Construction Inspector Training

Engineering Information

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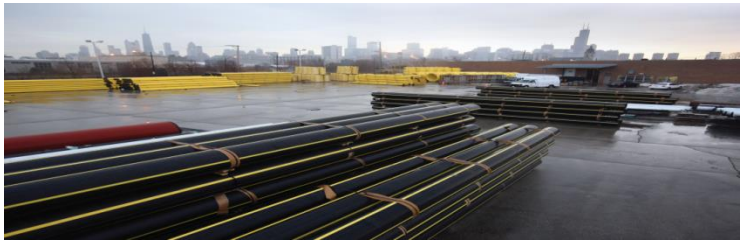
I. General

- Inspectors not expected to know all the design installation requirements that an engineer should know but must:
  - Recognize specific locations and materials used
  - Make certain that Contractors follow all construction specifications
  - Communicate any deviations to the design/standards to the engineer
  - Changes to be approved by company and Contractor
  - OQ certified

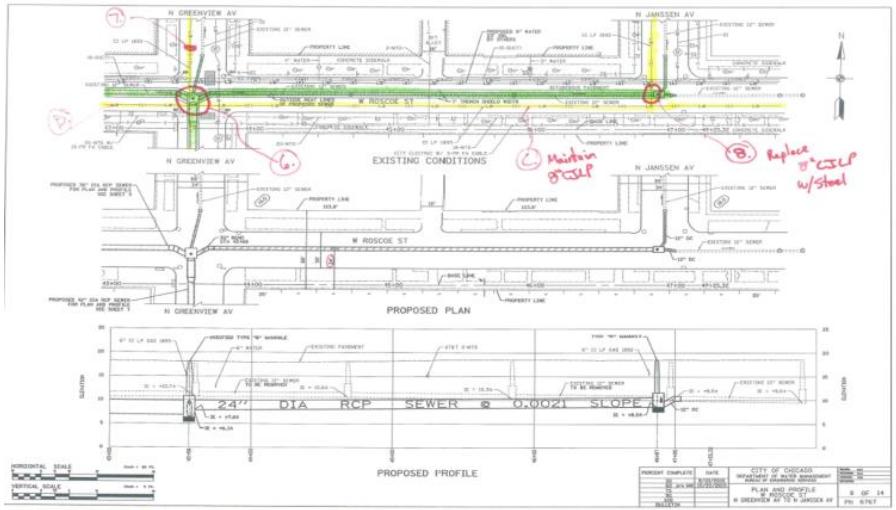


II. Origin of a Project – System Expansion

- New Development, load increase, add/remove meters, etc.

II. Origin of a Project – Public Improvement

- 3rd party utilities, DOT, City, County, State
- Planning and design conflict resolution

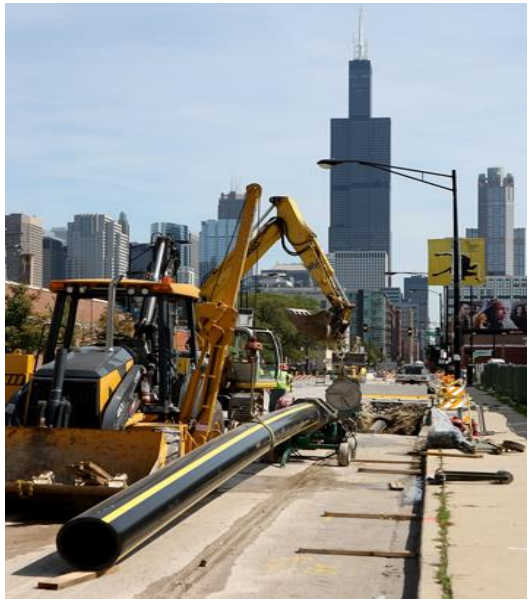


II. Origin of a Project – System Improvements

- Replacing aging infrastructure
  - System simulation driven work
  - Compliance
    - Corrosion
    - Uniform Main Ranking Index
  - Field driven requests

II. Origin of a Project – Infrastructure Upgrades

- System Modernization Program (SMP)
  - Replacement of Cast Iron & Ductile Iron
  - Upgrade of Low Pressure system
  - Neighborhood Approach



- High Pressure
  - System reinforcement
  - Gate Stations / Regulating Vaults

II. Origin of a Project – Design Process

- Information Retrieval
- Initial Design
- Peer Design
- Final Design
- OUC (Office of Underground Coordination) Design
- IFC (Issue for Construction) Design

III. Factors That May Delay a Project

- State and City
  - Moratorium holds
  - 3rd party conflicts
  - Traffic/Restoration requirements
- Long-lead items
  - Environmental/Railroad/Highway Permits
  - Material
- Customer ready dates
- System temperature constraints

IV. Inspector Responsibilities

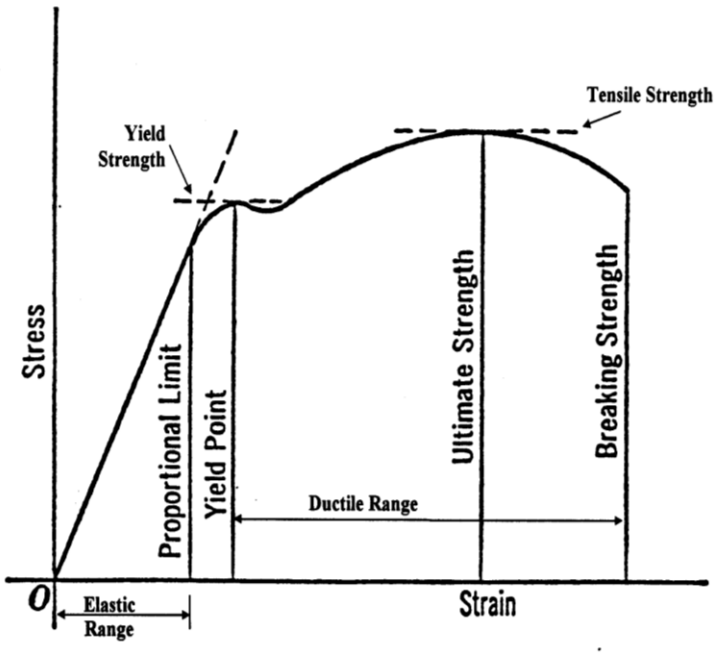
i. Construction Prints
ii. Pipe Requirements (Material)
iii. Fitting Requirements
iv. Material Substitution
v. Communications
vi. Retirement
vii. As-Built Drawings
viii. Installation and Testing Documentation

i. Construction Prints

- Familiarize on the details of the Construction Prints
- Identify unusual job requirements
  - Directional Drilling
  - Weld x-rays
  - Shoring / Erosion Control
  - Permitting (e.g. EPA) & Easements
  - Soft/Hard Surface Restoration
    - Bus Pads, Stamped Concrete, Streetscaping, etc.
    - Customer landscaping, Large diameter trees, etc.

