International Pipeline Conference 2020
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EARTHQUAKE IN PAPUA NEW GUINEA RESULTS IN NEW CONCEPT FOR SECURING PIPELINES IN RIDGELINE-RIGHT-OF-WAY: THE MICROPILE CONTIGUOUS WALL

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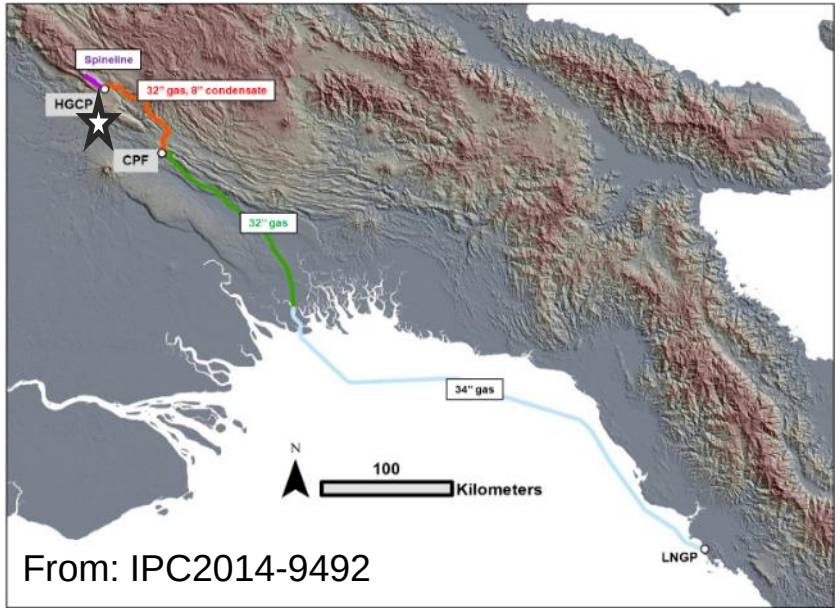
Contents

- Introduction
- Damage assessment
- Design considerations
- Geotechnical design
- Micropile system
- Pile drilling
- Equipment trial
- Construction

Introduction

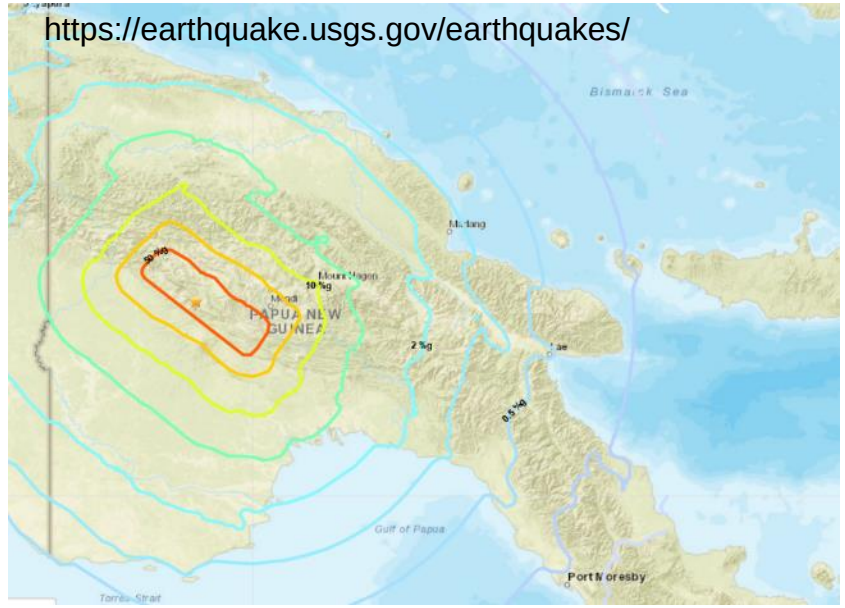
- The EMPNG LNG system consists of wellpads, gathering lines, a gas conditioning plant, onshore and offshore export pipelines, a gas liquefaction plant and a marine terminal in PNG.



