

# 26<sup>th</sup> World Gas Conference

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## SEISMIC VULNERABILITY ANALYSIS: The case study of the 3rd Azerbaijan gas pipeline in Iran.

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# Outline

- Lifelines & natural gas system.
- Possible effects of the earthquake on a gas system.
- The 3<sup>rd</sup> Azerbaijan gas system.
- Possible damages to pipeline.
- Pipeline monetary losses.
- Possible damages to compressor stations.
- Compressor stations monetary losses.

# Lifelines & natural gas system

## Transportation Systems

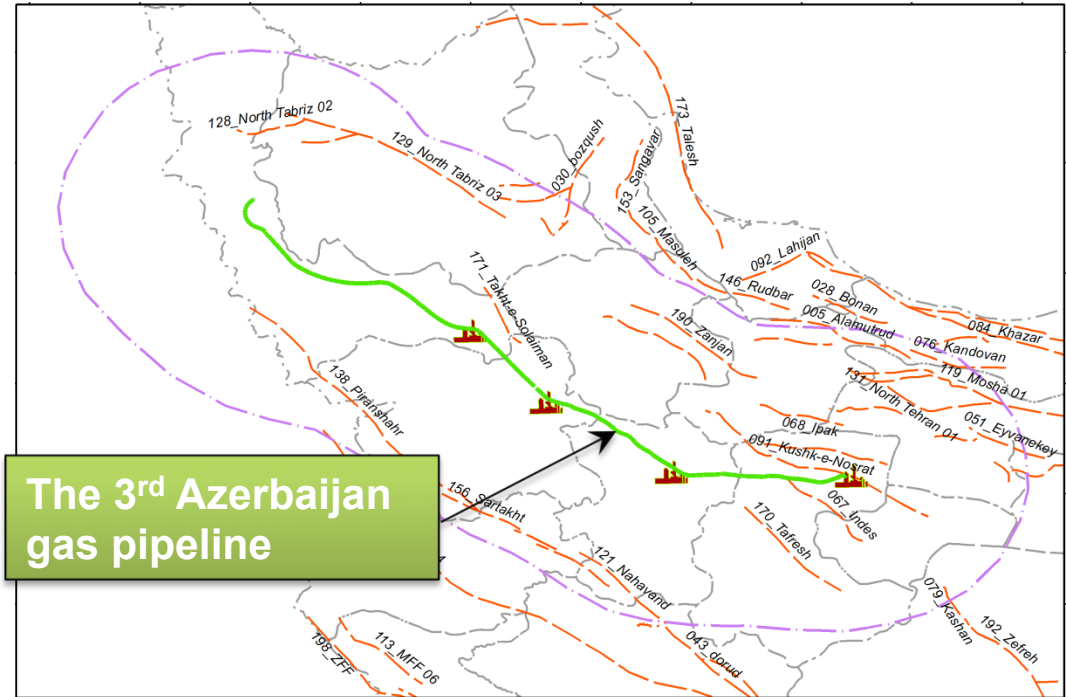
- Highway System
- Railway System
- Light Rail System
- Bus System
- Port System
- Ferry System
- Airport System