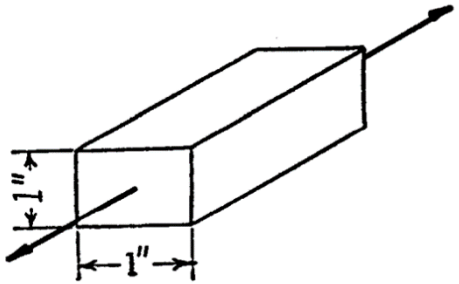
ii. Pipe Requirements - Material

- Pipe Material Strength Qualities & Measurements
  - Stress
  - Hoop Stress
  - Yield Strength
  - Specified Minimum Yield Strength (% SMYS)



ii. Pipe Requirements - Material

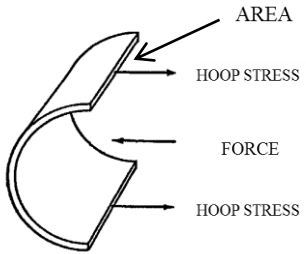
- Stress
  - Used by engineering to help determine type and strength of pipe to use. The internal force per unit of area developed within a body as a result of an applied force. The stress in the bar is 1000 lbs/sq inch.



1,000 POUNDS

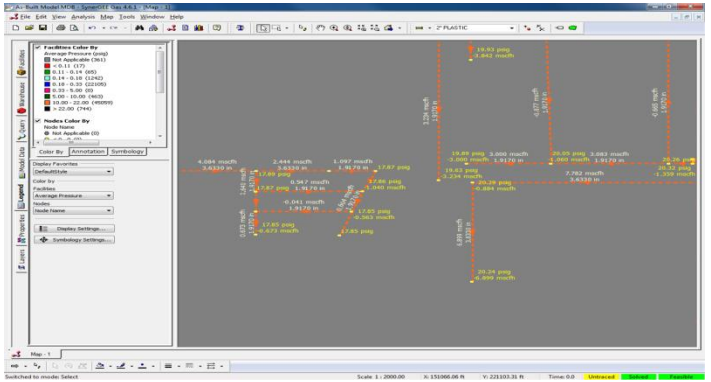
ii. Pipe Requirements - Material

- Hoop Stress
  - Used by engineering to help determine type and strength of pipe to use. The internal circumferential stress within the pipe material created by the internal pressure. This pressure pushes outward on the pipe wall throughout the circumference of the pipe, trying to increase the diameter of the pipe.



ii. Pipe Requirements - Material

- Design Factors that affect what pressure a pipe can operate at:
  - Specified Minimum Yield
  - Wall thickness
  - Diameter of pipe
  - Class location
  - Pipe fabrication method
  - Expected operating temperature



iii. Fitting Requirements

- Wall thickness should match pipe for plastic/steel
- Proper valves per specifications
- Ensure only pressure control fittings of adequate pressure rating are used

Common Fitting Ratings

ANSI Rating Class	Pressure Rating (psig)
150	275
300	720
400	960
600	1440

iv. Material Substitution

- Inspectors responsibility
  - Ensure all material are installed as specified
  - Any necessary material substitution must be approved by:
    - Inspector’s supervisor
    - Cleared through Engineering

v. Communications

- Company Personnel
  - Project Progress
  - Material Delivery
  - Cost & Schedule
  - Coordination of resources
- General Public
  - Customer notification and updates
    - Letters, Website, Social Media
  - Disruption of service/access
  - Restoration

v. Communications

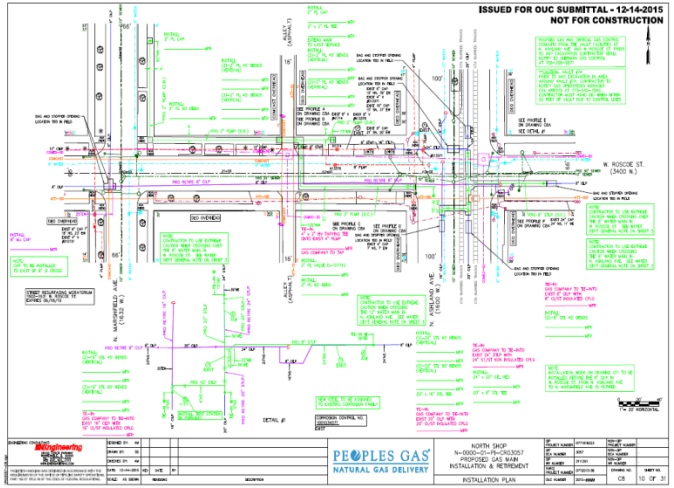
- Media
  - Not to speak to media unless authorized
- Governmental Agencies
  - Construction site audit (state or federal agencies)
  - Government Officials & City Agencies
- Contractor
  - Pre-Construction meeting
  - OQ Covered Tasks (welder/fusion)
  - OSHA Competent person on site

vi. Retirement

- Retirement of facilities
  - Shutdown procedure
  - System simulation
  - Verification of retirement
- Proper disposal by approved methods
- Testing of abandoned material to determine environmental sensitivity

vii. As-Built Drawings

- Location, type, and grade of all fittings and valves
- Installation elevation or depth
- Footage of installed/retired pipe
- Location measurements of pipe
- Material Substitution
- Clearances from 3rd party utilities
- Test points or locating stations



viii. Installation and Testing Documentation

- Pressure Testing
- Accounting information
  - Contract Pay Sheets
  - Time Sheets
- Material Usage Reports
- Construction Progress Reports

V. Elevation Readings

- Setting up level
  - Tripod legs are level
  - Rough Sighting

Construction Inspector Training

Engineering – Technical Information

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Pipe Restraint

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Pipe Restraint

- Keep susceptible parts of the gas system from pulling apart due to internal pressures and forces

