



Prevalent Structural Engineering Problems Observed in RC Buildings After Kahramanmaras Earthquakes

4/10/2024

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The earthquakes



- $PGA > 1.2g$
- Significant vertical ground motion
- V/H reaches 1.5

Pazarcık, $M_w 7.8$
February 6, 2023 04:17 am

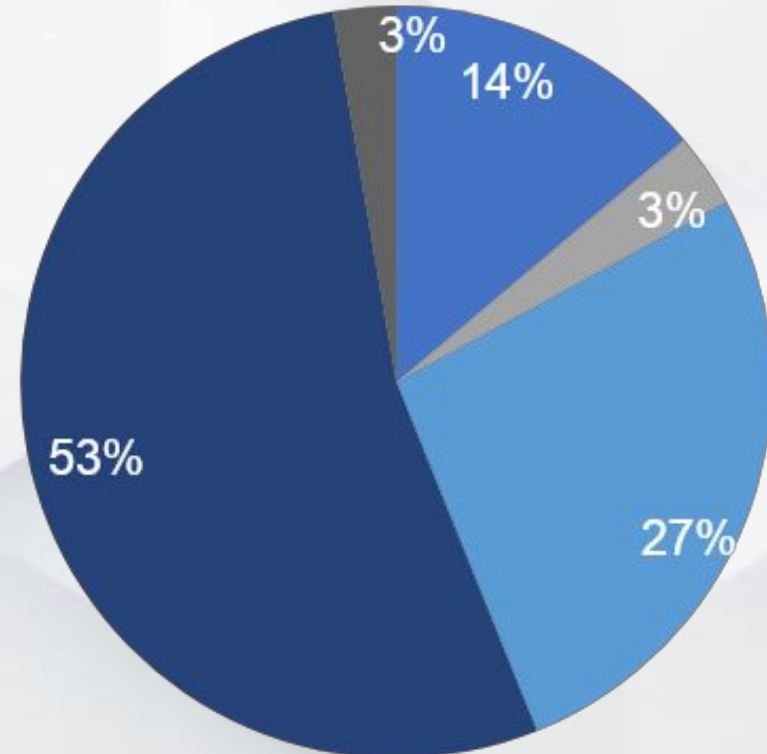
Elbistan, $M_w 7.7$
February 6, 2023 1:24 pm



