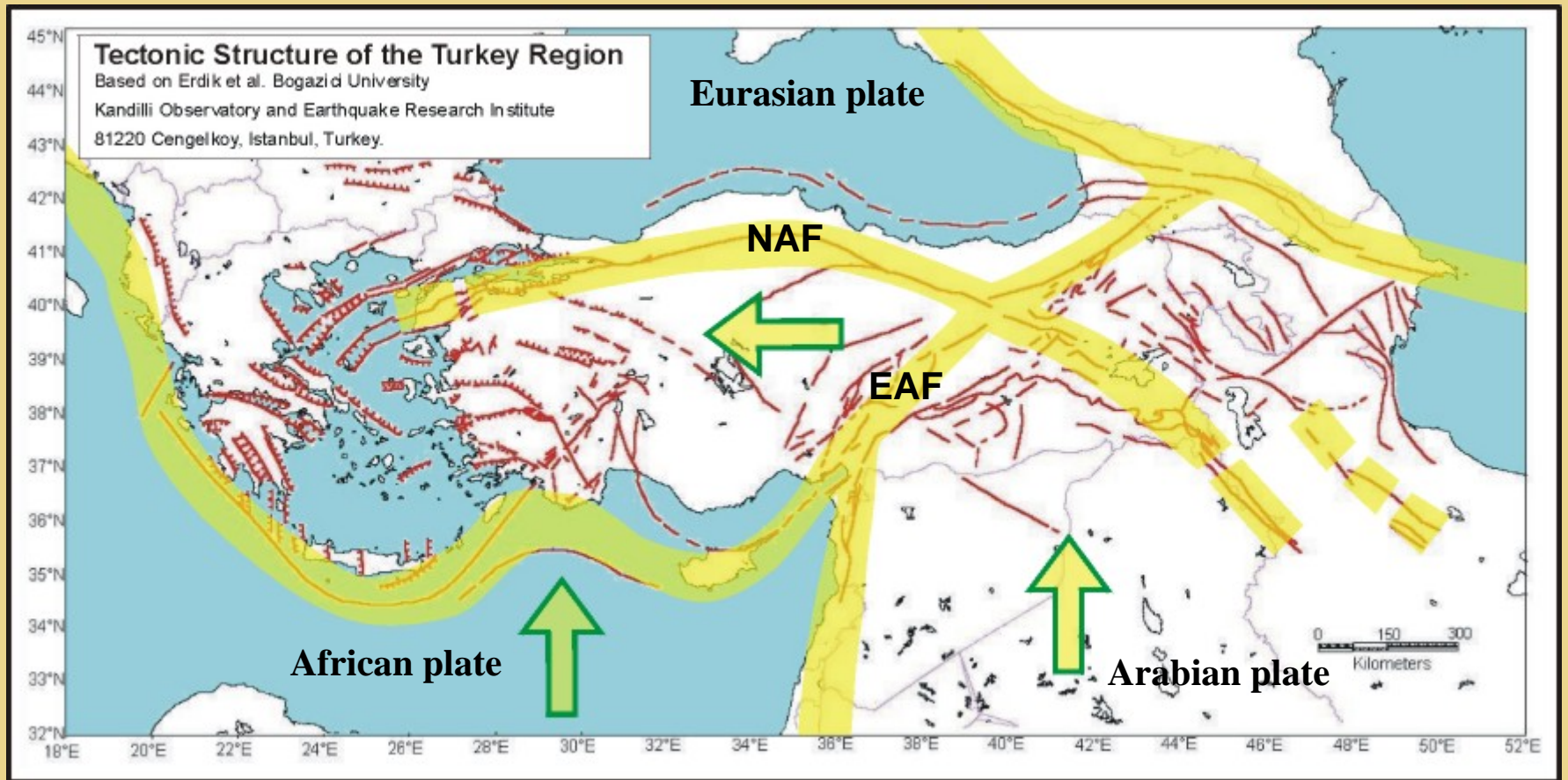
Scale 1:134,000,000
Robinson Projection
standard parallels 38°N and 38°S