Unrestrained Joints and Fittings

- Iron Pipe
  - Bell and Spigot

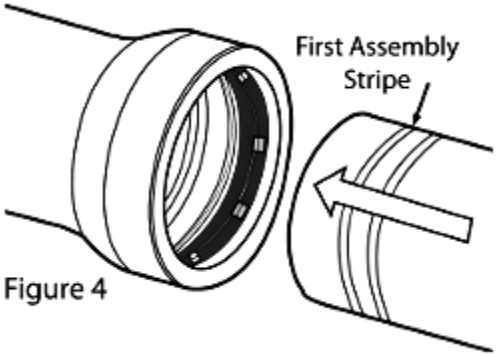
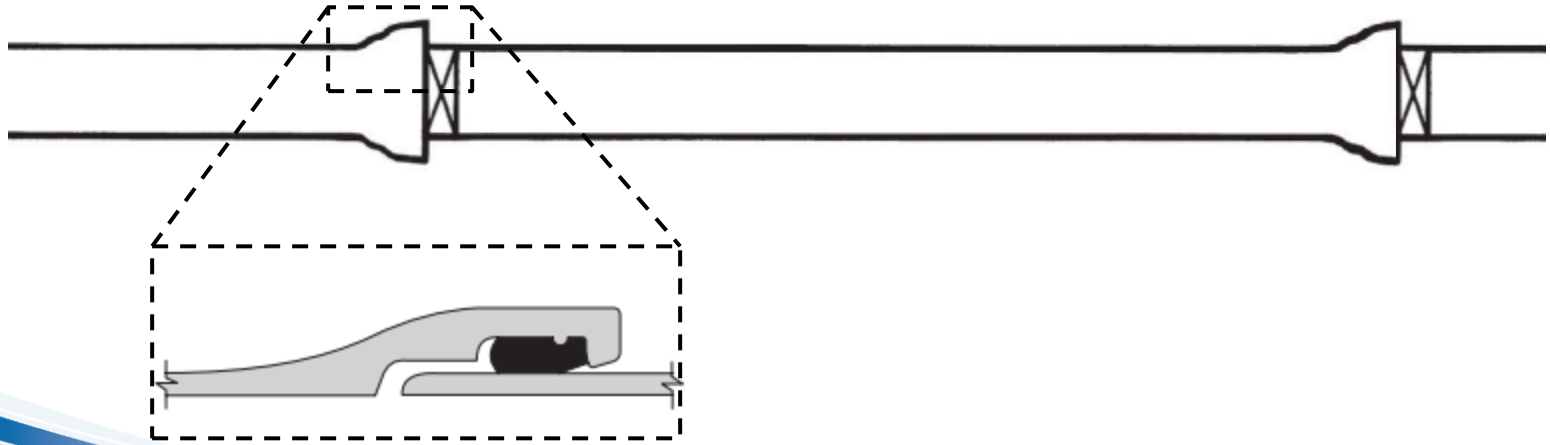
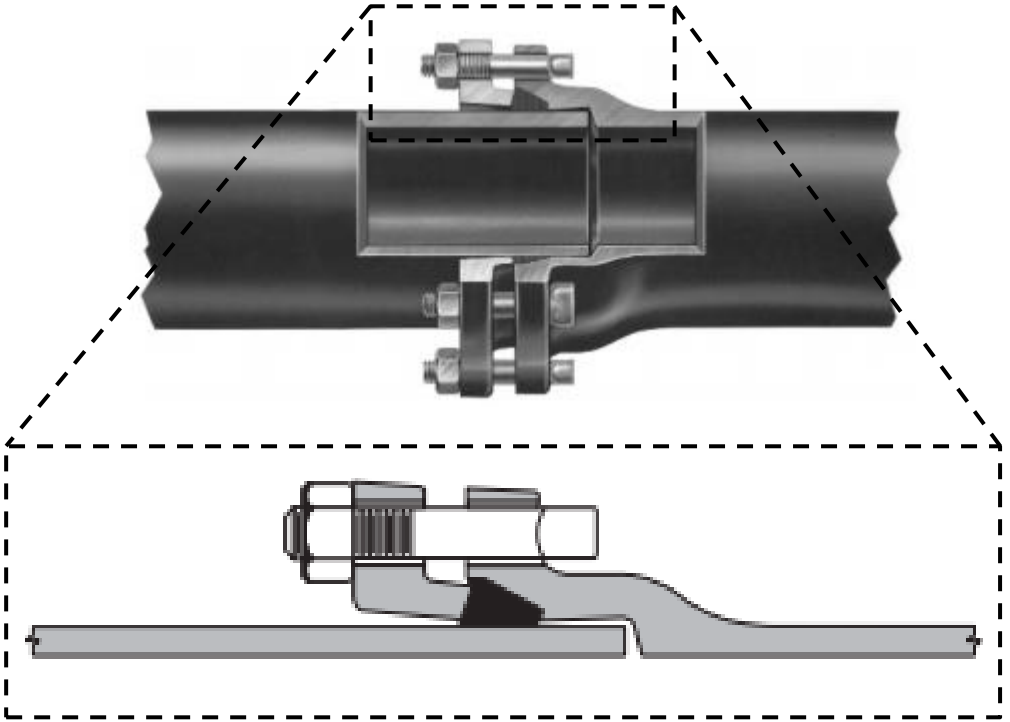


