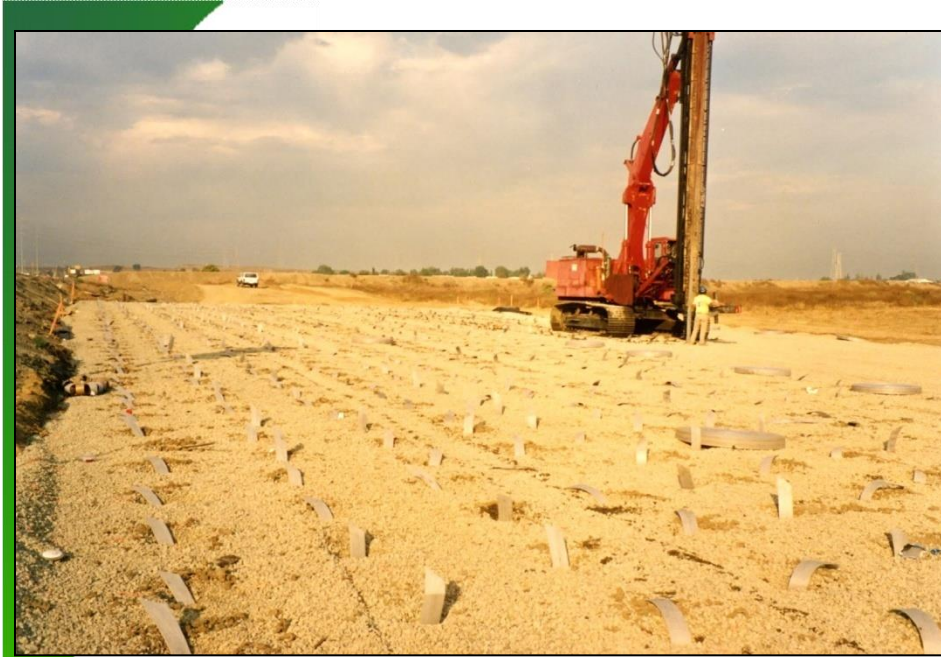


Part 5

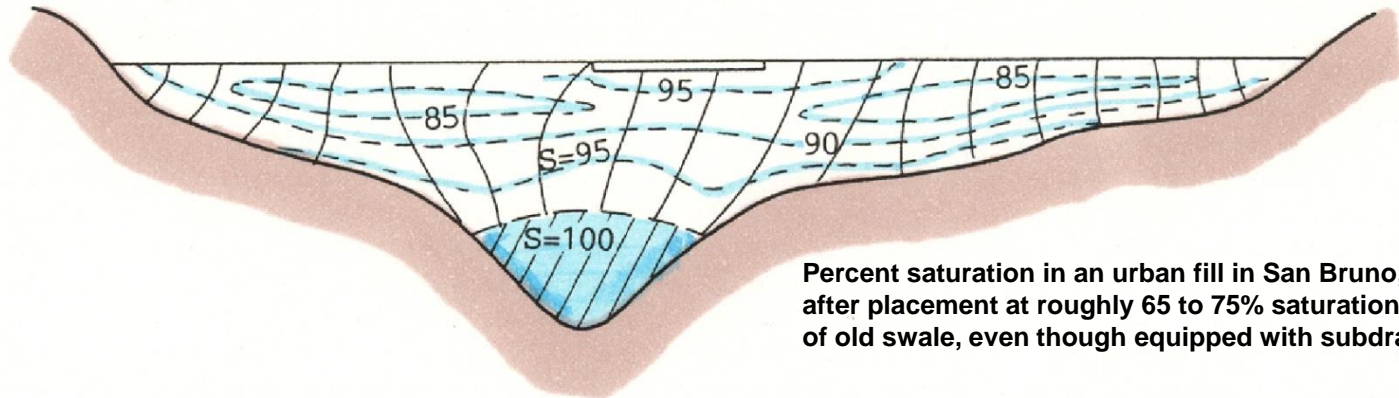
AGING OF FILL





- **Wick drains** or **sand drains** can be used to hasten primary consolidation through drainage and surcharging. Modern wick drains employ heat-welded geotextile filter cloths wrapped around plastic “straws,” which are pushed vertically through the soil, using a pile driving mandrel (shown at left).

