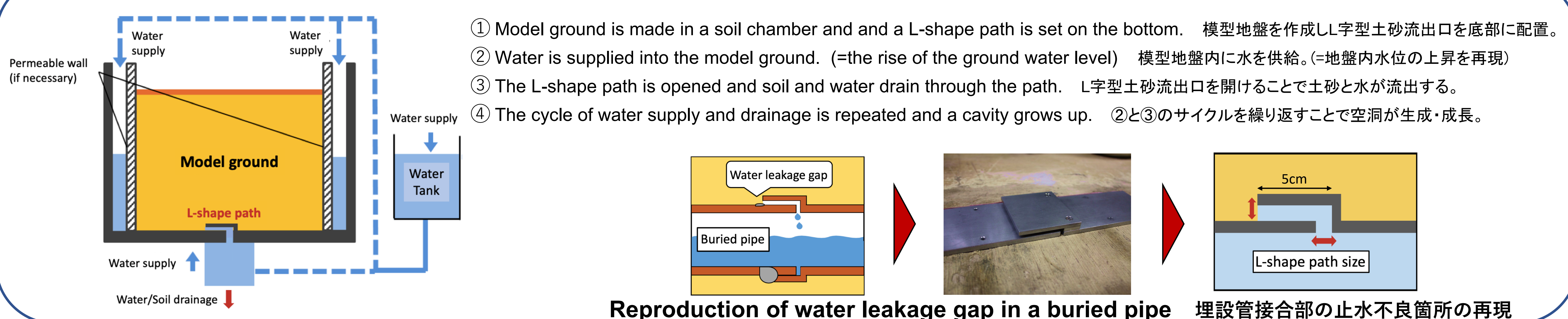


埋設管の止水不良箇所における地盤内空洞の生成・成長過程

A road cave-in is becoming a serious problem in accordance with the aging of infrastructure. Recently, a field excavation survey on subsurface cavities revealed that small damage in pipe joints can be a cause of cavities. Those damages are regarded as water leakage, not regarded as a structural breakage of pipe. In this study, the process of generation and expansion of subsurface cavities around the location of water leakage in buried pipes are investigated through a series of model tests.

インフラ老朽化に伴い道路陥没現象が深刻な問題となっています。近年実施された地盤内空洞の開削調査から、一見して破損が確認できないような下水管上に空洞が発生する場合があります。構造上の破損とは言い難い継手部の軽微な隙間、いわゆる止水不良箇所における地盤内空洞の生成・成長過程に対して、模型実験による考察を行いました。