June 2000

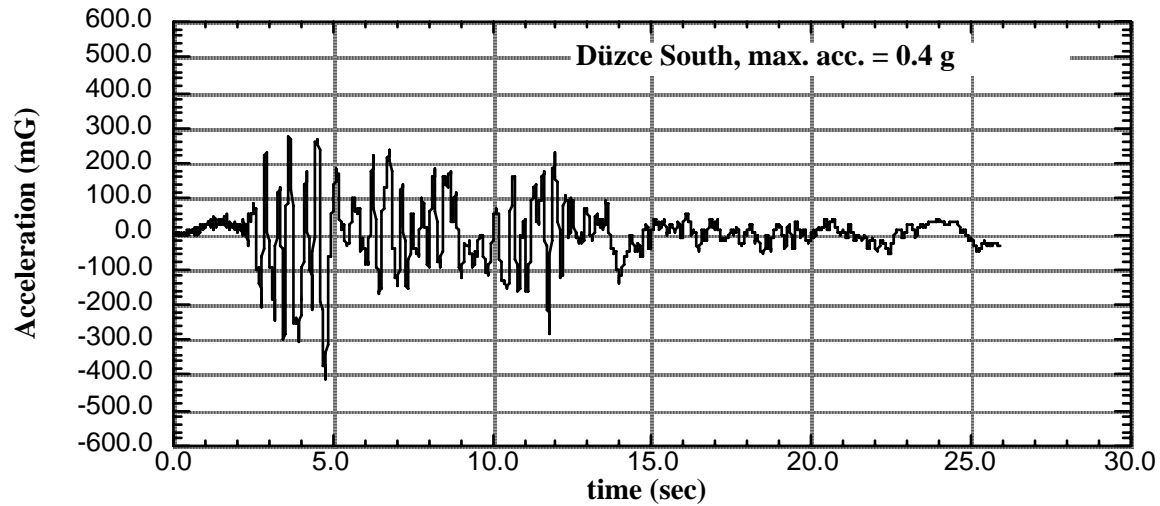
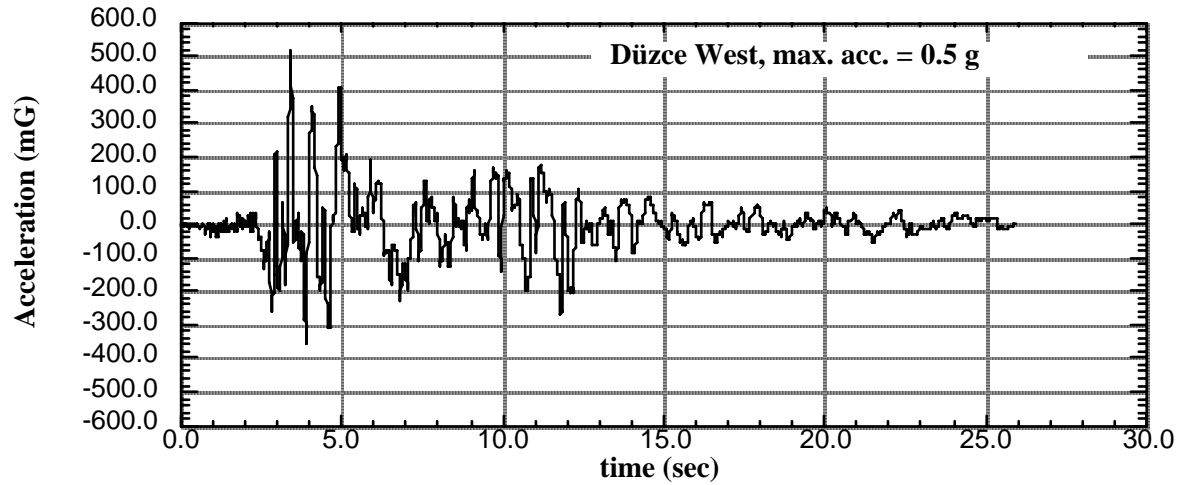
Boundary representation is
not necessarily authoritative.

