



**EUCLID CHEMICAL**

# ICRI National Convention

March 25, 2015

## CRACKS – THEY AREN'T ALL THE SAME

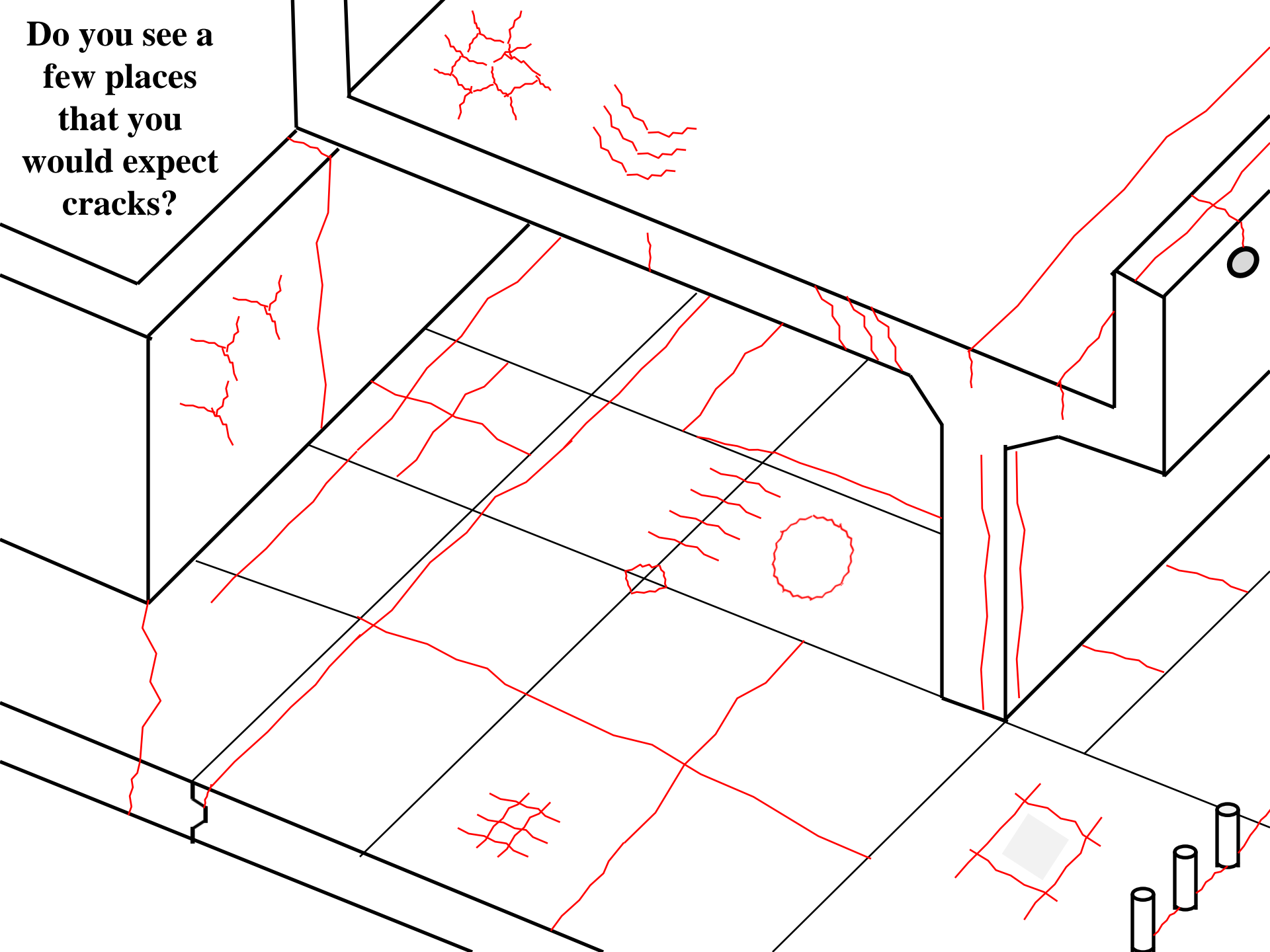
- **How to Identify Them**
- **What Caused Them**
- **How They Could Have Been Prevented**
- **How to Repair Them**

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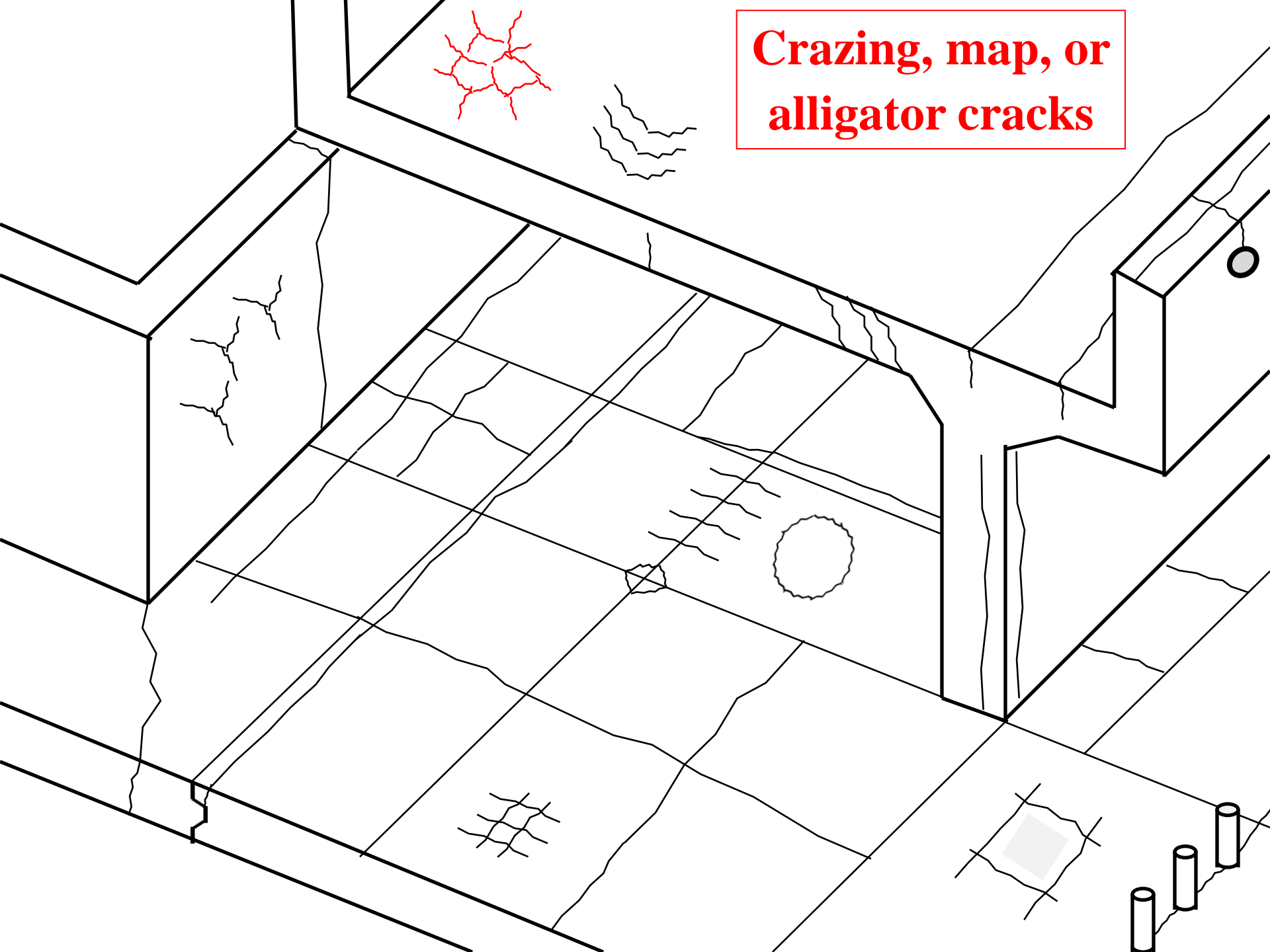
# **Dave Flax**

- ◆ **Civil Engineering Degree from RPI**
- ◆ **Over 35 years experience with concrete**
- ◆ **Years as a Field Engineer**
- ◆ **Years with a contractor**
- ◆ **Years with the Corps of Engineers  
doing research**
- ◆ **Published dozens of articles**
- ◆ **Specialized in cement and concrete**
- ◆ **Earned CDT and CCPR from CSI**
- ◆ **On 3 ICRI Committees**