ADIYAMAN, TURKEY
FEBRUARY 12, 2023

Earthquake Reconnaissance

- heavily damaged
- moderately damaged
- lightly damaged
- undamaged
- collapsed



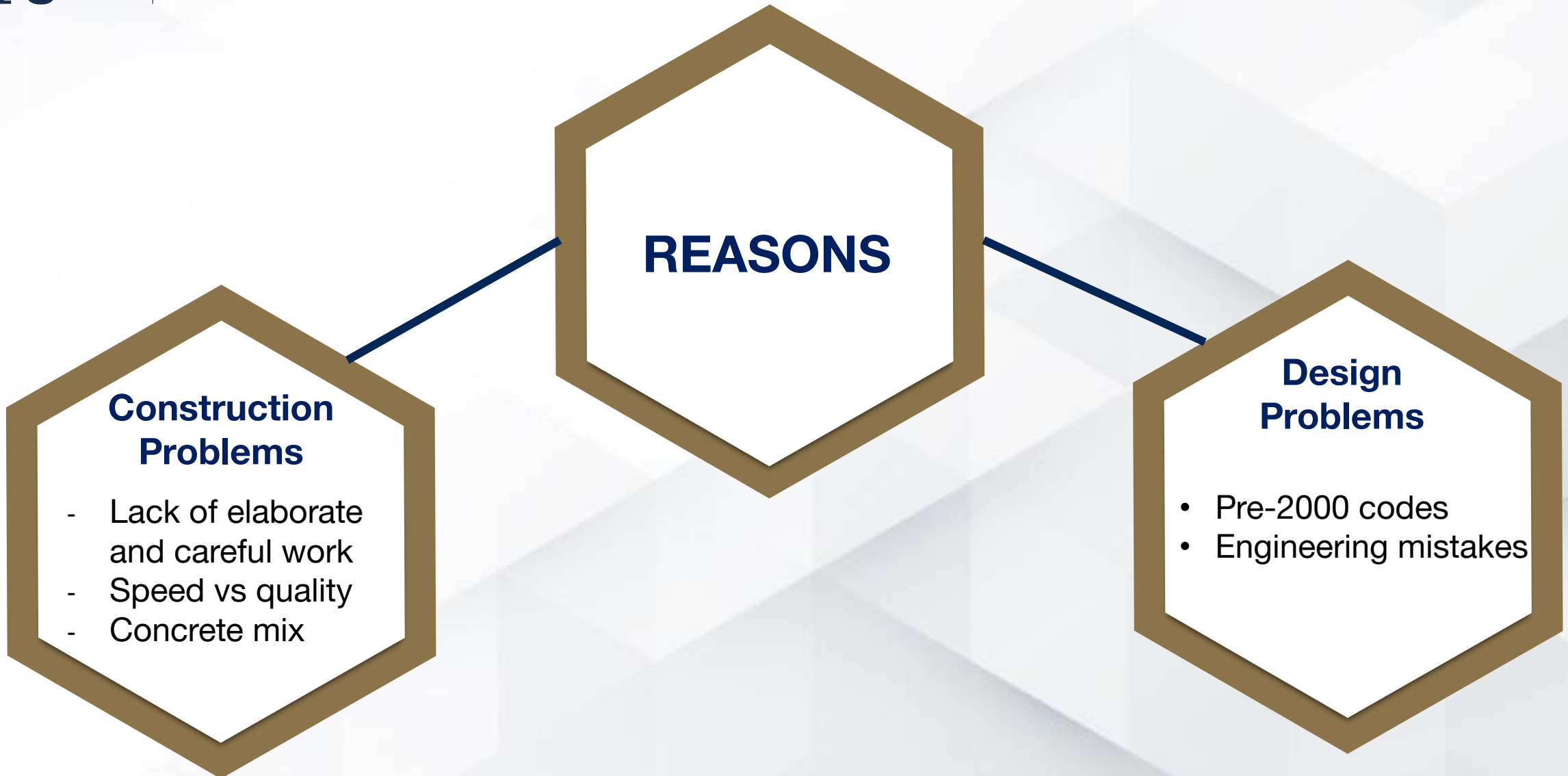
Source: Ministry of Environment, Urbanization and Climate Change