From: IPC2014-9492

Introduction

- M 7.5 earthquake on Feb. 25 (UTC)
- Epicenter directly beneath the HGCP



Damage assessment

- Hundreds of landslides
- Soil liquefaction
- Soil cracking
- Significant loss of RoW width


Foto: R. Albrecht,2018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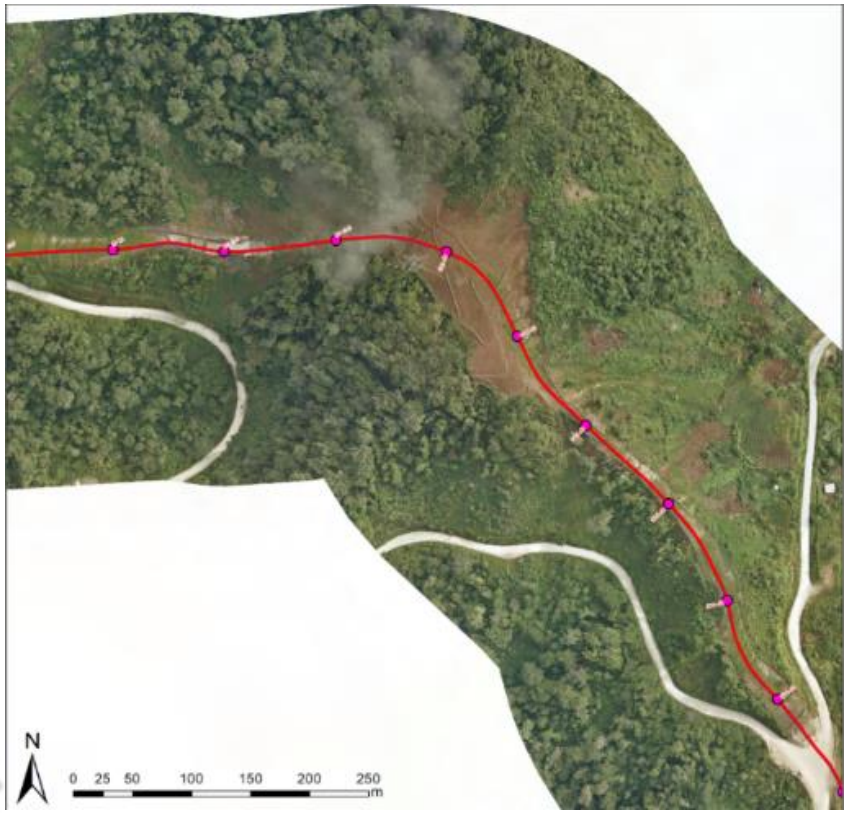
- **No loss of containment!**