**Do you see a few places that you would expect cracks?**

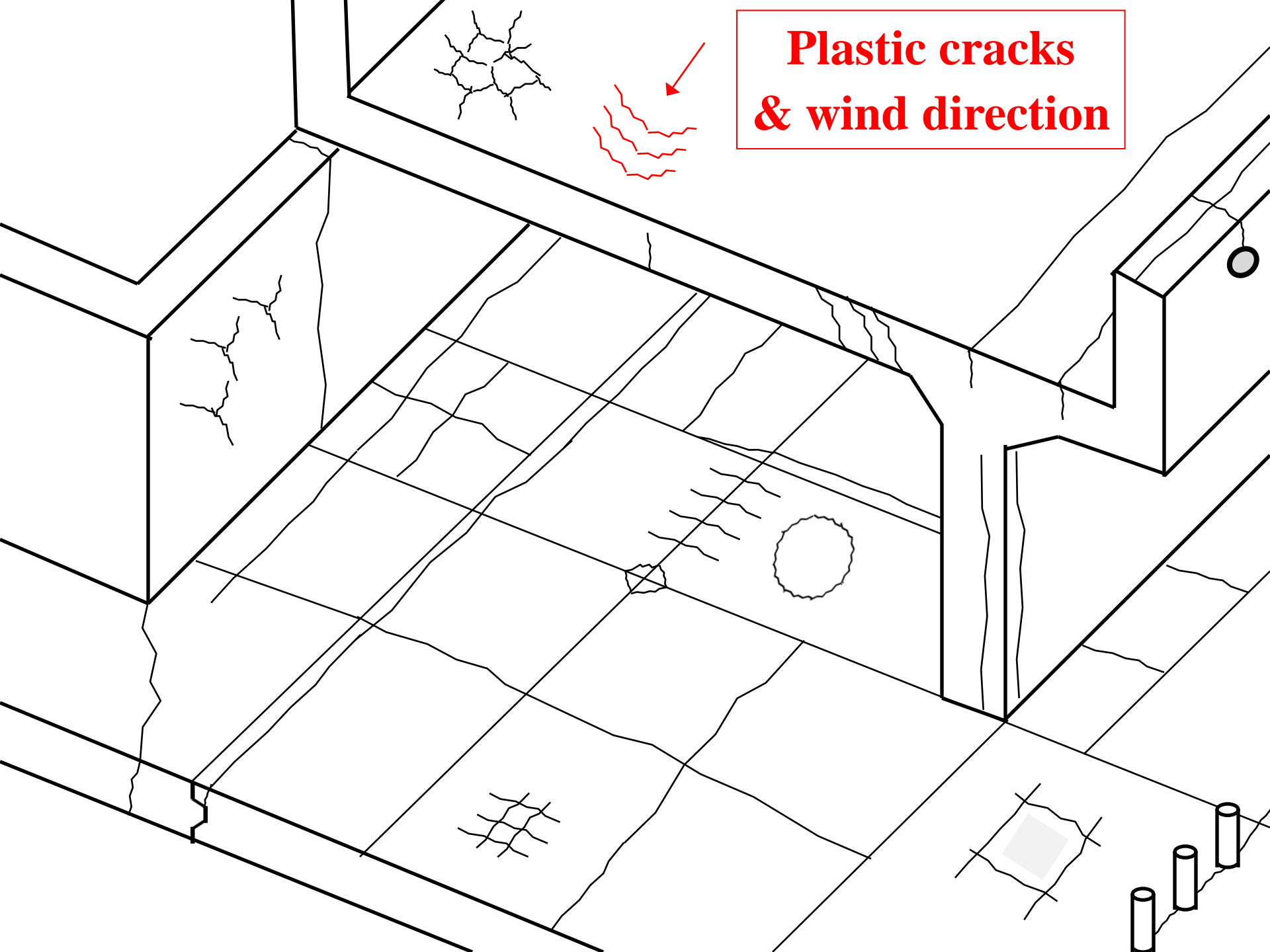


**Crazing, map, or  
alligator cracks**





**Plastic cracks  
& wind direction**





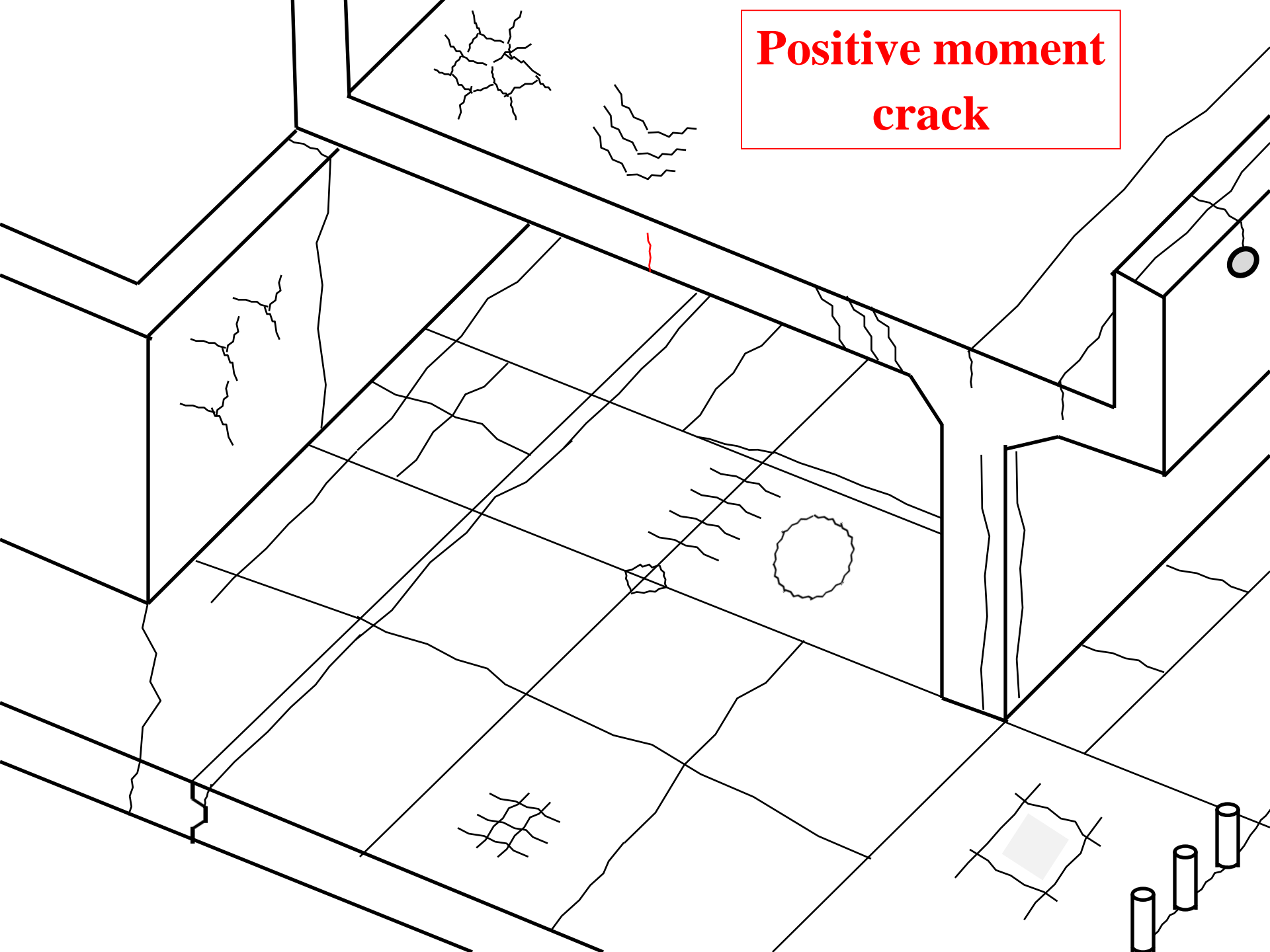
**WHEN WATER EVAPORATES OFF THE  
SURFACE TOO RAPIDLY, CRACKING  
USUALLY OCCURS**

**FOUR FACTORS CONTRIBUTE TO THIS:**

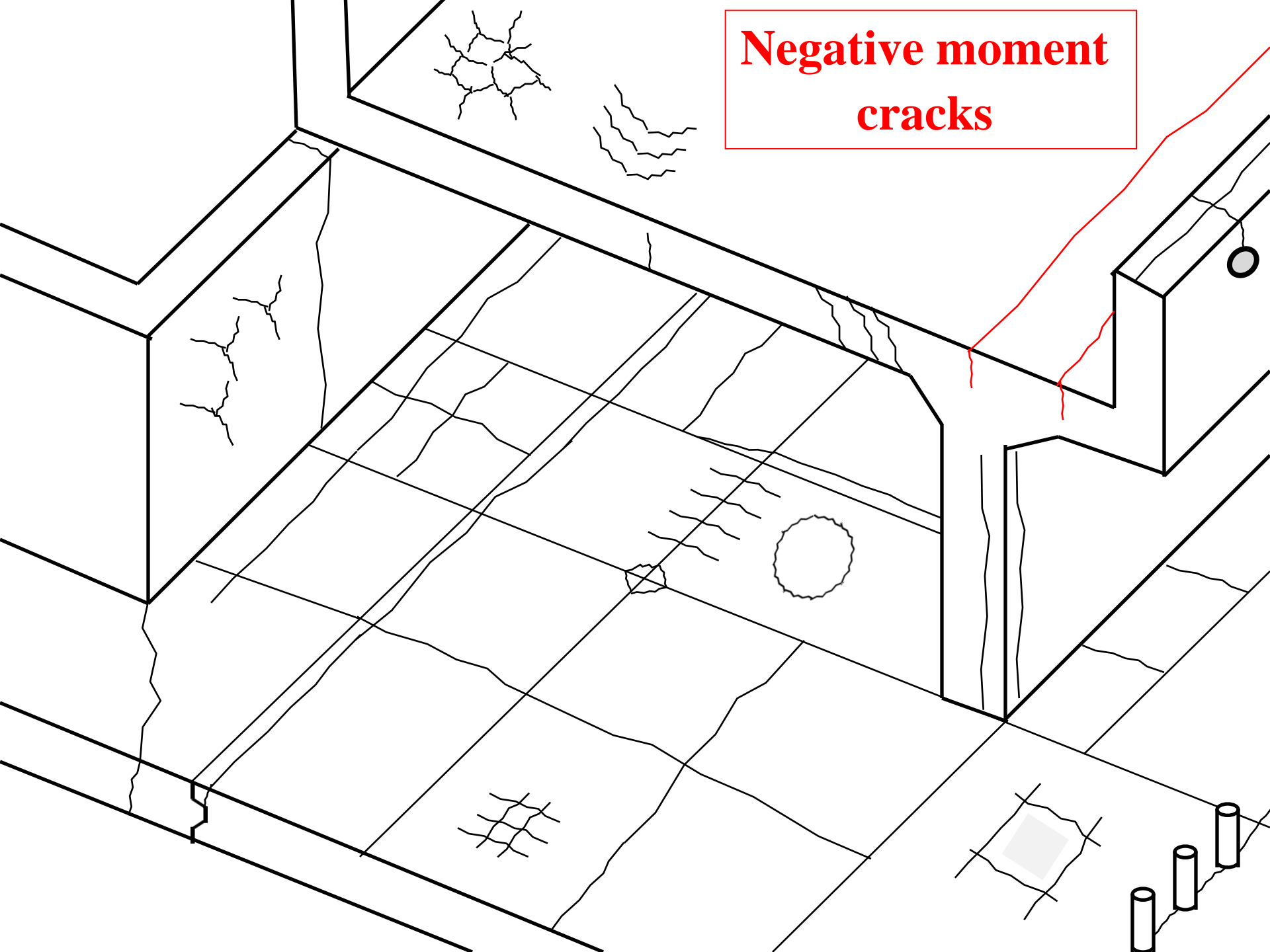
**HIGH AMBIENT TEMPERATURES  
HIGH CONCRETE TEMPERATURES  
LOW HUMIDITY  
HIGH WINDS**