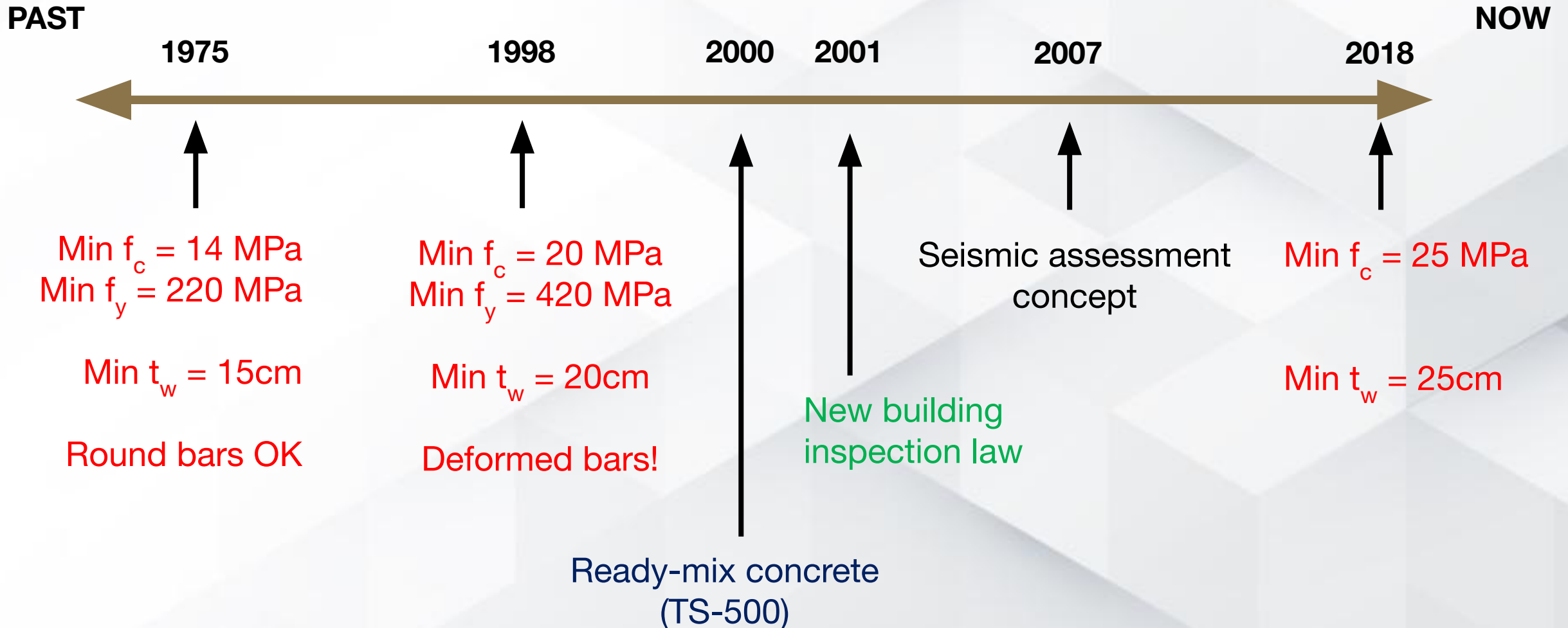
Earthquake Reconnaissance



Earthquake Reconnaissance









Construction

Poor material quality



- Site-mixed concrete
- Min code requirements

Construction

Corrosion of the rebars



Photo credit: Fatih Sutcu, PhD (ITU)



Construction

Lack of proper formwork construction



Construction

Lack of proper concrete work



Construction

Mechanical installation problems

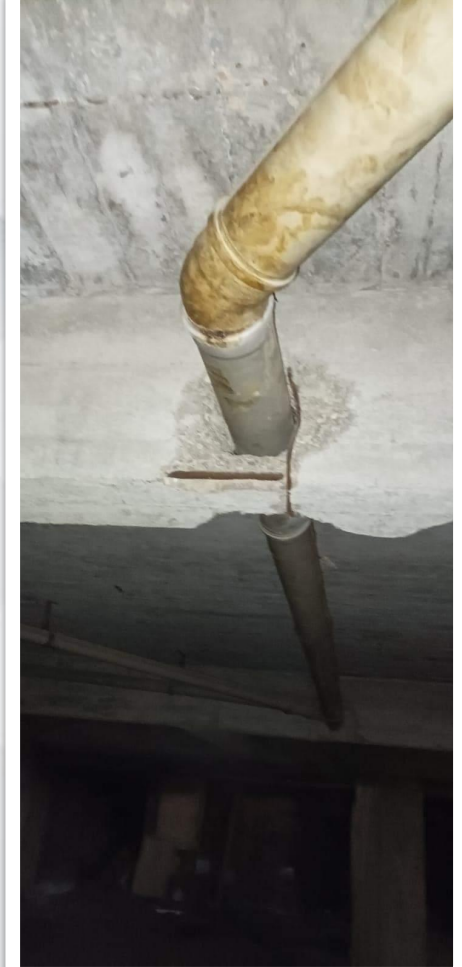
Ventilation system
passing through the shear wall!!