Figure 4



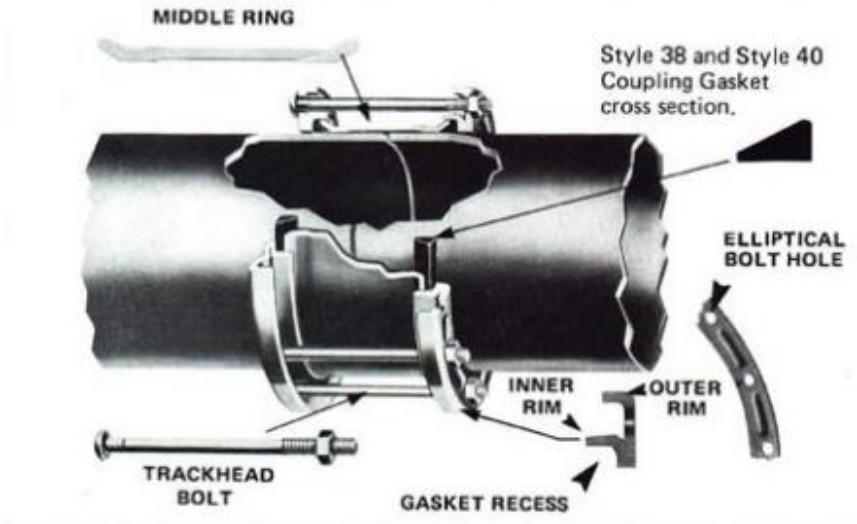
Unrestrained Joints and Fittings

- Iron Pipe
  - Mechanical Joint



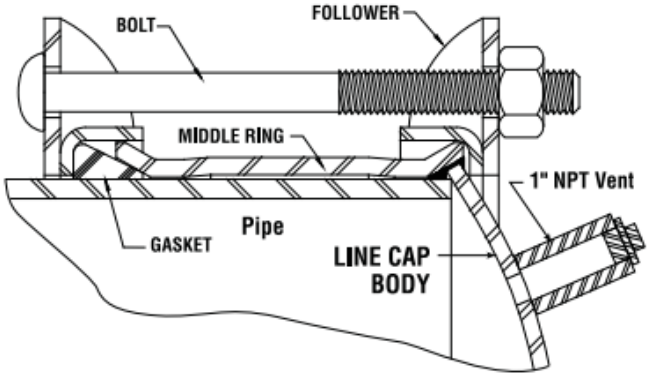
Unrestrained Joints and Fittings

- Iron or Steel Pipe
  - Mechanical Couplings

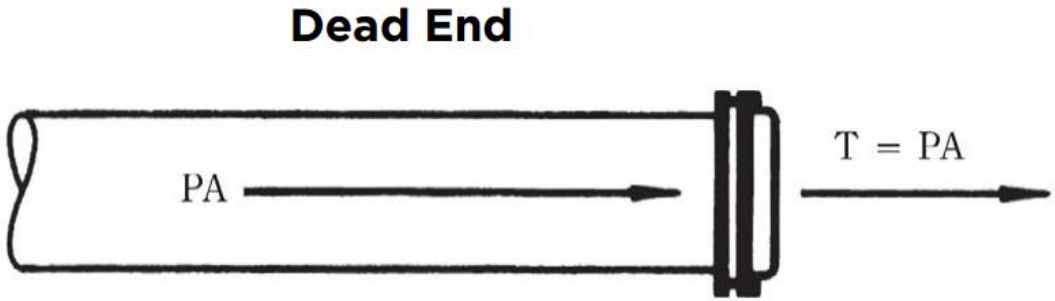


Unrestrained Joints and Fittings

- Iron or Steel Pipe
  - Mechanical Cap

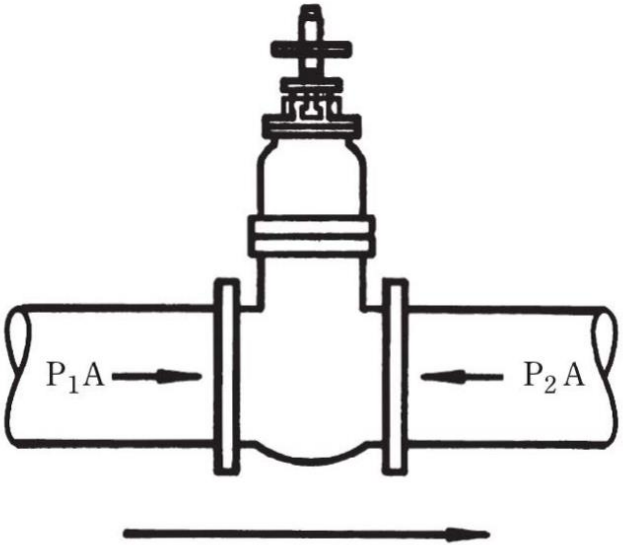


Internal Force Due to Pressure

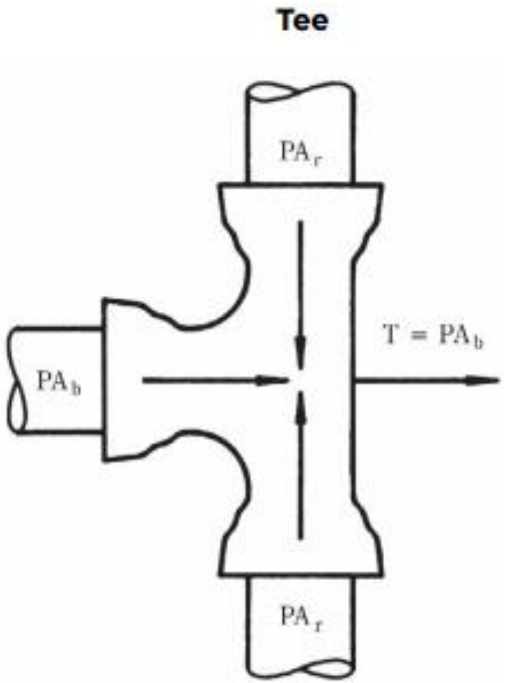


Internal Force Due to Pressure

