SEPTEMBER 13, 2006 - Foundations on Faults - A Formula for Failure

Speaker: Mr. Carl E. Norman, Ph.D., P.G., Consulting Geologist, Houston, TX, Tel. No. 713-461-7420

PRESENTATION SUMMARY

To a room of about 65, Dr. Norman, a professional geologist, a consultant since 1978 and Professor Emeritus (Geology) at the University of Houston, with a special interest in finding and mapping previously undiscovered faults and determining their rates of movement as well as details of the movement process within the disturbed zone along the faults, gave a presentation entitled, "Foundations on Faults - A Formula for Failure."

According to Dr. Norman, several hundred building foundations have been constructed, usually inadvertently, across the 350 plus active faults in the Houston Metropolitan Area. These faults, which vary in vertical movement from fractions of a millimeter per year to an inch per year, are particularly concentrated over deep salt domes that tend to liquify under pressure, causing instability of the ground above. These salt domes are located in the south, east and northeastern parts of Harris County, Texas.

Dr. Norman said there are no local ordinances prohibiting foundation construction over an active fault. Successful foundations overactive faults are mostly supported on the upthrow side of the fault and then cantilever a comparatively smaller foundation area over the downthrow side of the fault. Foundations supported on the upthrow side can safely be located inches from the fault line, whereas foundations supported on the downthrow side must be tens of feet (typically 30 - 40 feet) from the fault line.

Dr. Norman said that fault lines in the Houston area are usually slanted at a slope of around 3 verticals to 1 horizontal,causing substantial frictional resistance to movement. Hence there is little chance of earthquakes in the Houston area, However, one should expect foundations built over the downthrow sides in Houston to walk or separate about athird of the distance that they settle due to fault movement. In contrast, faults in California are typically vertical, reducing the friction and walking, but increasing the seismic energy released when slip suddenly occurs.

Dr. Norman said that faults can sometimes be observed in aerials, particularly after heavy rainfalls, but are more evident in LIDARS images that have recently become widely available as a result of the post-Allison flood plain mapping in Harris County. Site reconnaissance is necessary before construction, just looking for sudden dips in the land. He said those working in the Houston area should purchase the O'Neill / Van Siclen map published in 1978-79 and available through USGS in Denver. Although this map only shows 108 (about a third) of the known active faults in the Houston area, it is a good starting point from where the user may want to contact him for more detailed but unpublished information on the precise location of faults in the area on interest.

Dr. Norman's presentation included some case histories of local faults he had monitored during the last several decades. He concluded with the following recommendations for those that decide to build near a known fault:

1. Establish the location of the fault as accurately as possible.

2. Find the width of the shear zone, which varies locally from 15-100 ft. and is usually 30 - 40 ft. wide.

3. Determine the 3-D orientation of the fault's movement vector.

4. Determine past rates of movement of the fault, perhaps from his records or from viewing repaired structures.

5. Avoid construction of substantial structures (e.g., houses) in the fault deformation zone.

6. Always warn your client there may be a fault on the property

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