Arch around a cavity in sandy ground based on penetration resistance

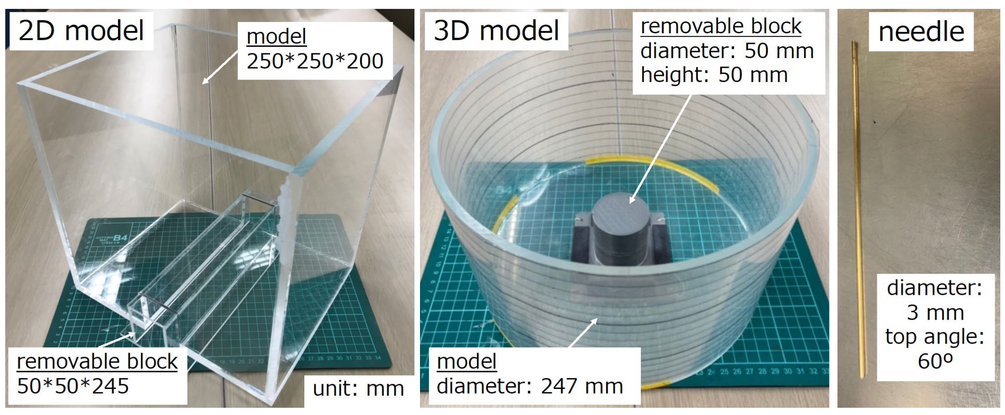
砂質地盤内空洞周辺に生じるアーチングの貫入抵抗に基づく考察

Recently, many cave-in cases have been reported in sandy ground. A cave-in happens when soil above an underground cavity cannot be retained. Arch action formed above/around a cavity is highly related with the stability of cavity. This arch has been analyzed based on strain which can be observed in a trapdoor test. In this research, a series of needle penetration tests was conducted on the sandy model ground with a cavity and arch around a cavity was evaluated based on stress distribution.

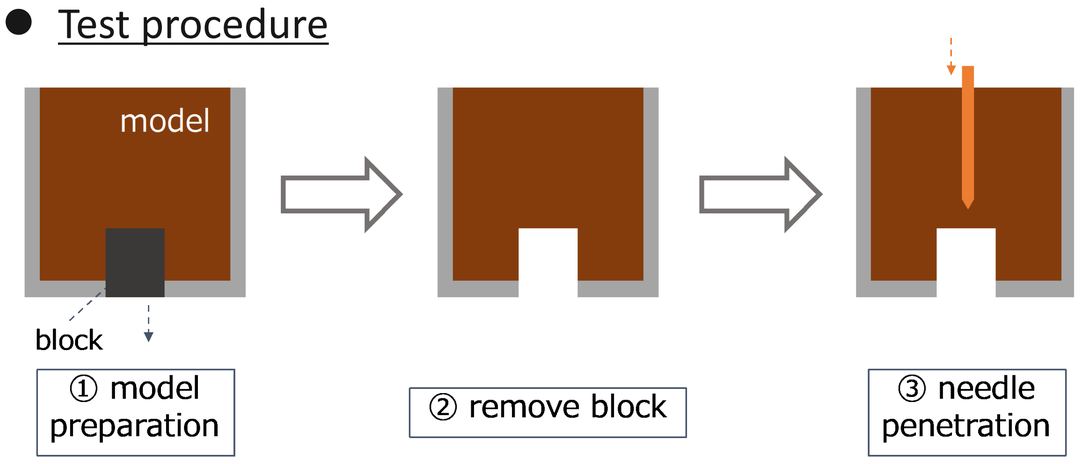
近年各地の砂質地盤で発生する地盤陥没は，地盤内に生じた空洞によってその上部の土塊が支持できなくなることで発生するため，地盤内空洞の安定性が地盤陥没の発生を左右します．地盤内空洞の安定性には空洞周辺に形成されるアーチが重要な役割を果たしますが，そのアーチに関しては主に落とし戸実験から観察されるひずみをもとに考察されてきました．そこで本研究では，砂質地盤を対象に，地盤内に空洞を生成した模型地盤に対し針貫入試験を実施することで，貫入抵抗をもとにアーチングに関する考察を行いました．