Closed Valve

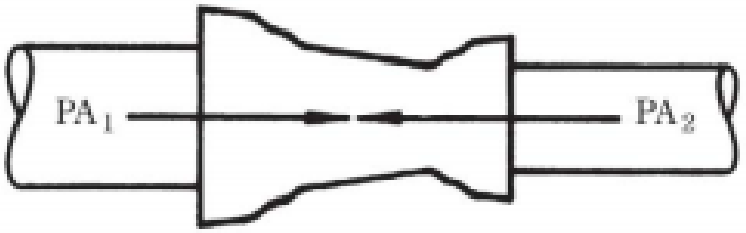


Internal Force Due to Pressure

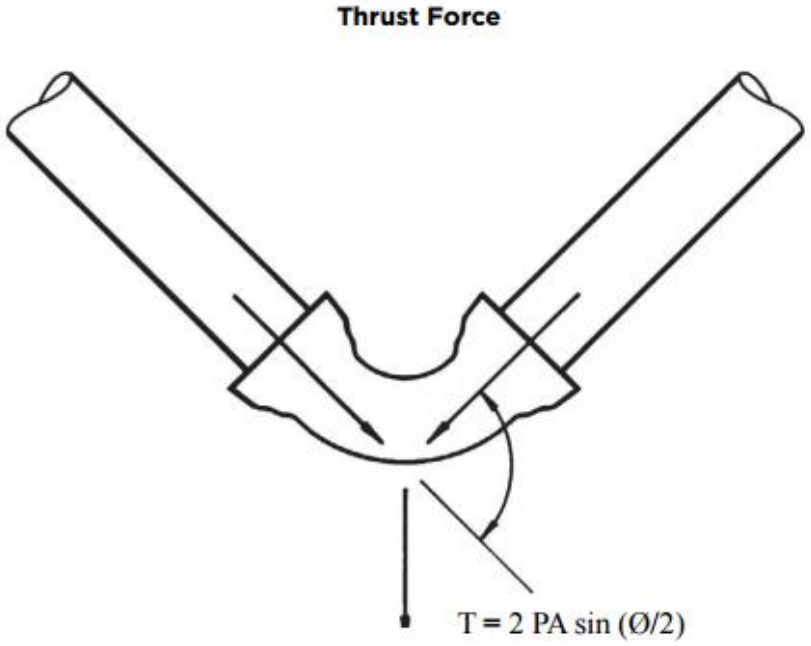


Internal Force Due to Pressure

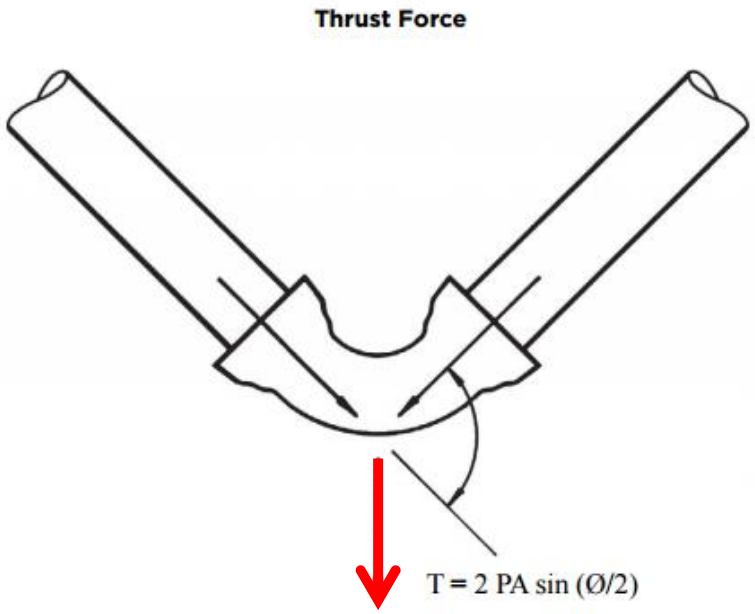
Reducer

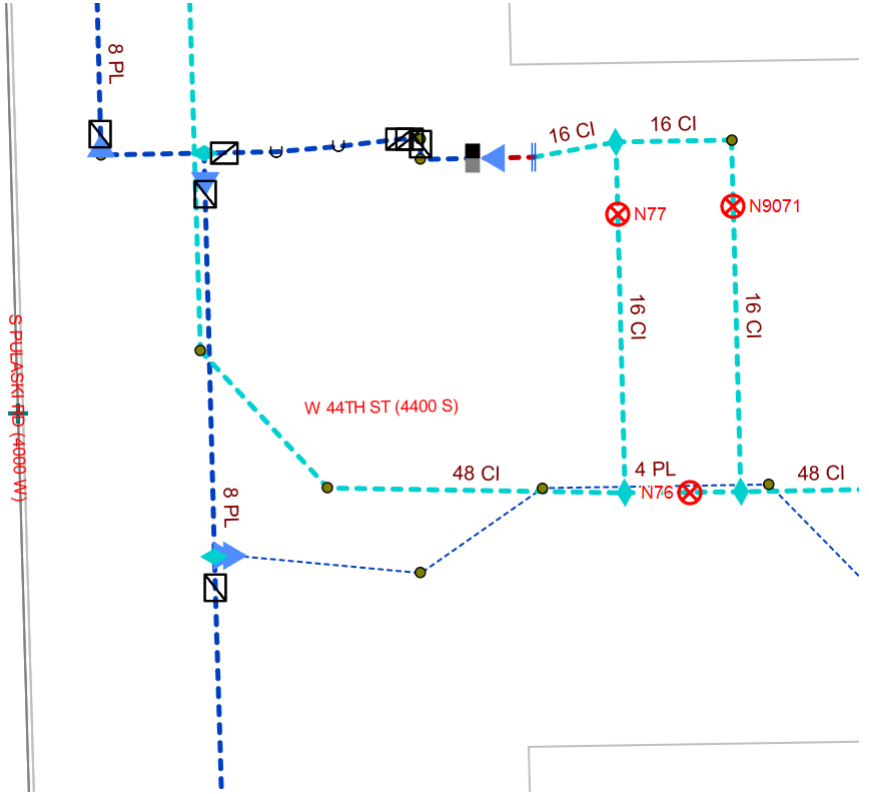


Internal Force Due to Pressure



Brace Bend Due to Pressure





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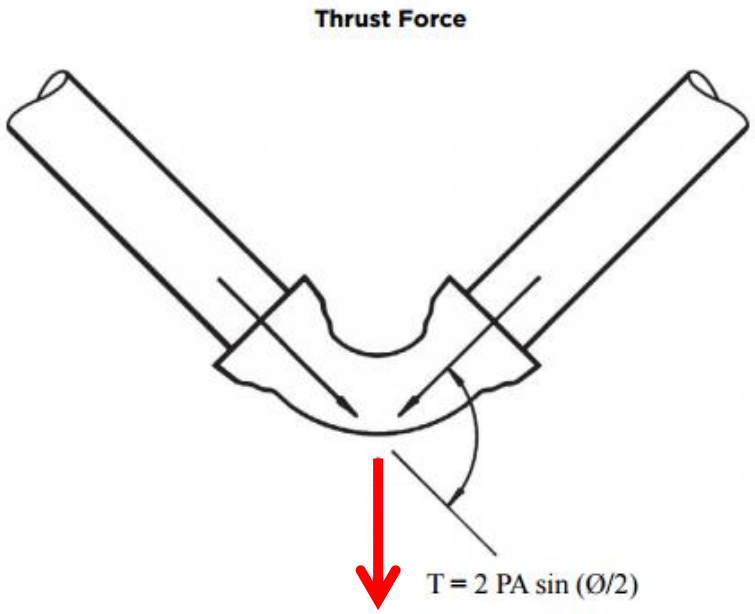
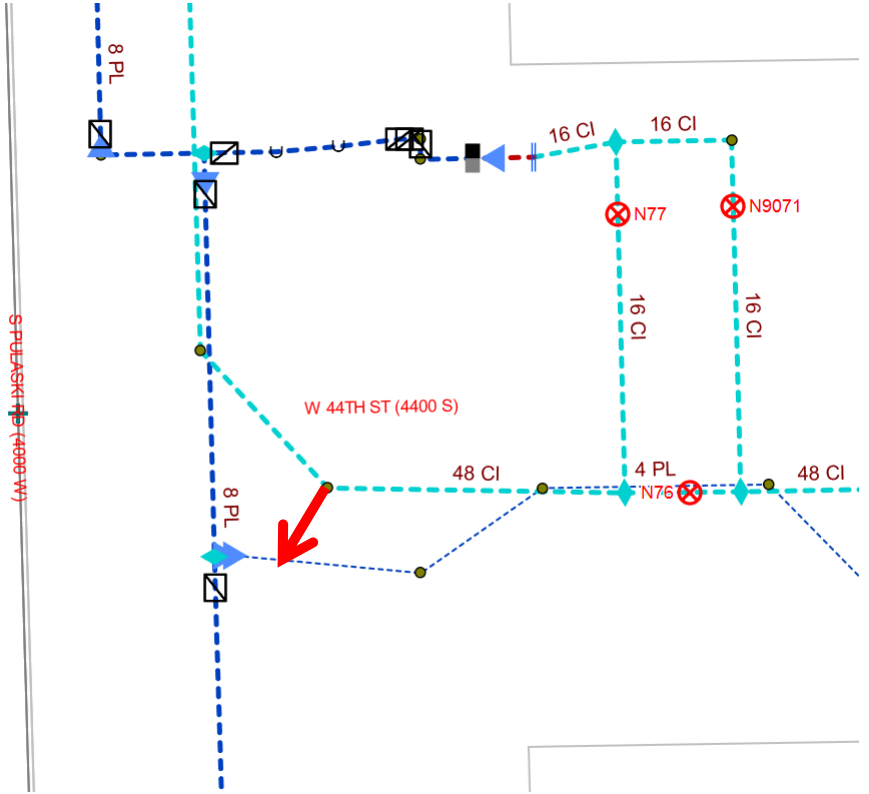
Brace Bend Due to Pressure





