Unintended Consequences of Good Reconnaissance Reports

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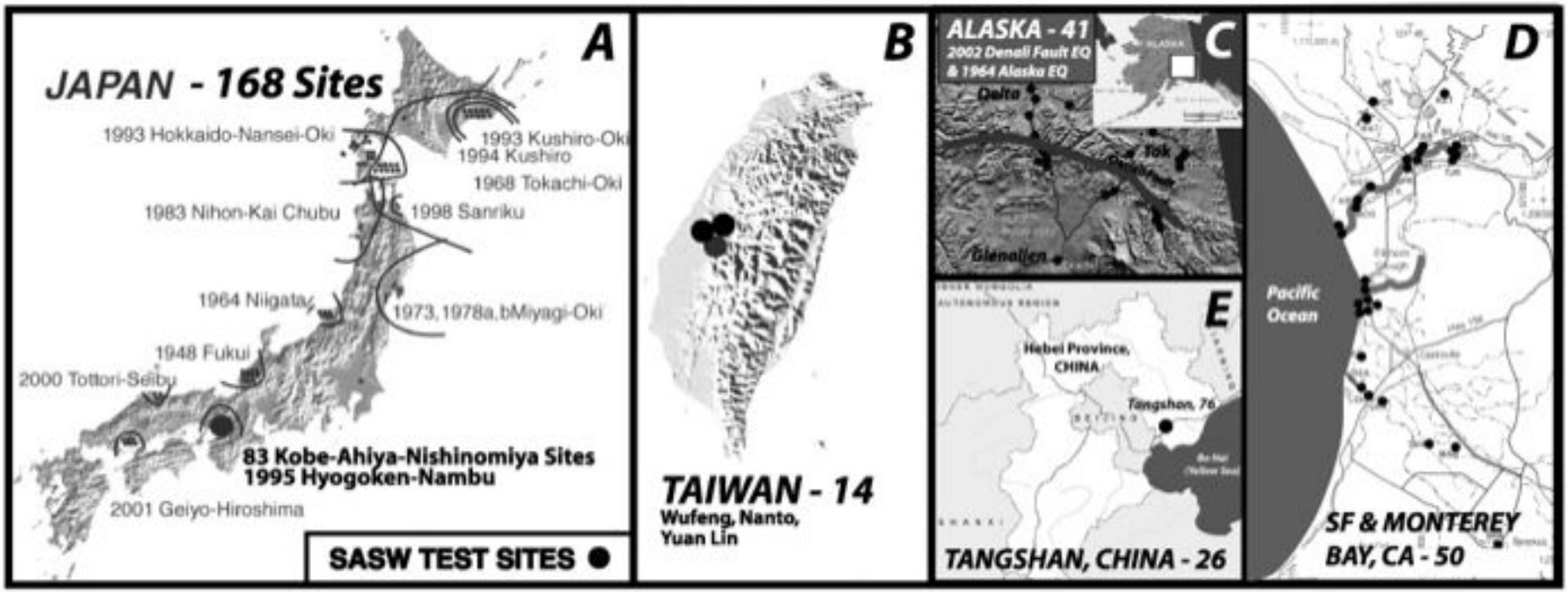

Using Reconnaisance Reports as Investigation Road Maps:

Using reconnaissance reports, we relocated on ground failure sites from 19 earthquakes in 4 countries.

Approximately 3 dozen Recon. reports were carried into the field and used as an aid to the scientist.

Useful & *Enduring* Reconnaissance Reports Allow Researchers to Accurately Relocate on Well-Documented Sites Decades Later and Visualize the Damage Zone.

1) Good reports include observations in the negative space beyond the zone where ground failure features are observed. *Why did damage not occur at a location?*

2) Good reports document where ground failure features are minor at high intensities of loading*...features that help characterize the threshold boundary of the failure domain.*

3) Good reports identify all observations and locations with informative multi-layered maps and position coordinates so that *future third-party post-earthquake investigations can re-occupy sites*.

Good Recon. Reports from long, long, ago…

…accurately direct us to field sites today.

Good Reconnaissance Reports Have Useful Maps and Photographs that Aid in Relocating on Features.

(Hamada's products are the best!)