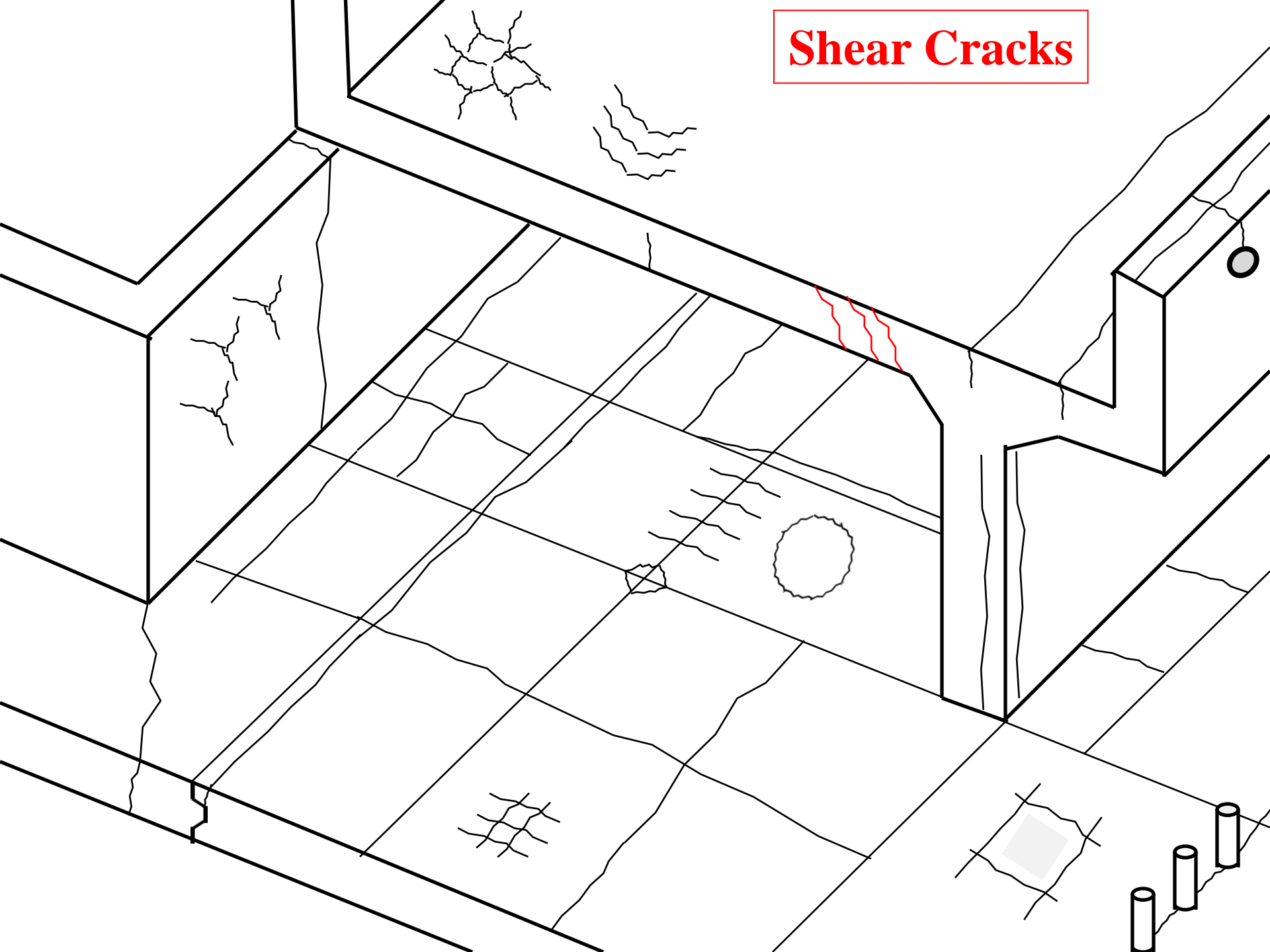
**Positive moment  
crack**



**Negative moment  
cracks**



# Shear Cracks



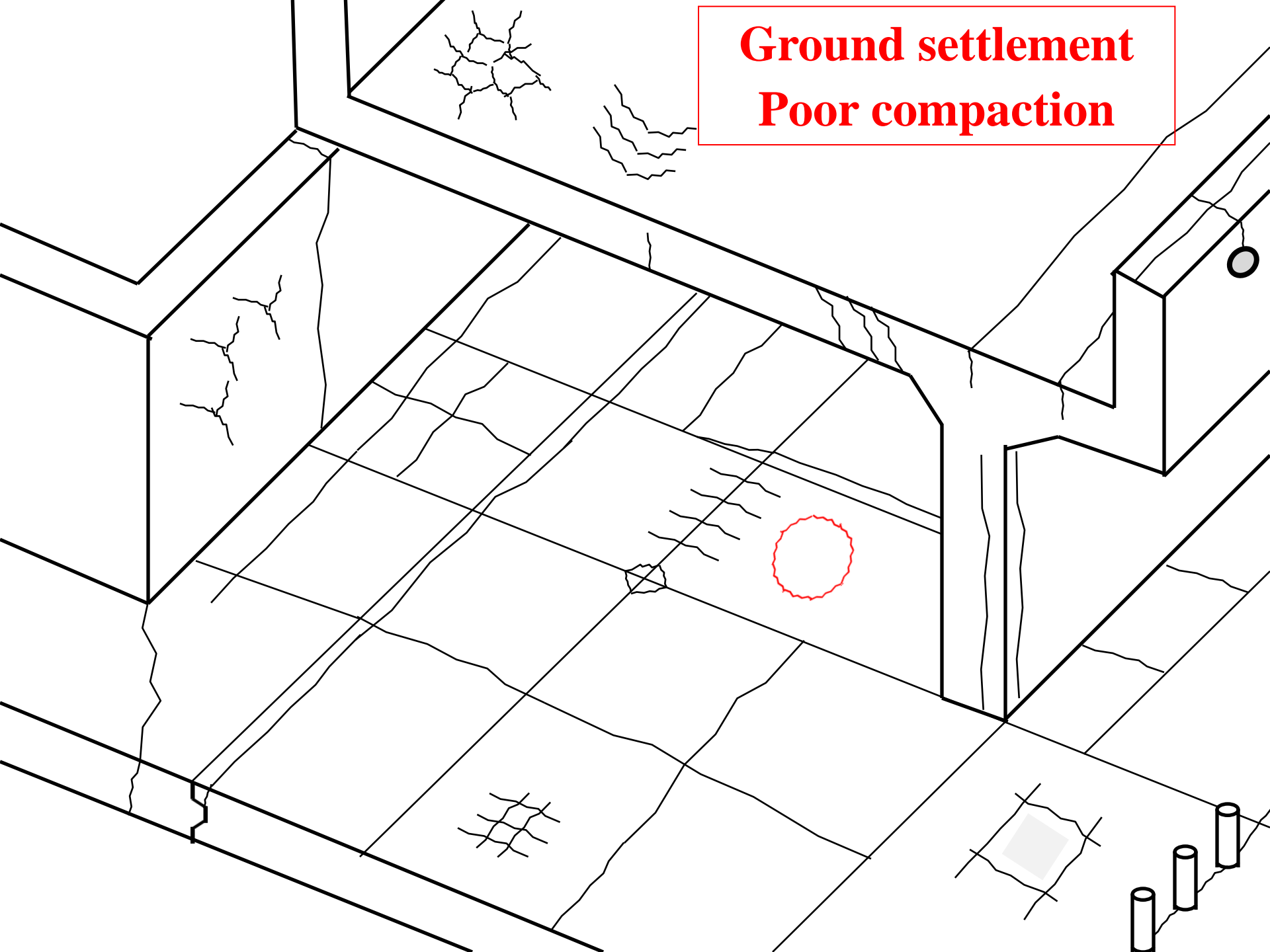


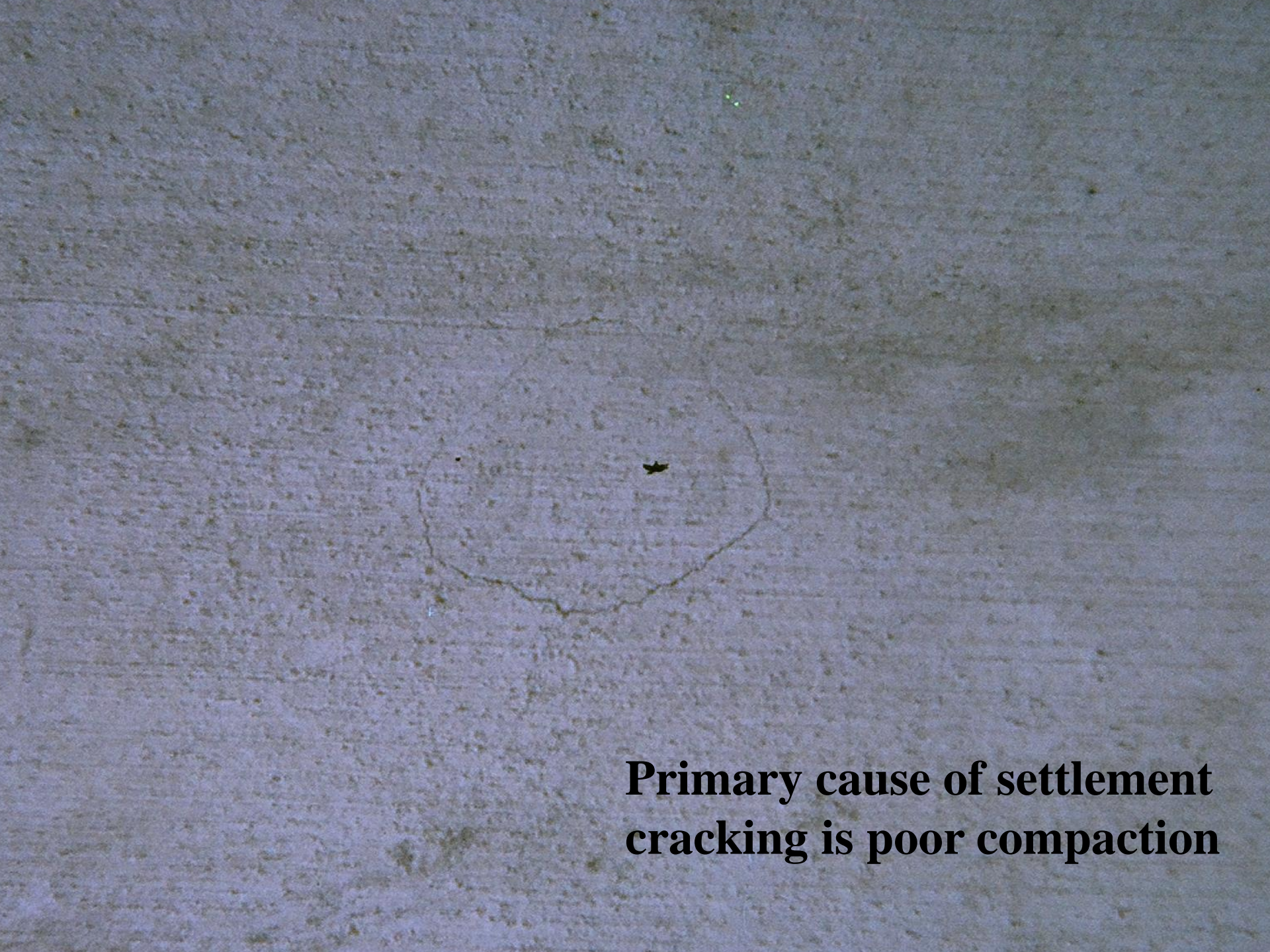
05.09.2012 15:27

**These are all structural and could have been caused by:**

- **Incorrect steel placement**
- **Under design**
- **Change of use**
- **Excessive loading**
- **Poor compaction**
- **Earthquake**
- **Etc**