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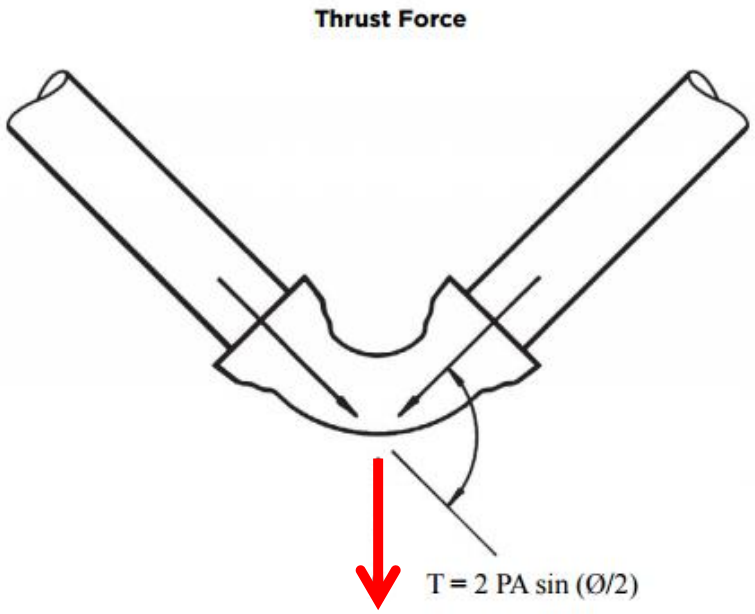
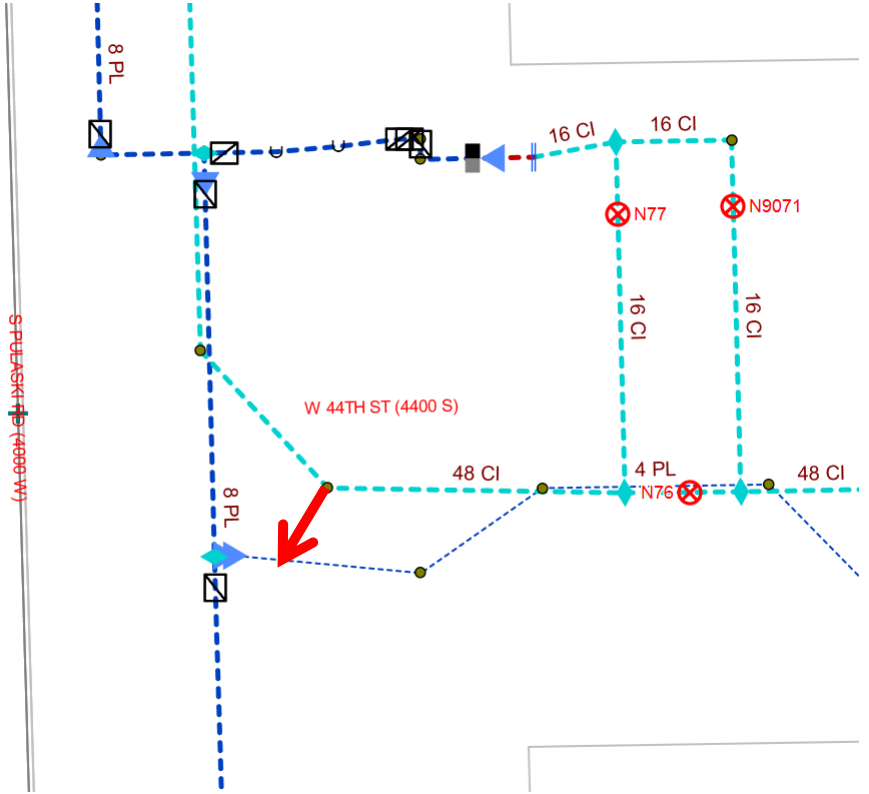
Brace Bend Due to Pressure