Apparatus

- Simple cavity model（小型空洞模型）

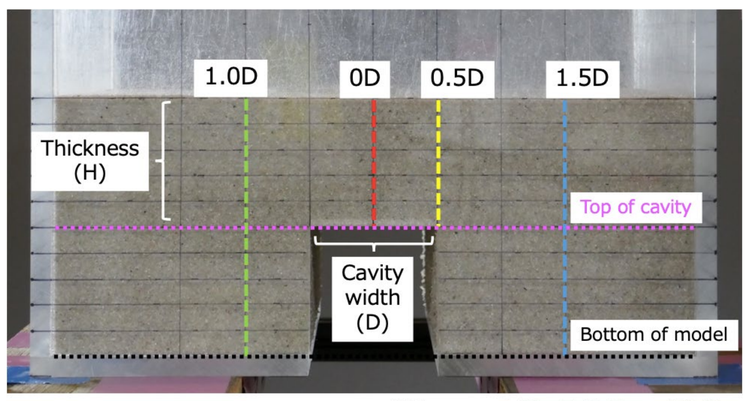


- Test procedure

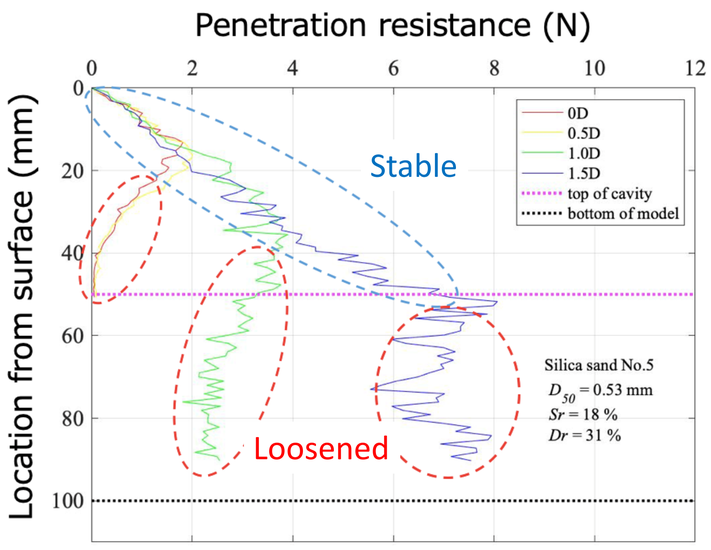


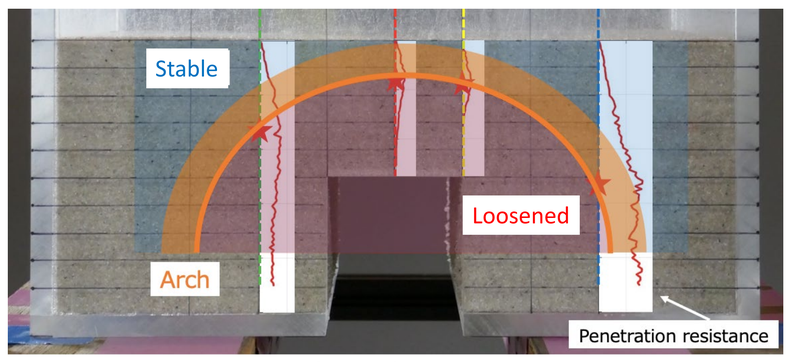
Shape of arch

- Typical shape of arch

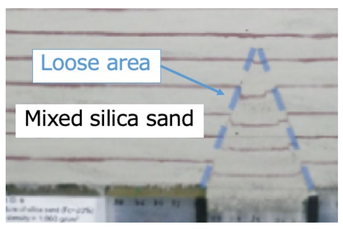


Silica sand No.5 @*Sr* = 18 %





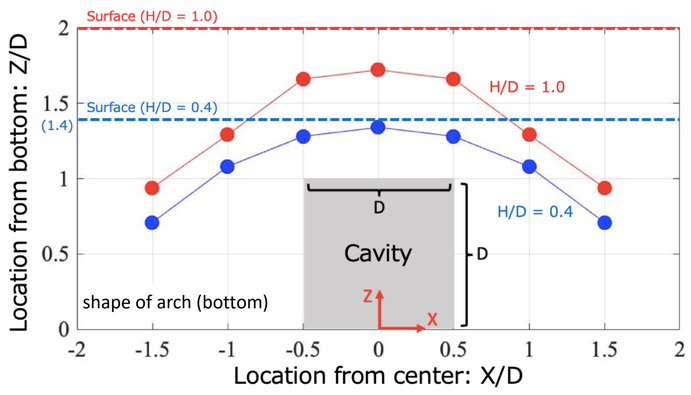
based on penetration resistance



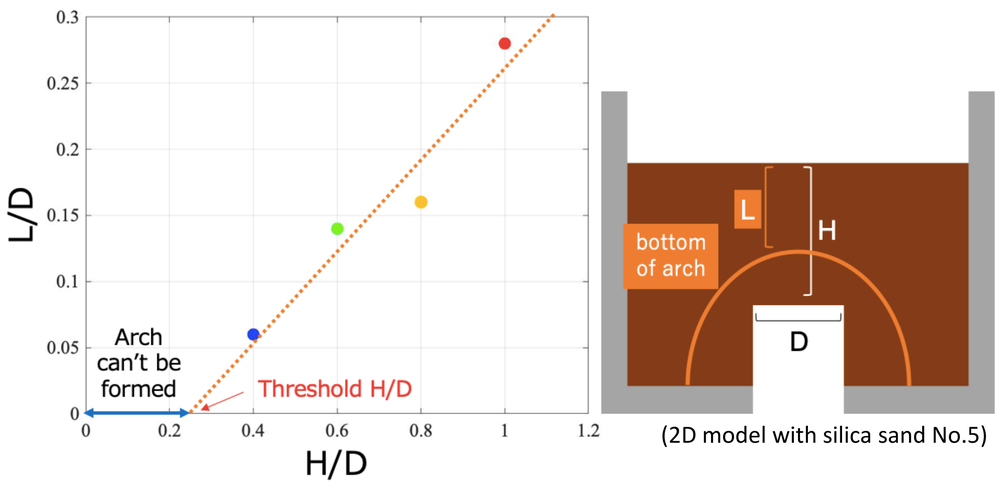
based on strain distribution

- Border between stable area and loosened area indicates shape of arch