802703AI (R00352) 6-00











Adapazari



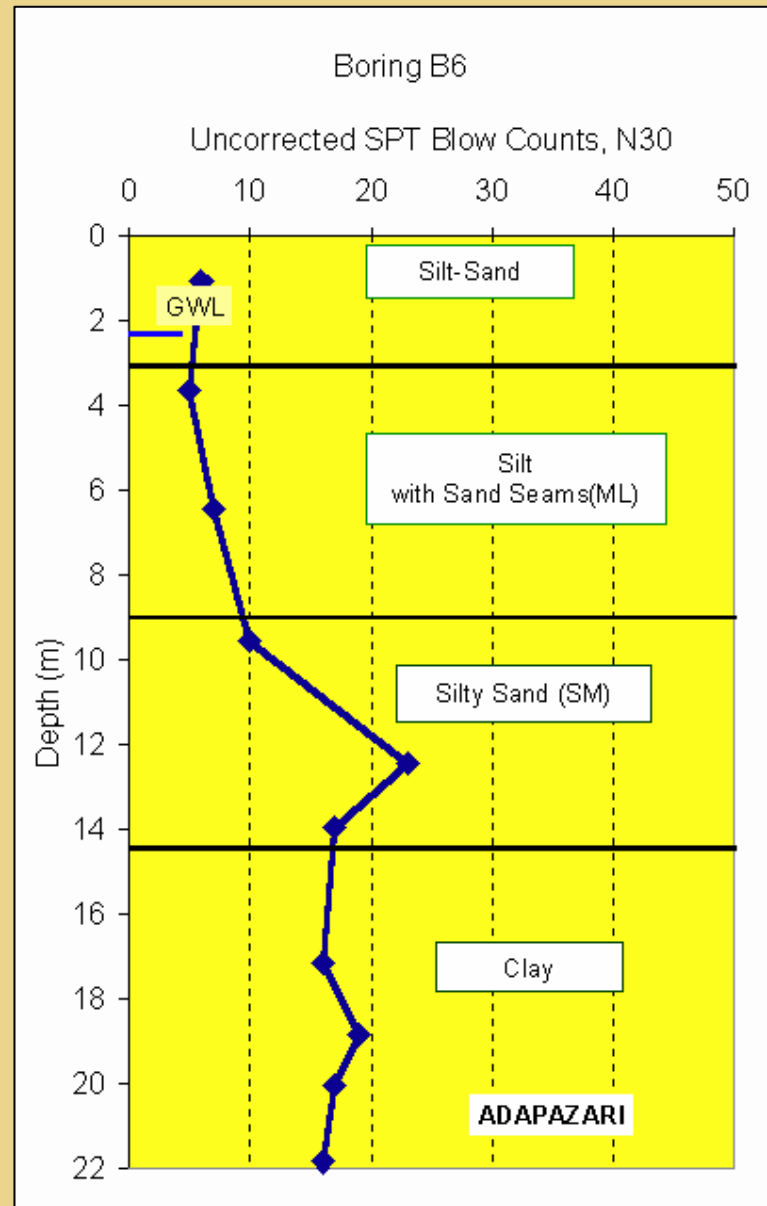
Adapazari



Adapazari



Adapazari
Localized damage



Adapazari



Adapazari. Typical Foundation



Düzce



Düzce






Düzce



Düzce



Düzce

 LOG OF TEST BORING Boring No.: C-12/4357 25/9/63 Location: Düzce Town NE Date: 16/10/63							 LOG OF TEST BORING Boring No.: C-12/4357 25/9/63 Location: Düzce, NE Date: 16/10/63							 LOG OF TEST BORING Boring No.: C-12/4357 Location: Düzce, NE Date: 25/9/63 16/10/63									
							Coordinate							Coordinates									
							Sheet 2							Sheet 3 of 3									
SAMPLE				DESCRIPTION/CLASSIFICATION and REMARKS	SAMPLE				DESCRIPTION/CLASSIFICATION and REMARKS	SOIL		SAMPLE				DESCRIPTION/CLASSIFICATION and REMARKS	SOIL PROPERTIES						
No.	Type	Rec %	SPT		Depth (m)	No.	Type	Rec %		SPT	Depth (m)	Su	γ	No.	Type		Rec %	SPT	Depth (m)	Su	γ _d	w %	LL %
				0	0-2m Topsoil Sandy clay. Brown. Clay. Brown. Little sand. Sand. Little clay. Fine gravel. Gravelly clay. Gray.				100							200							
				10	Clay. Dark gray with little gravel. Clay. Gray with gravel and sand Sandy gravel Clay. Dark gray.				110							210							
				20	Clayey sand. Gray Sand with little clay. Clay with little sand. Gray				120							220							
				30					130	Clay						230							
				40					140	Clayey sand						240							
				50					150							250							
				60	Gravel with little clay and sand				160	Gravel						260							
				70					170							270							
				80	Gravel. The gravel is peridotite and serpentine.				180							280							
				90					190							290							
				100					200	Clay with sand						300							
GENERAL OBSERVATIONS:					GENERAL OBSERVATIONS:					GENERAL OBSERVATIONS:													
5-40m Aquifer (shared) 65-130m 180-210m					Dustion Static Dynamic 8 hr +17.0m +1.65m																		