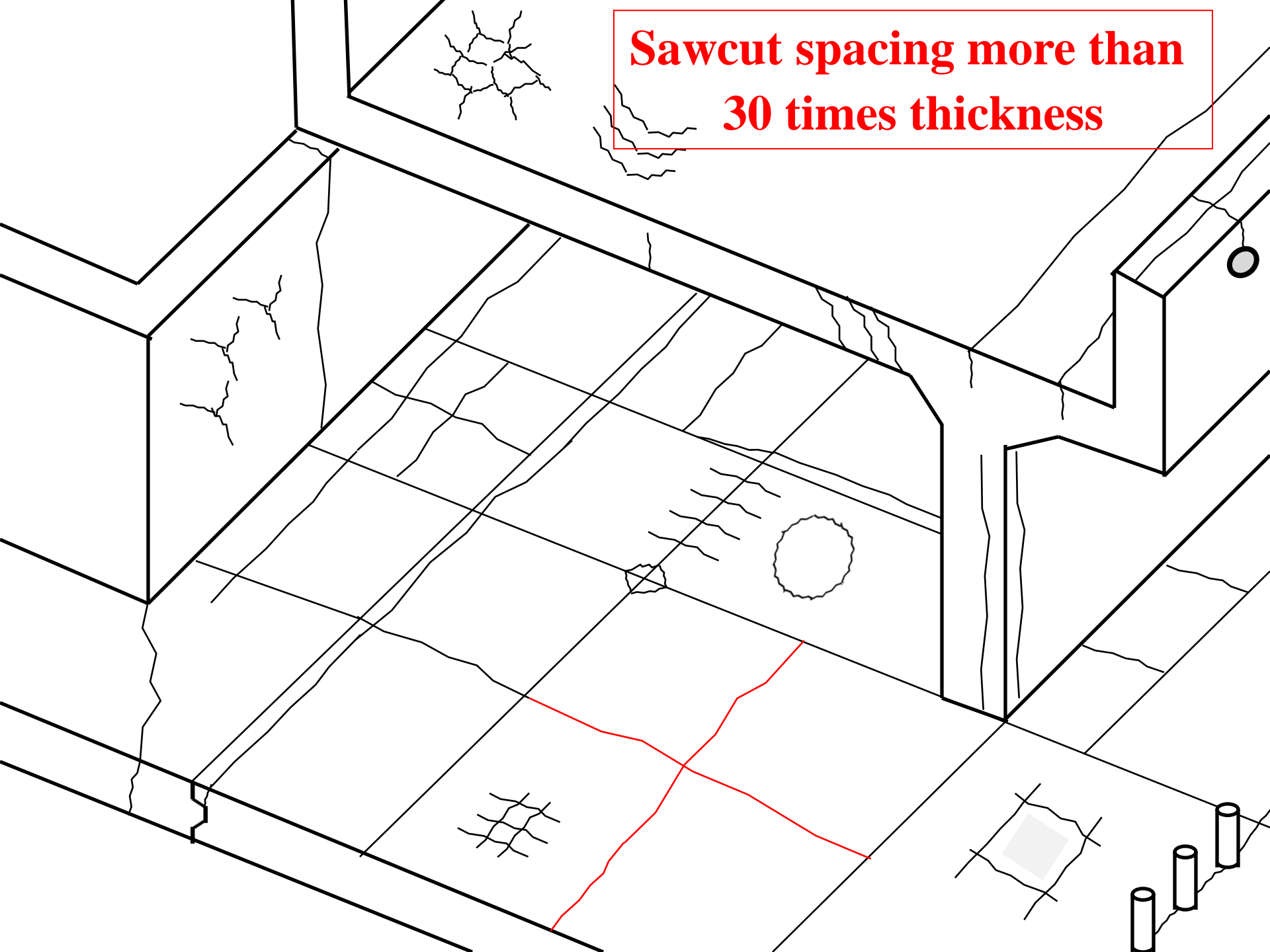
**Ground settlement**  
**Poor compaction**





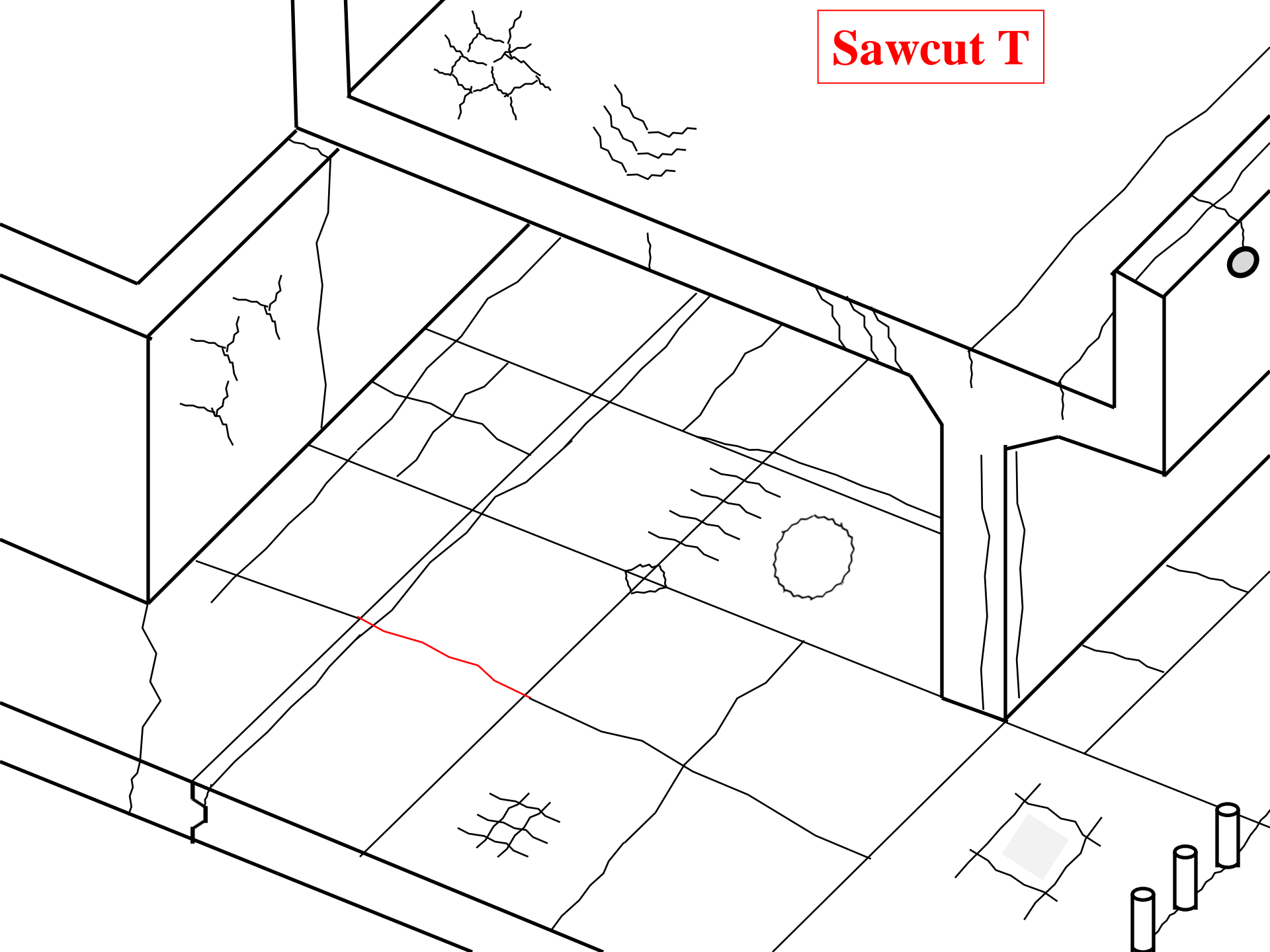
**Primary cause of settlement  
cracking is poor compaction**