Model test apparatus and test procedure 実験装置と手順

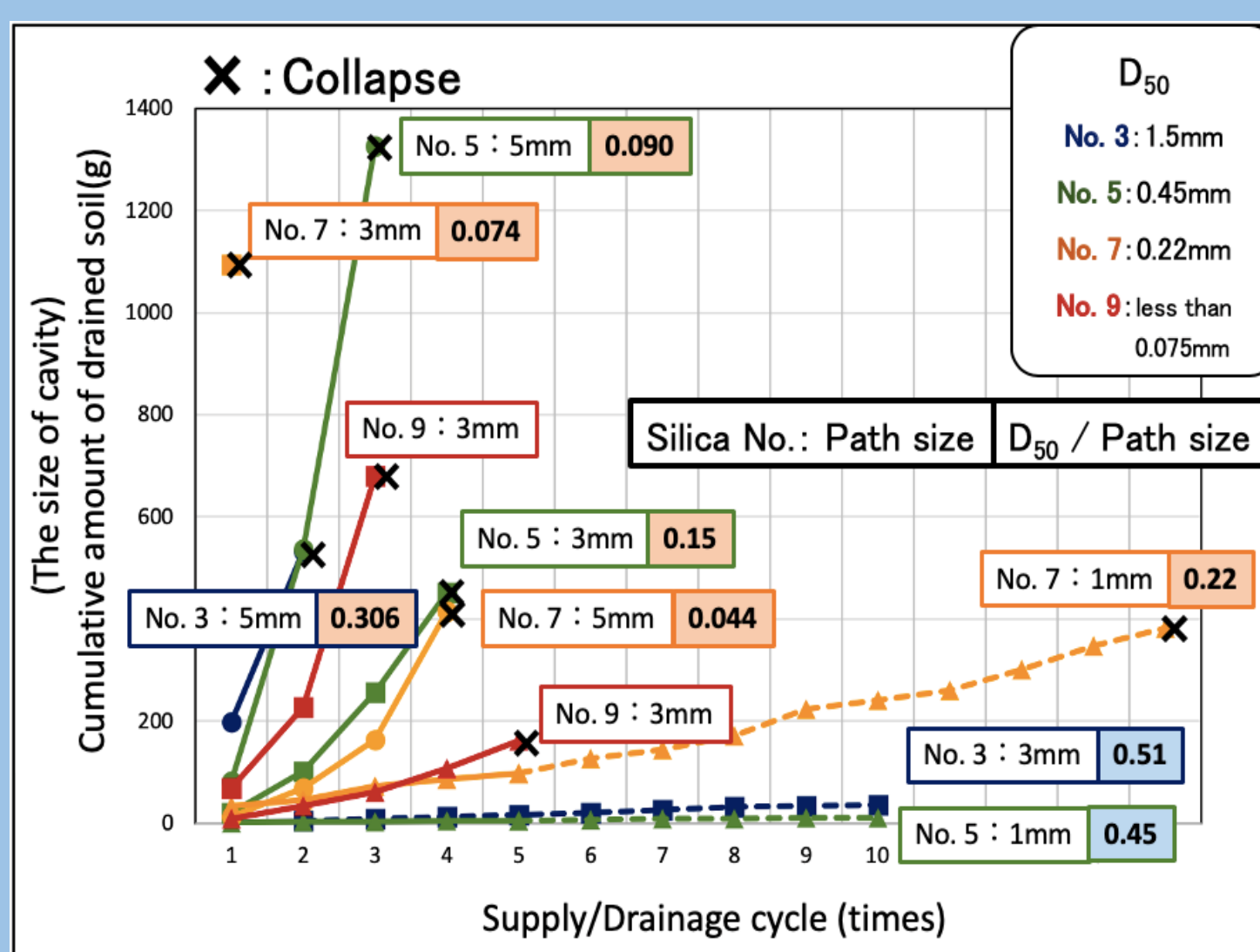
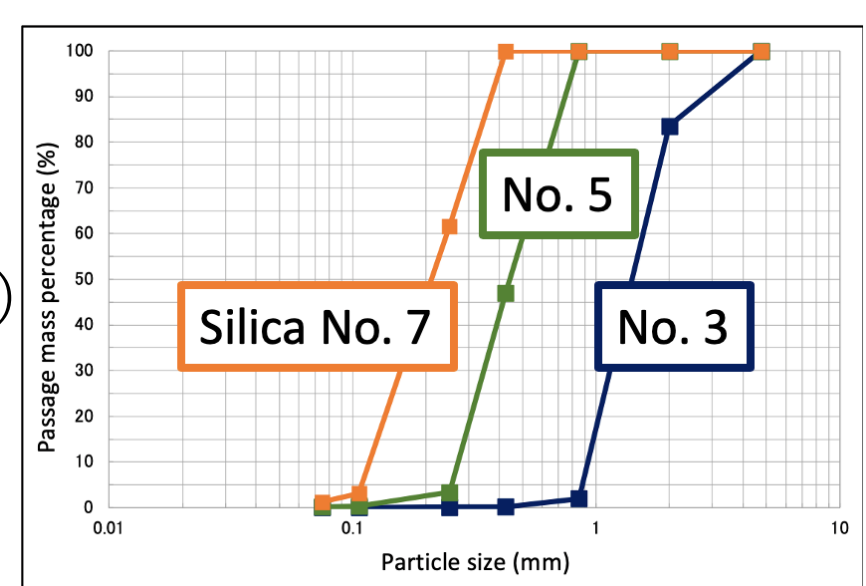