Düzce



Düzce



Düzce



Düzce

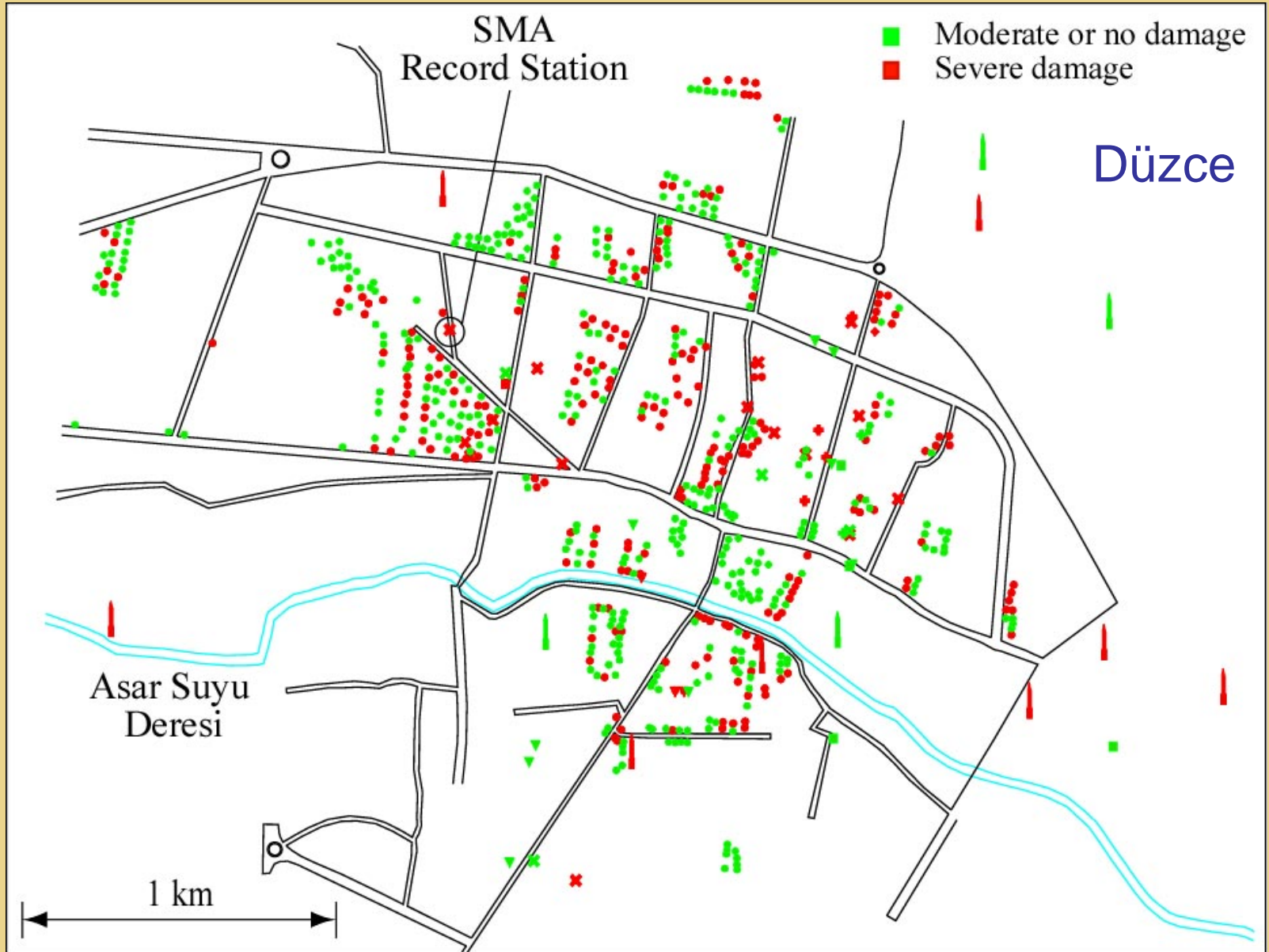


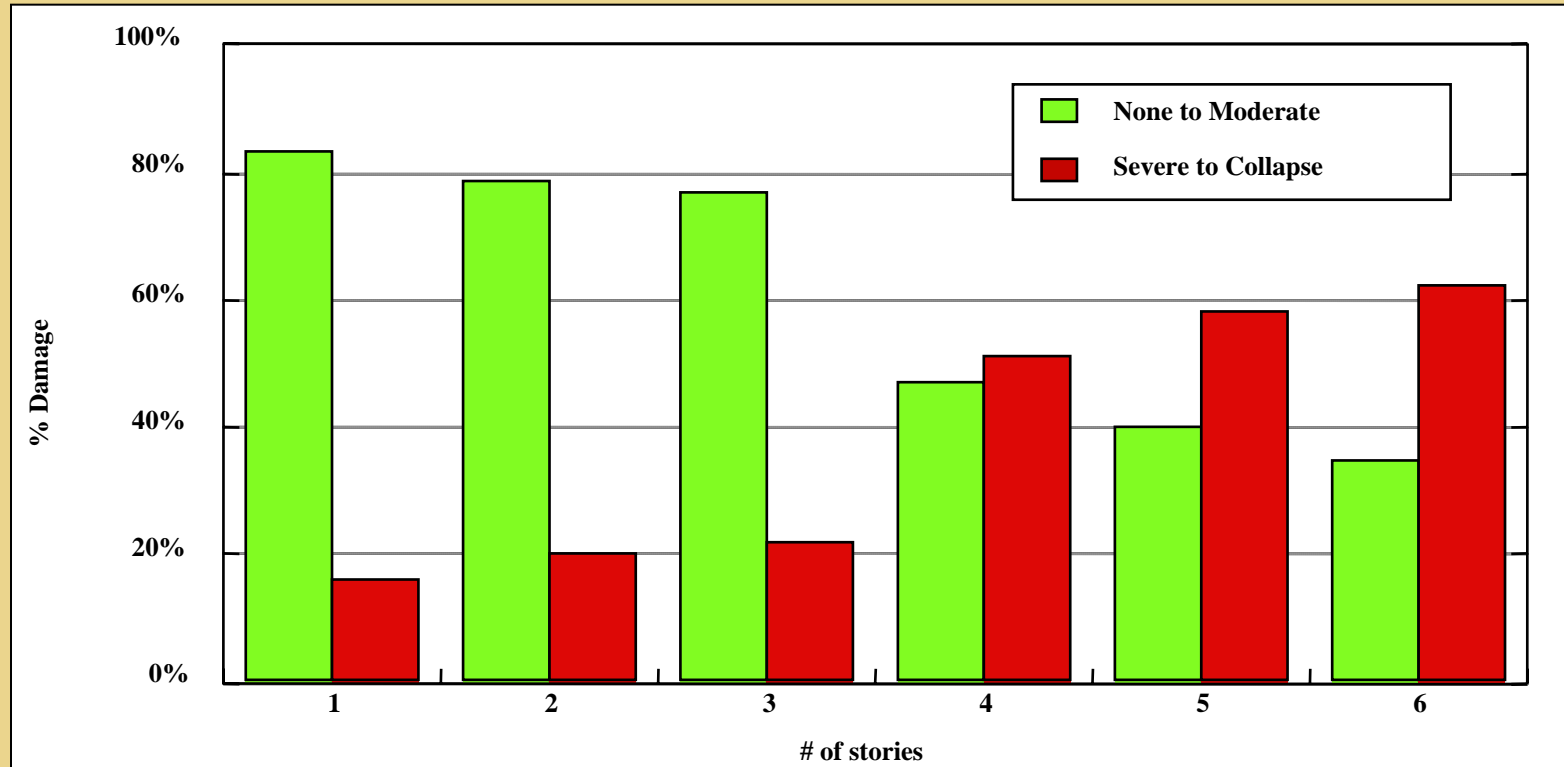
Bingöl

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Shaking Damage