Adıyaman, Private Hospital



Kahramanmaraş, residential buildings



Construction

Stirrup hook angle



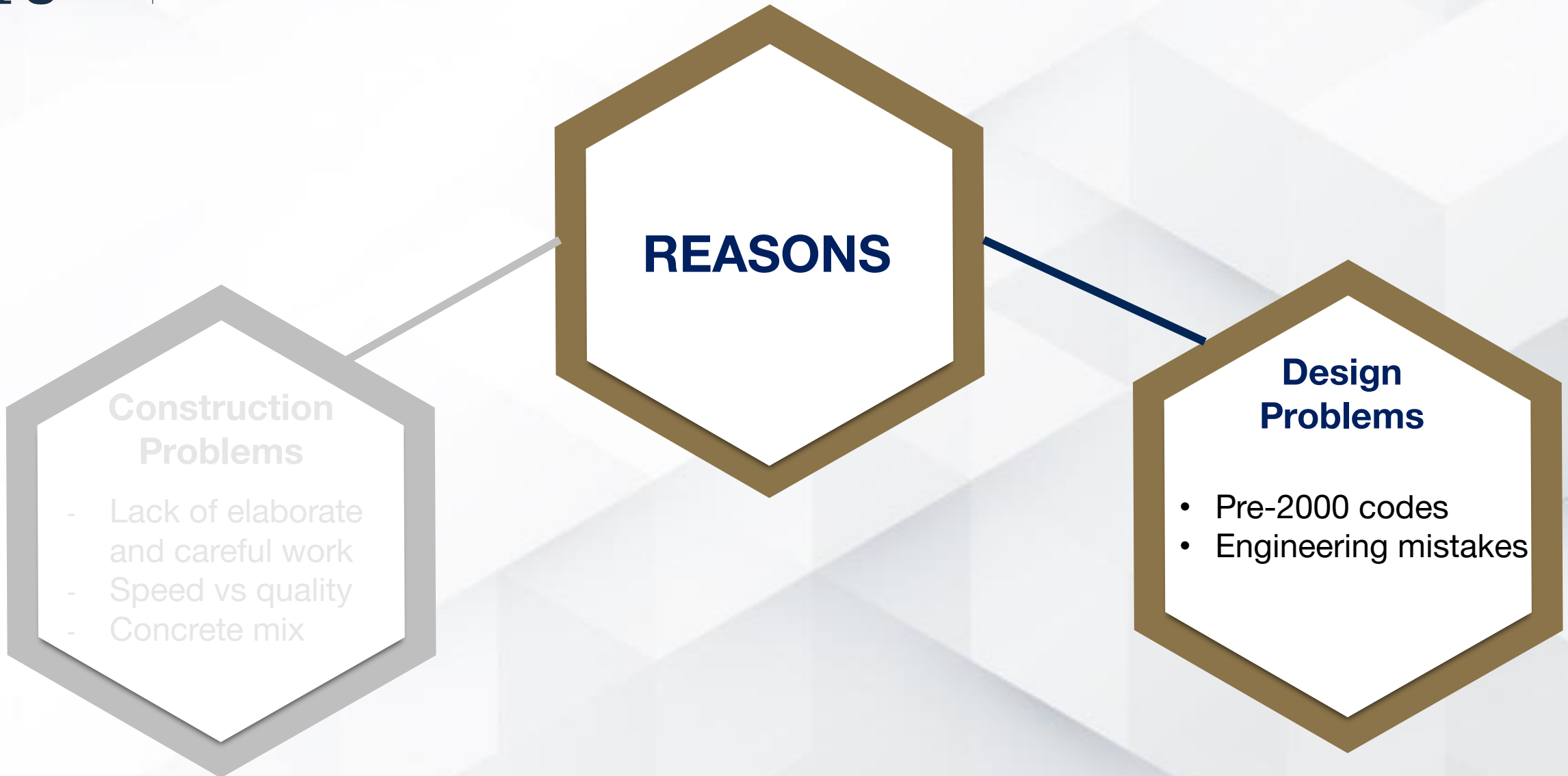
**Onikişubat, Kahramanmaraş
Residential building**

Photo credit: Fatih Sutcu, PhD (İTÜ)