- Arch based on penetration resistance is flatter than that indicated in loose area in trapdoor test

Effect of cover soil thickness

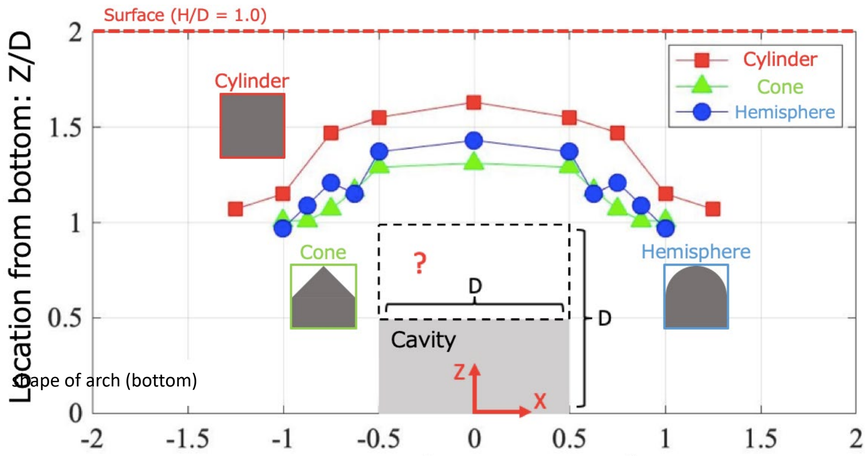


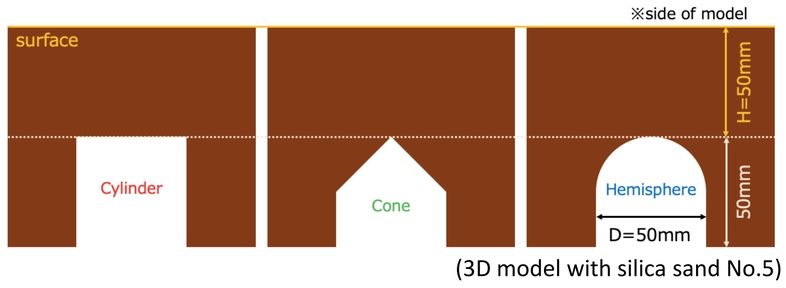
- Lower H/D causes lower L/D
- Arch can't be formed with small H/D



(2D model with silica sand No.5)

Effect of cavity shape





(3D model with silica sand No.5)

- When cavity is cylinder shape, arch is larger compared with cone or hemisphere shape

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