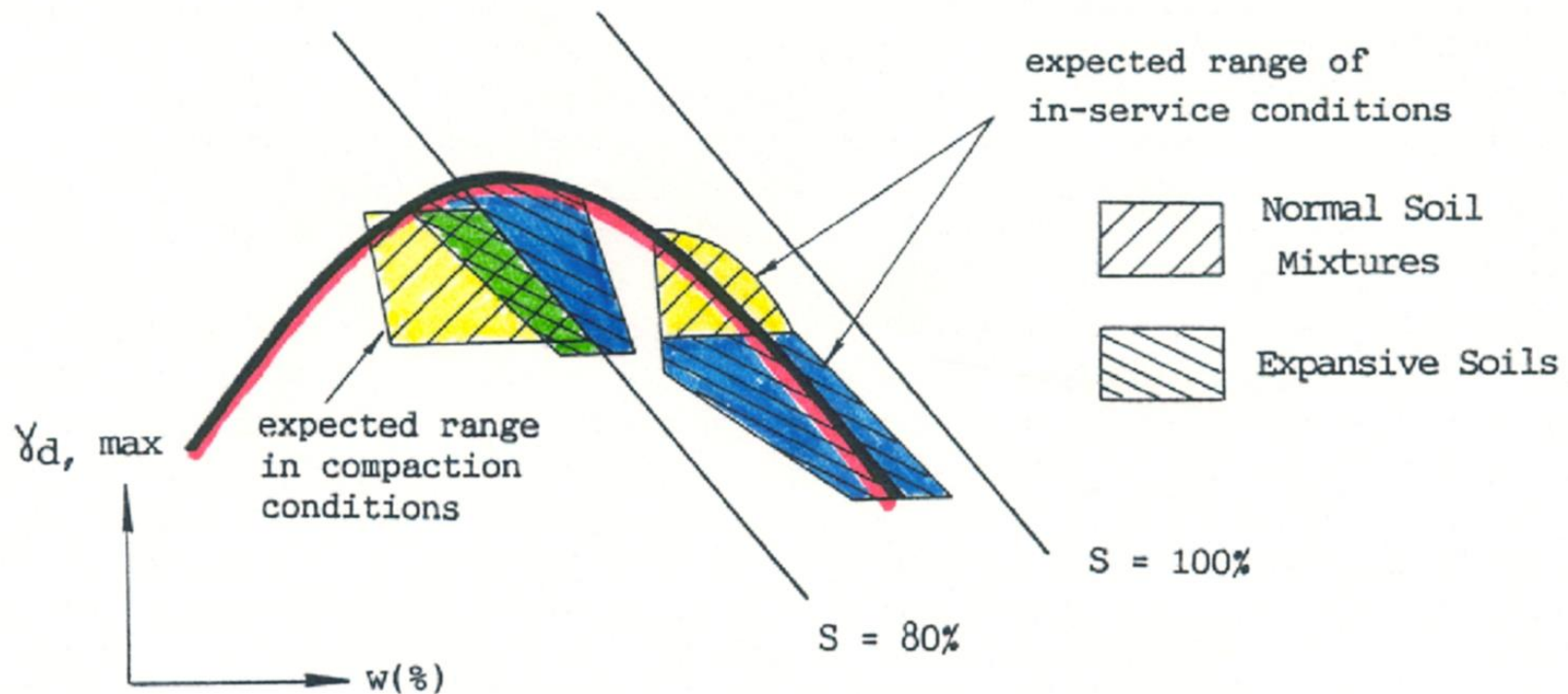
LONG TERM MOISTURE ABSORPTION



Percent saturation in an urban fill in San Bruno, CA 26 years after placement at roughly 65 to 75% saturation. Not saturation of old swale, even though equipped with subdrainage.

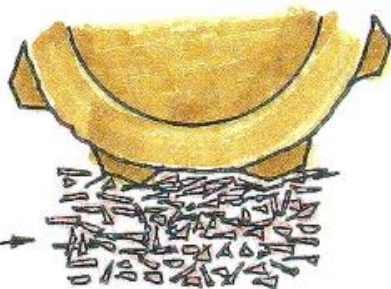
- **Urban embankments tend to absorb moisture with time**, but complete saturation is usually limited to near-surface areas subject to landscape irrigation and infilled channels, like that shown above. This sketch depicts percent saturation of an urban fill in San Bruno, CA about 26 years after placement (from Rogers, 1992).