Model test with single-particle-size ground 均一粒径地盤を用いた模型実験

Material 地盤材料

- Silica No. 3 (D_{50} : 1.5mm)
 - 矽砂 No. 5 (D_{50} : 0.45mm)
 - No. 7 (D_{50} : 0.22mm)
 - No. 9 (D_{50} : Less than 0.075mm)
- ※ D_{50} : 50% pass particle size
通過重量百分率50%の粒径

Relative density: 50%
相対密度: 50%



✓ The ratio of particle size to path size is related to the degree of soil drainage.

・土粒子の粒径と土砂流出口の幅との比が土砂流出の程度に関与。

D_{50} / Path size D_{50} / L字型土砂流出口の幅

Less than 0.31 → Cavity growth (→Collapse)
0.31以下 空洞成長あり (→陥没)

More than 0.45 → No cavity growth
0.45以上 空洞成長なし

✓ The degree of soil drainage is not necessarily in proportion to the path size.

・土砂流出の程度は土砂流出口の幅に必ずしも対応しない。

The degree of soil drainage 土砂流出の程度

Path size 土砂流出口の幅 **3mm > 5mm > 1mm**

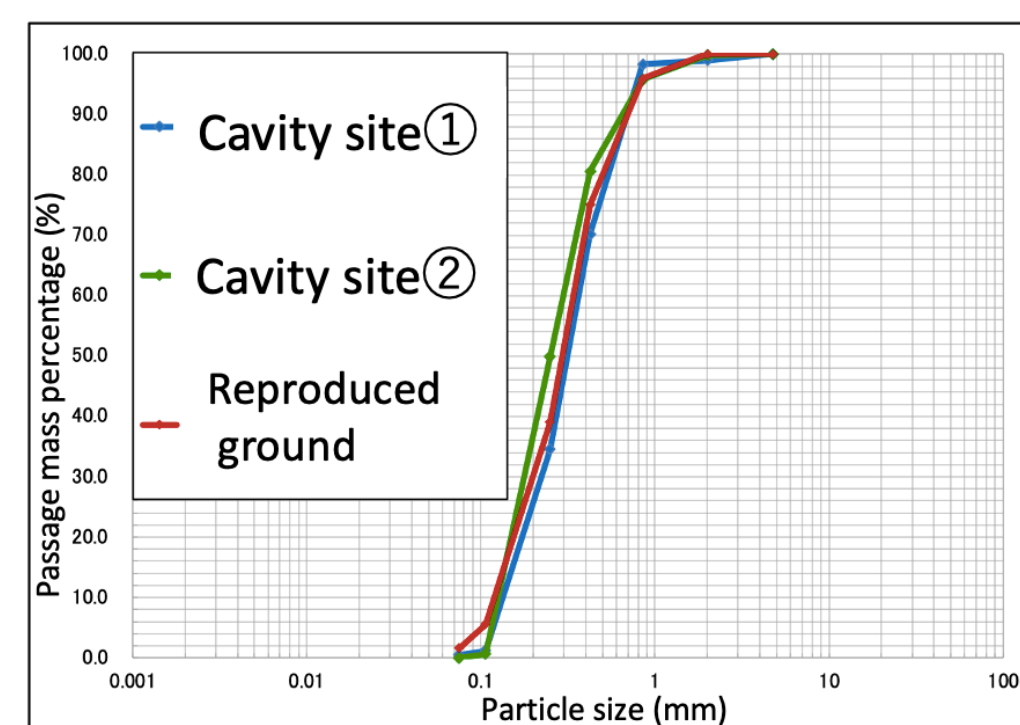
※ In the case with Silica No. 7 矽砂7号を用いた実験