T = 2*(25 psi)*(1809 in^2)*sin(45°/2)
T = 38,325 lbs



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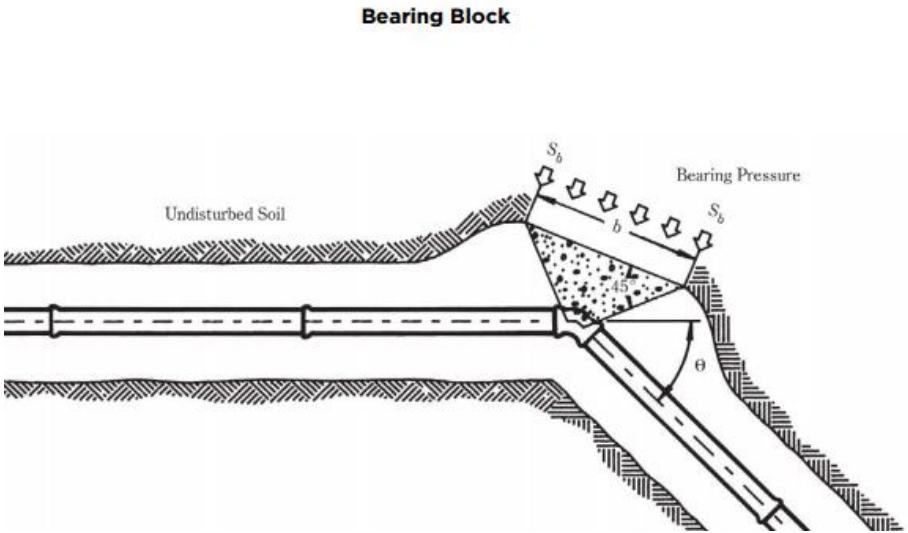
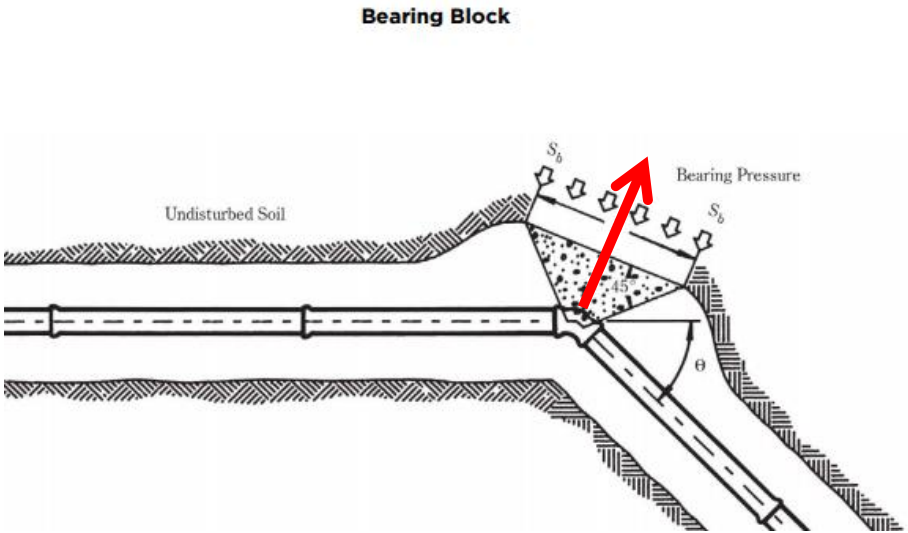
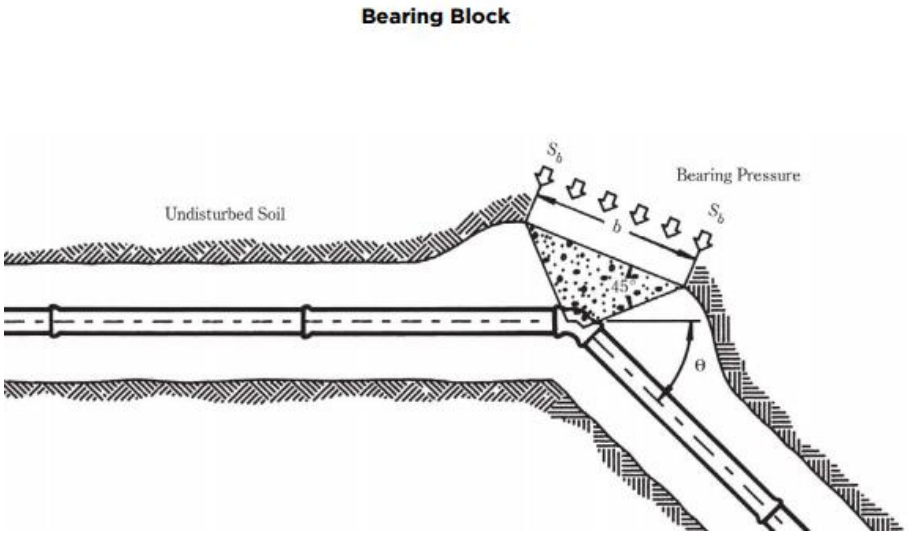
Brace Bend Due to Pressure



