Earth Fissures, Urbanization and Litigation: A Case Study from the Temecula Area, Southwestern Riverside County, California

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ABSTRACT Ground fissures occurring in 1987 extended discontinuously along a 12-km long zone in the rapidly-urbanizing Temecula-Wolf Valley area of southwestern Riverside County, California. Impacted were new residential and industrial buildings. Litigation has ensued, and damage is now alleged to exceed about 50 million dollars. Defendants include County government, a local Water District, developers, and consulting engineers and geologists.

INTRODUCTION

In the mid-1980s, urbanization dramatically increased in the Temecula area of southwestern Riverside County, California. From a population of 8,324 in 1980, the previously serene town, about 41 km north of San Diego and 53 km southeast of Los Angeles, jumped to a population of over 29,000 in 1988 (Fig. 1). Developers seized on the increasing popularity of southern California as a desirable place to live, and vast new residential and light industrial complexes ("Business Parks") were built. The rapid urbanization produced the usual plethora of environmental constraints for both the developers and residents of Temecula. The most unexpected problem was the mid-1987 occurrence of earth fissures, the resulting allegations of property damage and general loss of value, and the perhaps inevitable litigation that has since followed.

GEOLOGICAL FRAMEWORK

The Temecula area lies in the Murrieta-Temecula-Wolf Valley, an approximately 20-km long and 1.5 to 2.0-km wide structural graben bounded by major splays of the Elsinore fault system: namely, the Wildomar fault on the east and the Willard fault on the west (Mann, 1955; Kennedy, 1975; Fig. 1). The Wildomar fault is active,
according to State of California criteria, for it has geomorphic expression and has offset Holocene sediments and soil profiles (Hart, 1985). Accordingly, habitable structure "setback zones" have been established for the fault (Calif. Div. Mines and Geology, 1990). In contrast, recent investigations show that last movement of the Willard fault occurred in pre-Holocene time, and the fault is therefore presently deemed "not active" for purposes of engineering design (Schaefer Dixon Associates, 1988a). Prior to mid-1987, no other active faults had been identified in the Temecula-Wolf Valley area despite the fact that literally tens of engineering-geological investigations had been conducted in support of residential and industrial development. Neither identified were buried stream terraces or older faults underlying valley alluvium, geologic discontinuities that often control the surface location of ground fissures (Holzer, 1984).

Quaternary sediments underlying the Temecula-Wolf Valley area are more than 800 m thick, and have yielded abundant water for both domestic and agricultural use (Scheliga & McGoldrick, 1984). Two principal aquifers are the upper "Pauba beds," generally producing from
depths within about 100 m from the surface, and the lower, more prolific "Temecula sands" generally encountered between about 200 and 400 m. The Temecula aquifer is a source of relatively high quality and inexpensive water, and two Temecula-Wolf Valley wells, pumping since at least 1982, have the capacity to produce 8,000 to 9,000 l/min. In 1984 it was pointed out to the Rancho California Water District (RCWD) that: "Because of the depth of saturated sediments and the potential for construction of additional high capacity wells, the Murrieta-Wolf [hydrologic] Unit offers a location for development of a substantial increase of ground water resources to RCWD supplies" (Scheliga & McGoldrick, 1984, p. 3-21). By late 1986 an additional six, deep wells tapped the Temecula aquifer. After initial tests, most started production in 1987 (Leighton & Associates, 1987).

THE TEMECULA FISSURE

In August 1987, a northwest-trending curvilinear system of earth fissures about three km long was discovered in recently-developed residential tracts in the southern part of the Temecula area. In October 1987, similar northwest-trending fissures were observed in a new Business Park approximately four km to the northwest. Despite diligent search, no fissures were identified in the intermediate area (Fig. 1).

The fissures were expressed at the surface by 10 to 20 m long cracks in street pavement and in adjacent gutters and curbs. Most fissures were en-echelon, the overlapping width generally less than about three or four m. Vertical relief was typically less than a few cm with the east side down. In the residential area, fissure damage was mainly displaced curbs and floor slab cracks in four or five buildings. However, some homeowners several blocks away alleged that small cracks in their residences were caused by the fissures, rather than the "normal" settlement typical of new construction in the area. In the northern business parks, the fissures promulgated through up to five m of compacted fill, and eventually widened along widely dispersed "sinkholes" up to a meter wide.

The cause and specific location of the fissures has been argued in the press and by technical experts. Two general hypotheses have been advanced: the 1987 fissures were caused by increased groundwater withdrawal, and localized along either previously-unrecognized, graben-bounding discontinuities such as faults or buried channel escarpments; or by aseismic creep occurring on heretofore unrecognized active faults (Shlemon & Davis, 1988).