**Sawcut spacing more than  
30 times thickness**



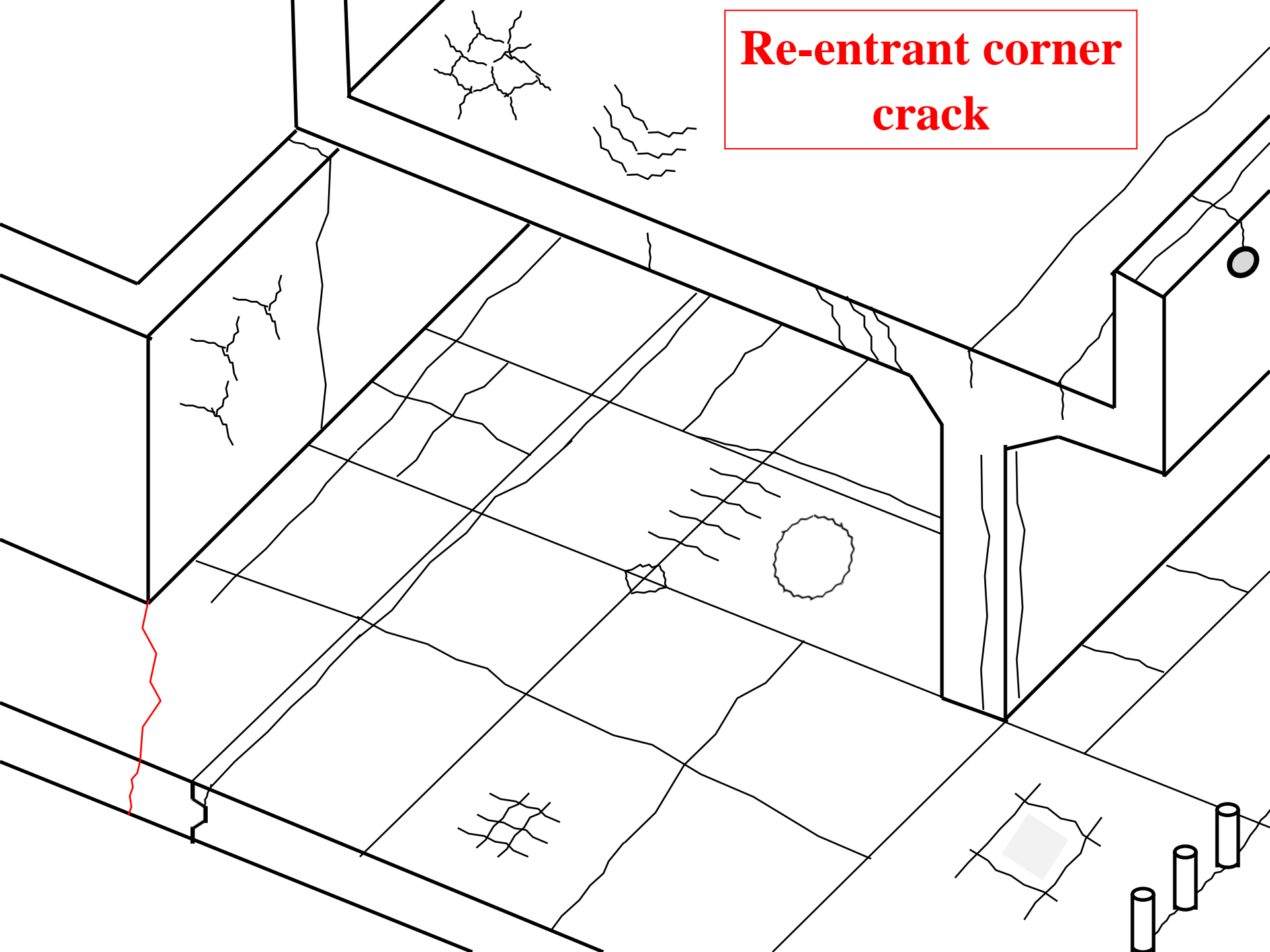


# Sawcut T



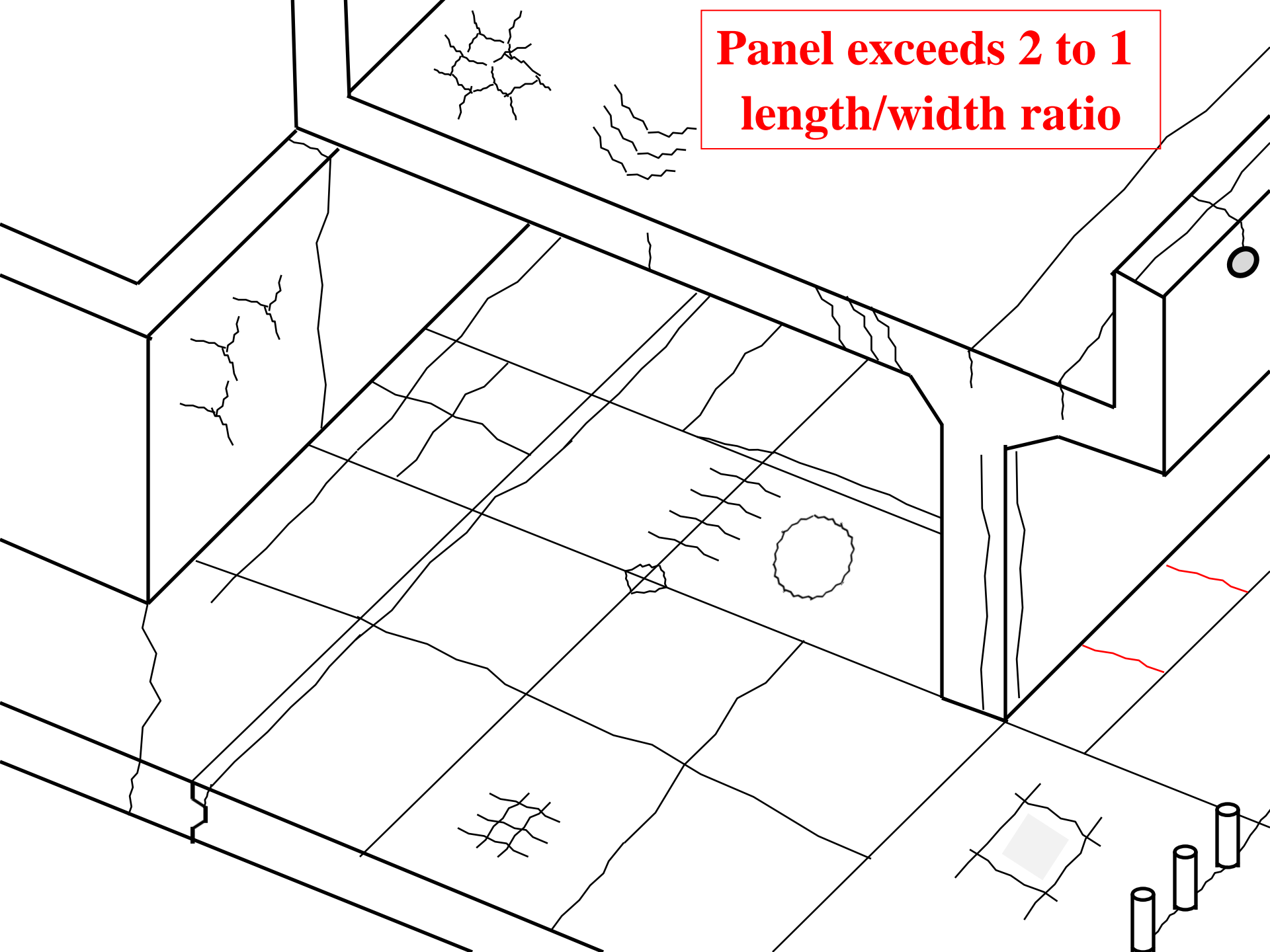


**Re-entrant corner  
crack**

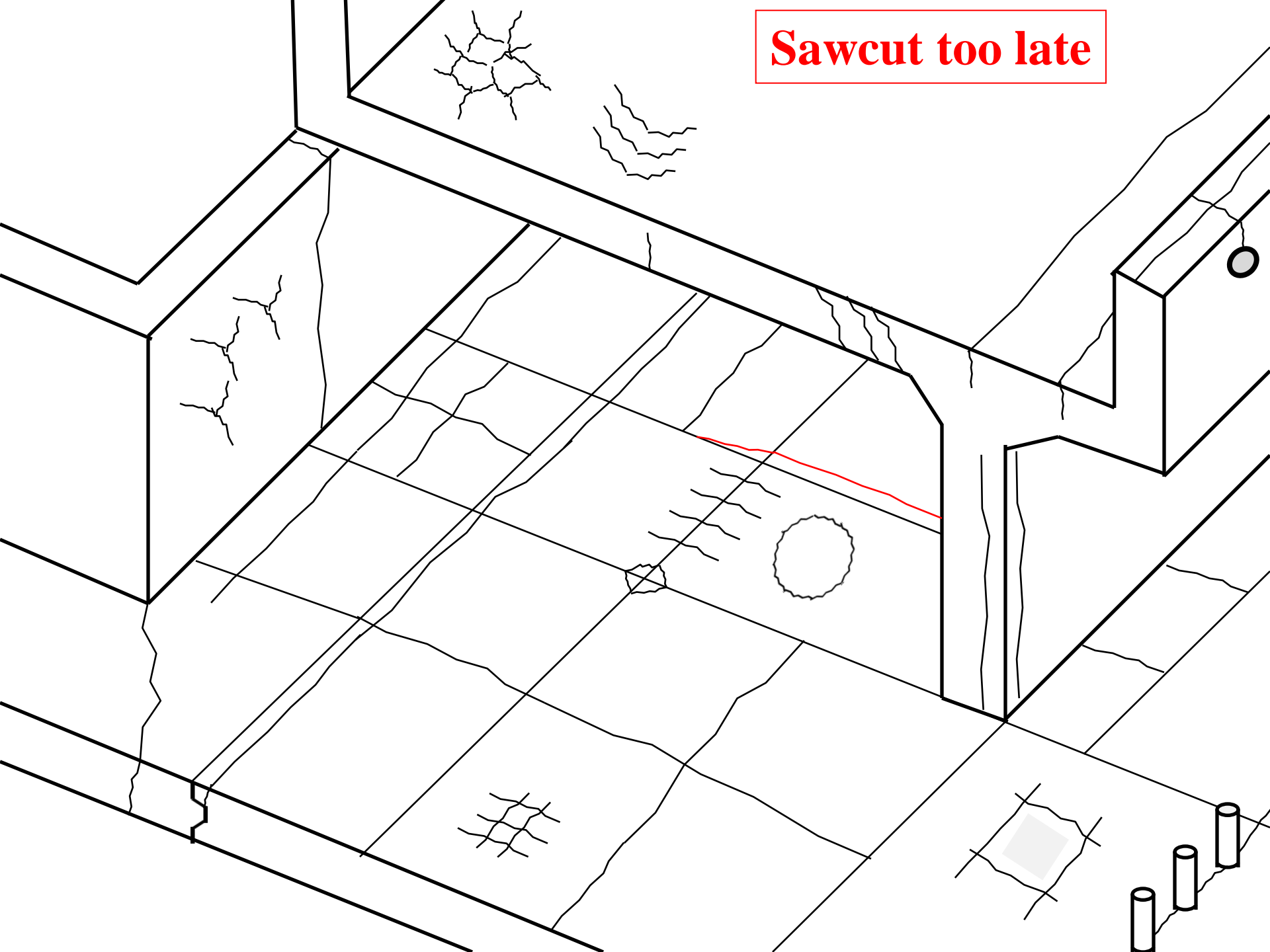




**Panel exceeds 2 to 1  
length/width ratio**

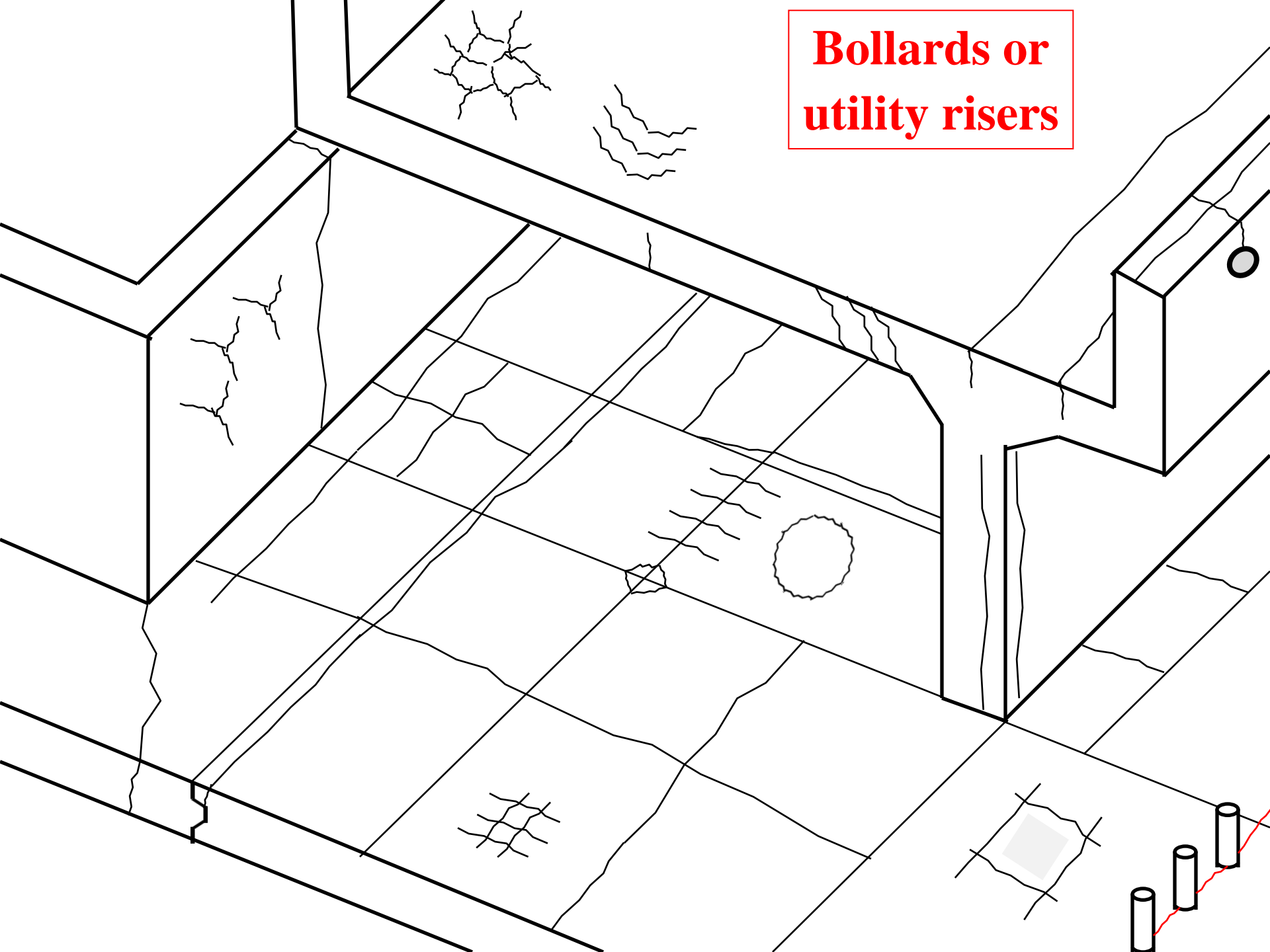