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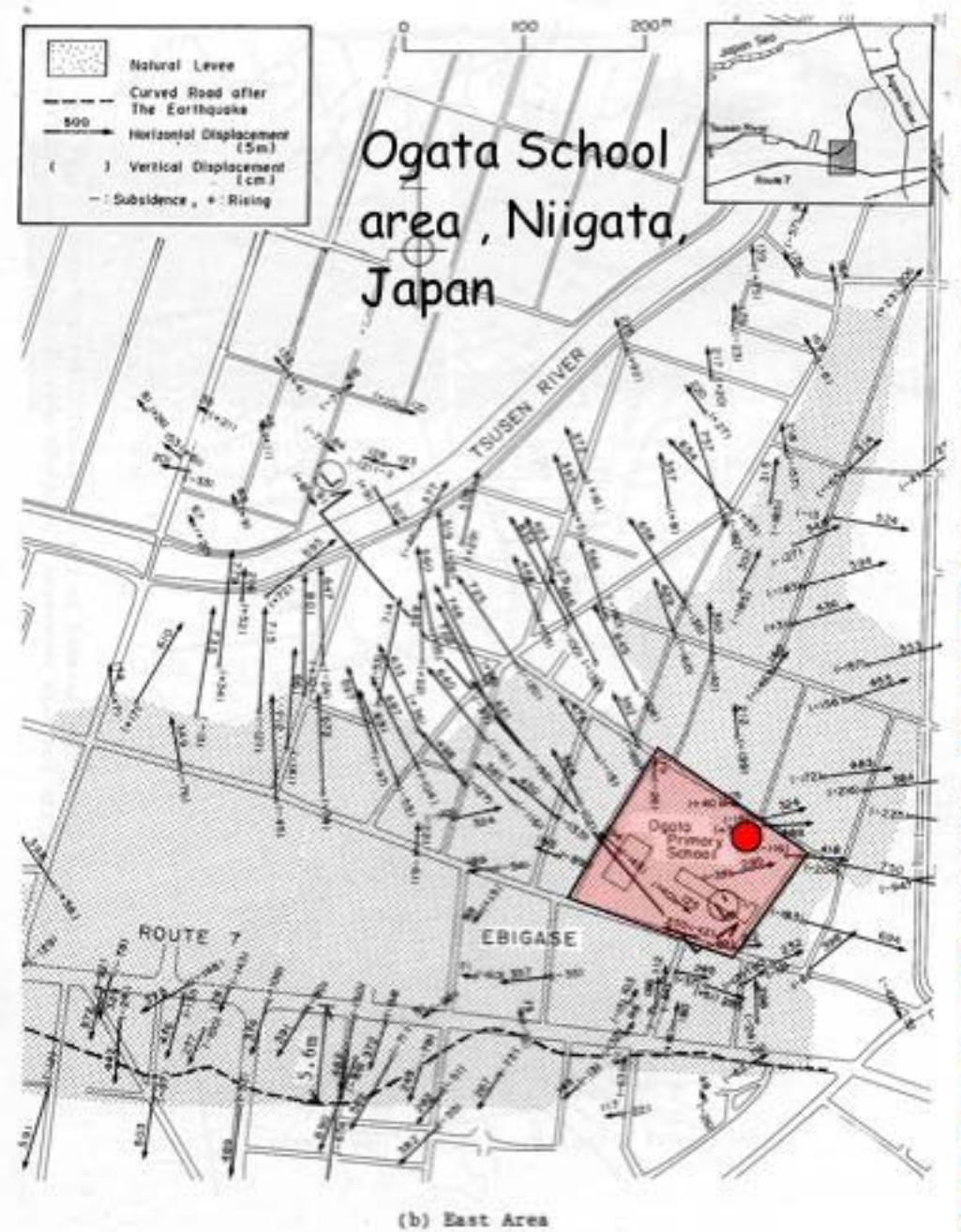
Examples of Hamada' Air Photo Products:

Morita cho, 1948 Fukui, M7.1

(a) Before earthquake (1945) (b) After earthquake (1948)

Morita-cho, North bank of Kuzuryu Gawa, Fukui

Denali Flt EQ, 2002: We mapped lateral spreads, on foot, using digital air photos collected the day before during the aerial reconnaissance.



(b) East Area

Figure 37. Permanent Ground Displacement in Ebigase and Ohgata Areas

Hamada's Displacement Vector Products

Hamada's abundant use of maps and aerial photos greatly improve our chances of accurately reoccupying sites