Model test with real cavity site ground 空洞発生現場の再現地盤を用いた模型実験

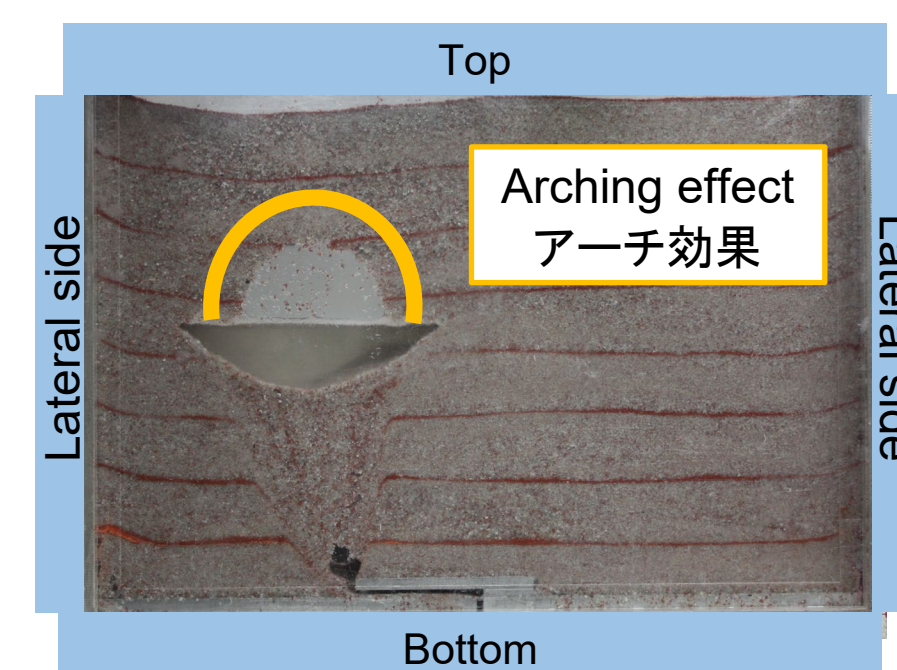
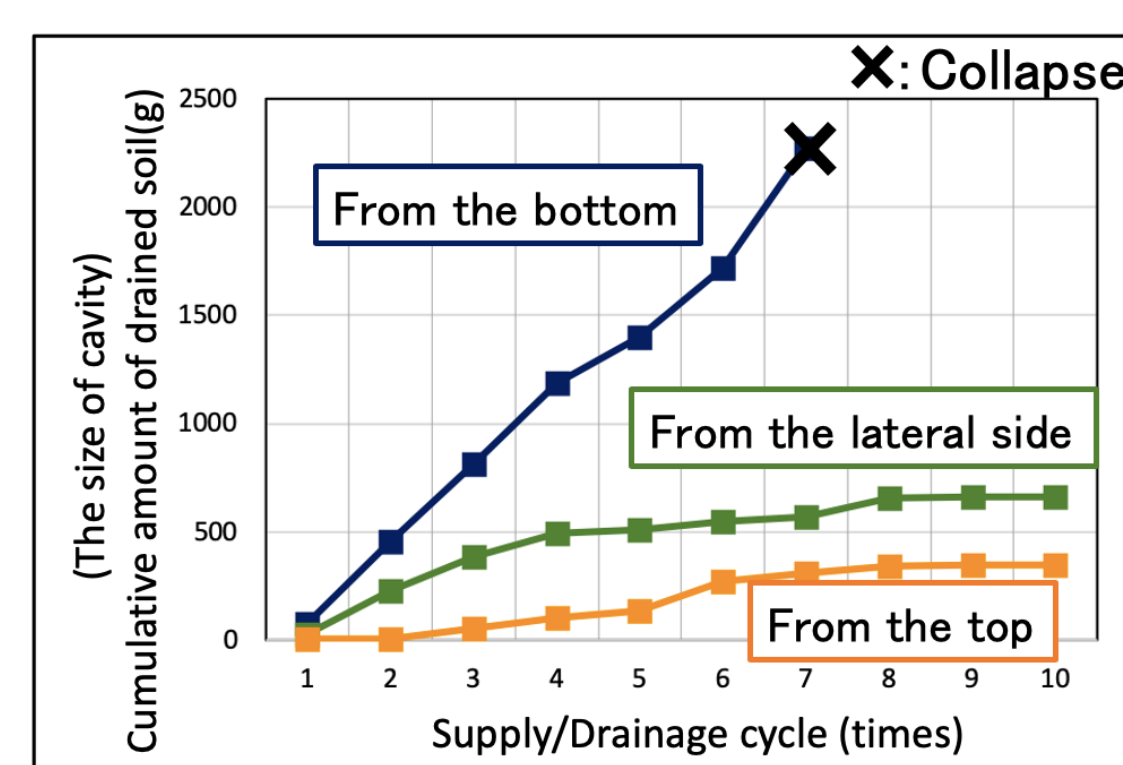
Material 地盤材料