IN-SERVICE CONDITIONS



- **Compacted fill deeper than the zone of seasonal drying tends to absorb moisture with time, becoming softened and less dense. You cannot make assessments of soil density during construction years later because the moisture content increases (from Rogers, 1998).**

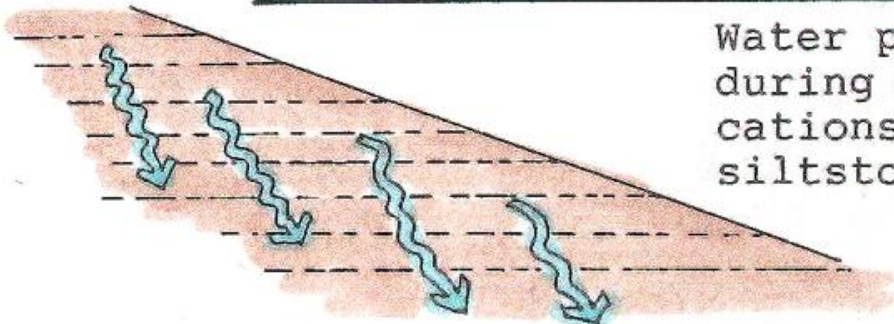
DURING COMPACTION



Pressures of up to 230 psi can be exerted by vibratory sheepsfoot compactors. Disaggregated bedrock particles are sufficiently strong to easily support heavy equipment.

Individual Particles engender a high specific surface area.

FOLLOWING CONSTRUCTION



Water percolates thru the embankment during winter months and exchanges cations with the disaggregated siltstone/claystone particles.