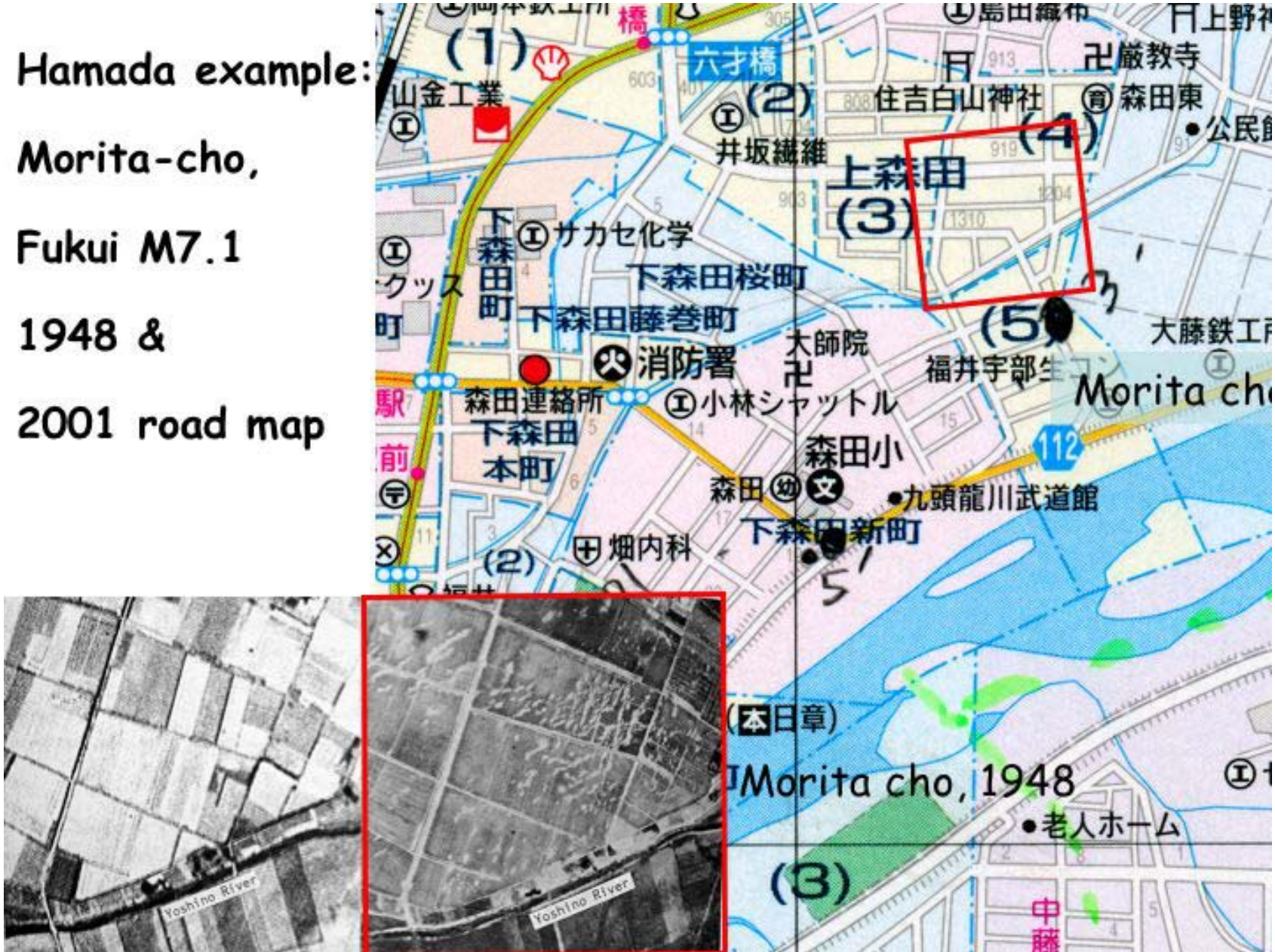
Hamada example:

Morita-cho,

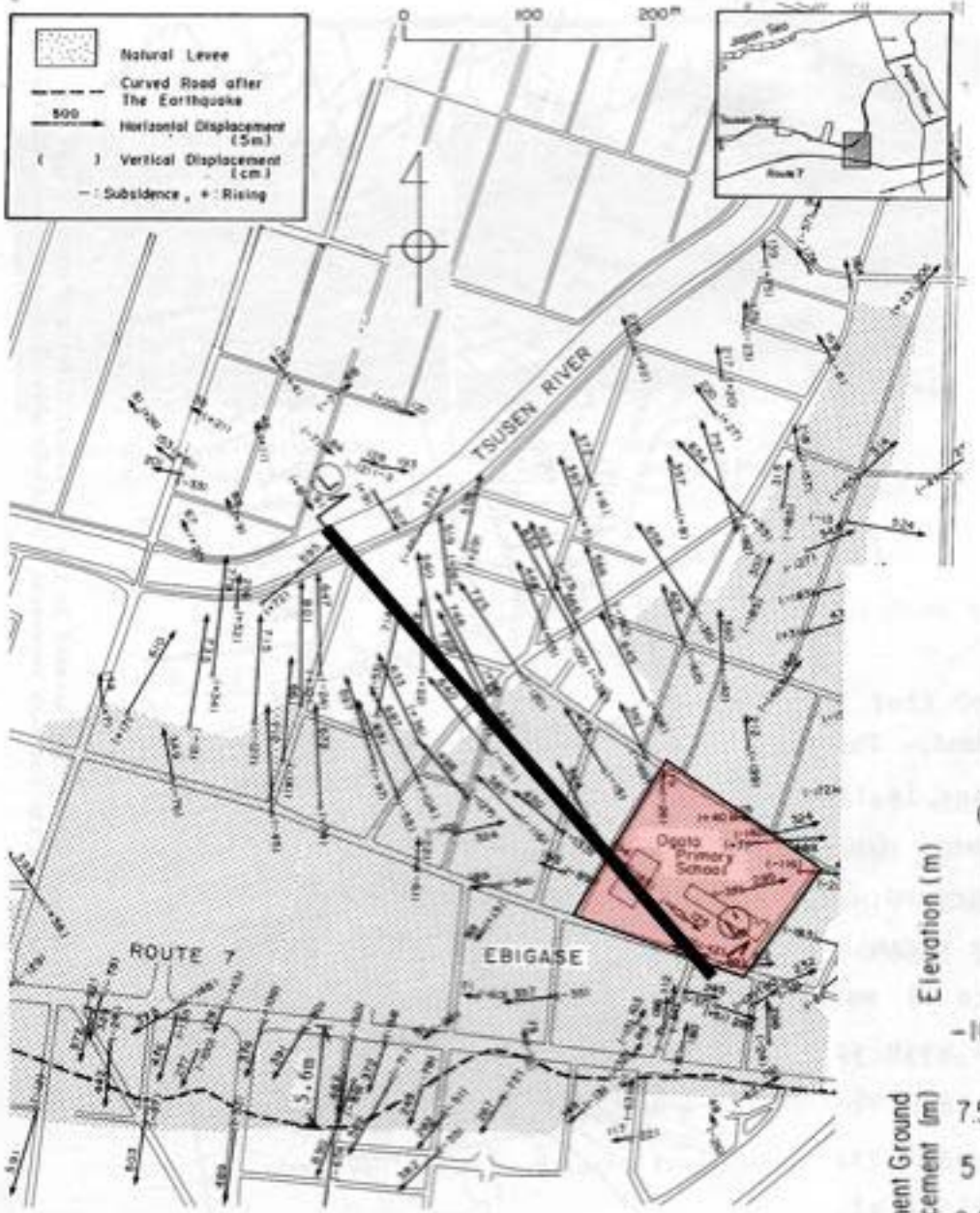
Fukui M7.1

1948 &

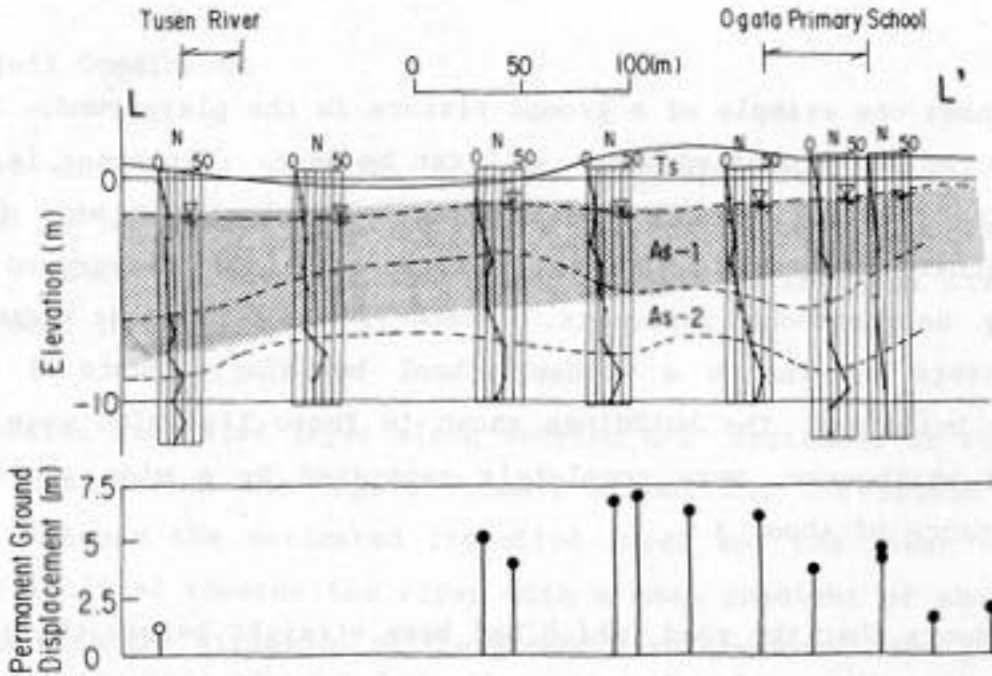
2001 road map



Hamada's Cross Section Products



(b) East Area



(a) Section L-L'