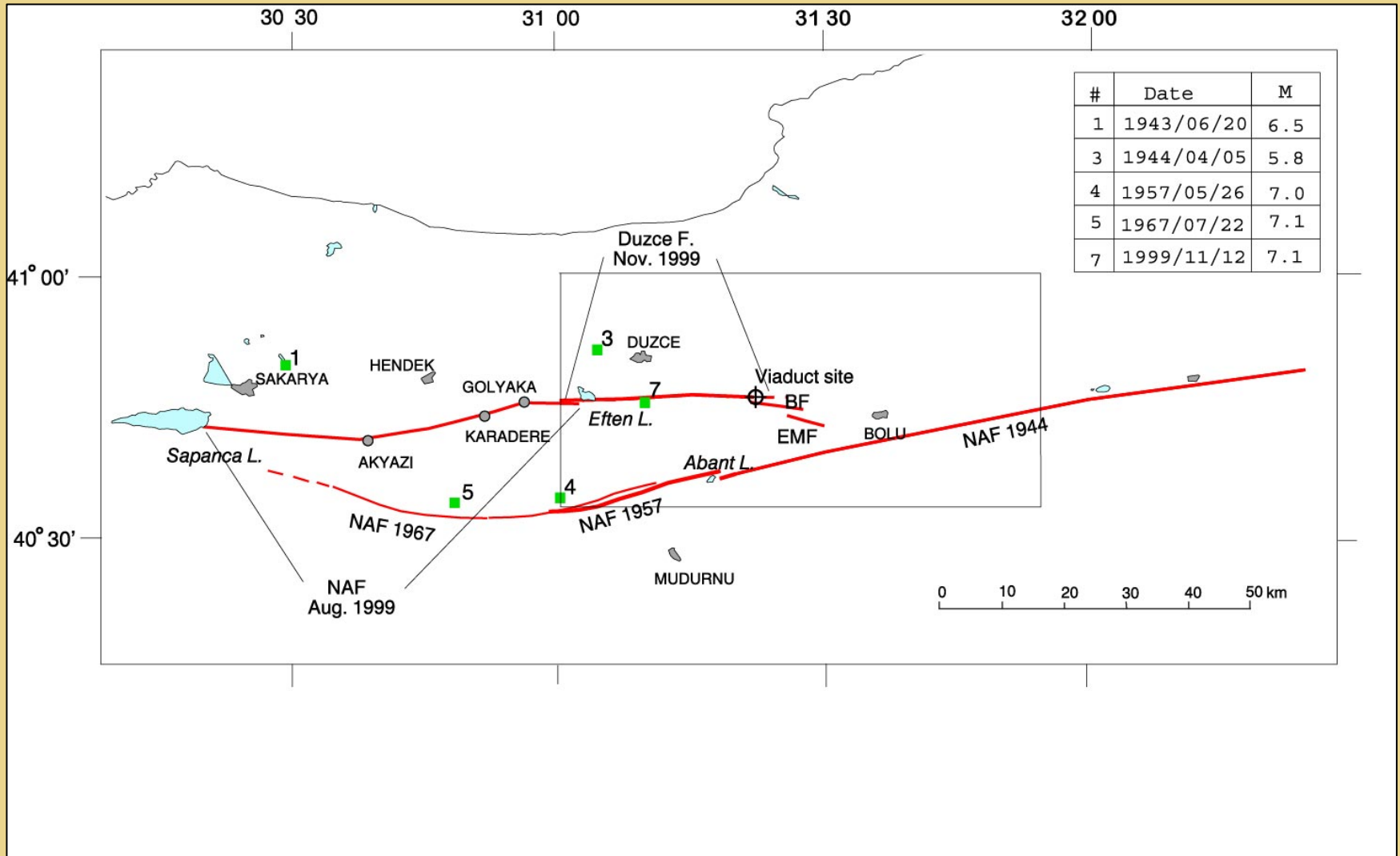


Düzce

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Fault Rupture





Fault Displacement





Tensile rupture



Fault Rupture