Damage assessment

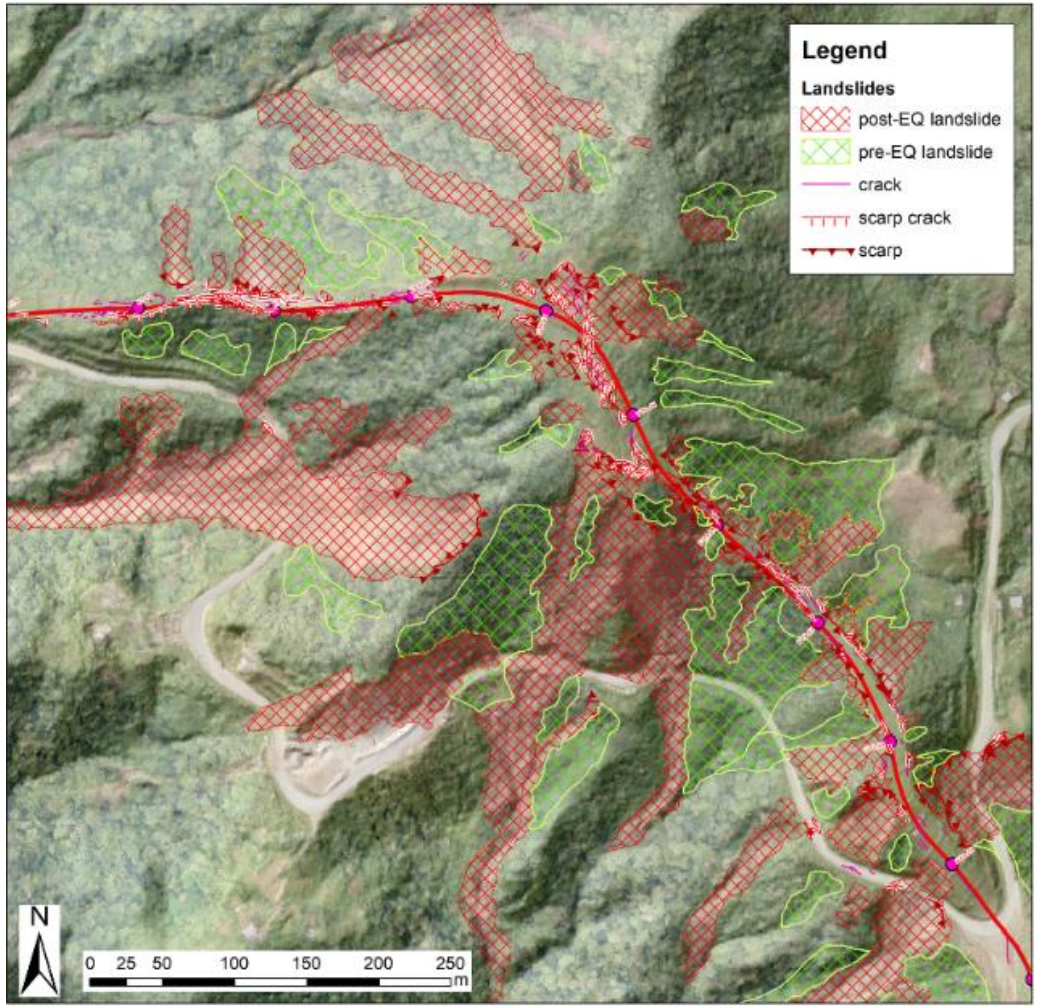
- Orthoimagery 2016



Orthoimagery 2018

Damage assessment

- Post-earthquake landslide mapping

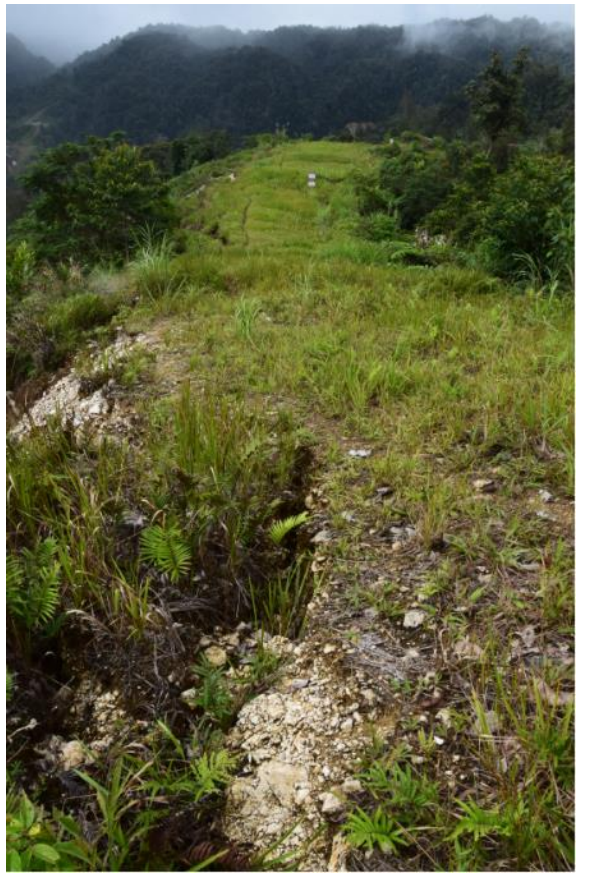


Design considerations

- Remoteness of RoW repair sections
- Numerous sites in need of repair
- Weak soil conditions and instable terrain
- Need for light-weight equipment (capable of being transported by helicopter)
- Necessity of easy installation
- Meeting the original design basis requirements
- Certain degree of vandalism resistance

Design considerations