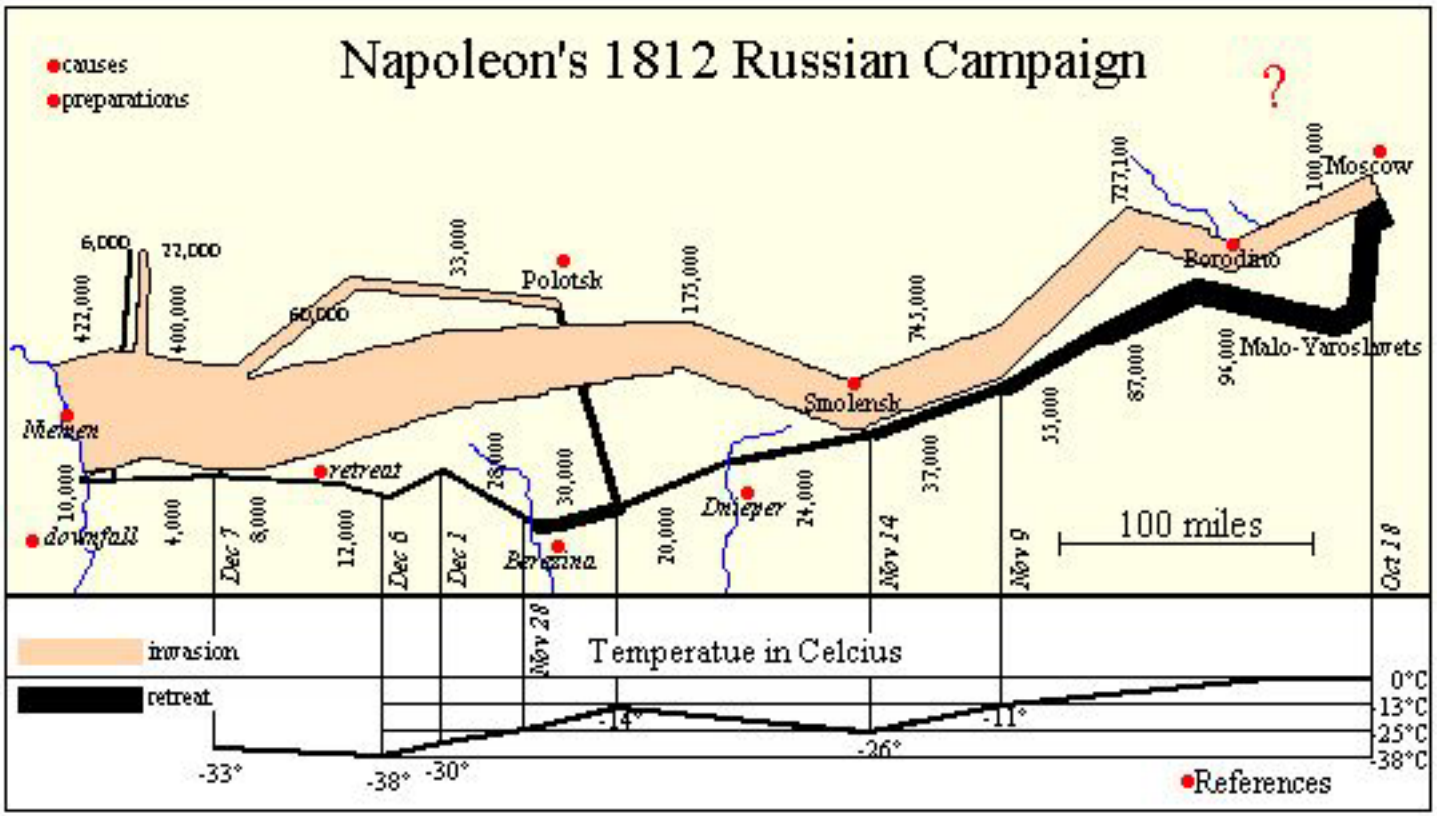
Figure 37. Permanent Ground Displacement in Ebigase and Ohgata

Lessons from Hamada

- Maximize use of air photos for interpretation.
- Include well-drafted large scale street maps and cross sections of damage locations.
- Use photogrammetry, satellite imagery, or inSAR-type data to produce lateral displacement vector maps.

What makes a good regional map?

- A good post-mortem map layers multiple parameters on a single graphic-image (…here in Minards 1861 map of Napolean's Russian march, seven layers of information were presented: army size; events; direction of travel; location; stops; temperature; and traditional spatial information).



What defines a good Regional MAP: Scale, north arrow, lat/long ticks!

Data layering: Common symbols to merge and co-locate different observations, *and severity*

1) Present & Past M7+ epicenters

2) 2) Damage zone

3) PGA'S

4) Tsunami runup heights and locations.