Construction

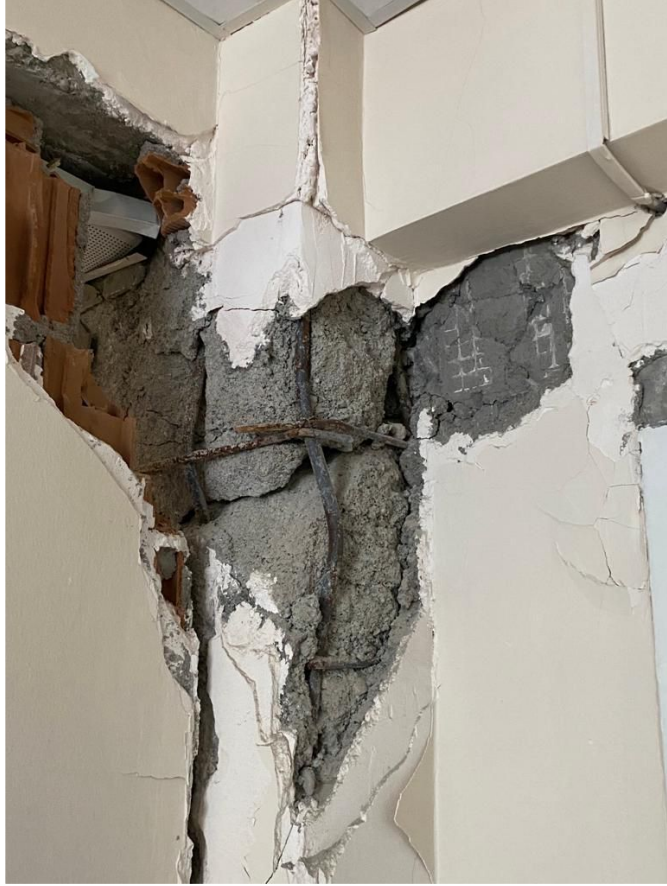
Pounding Effect





Design Problems

Lack of sufficient transverse reinforcement



Adıyaman, Public Hospital



Dulkadiroglu, Kahramanmaraş
Residential buildings

Design Problems

Invitation to torsion



Design Problems

Strong column – weak beam



Design Problems

Strong column – weak beam



- Higher first story height
- Soft story collapse

Design Problems

Poor joint design



Design Problems

Pancake collapse



Source: ITU Kahramanmaraş Earthquakes Report, March 2023.

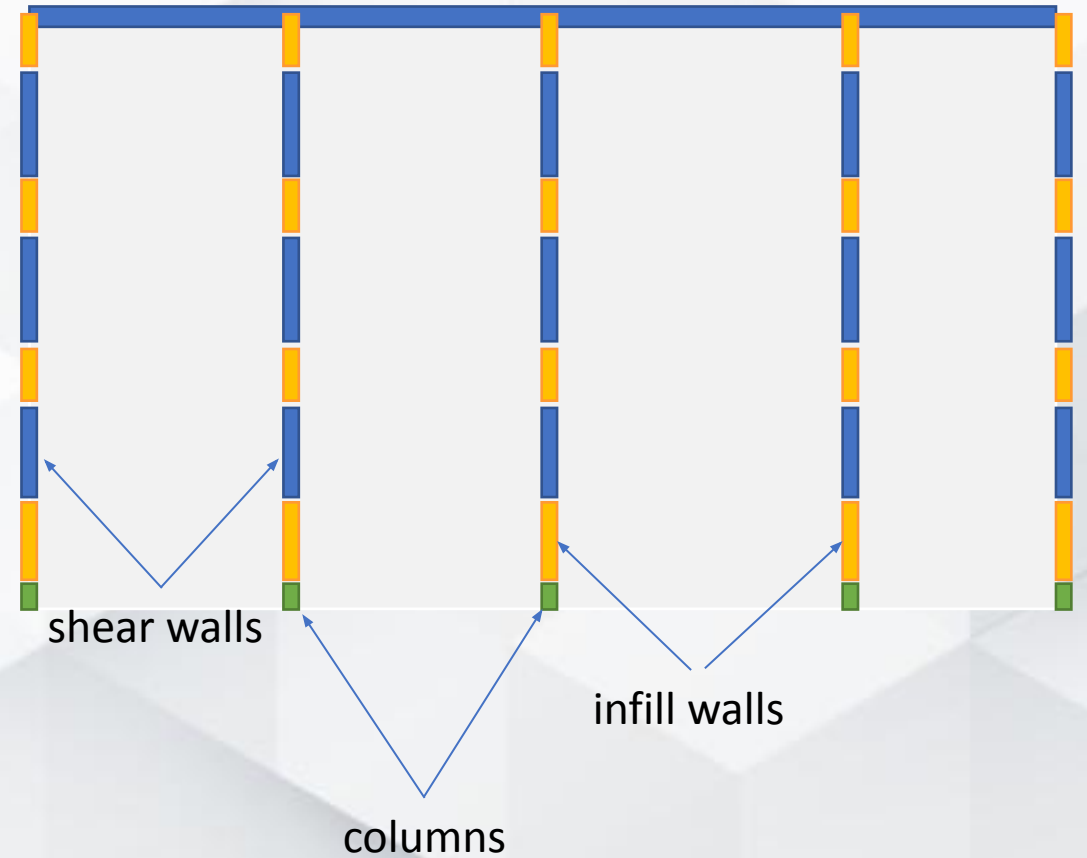
Design Problems

Short Column



Design Problems

Unfavorable wall configuration



A building under construction, Kahramanmaraş



THANK YOU!

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