- ILF has worked on earthquake assessment and repair concepts on this project since 2017.
- Early design concepts have been developed for slope stabilization.
- Adaptation to new requirements:
  - **RoW and pipeline protection instead of slope stabilisation**!

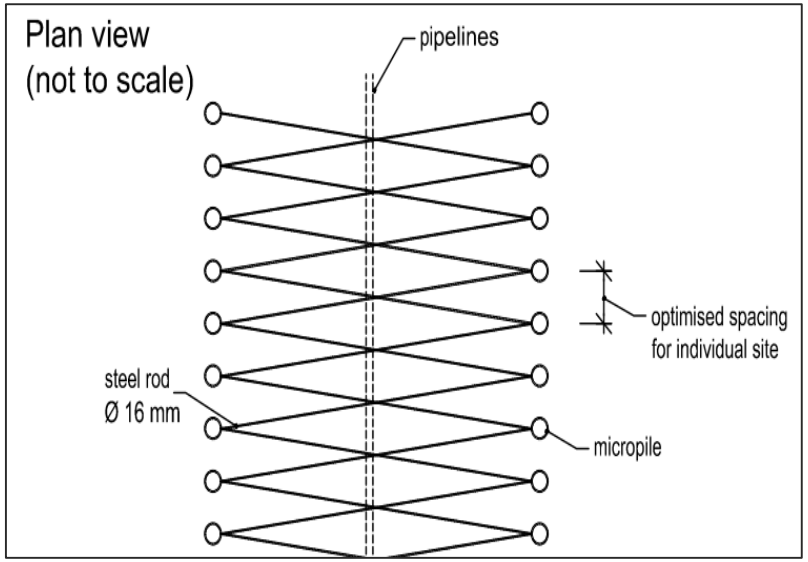


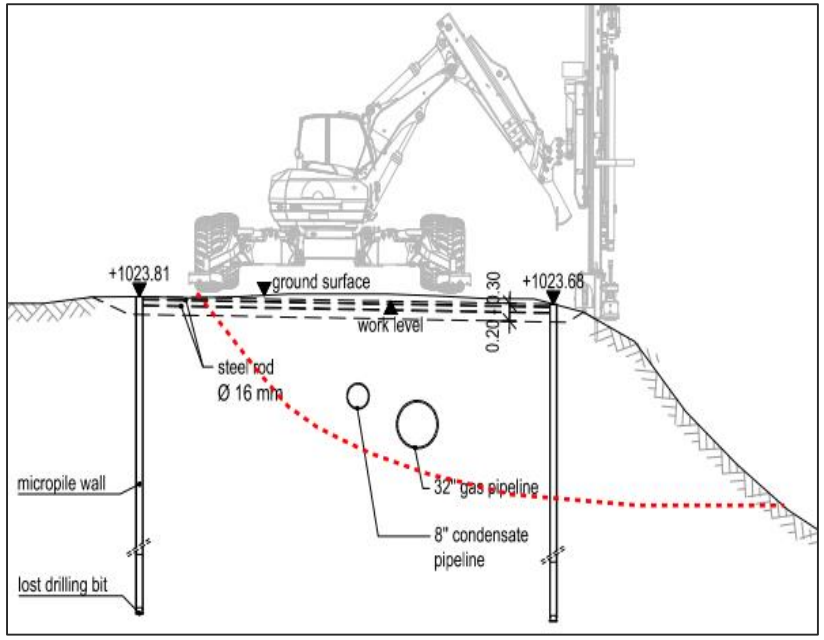
Geotechnical design

- Design life of 30 yrs achieved
- Design based on:
  - location on steepest slope
  - most narrow parts of the ridge
  - location of maximum landslide thickness
  - back-calculated slope stability
  - sensitivity checks
- …

