



**Gannett Fleming**

**100 Years**

*of Excellence Delivered As Promised*



# ***Dissecting the Failure of a Newly Constructed Dam***

**Rodney E. Holderbaum, PE**



**58<sup>TH</sup> Annual Meeting**  
**SEPTEMBER 21 - 26**  
**PITTSBURGH**

# Hope Mills Dam – Prior to 2010 Failure





# Hope Mills Dam – Hope Mills, NC

## HISTORY:

- **1839: Rock-Filled Timber Crib Dam; Failed in 1923 during a flood; Life span = 84 years**
- **1924: Embankment Dam; Failed in 2003 during a flood; Life span = 79 years**
- **2007-2008: Concrete, Pile-Supported Dam; Failed in 2010 (sunny-day failure); Life span = 2 years**
- **Oct 2012: Lawsuit filed by Town**
- **July 2014: Legal settlements reached**



**Site Visit – July 2010**













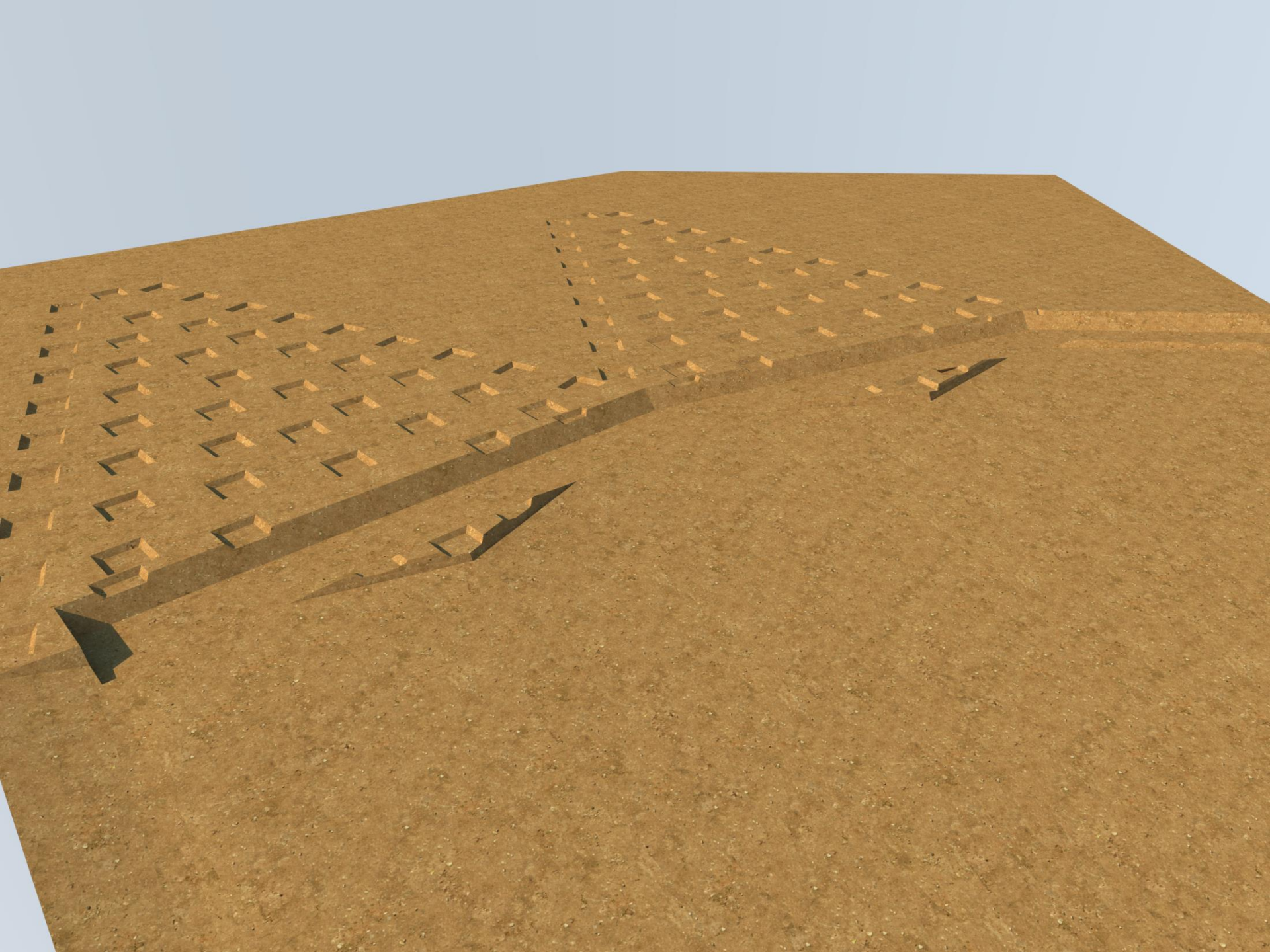