Same particle-size-distribution ground of real cavity site which is based on the data of a field survey in Fujisawa city
藤沢市にて実施された現地調査のデータをもとに、実際に空洞が生じている地盤と同一の粒度分布を持つ再現地盤を作成。

Relative density: 50%
相対密度: 50%

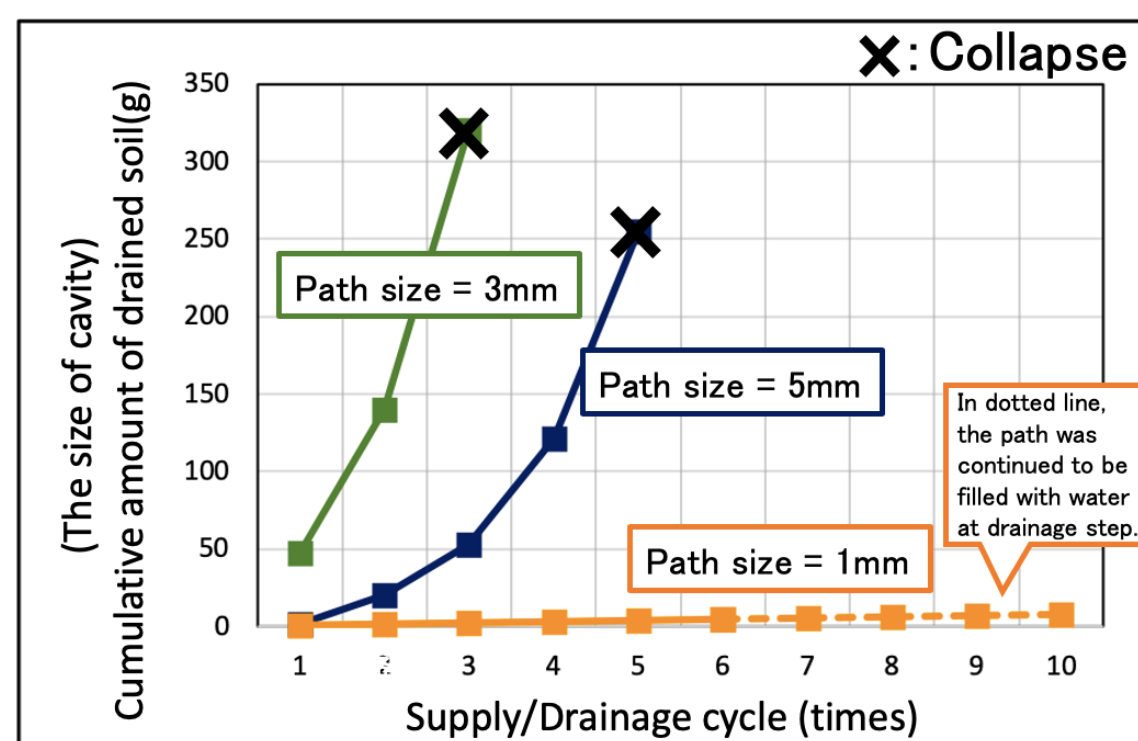


The effects of water supply method 給水方式が土砂流出に及ぼす影響



- ① Rise of water level → 地下水水位の上昇
- ② Collapse of arching → アーチの崩壊
- ③ Reformation of arching → アーチの再形成
- ④ Growth of cavity → 空洞の成長

