The Great Kanto Earthquake (1923) and YOKOHAMA (3)

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1. none

1. Preface: In this paper, we have gived careful consideration to none collapsed utility poles and a pole shape (include a tree). We had looked many photos of The Great Kanto Earthquake (1923).

Mainly YOKOHAMA and TOKYO City. We had noticed to many none collapsed pole shapes.
In this paper, we had investigated of this reason of these none collapsed shapes.

2. The Theory: Showed three vibration in Fig-1. "M" is mass of pole. "K" is spring constant.
We know two factors to decide nature of this vibration. That is to say, Mass and elasticity of the pole. Introduced method of this equation of motion, two methods namely, the principle of D'Alembert and Lagrange equation. Namely, in free vibration, the mean value lasted over one period of kinetic energy is equal to it of potential energy. In this nature, this principle (theory) stands up all right in free vibration But does not stand up a case received an forced external force. Because $P=\sqrt{(k/m)}$ is not valid generally.

Now, we considers a pole of rigid body (for example a utility pole)
See Fig-2
The slope of this pole: θ Anti-moment in proportion to θ act on pole. Find the free vibration of this rigid body.

See Fig-3. for the circular frequency P.
Fig-3. …(1)

Reference: “Vibration” For a constructor technical expert. Published by Syunzoo Okamoto.
Ohm Company. 1976.

This is a rocking vibration of pole. The reaction coefficient of the ground K is small (for example, liquefaction of the ground). P is too small. And k=(rAl2/2) , then P=0.
This P=0 shows the instability state of the pole. In the factly, the rigid pole fall over by receives very small force.

It's just the right times for Niigata Earthquake. Buildings by the side of SHINANO river had learned very much based on a decrease in the reaction coefficient of the ground K.

The right times for the Great Kanto Earthquake, many photos (include aerial photos) showes standing up straight (not leaned) utility poles, trees and gateways to a Shinto shrine and so on. I think that this fact showes the firm ground (not soft ground).

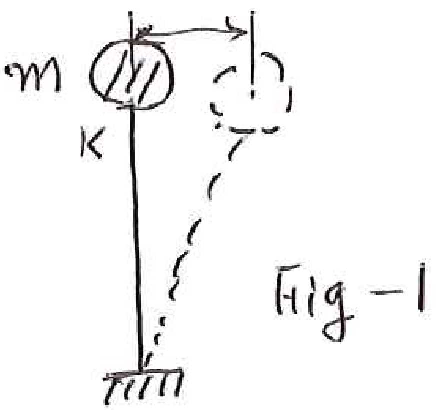
The reclaim land and soft ground, K (the reaction coefficient of the ground) decrease based on above reason.

Reference:
1. Vibration: Published by Syuzoo Okamoto, Ohm Company

2. Earthquake Disaster Archives
3. TOKYO Earthquake Disaster Archives

Abstract
1. On the NIIGATA Earthquake Motion, The apartment buildings had leaned very much SHINANO River side. This reason is that the reaction coefficient of the ground K decrease much. For example, liquefaction of the ground by an Earthquake.
On the Great Kanto Earthquake, many pole (pole shape) standing place, we are thinking firm ground place.

Keywords: Vibration, lean, Pole, Rocking Vibration, Reaction Coefficient of the ground



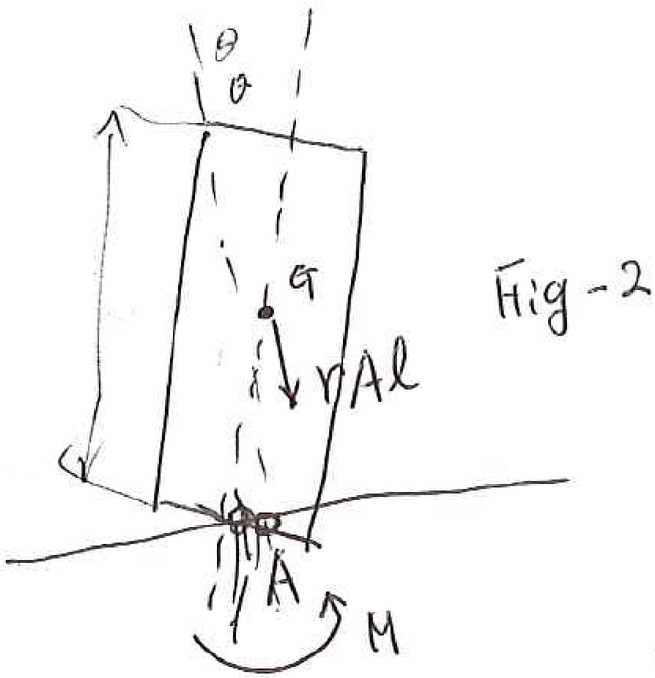


Fig-3.

$$P = \sqrt{\frac{3g}{rAl^3}\left(k - \frac{rAl^2}{2}\right)} \cdots (1)$$