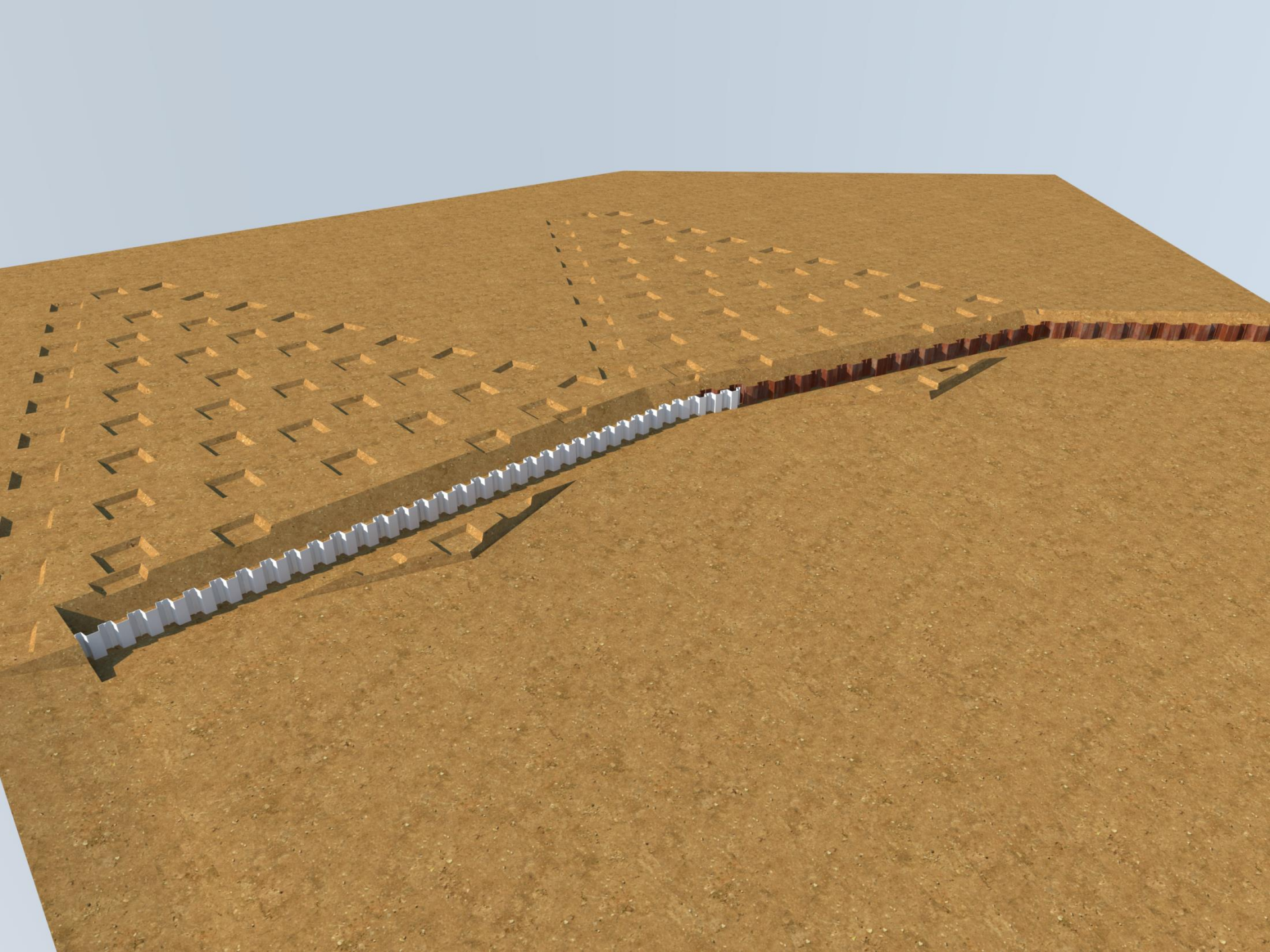




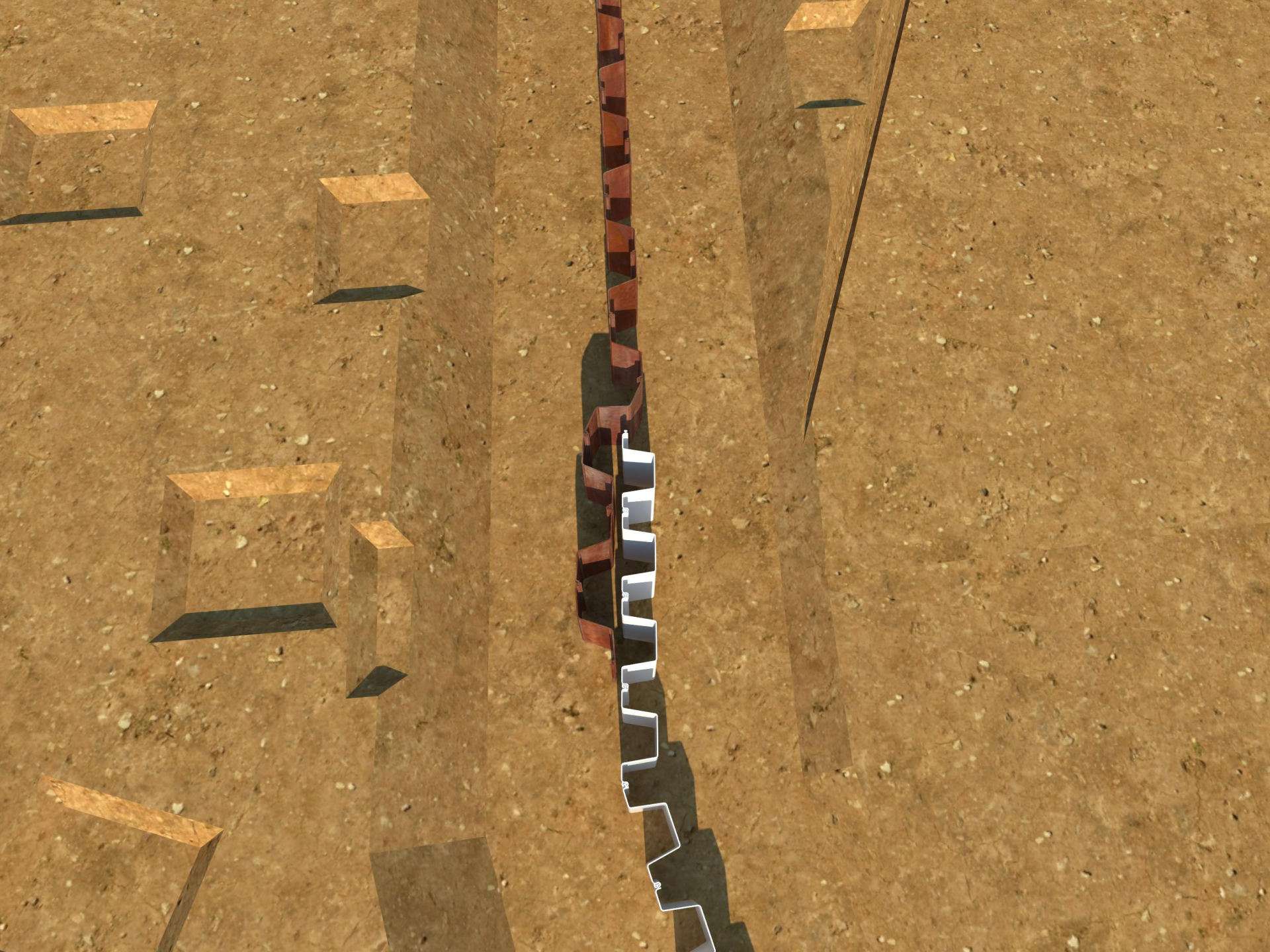














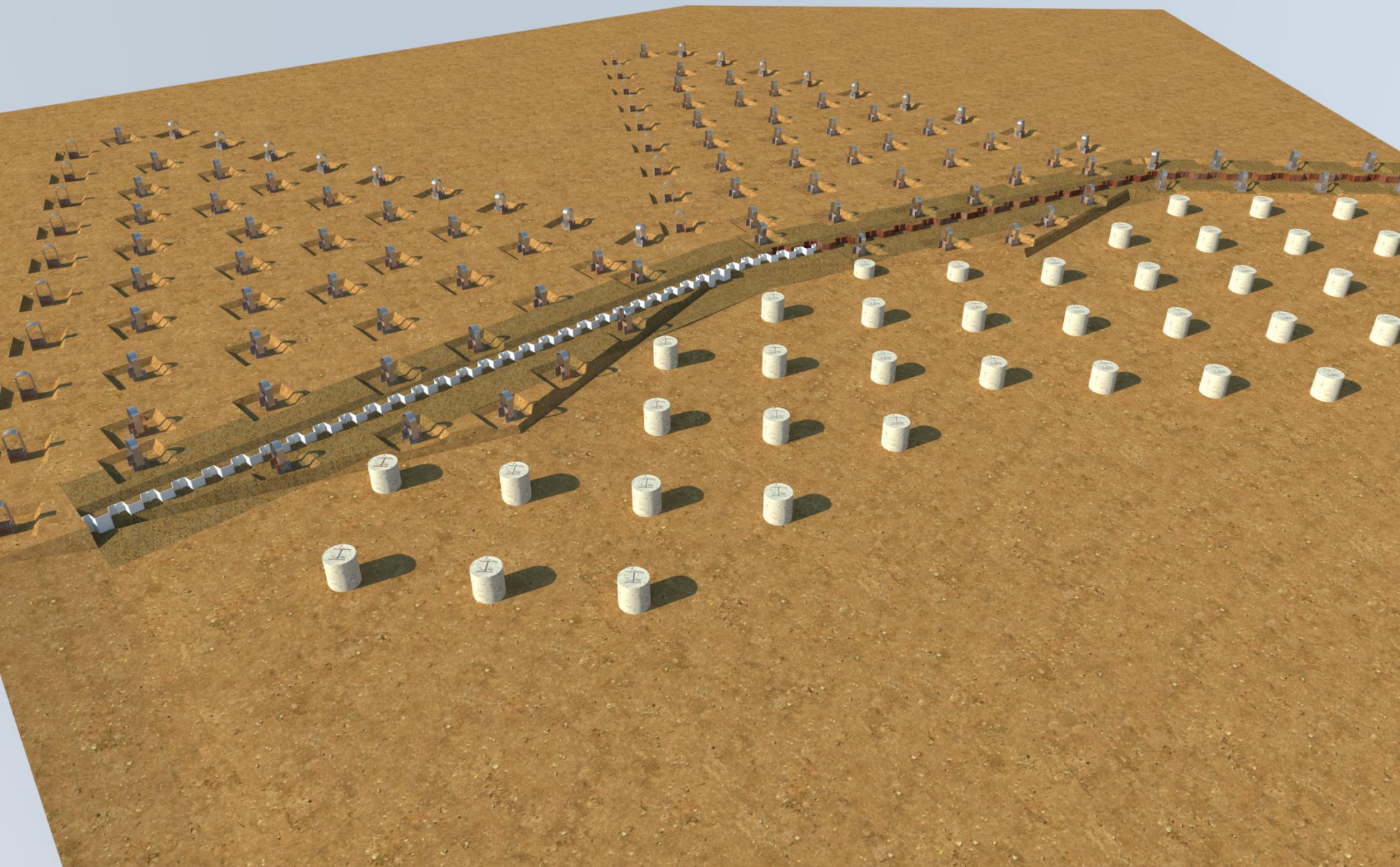




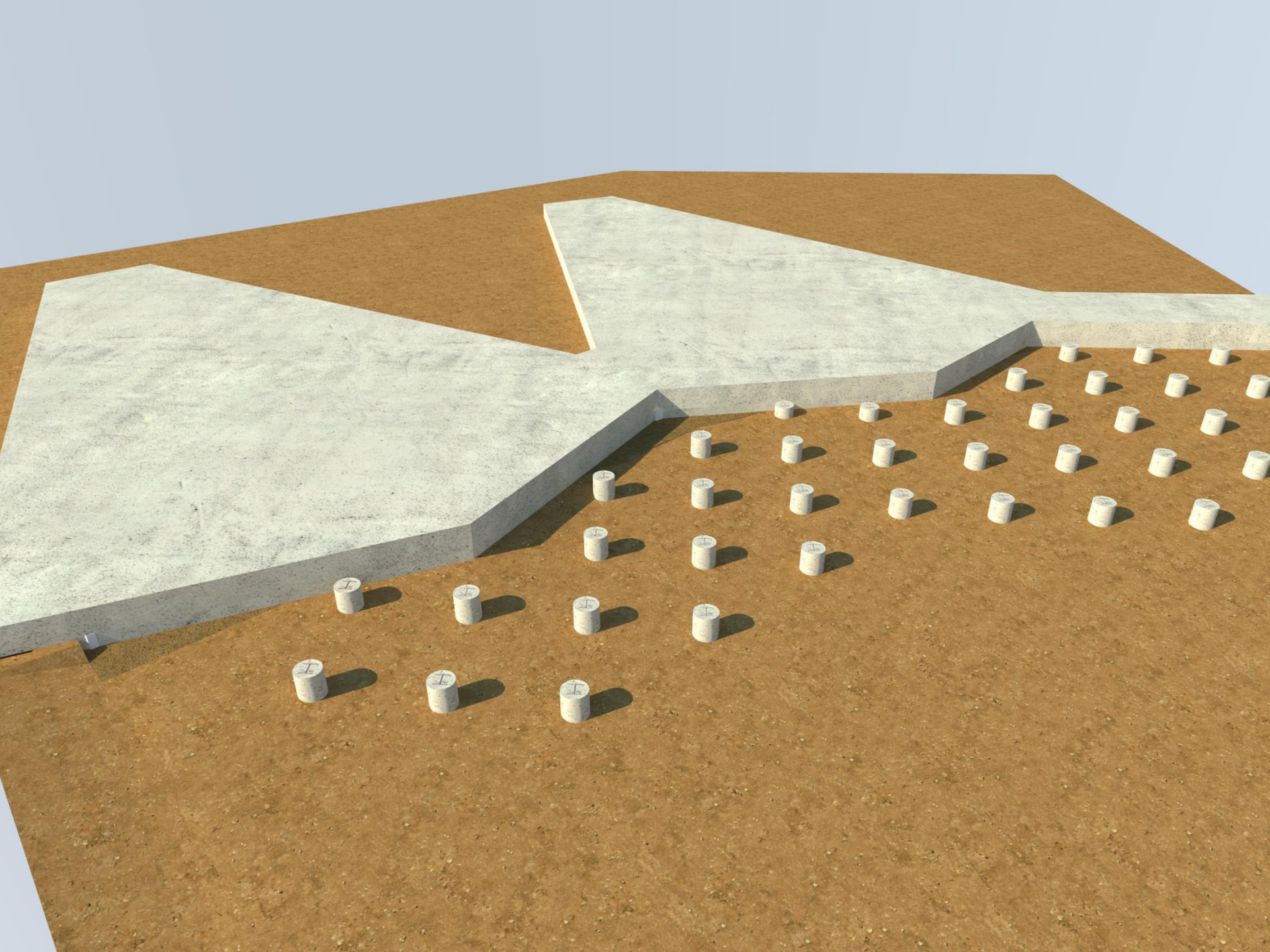


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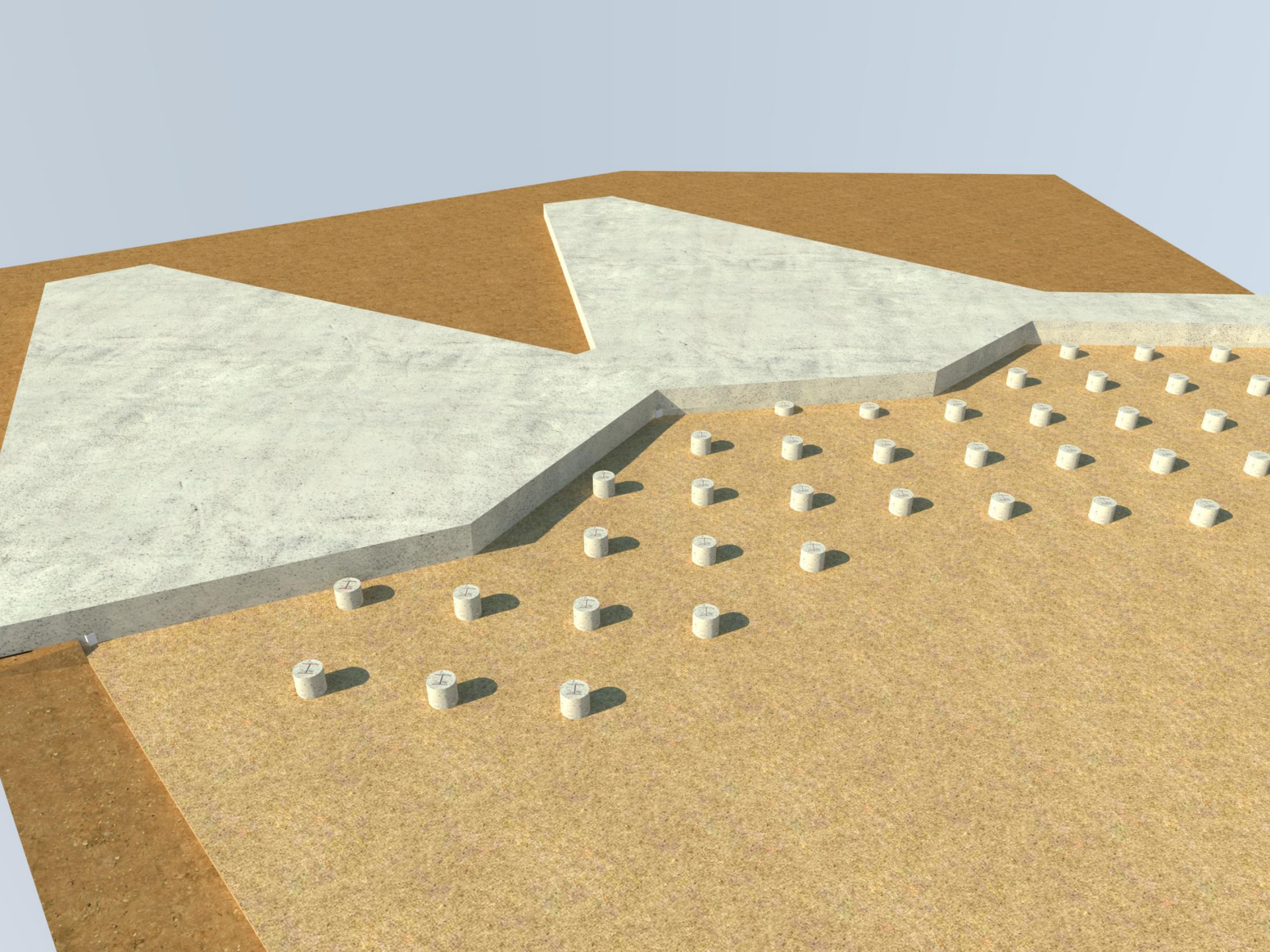