**Sawcut too late**



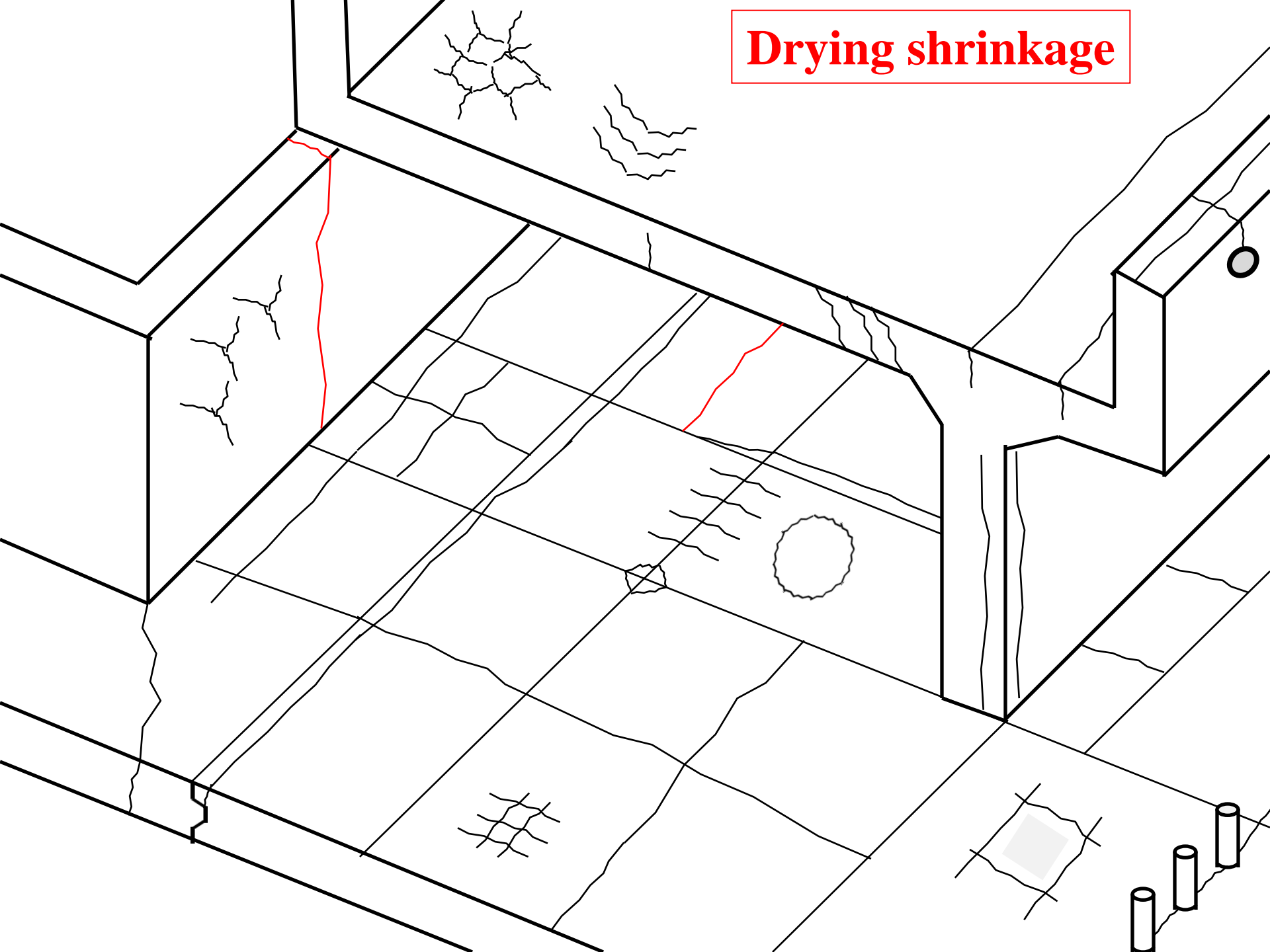


**Bollards or utility risers**





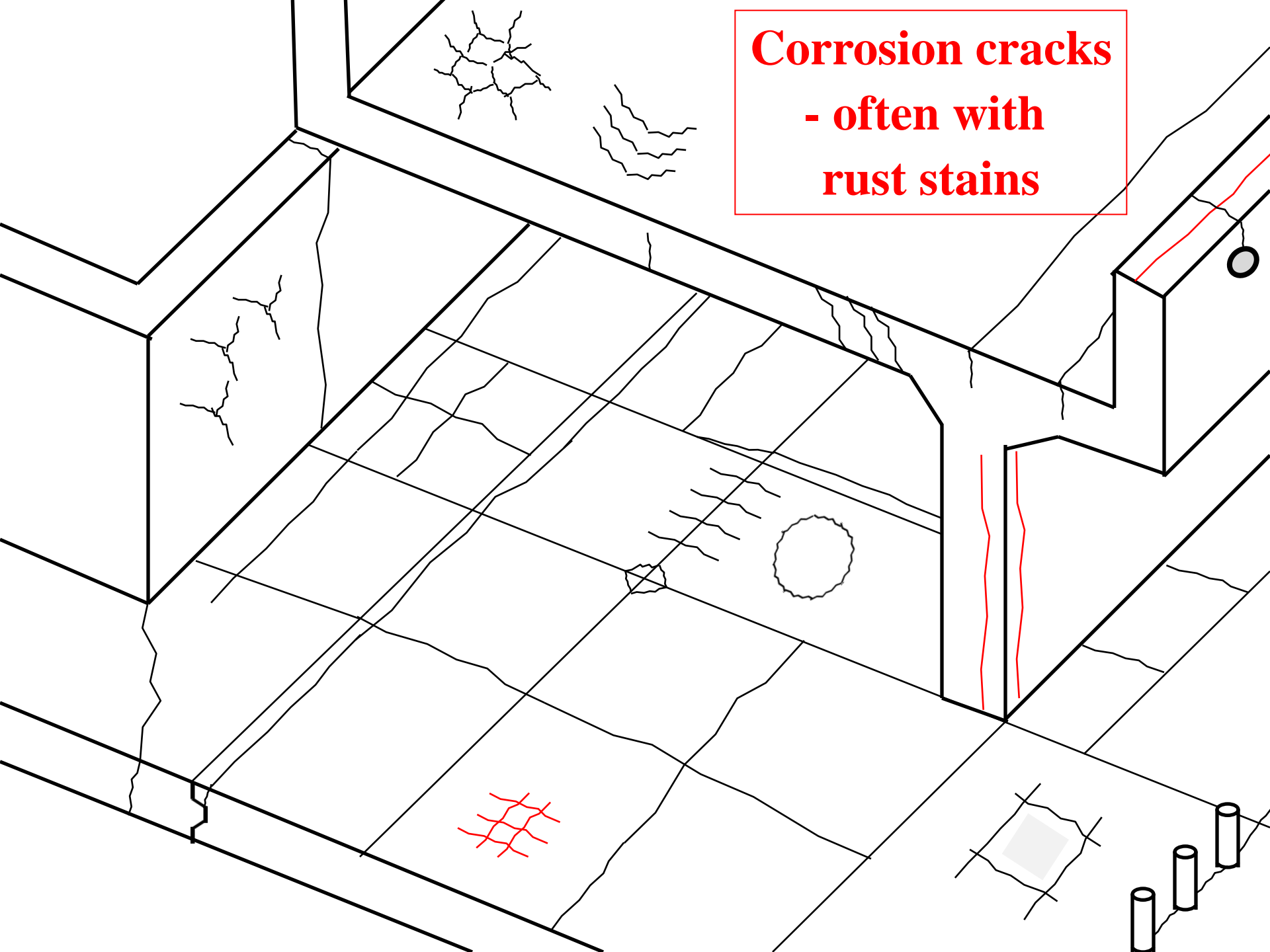
# Drying shrinkage





**Usually Mid-Panel**

**Corrosion cracks**  
**- often with**  
**rust stains**

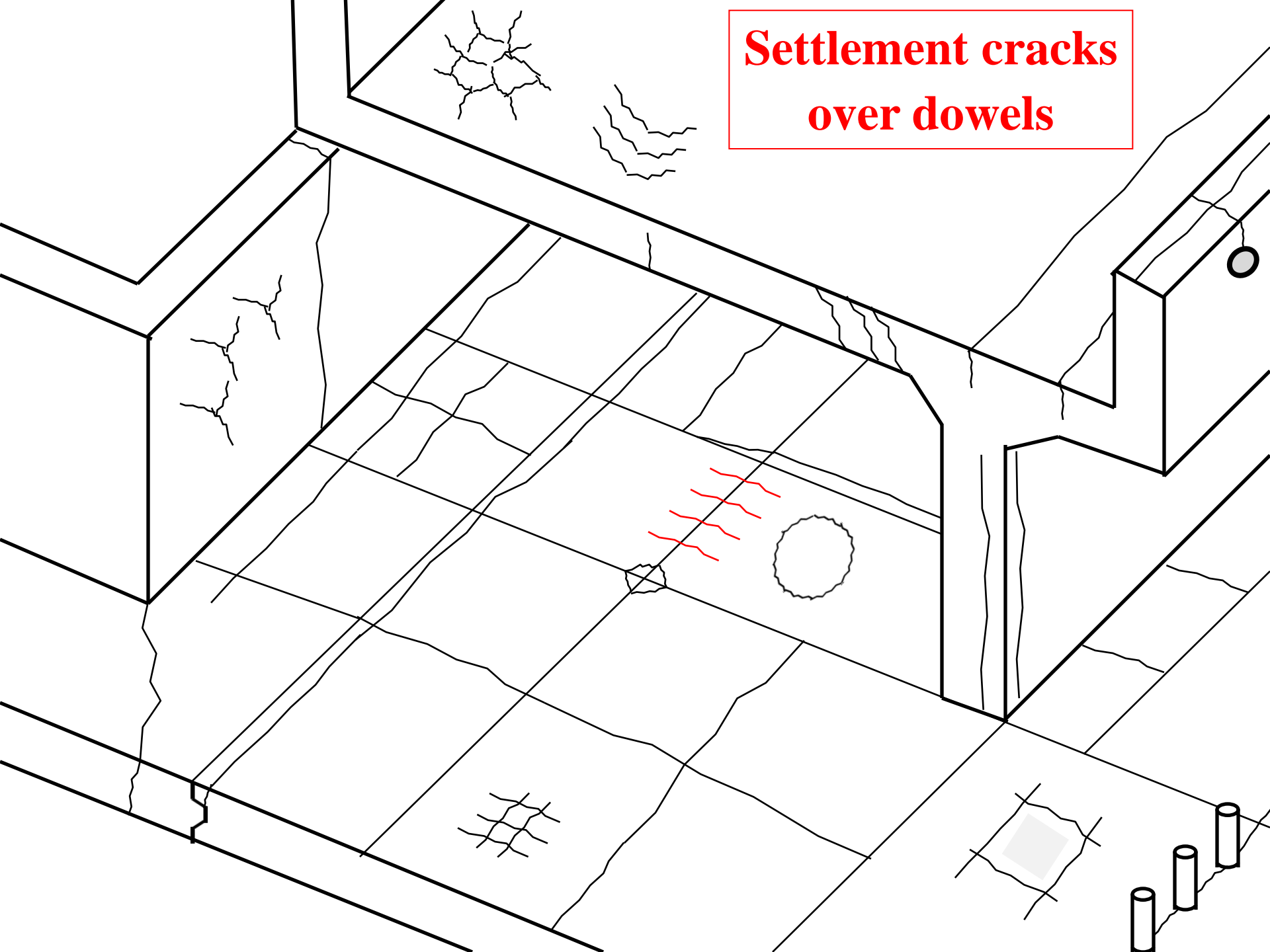






**I don't  
think we  
can fix these  
cracks**