10-25 YEARS LATER

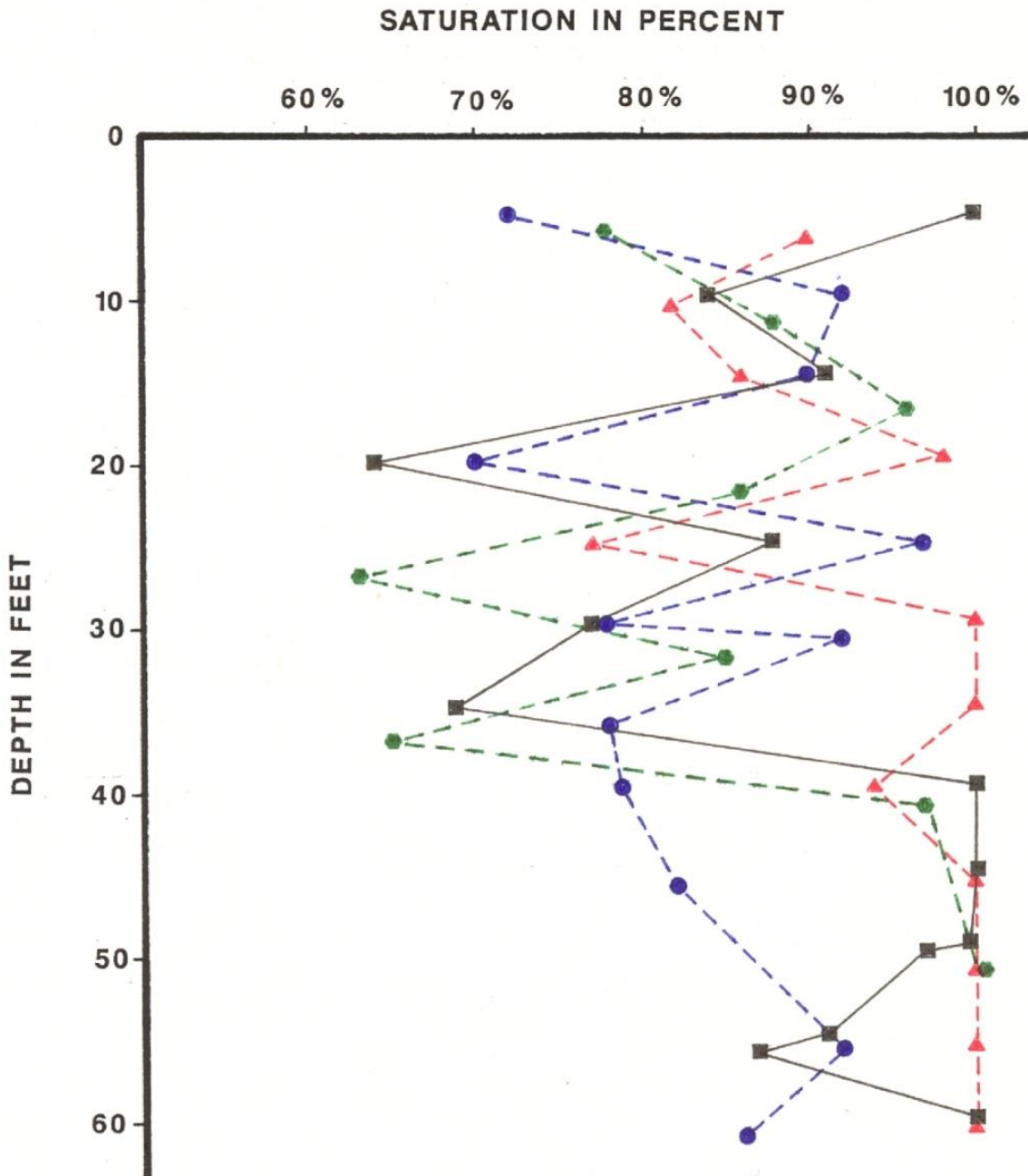
DISAGGREGATED
SILTSTONE



CLAYEY
MUSH



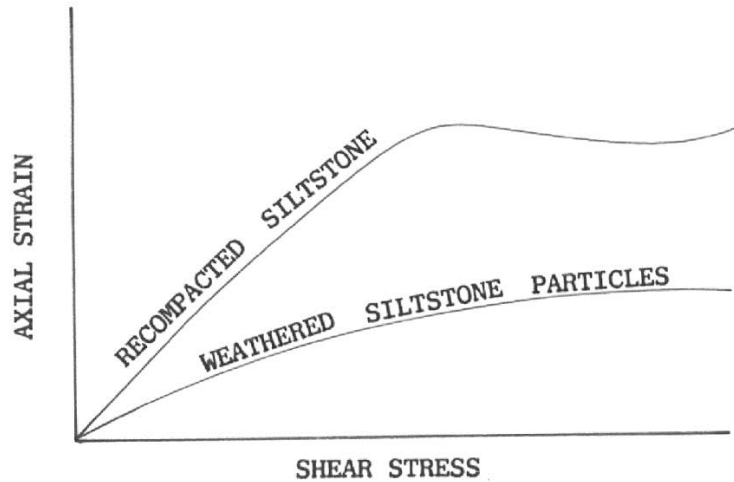
high water retention
high water content
low strength



- Comparison of percent saturation with depth in an urban fill
- Blue and green data were taken from construction records (as constructed)
- Black and red data were measured 7 years later
- Note increase in moisture content

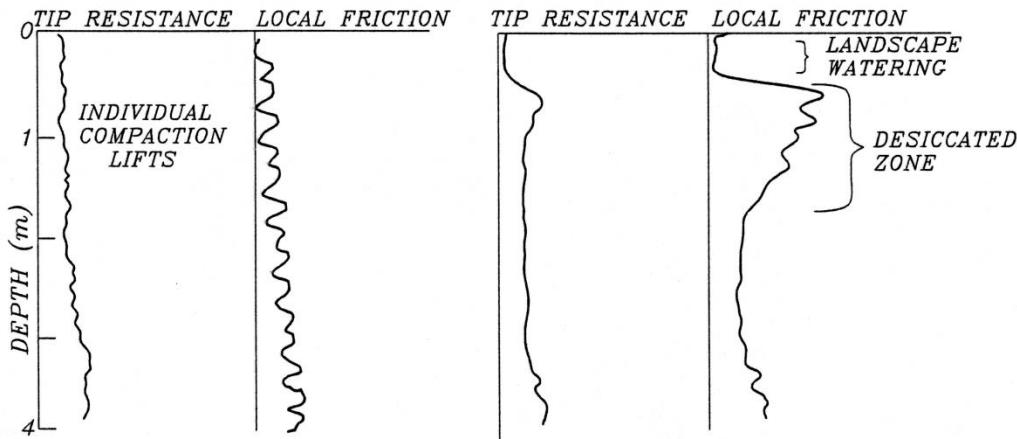
LOSS OF STRENGTH WITH INCREASING MOISTURE CONTENT OF FILL

STRENGTH VARIATIONS



Direct shear tests on Briones formation in Walnut Creek, California, at time of placement, and 23 years later.

- Fills comprised of finely disaggregated particles can absorb large volumes of moisture over time and noticeably soften, often exhibiting marked strength loss (above left).



- Lower left: CPT soundings on same lot illustrating the change in behavior of compacted silty clay in Blackhawk, California, after severe cycle of desiccation, followed by development and landscape watering.

CPT SOUNDINGS WITHIN 1 YEAR OF PLACEMENT

CPT SOUNDINGS AT SAME LOCATION 7 YEARS LATER