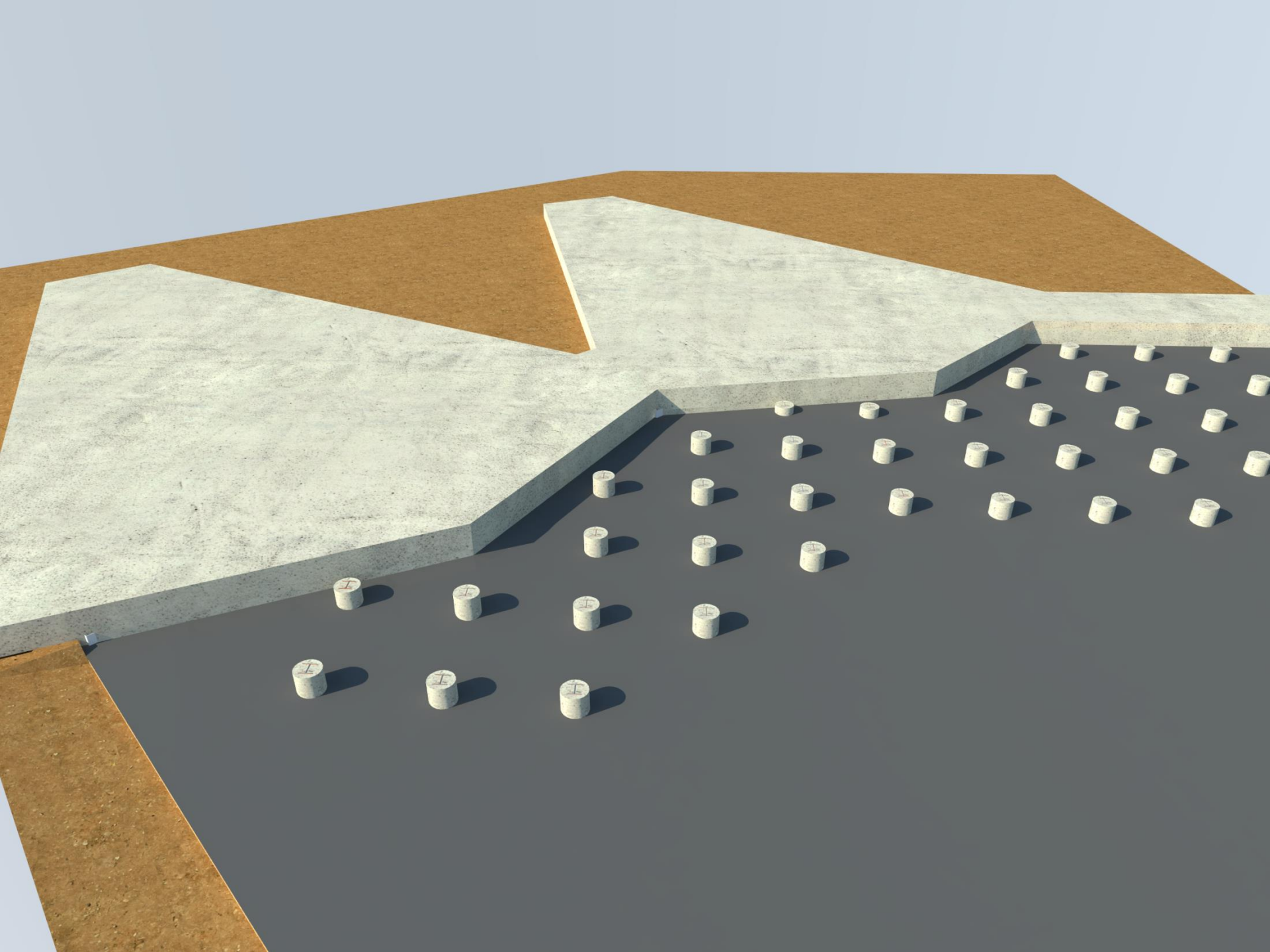




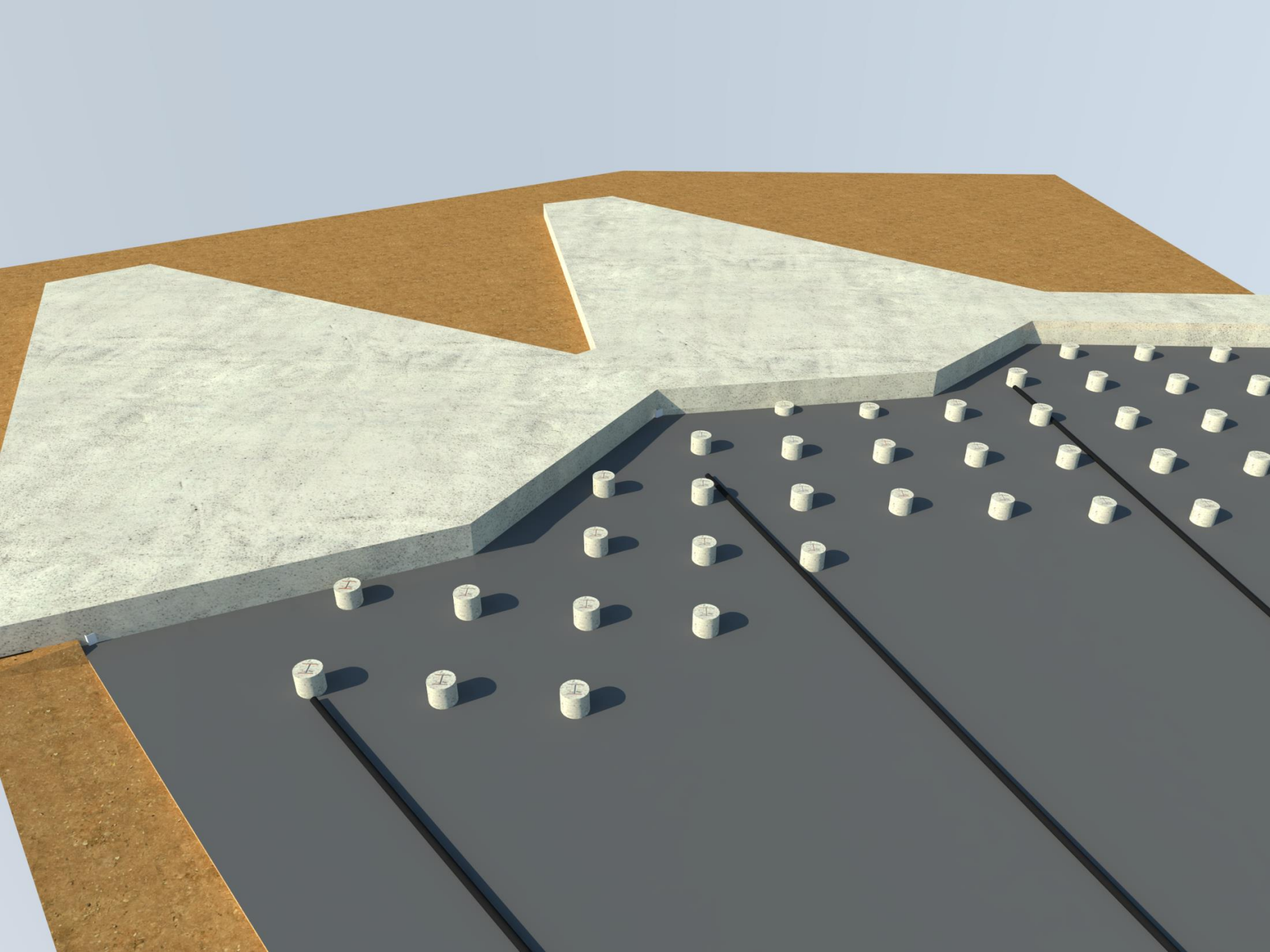




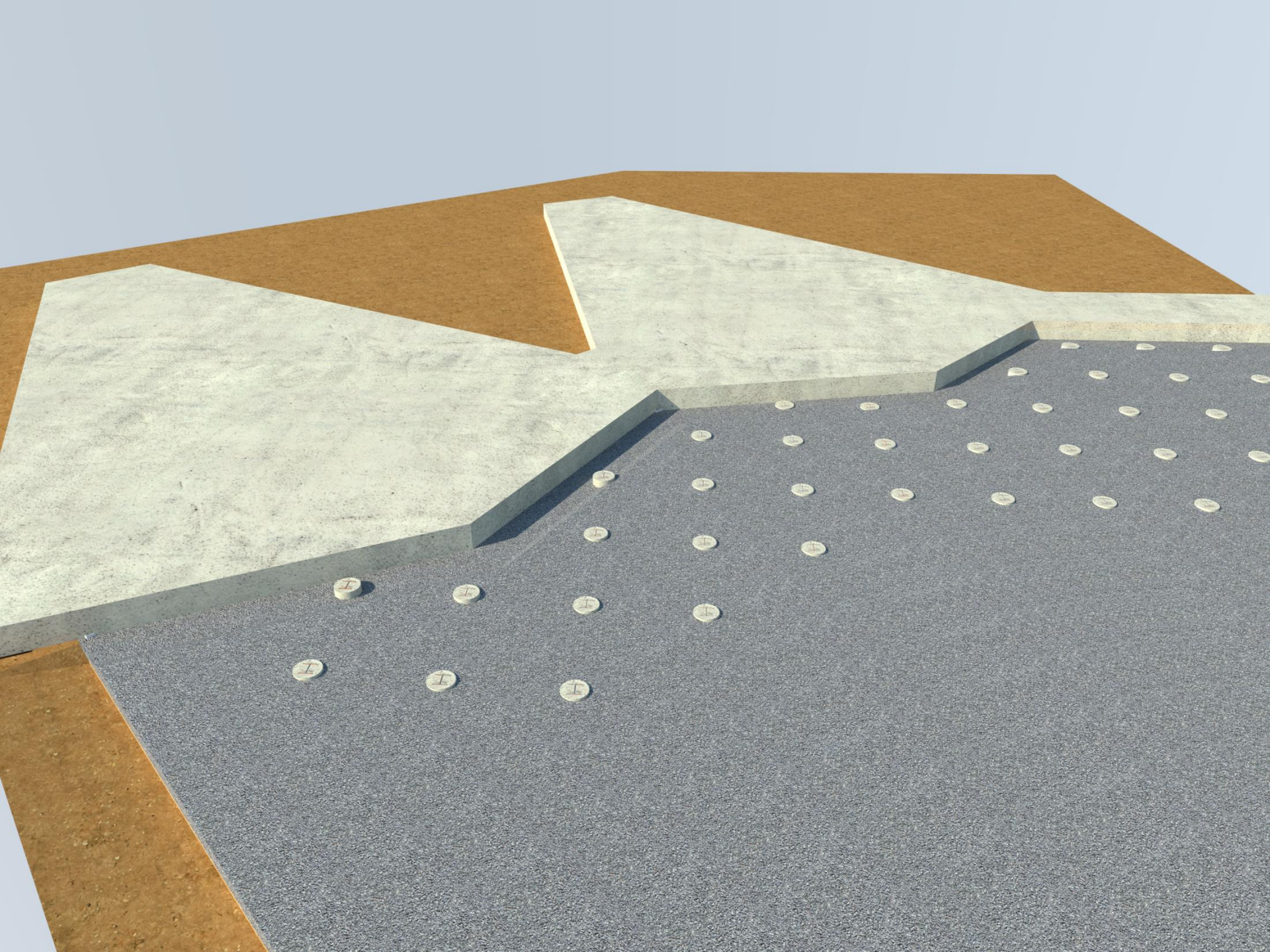




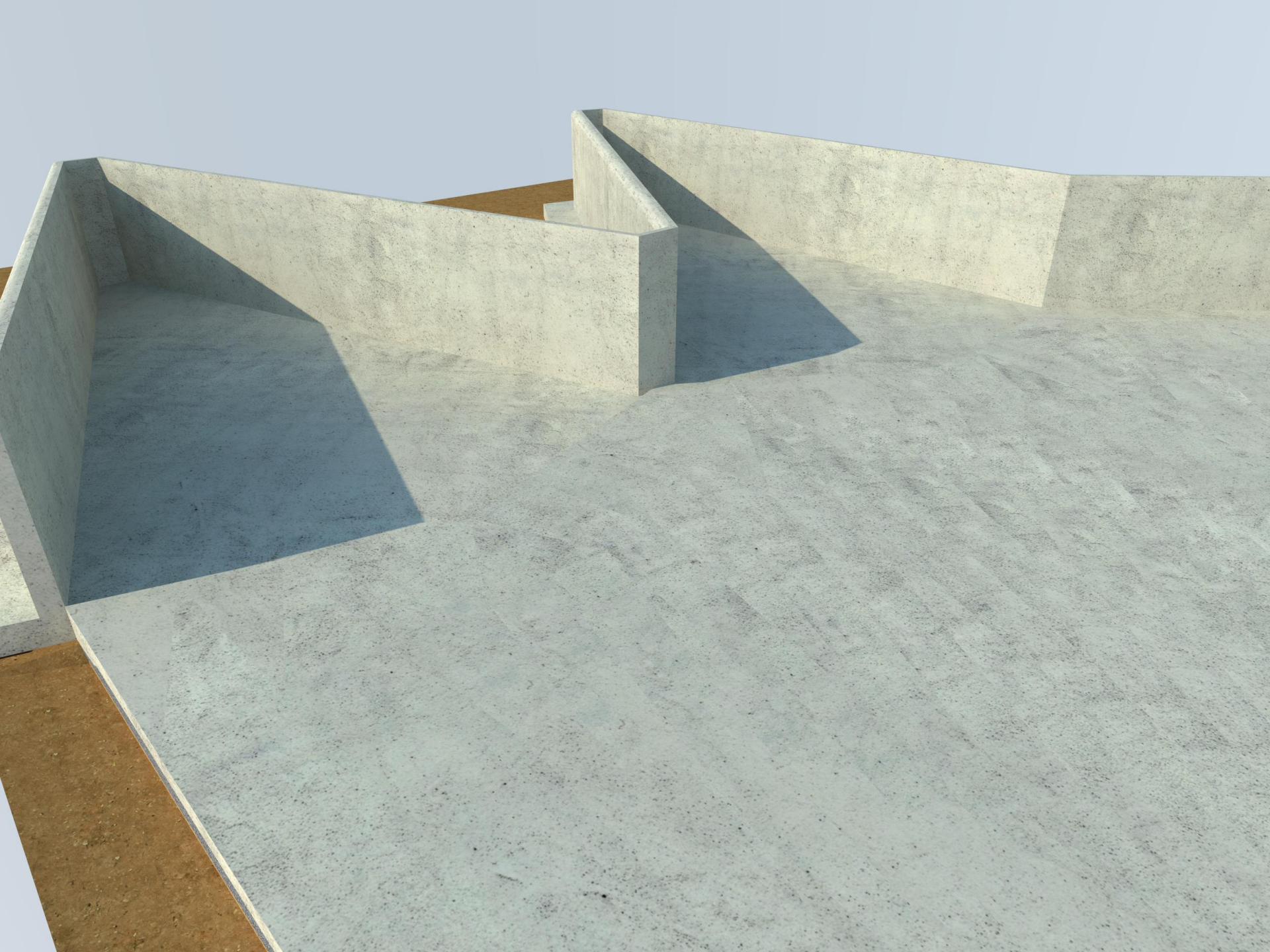




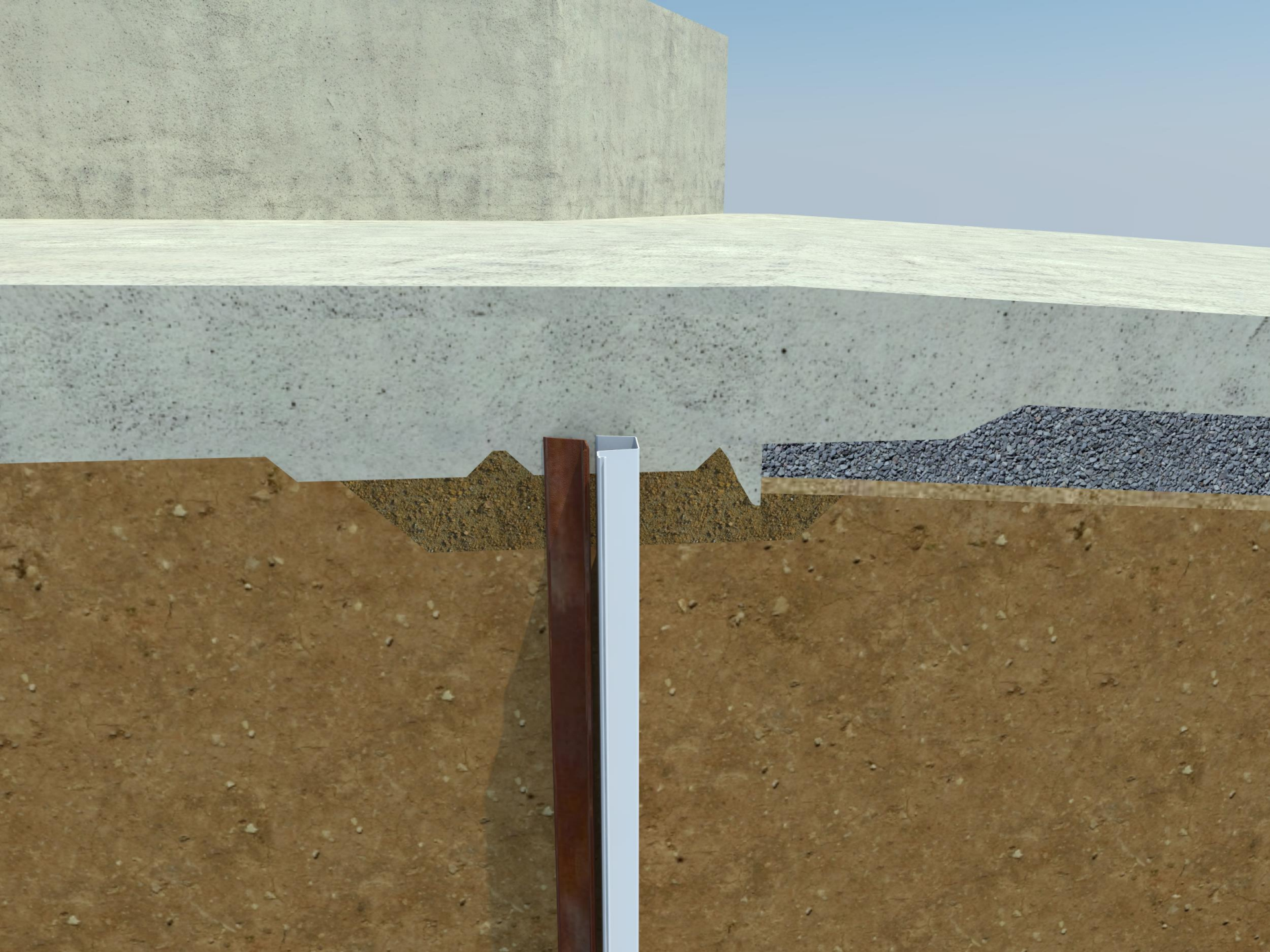














# Hope Mills Dam

## Post-Construction Monitoring

- **Visual inspections (quarterly)**
- **Survey monitoring**
  - Structural movement
- **Drain pressure measurements**
  - Pressure gages added during construction
- **Drain flow observations**
  - Visual only, no measurements



## Hope Mills Dam – Drain Flow-September 2009





# Hope Mills Dam - Drain Flow–December 2009







**Site Visit – January 2011**







































# Hope Mills Dam – Cause of Failure

## Conditions Required for Piping:

- Seepage
- Erodible Soil
- Sufficient Hydraulic Gradient
- Unfiltered Outlet



# Hope Mills Dam – Cause of Failure

## Factors Likely Contributing to Failure:

- **Location of foundation cutoff wall**
  - Resulted in structure uplift
  - Caused high flow gradient to develop
- **Pile foundation**
  - Low confining stresses in foundation soils
- **Use of geotextile as a filter**
  - Numerous locations for filter discontinuity
- **Presence of sheet pile overlap**
  - Created a potential seepage path
- **Failure to recognize clear warning signs during monitoring program**





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