**Settlement cracks  
over dowels**



# Settlement crack

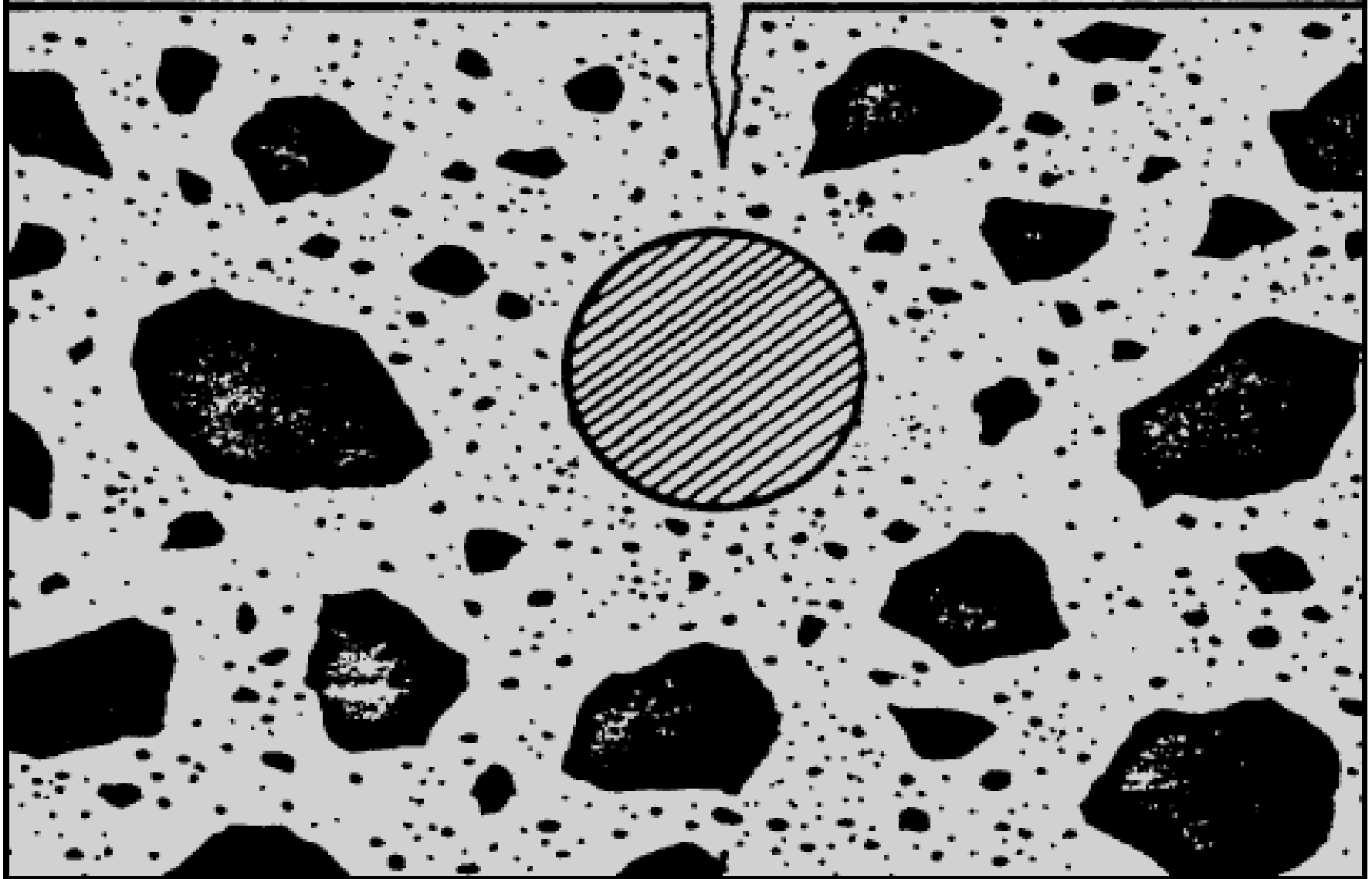
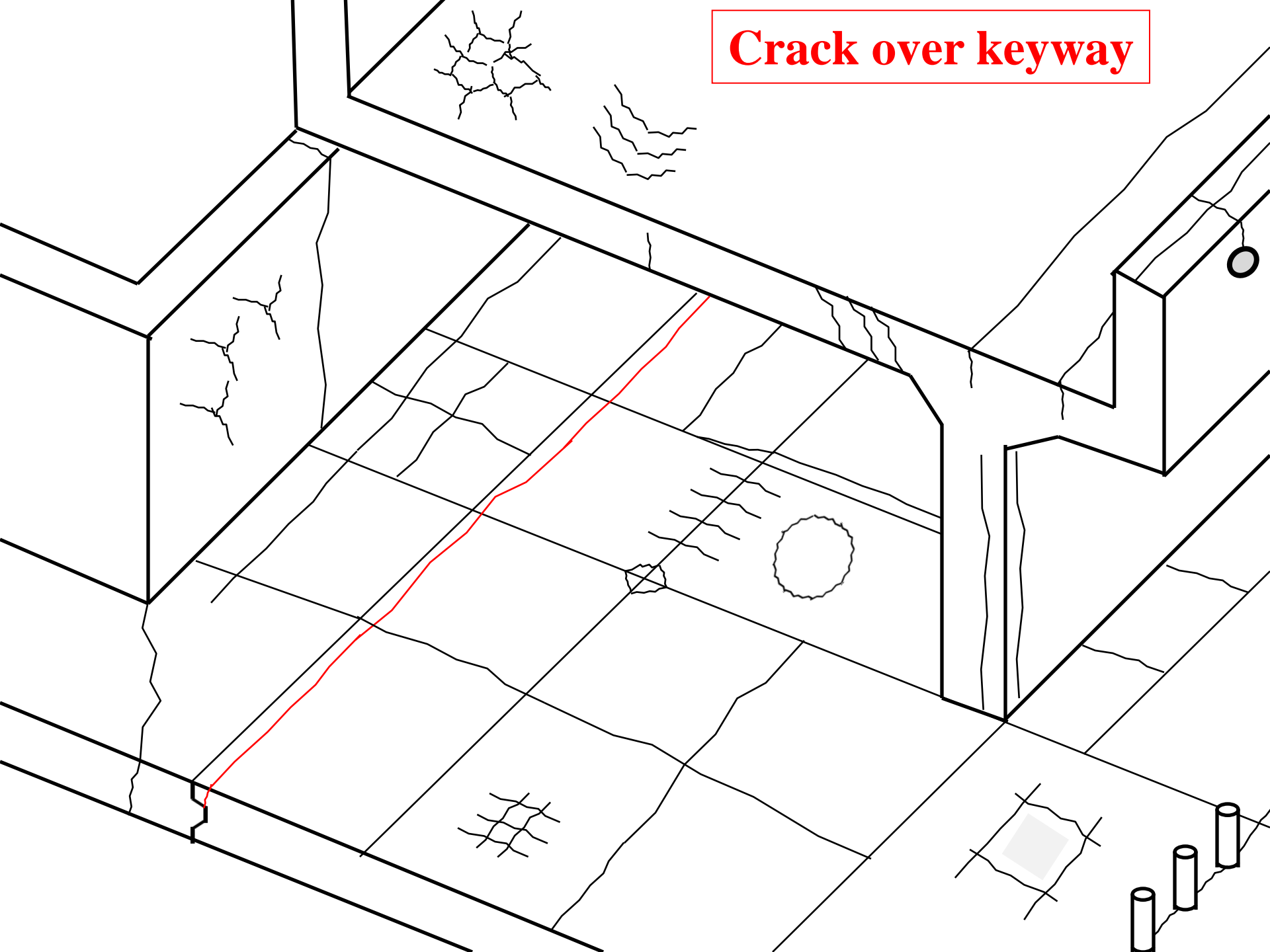
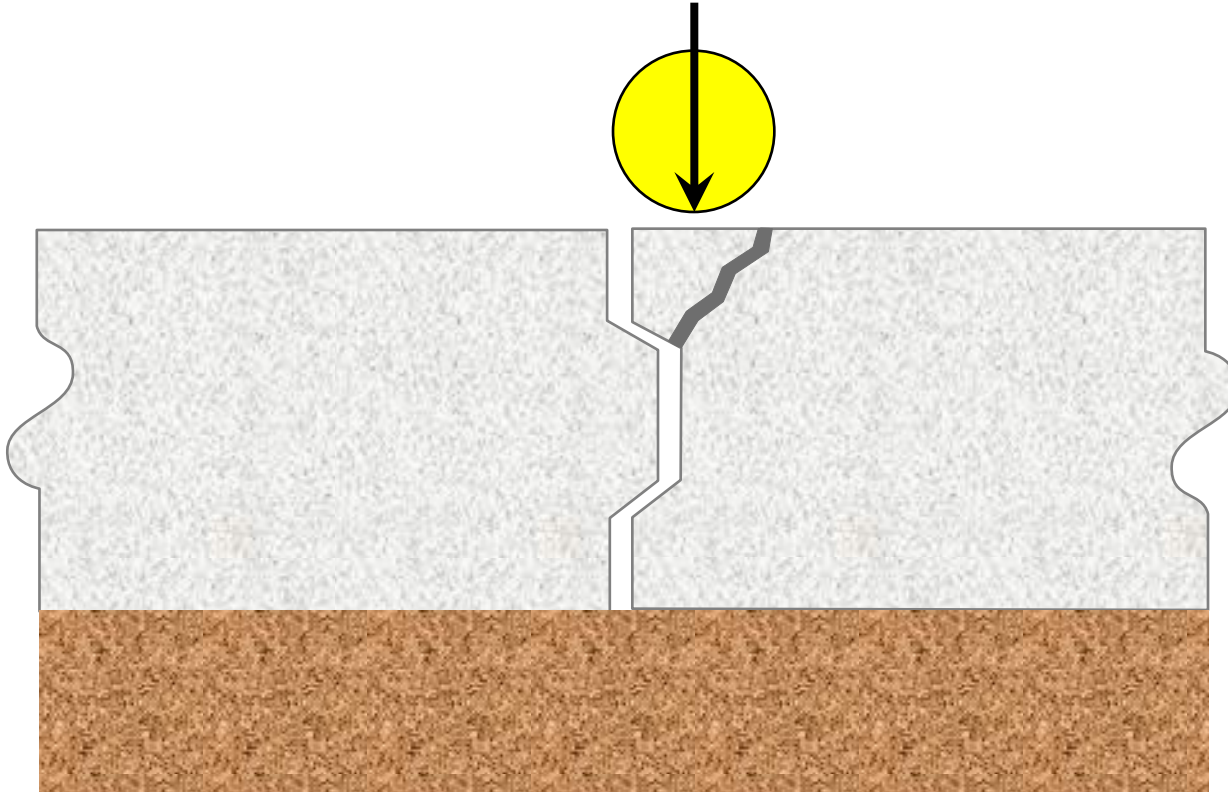


Figure 1. Subsidence cracks form when fresh concrete settles around the rebar and separates, usually within 2 to 5 hours of concrete placement.