Compressive rupture



Fault gauge

Slickensides



Fault Rupture



Fault Rupture



Rupture

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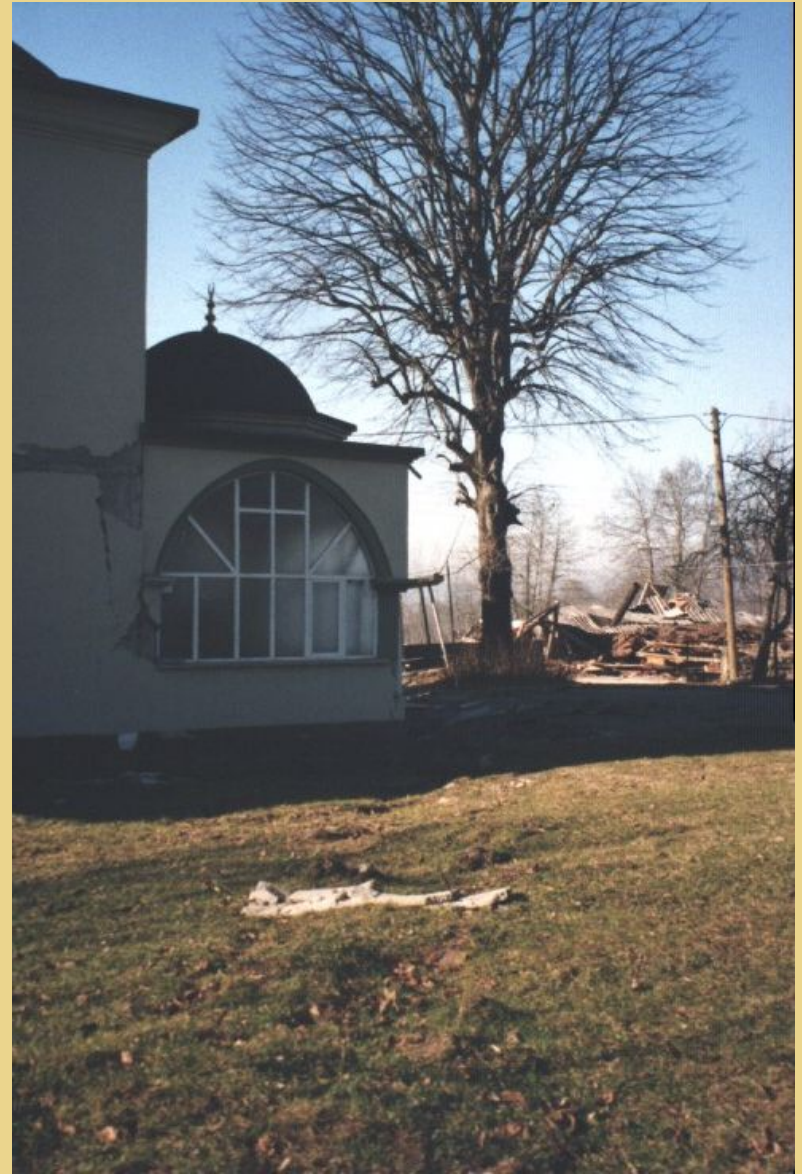