Geotechnical design

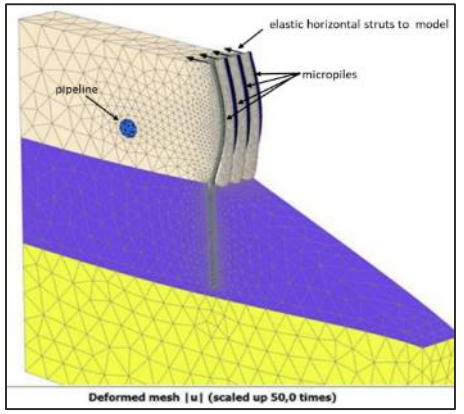
- Micropile wall layout

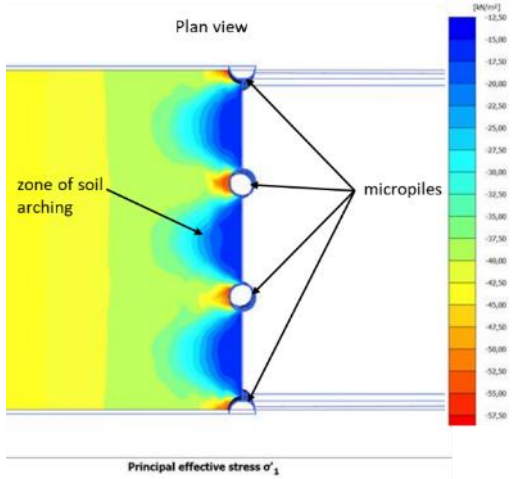




Geotechnical design

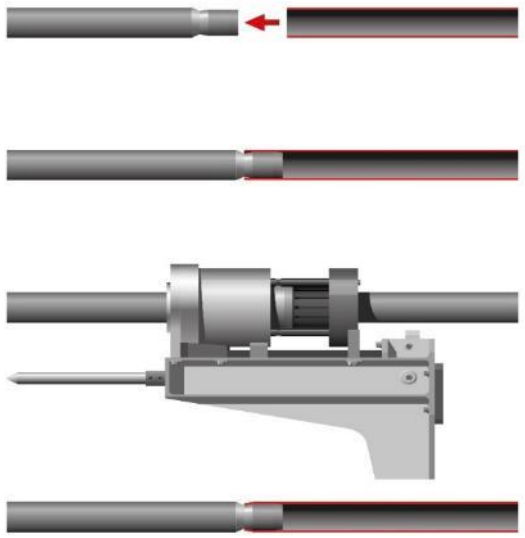
- Optimal distance between and length of the micropiles defined by FE soil arching analysis
- Defines the embedment depth and spacing of the micropiles
- Shows elastic deformation behaviour of the pipeline