The effects of path size 土砂流出口の幅が土砂流出に及ぼす影響



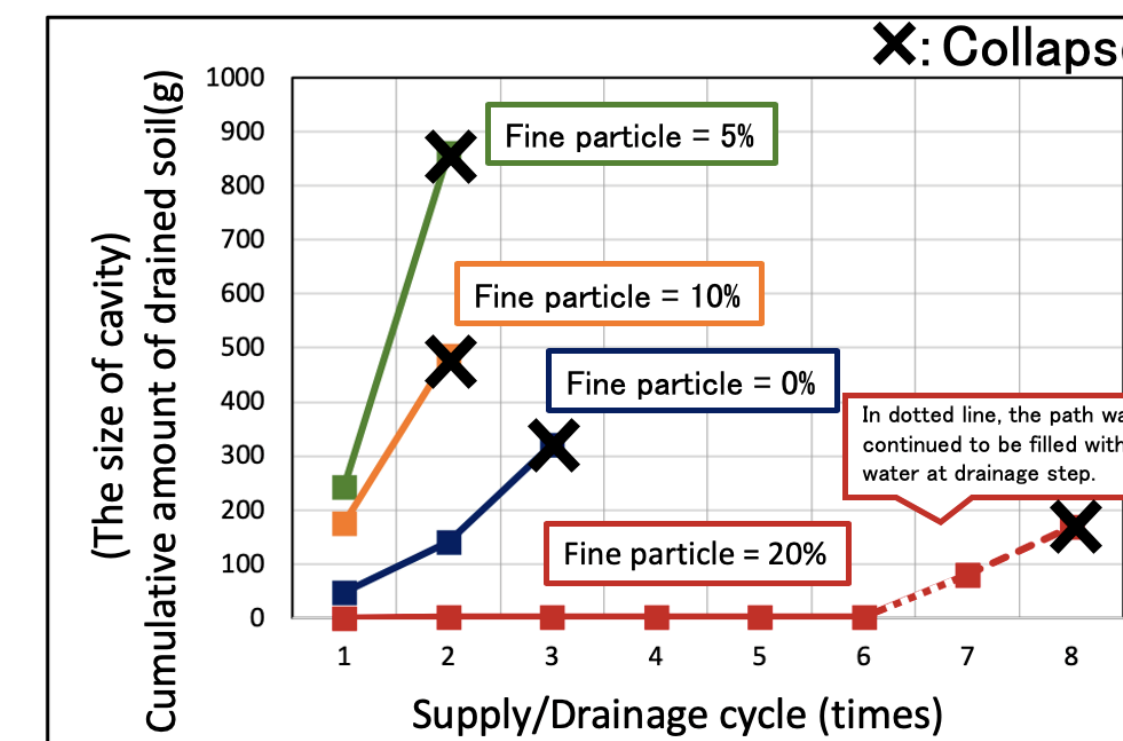
The degree of Soil drainage 土砂流出の程度

Path size 土砂流出口の幅 **3mm > 5mm > 1mm**

✓ In the 3mm-path-size case, Soil and water filled the horizontal part of the path and sustainably drained together as fluid.
・流出口幅が3mmのケースでは、土砂と水が流出口の水平部を満たし、流動体として一体となって持続的に流出。

= The Mechanism which can promote soil drainage 土砂流出を促進し得るメカニズム

The effects of fine particle 細粒分が土砂流出に及ぼす影響



In the case in which fine particle rate is 20%, the tendency of soil drainage was smaller.

- The increase of fine particle rate 細粒分含有率の増加
- ↓
- The decrease of Permeability 透水係数の低下
- ↓
- The suppression of water stream 水流の抑制
- ↓
- The decrease of soil drainage 土砂流出の低減