Near Fault Effects —









Outline

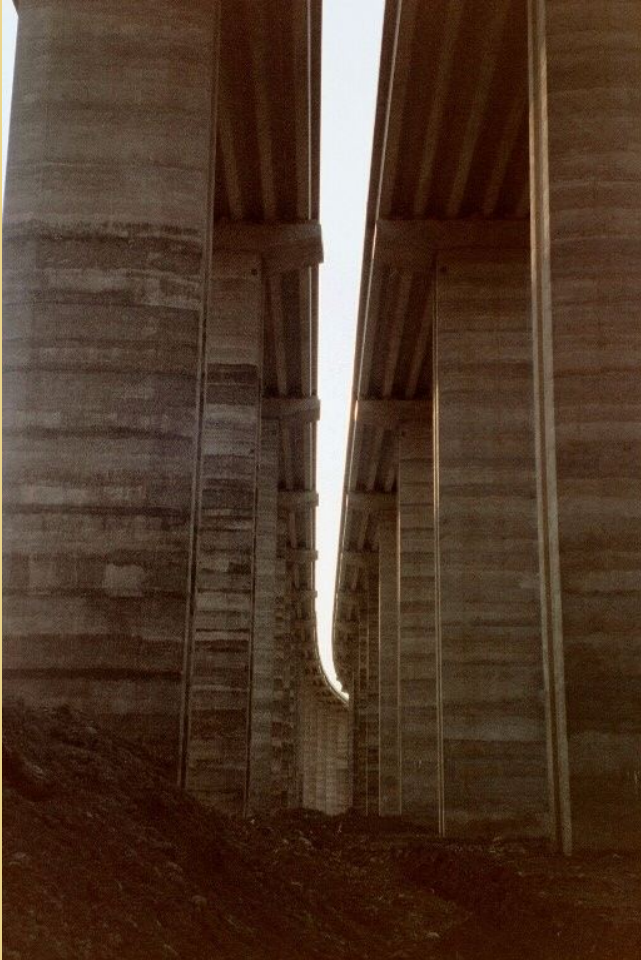
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Rigid vs. Flexible Structures