Arguments to support both hypotheses abound: on the one hand, several new wells began production just
prior to fissure occurrence, and no obvious fissure rejuvenation has taken place since certain "suspect" wells were shut down; on the other hand, post-1987 investigations now show that the fissures are localized along a previously-unrecognized active (Holocene) fault, although no microseismic events have been recorded (Leighton & Associates, 1987; Geowest Soils Consultants, 1987; Schaefer Dixon Associates, 1988b). The southern residential area fissure coincides in part with the previously-recognized Wolf Valley fault (Kennedy, 1987); and the northern fissure is now informally designated as the "Murrieta Creek fault" (Bergmann & Rockwell, 1989; Fig. 1).

LITIGATION

Shortly after ground fissure stories and photographs appeared in the local and regional newspapers, Plaintiffs' attorneys signed up clients in the residential areas affected by fissures. By early 1988, over 200 lawsuits alleging over $25 million in damages had been filed against the developers, the County of Riverside, the local water district, and several geologic and soils engineering consulting firms. The individual suits were later consolidated into a few large actions which ultimately proved too large for the Riverside County Superior Court system to handle. As a result, the parties to the lawsuits stipulated to have the cases litigated before a retired judge, who was given all of the powers of a Superior Court judge.

Plaintiffs as a group and Defendants individually hired their own technical experts, including specialized geologists, geohydrologists, soils engineers, and construction experts. In the first year of the litigation, the judge also hired additional "joint experts" in order to investigate the fissure-related problems. However, the Business Park developers, the private landowners affected by the business park fissures, the County of Riverside, and the local water district each hired their own technical consultants to investigate the Business Park fissures. In 1990, three years after fissure occurrence, owners of a large Business Park commercial building damaged by the fissures, filed a lawsuit against the developer, the County of Riverside, and the local water district.

The cost to date for technical investigations is in the range of $2- to $3 million; and the studies continue. Legal fees for the residential area litigation alone are conservatively estimated at more than $2 million for all parties. Total costs will ultimately exceed at least ten-fold the value of the structures allegedly damaged by the fissures.
The News Media

Predictably, the local and regional news media, including television, radio and print, provided alarmist coverage of the ground-cracking for the first year after fissures occurrence and periodically thereafter. Television stations and newspapers in Temecula, Riverside, San Diego, and Los Angeles all carried stories about the assumed catastrophic impact of a major earthquake on the families and businesses situated near the Temecula ground fissures. Headlines such as "Crack-Watchers Turn Homeowners Into Tour Guides" and "On Uncertain Ground: Homeowner Says Yard Is Sinking" were common.

The County of Riverside

The County, as a defendant in the litigation, initially instituted a total ban on new building permits, then later adopted a local "Subsidence Report Zone" ordinance. The subsidence zone, approximately 1.6 km wide and 15 km long, encompassed the known fissure area in length and extended in width from the Wildomar fault on the east to the Willard fault on the west (Fig. 1). The intent of the County ordinance was to ensure that no new buildings were constructed across known or potential fissures and it required, among other things, that structural and geotechnical engineers formally document possible seismically-induced liquefaction and subsidence problems. The area of the zone was much greater than even the typical 240-m wide active fault "Special Study Zone" required by the State of California (Hart, 1985). The impact on development was therefore almost immediate, with many escrow closings frequently delayed or even failing as real estate agents sought to ensure the public that the Temecula Valley was as geologically "safe" as almost any other place in California.

The Water District

Almost immediately after the fissures appeared, the Water District shut down several wells near the fissures. The Water District has since been extremely cautious and defensive in its water management policy for the Temecula-Wolf Valley area. Owing to court injunction, several of the deep wells have remained inoperative since the onset of the 1987 fissures; while others, apparently based on Water District decision, have subsequently pumped less than about one-half their pre-fissure production. The Water District has thus been obliged to increase import of water from sources outside the local groundwater basin, resulting in a
more costly and generally lower quality supply. Consultants for the Water District, as those for some of the developers, continue to monitor fissures for evidence of any further movement, usually by periodic observation of lines painted across the cracks and by quadrilateral-survey readings.