## Utility Systems

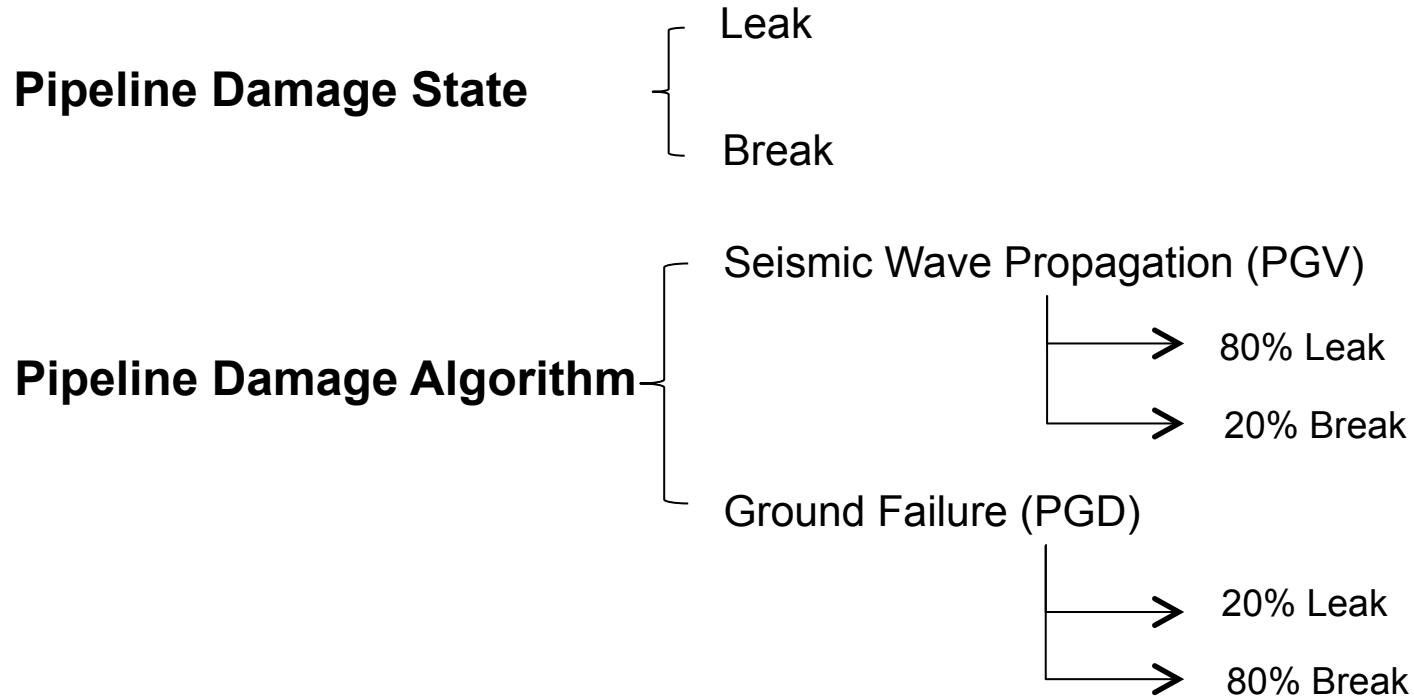
- Potable Water System
- Waste Water System
- Oil System
- Natural Gas System
- Electric Power System
- Communication System

# The 3<sup>rd</sup> Azerbaijan gas system.

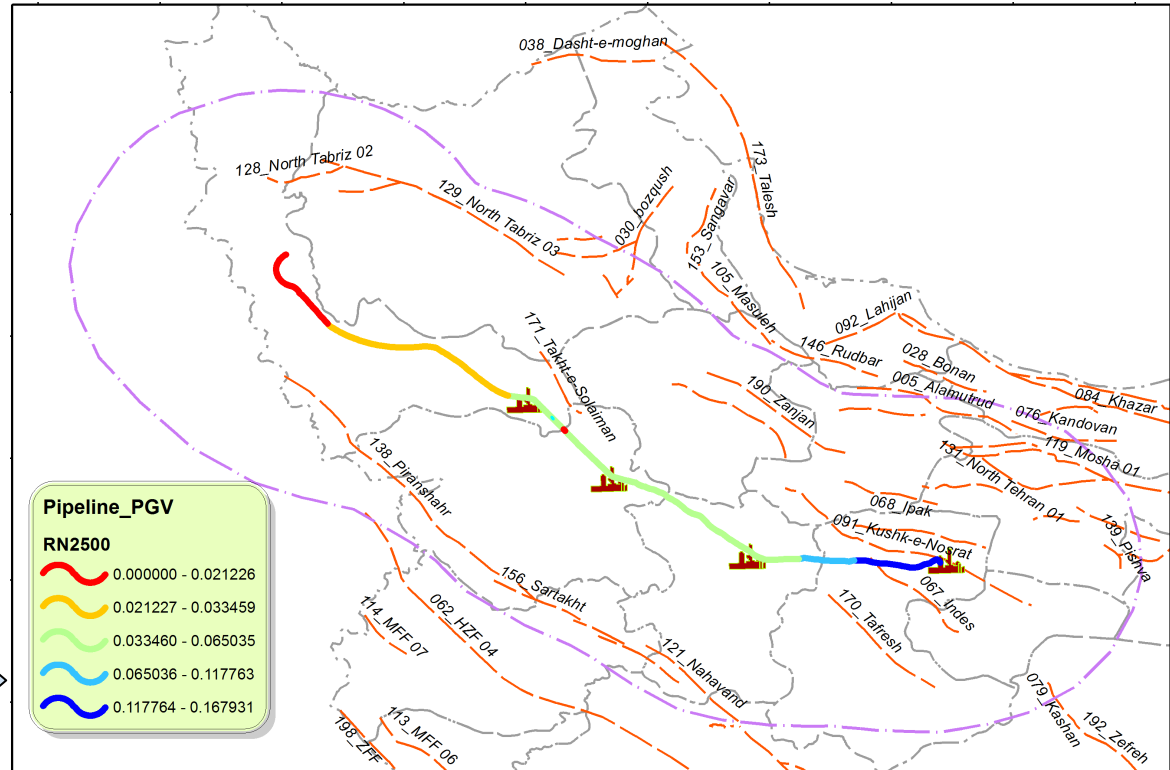
- **618 Km** pipeline length
- **42"** diameter of pipeline
- **4** compressor stations
- **36** active seismic sources
- **20** seismic zones in IRAN