5) Ground failures/landslides

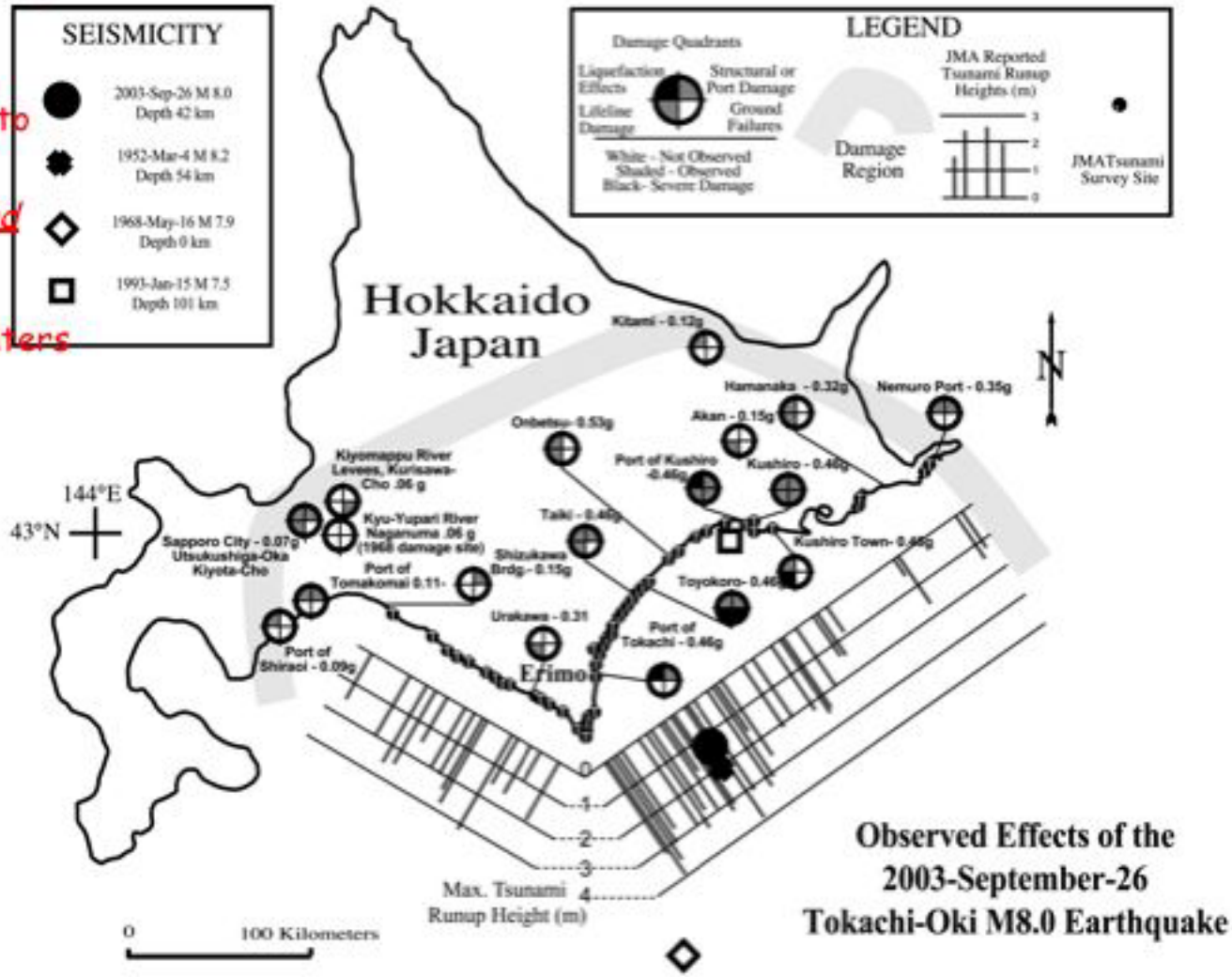
6) Structural/Port damage

7) Liquefaction damage

8) Lifeline Damage

From EERI SEP 12/03

Ashford, Kayen, Kawamata &Sugano



Multiple-Data layers with severities:

1) Present & Past M6+ epicenters

2) Damage zone

3) PGA'S

4) 3 faults/ surface ruptures

5) Ground failures/landslides

6) Structural damage

7) Liquefaction damage

8) Lifeline Damage

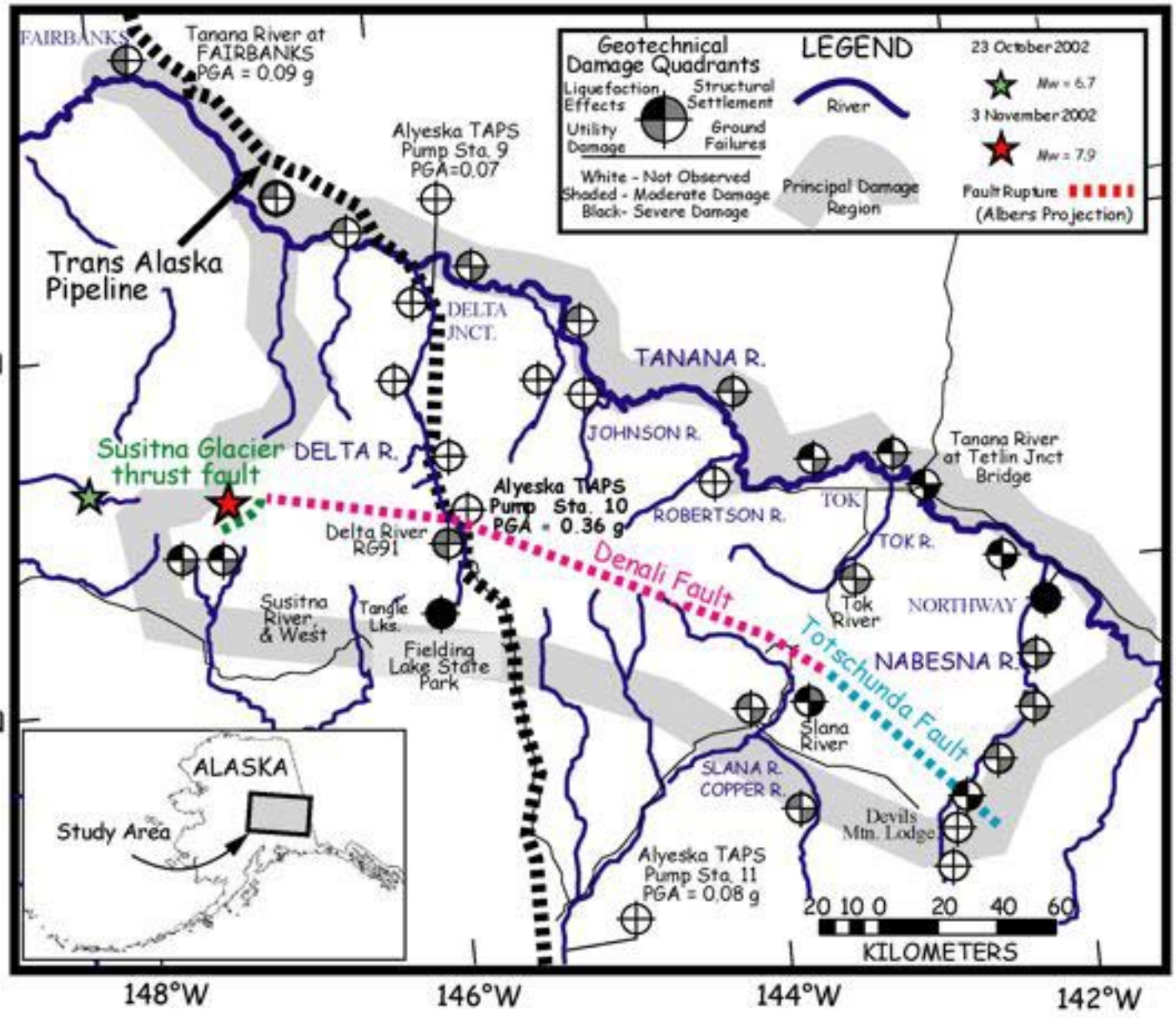
9) River network

10) Trans Alaska Pipeline route.

From

Kayen et al., 2004, Earthquake Spectra, 20(3), 639-667

Denali Fault Earthquake, Nov 3, 2002



Reporting Negative Space:

Youd et al. 1994 (e.g., at Port of Okishiri), and Hamada, et al. 1992, 1995 report on deposits that did not have ground failure and on marginal zones of ground failure.

Teams often gravitate towards reporting the most spectacular damage. The most interesting ground/lifeline/structural failures are not spectacular and are near the boundary of a non-failure condition.

Youd et al., 1994

1) photos w/background and scale

2) conceptual models

3) good discussion of negative space

Figure 6-58 Dike along north bank of Assabu River: view along north flank showing fissure with southward-facing scarp (facing toward dike), indicating flank had risen relative to dike.

Figure 6-59 Dike along north bank of Assabu River: westward view showing irrigation ditch that was pushed outward and settled. A hose carries water past the damaged section.