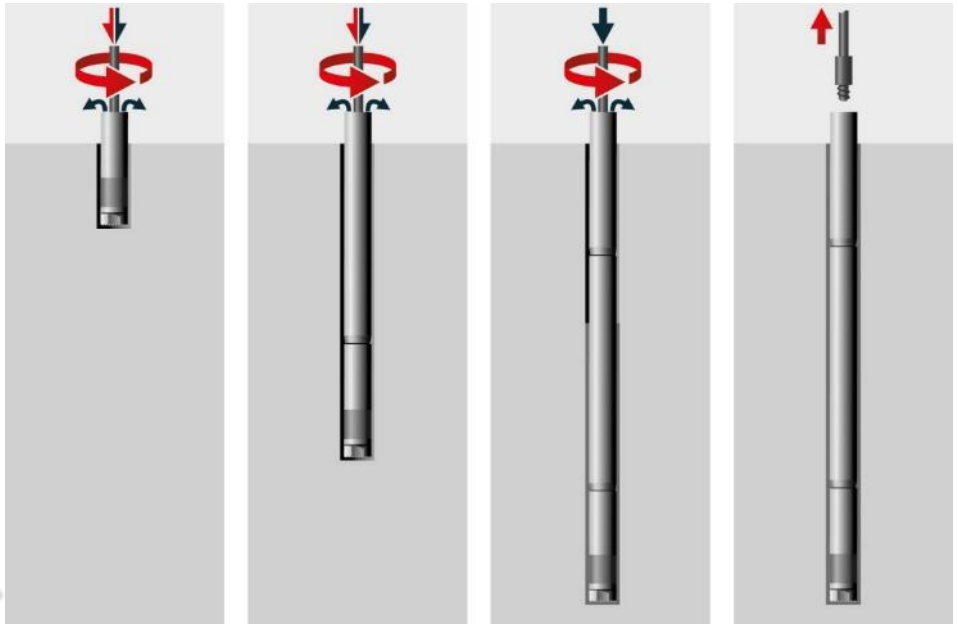
Micropile system

- Hollow steel pile (140mm diameter, 8mm wall thickness)
- Squeezed connection between pile segments



Pile drilling

- Drilled to depths of 15 m in any soil / rock type
- Micropiles filled with grout



Equipment trial

- The equipment setup was tested and optimized.

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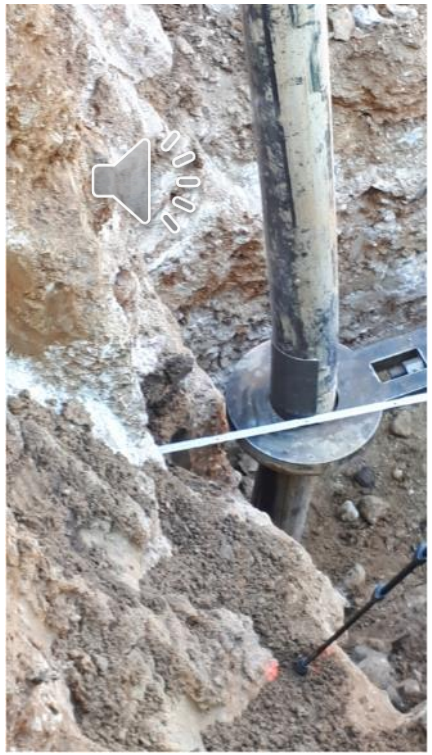

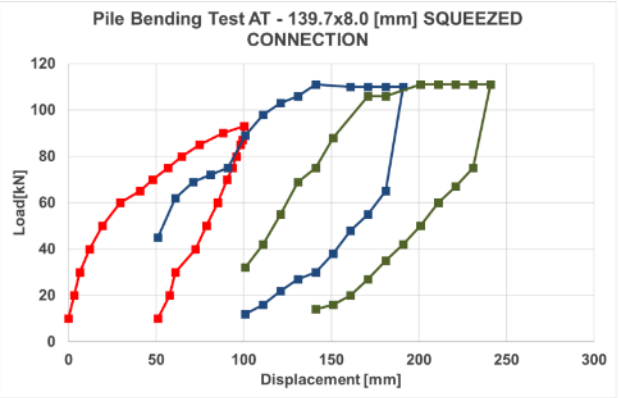

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PNG LNG

Construction

- Micropile installation in PNG

Construction

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Construction

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Thank you for your attention! Stay healthy!

For more information please contact Christoph.Ladenhauf@ilf.com