Bolu Bridge

Rigid vs. Flexible Structures





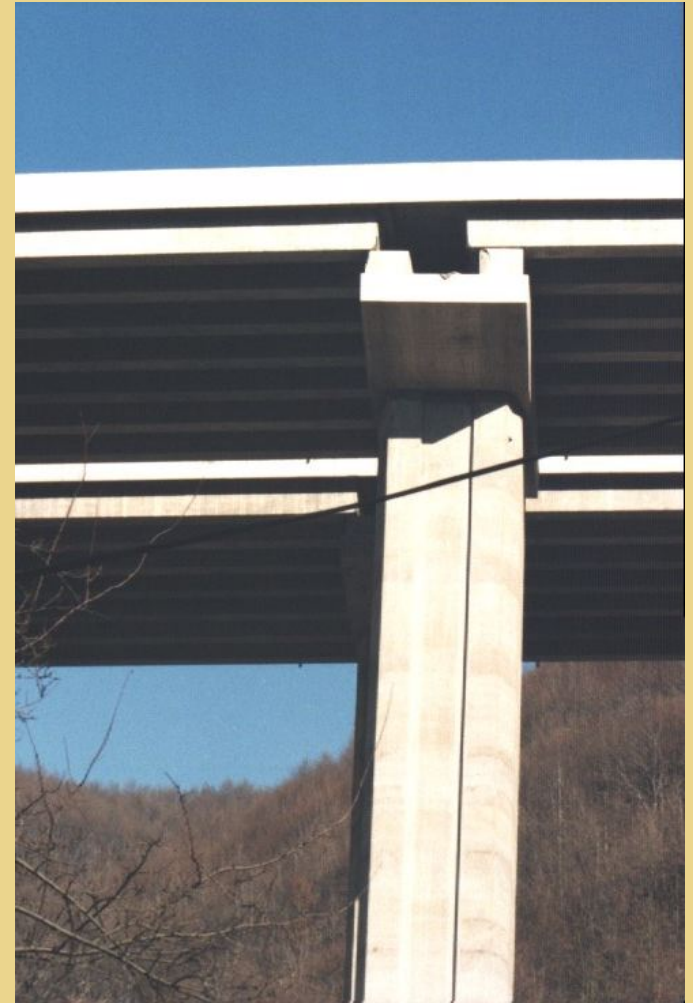
Courtesy A. Johnson

Rigid vs. Flexible Structures



Courtesy A. Johnson

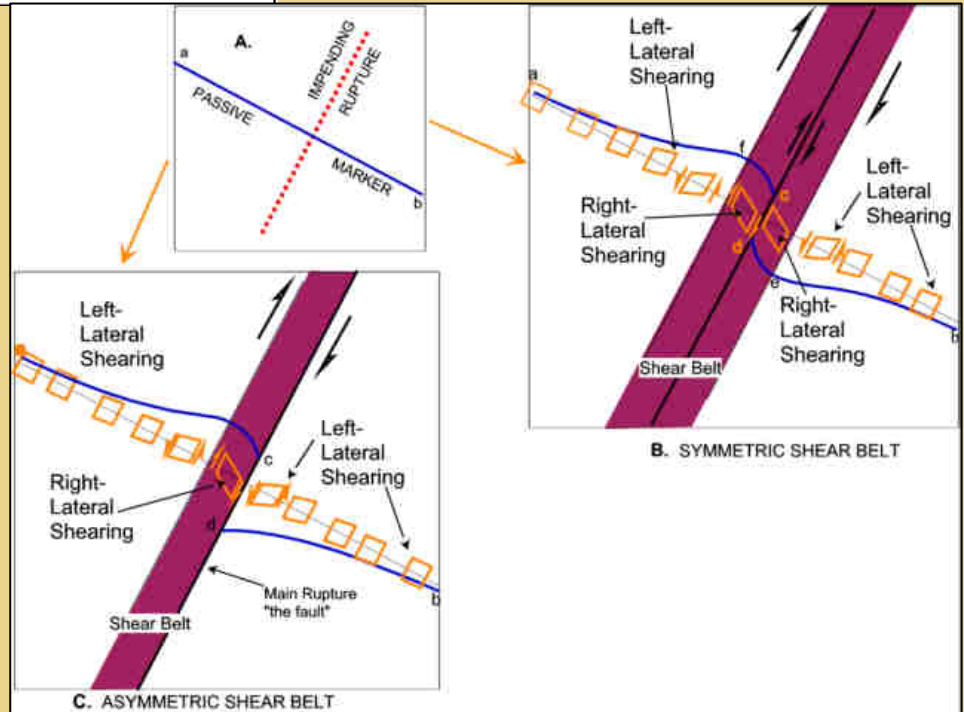
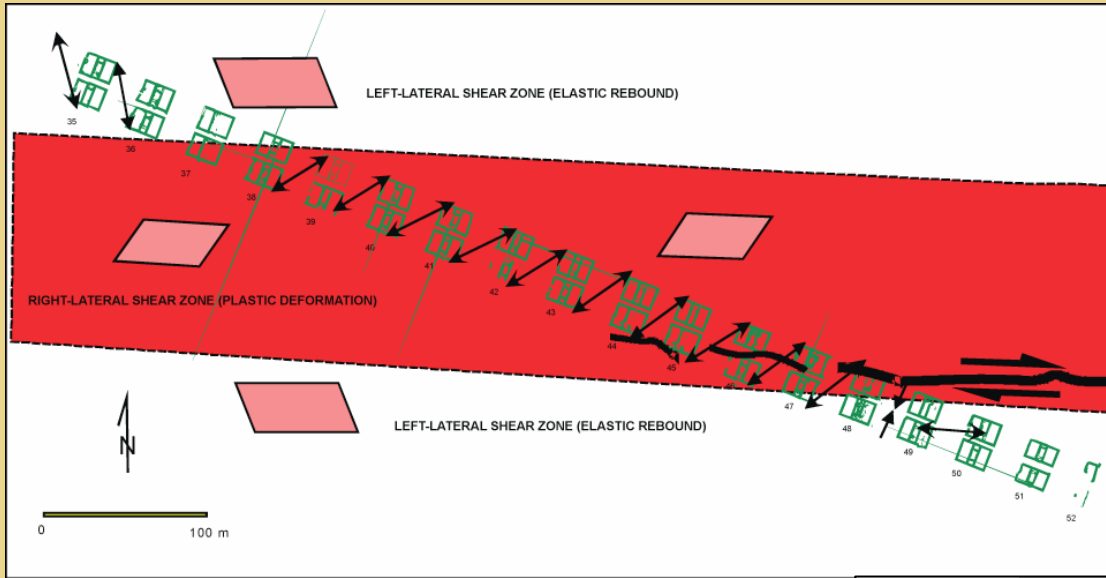
Rigid vs. Flexible Structures



Rigid vs. Flexible Structures



Rigid vs. Flexible Structures



Courtesy A. Johnson

Rigid vs. Flexible Structures





Courtesy A. Johnson

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- **Geology is the critical factor**
- **Need site-specific analysis**
- **Construction details are critical**
- **Near-fault effects: elasto-plastic rebound**

SPONSORS

NSF

ACKNOWLEDGMENT

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“the team”