**Crack over keyway**





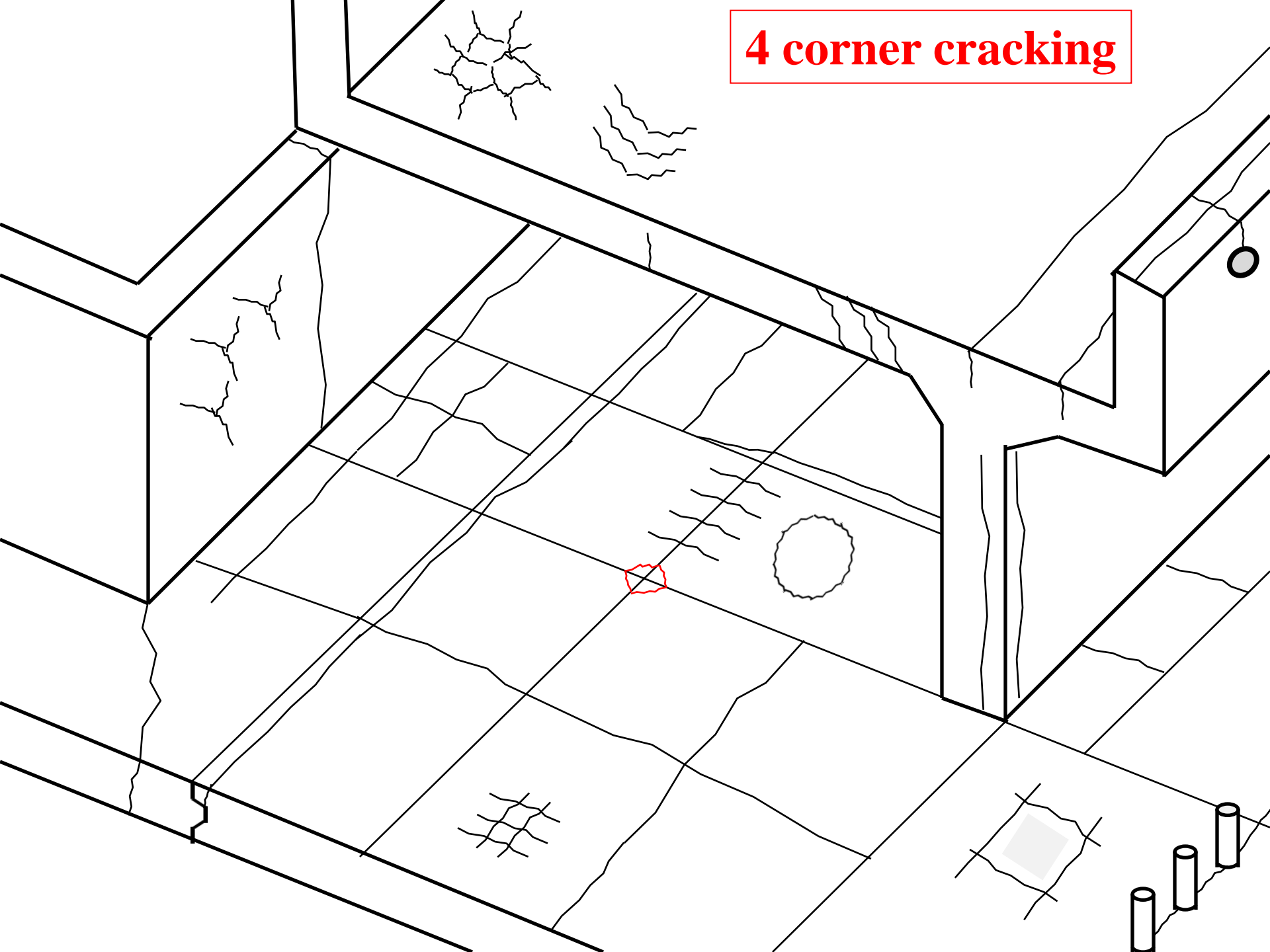


**Not for exposed wheel traffic**

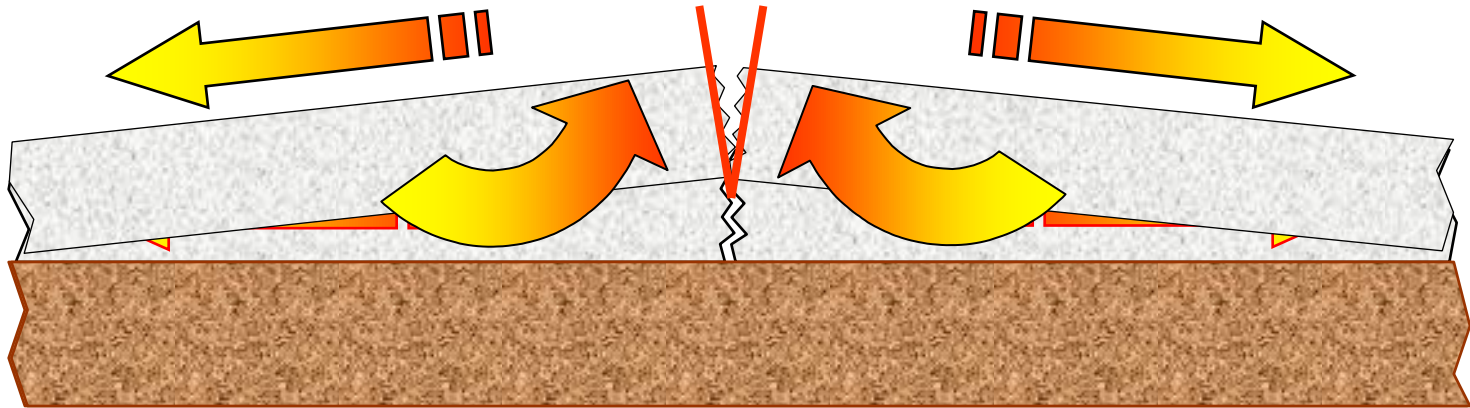
**Broken  
Keyway  
Joint**



**4 corner cracking**



# Cracks and Joints



**Differential drying causes curling**  
**Cracks (joints) form in “V” shape**



# **HOW TO REPAIR CRACKS**

# Gravity Feed



# Injection



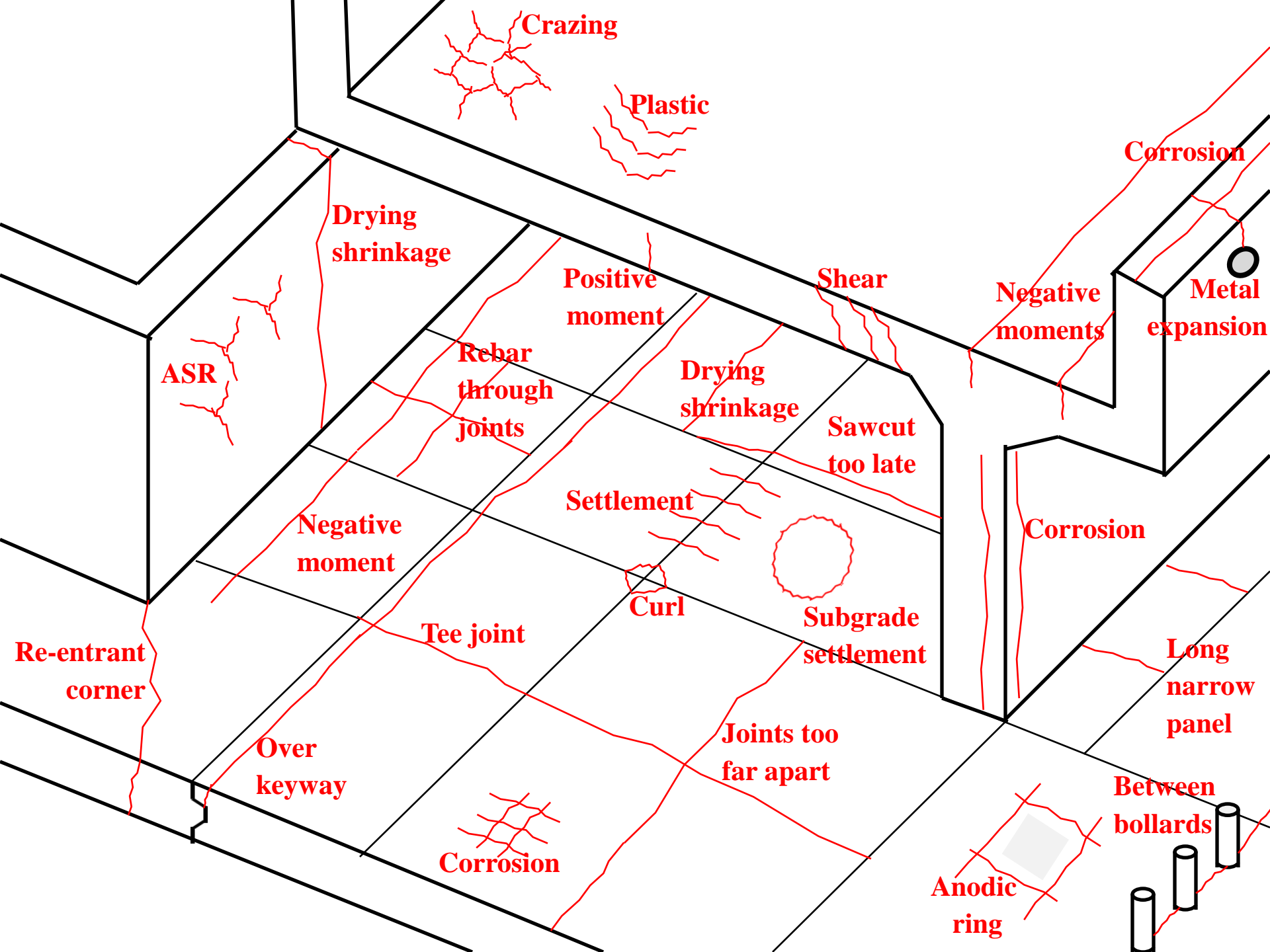


# Aesthetic



# Two Seldom Used Crack Repair Methods





**The Preceding Has Been an Advertisement**

**From Committee 320**

**A New ICRI Guideline**

**Meets Thursday at 10 AM**

**We Could Use Your Help Writing It**

**Please Join Us Tomorrow**



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**QUESTIONS?**

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