The Developers

Several developers of both residential and business parks were named in the original litigation. The developers and their insurance carriers retained various geotechnical consultants to determine the cause of the 1987 fissures and to recommend appropriate setback zones commensurate with public safety and the requirements of the State of California and the County of Riverside. The numerous studies following the 1987 fissure events demonstrated that the fissures were, for the most part, controlled by faults. And these faults were judged to be Holocene in age, and therefore active according to State of California criteria (Leighton & Associates, 1987; Geowest Soil Consultants, 1987; Schaefer Dixon Associates, 1988b). Developers of the residential tracts in the southern fissure area bought back several recently-constructed houses, and eventually moved houses astride the fissure to other yet unbuilt lots in the area. One developer in a northern Business Park provided technical data to the owner of a large industrial building through which the fissure passed, as well as assisted in obtaining a County occupancy permit. In all cases, new, extensive geotechnical investigations were required, including the backhoe trenching of previously-compacted fill in order to determine the exact location of the fault-controlled fissures, and to establish an active fault setback zone. A beneficial side effect of the 1987 ground fissures is that almost all builders in Riverside County generally, and in the Temecula area specifically, have since become aware of potential "ground cracking" and subsidence problems, and thus have taken a much more conservative view with regard to buying and developing various parcels.

State of California

The California Division of Mines and Geology (CDMG) is the state agency given the authority to identify and designate active fault zones. According to California law, no habitable structures may be placed across known active (Holocene) faults. Based mainly on consultants' reports and on the CDMG's own observations, "Special Study Zones" are established for active faults (Hart, 1985). The developers' consultants then typically
perform appropriate geotechnical investigations to locate active fault traces within the Zone, recommend a setback zone for habitable structures, and document all findings in reports that are reviewed by local agencies. The typical Special Study Zone is about 240 m wide and is intended to encompass, within geological uncertainty, all faults that may be active, based on geomorphic expression and on subsurface (usually trenching) information. An actual building setback zone is usually much less wide, dependent on the amount and quality of geological data obtained.

In July 1989, following critique of consultants' reports and field verification, the CDMG issued a preliminary Special Study Zone for the Temecula area. After a six-month period during which developers and other interested parties had the opportunity to provide additional information as to the location and dimensions of the new fault, the CDMG issued final Special Studies Zone maps in January 1990 (California Div. Mines and Geology, 1990). As a result, ground fissures and active faults are now often combined in the minds of the layman, regardless of any cause-and-effect relationship.

The Temecula Residents

The response of Temecula area residents to the ground fissures has been mixed. Some have moved out of the area, fearing a large earthquake; but others have simply accepted the fact that earthquakes are a way of life in California, and that nobody has yet been killed by a ground fissure. However, as revealed during the litigation, some homeowners sought the help of health care providers for alleged emotional problems resulting from the fear of living on or next to what they perceive as an active fault. Ironically, several ground fissures elsewhere in Riverside County have been shown to be not located along near-surface active faults (Lofgren, 1976; Morton, 1978).

In 1988, some of the residents living near the ground fissures allegedly had difficulty in selling their homes, and there were reports that many real estate brokers were refusing to become involved in sale of homes located near the ground fissures. Also alleged was that near-fissure homes decreased in value because of the fissures, the lawsuits, and the resulting press coverage. It is probably more accurate to say, however, that most homes may have experienced a slower rate of appreciation, rather than an absolute decline in sale price.
LITIGATION STATUS

At the time of this writing (October 1990), the litigation involving the residential homes has in most respects been settled. Except for one defendant developer who conducted preliminary engineering and sold a tract of land to others who eventually constructed houses, all defendants have settled with the plaintiff homeowners, for about $2.8 million. Ironically, the Water District, which still refuses (at least publicly) to accept the theory that its deep groundwater pumping caused the 1987 Temecula ground fissures, paid the largest pro rata share of the overall settlements.

In contrast to the residential litigation, the lawsuit involving ground fissuring in a Temecula Business Park has just started, and promises to be nearly as costly.

The Temecula area fissure litigation points out that urbanization, especially in geologically sensitive locations, will continue to cause increasing friction between developers, federal, state and local regulatory authorities, utility concerns, and private business and residential interests. Cooperation at the earliest stages of development planning is therefore crucial to prevent disruption or injury to the environment, to property, and to the health and safety of individuals, and to minimize related litigation.

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REFERENCES

California Division of Mines and Geology (1990) Special Studies Zones Maps, Pechanga, Murrieta and Temecula Quadrangles, Sacramento, California, scale 1:24,000.
Geowest Soil Consultants (1987) Geotechnical investigation, Tract 19939 fissure, Pala Road between Via Gilberto and Via Eduardo, Wolf Valley area, County of Riverside, California.
Consultants' report prepared for Jostri, Inc.