# Possible damages to pipeline



# Possible damages to pipeline



Typical repair numbers  
caused by PGV.

# Pipeline monetary losses

## 1- The vented gas cost

Approximately 140,500 \$ for each damage state.

## 2- The repair cost

Leak : 3,500 \$

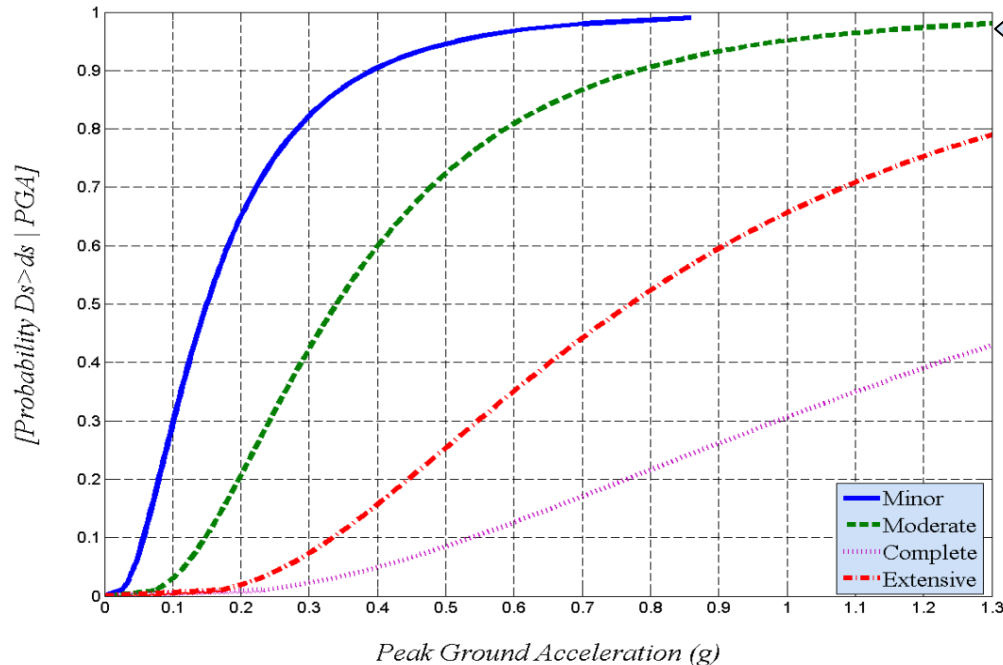
Break : 60,000 \$

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### **Total monetary loss for pipeline:**

For 500 years return period = 1,400,000 \$

# Possible damages to compressor stations



Fragility curve for compressor stations

## Subcomponents of a Compressor Station

- Electric Backup power
- Pump
- Building
- Electrical/Mechanical Equipment



# Possible damages to compressor stations

Station Name	PGA 500 years(g)	No Damage	Minor	Moderate	Extensive	Complete
<b>Station 1</b>	0.24	27%	47 %	22 %	3 %	1 %
<b>Station 2</b>	0.11	77 %	21 %	2 %	0 %	0 %
<b>Station 3</b>	0.09	78 %	20 %	2 %	0 %	0 %
<b>Station 4</b>	0.12	60 %	35 %	4 %	1 %	0 %

Damage states probability  
for compressor stations

# Compressor stations monetary losses

## Total monetary loss for Compressor Stations:

For 500 years return period = 4,600,000 \$

Total direct monetary loss of a gas network:

Pipeline + compressor stations =

1.4 + 4.6 = **6 Million Dollars**

# THANKS FOR YOUR INTEREST

**Inverted TULIPS  
of IRAN**