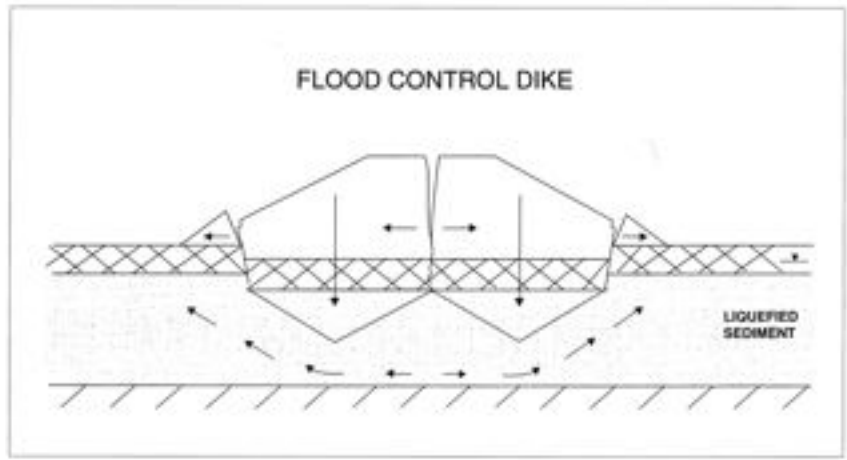
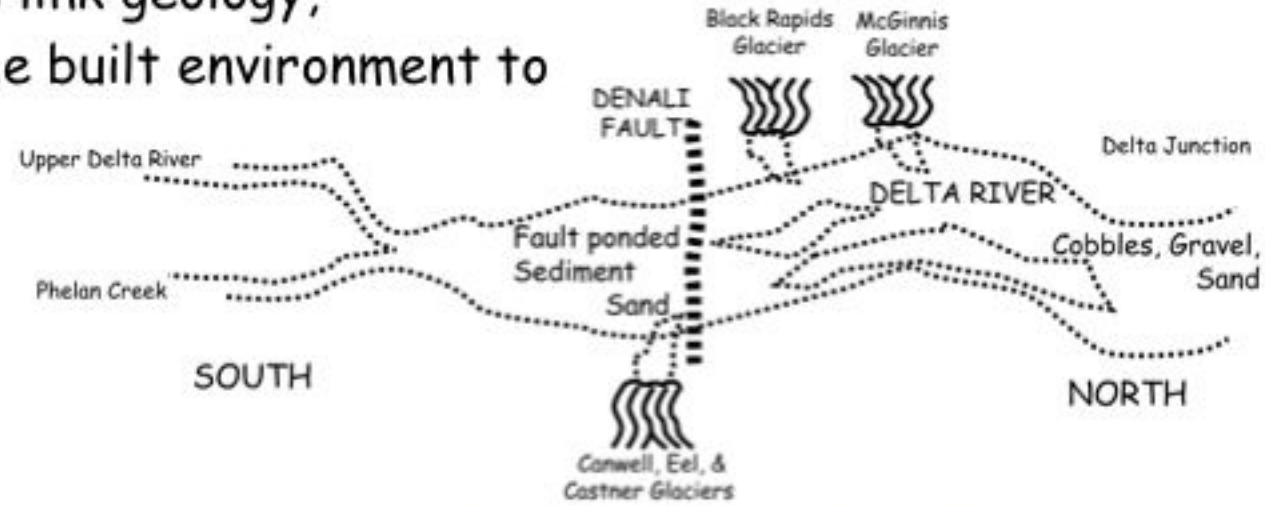
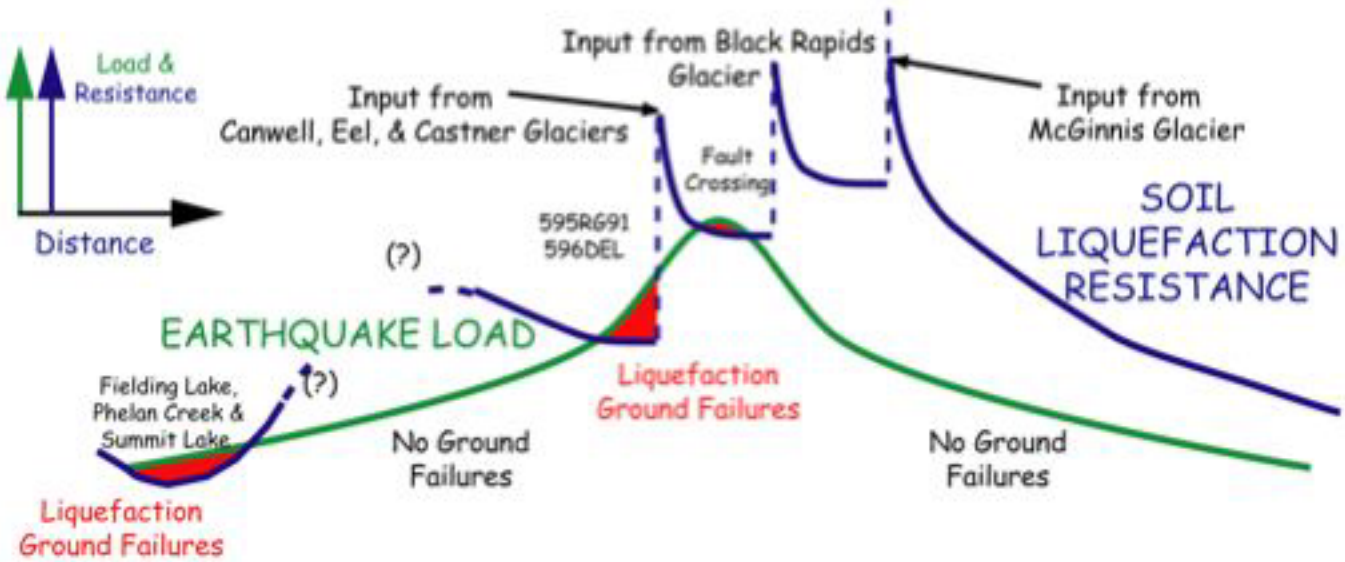


Figure 6-60 Diagram illustrating mechanism of failure for dikes that split along crest, settled, and spread laterally (Figures 6-57 through 6-59). The failures appear to have been caused by loss of bearing strength, with the central part of the dike penetrating into the underlying ground while the flanks were pushed upward and outward. In some instances one or both sides of the dike rotated or slumped as well.

Conceptual models link geology, seismology, and the built environment to observed damage:



Map view along Delta River drainage



Earthquake load and soil capacity along Delta River drainage

From

Kayen et al., 2004, Earthquake Spectra, 20(3), 639-667

Conclusion: Useful & *Enduring* Reconnaissance Reports Allow Researchers to Accurately Relocate on Well-Documented Sites Decades Later and Visualize the Damage Zone.

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