Brace Bend Due to Pressure



Brace Bend Due to Pressure



Brace Bend Due to Pressure

Thrust Force = 38,325 lbs

<u>4.5 Cubic Yards of Concrete</u>

Resisting Friction Force = 6,400 lbs

Resisting Soil Bearing Force = 54,000 lbs

Slope Stability

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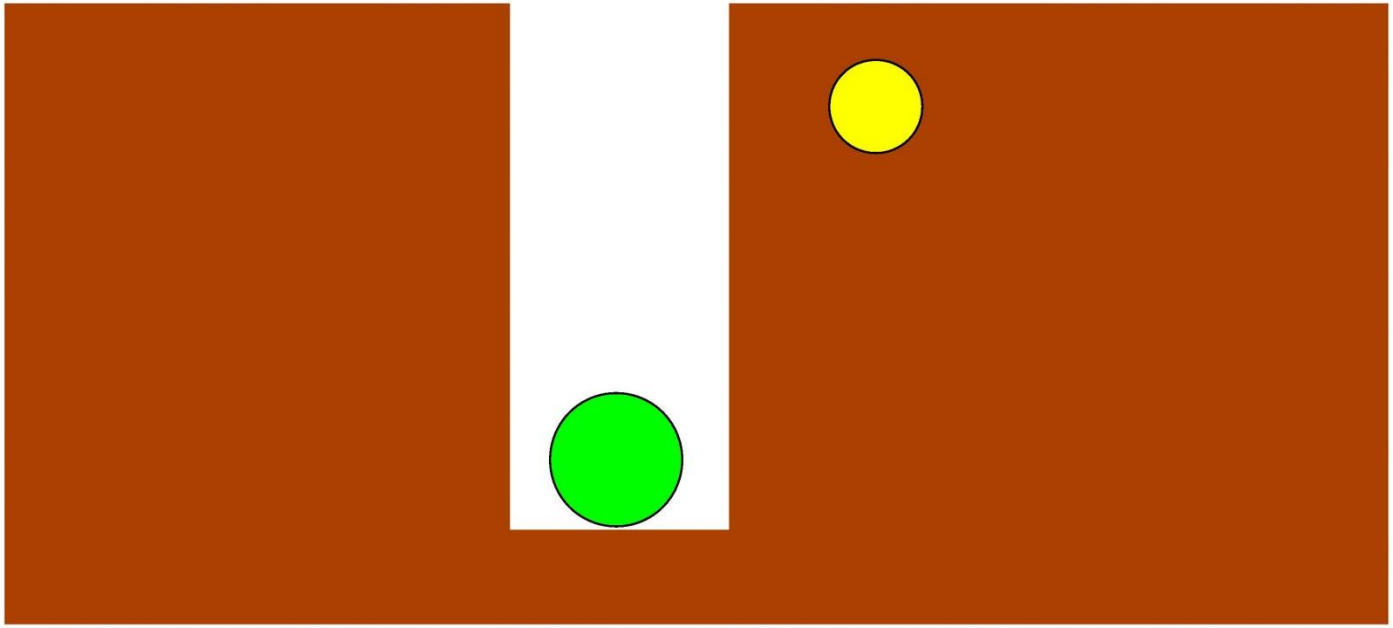
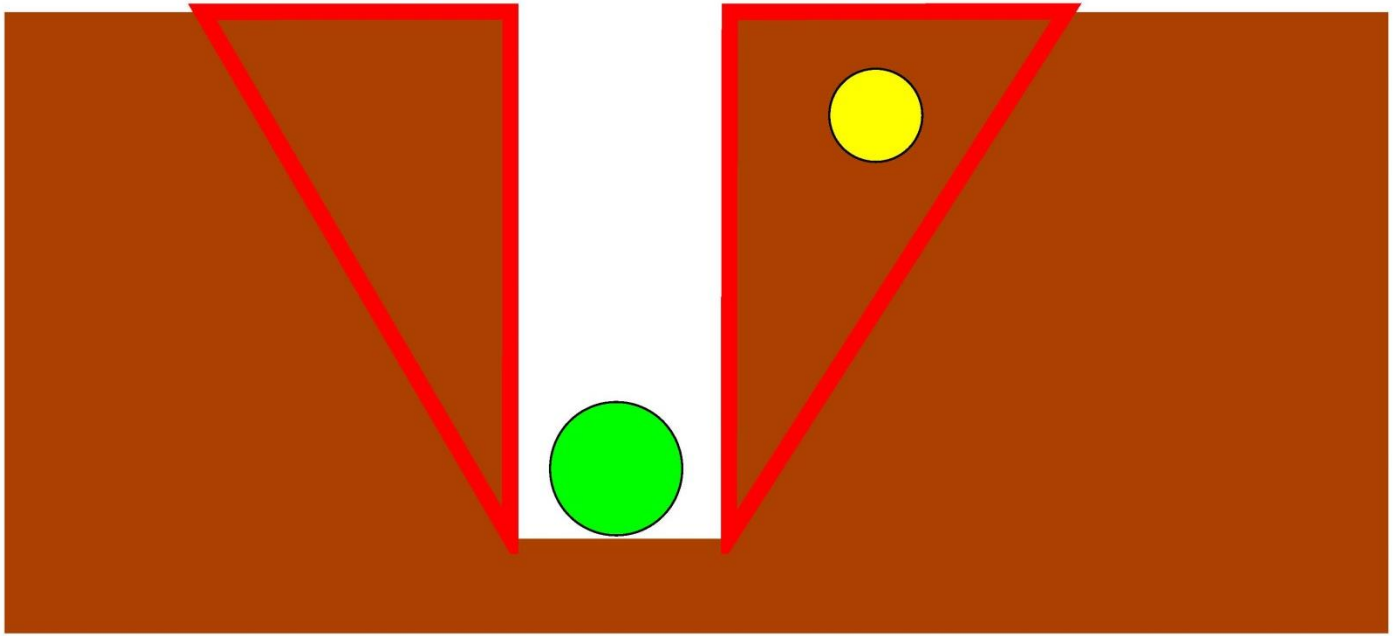
Slope Stability

- Determine if existing gas main adjacent to a trench is in stable soil

Slope Stability



Slope Stability



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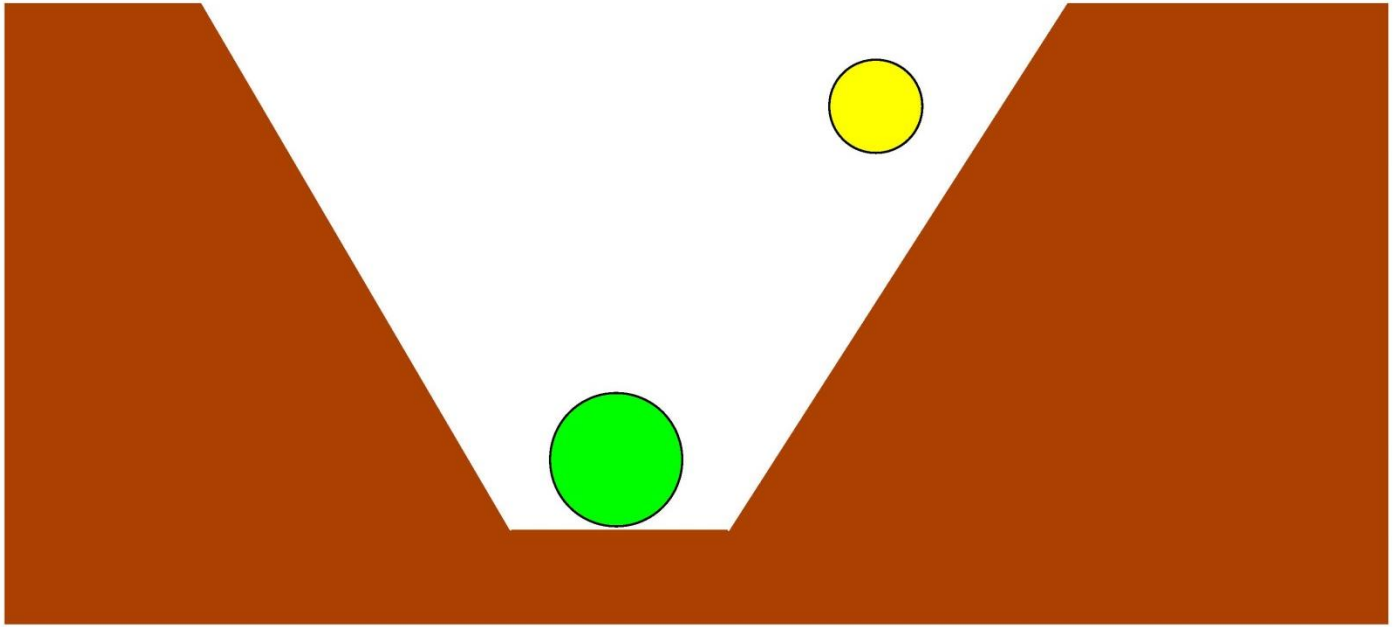

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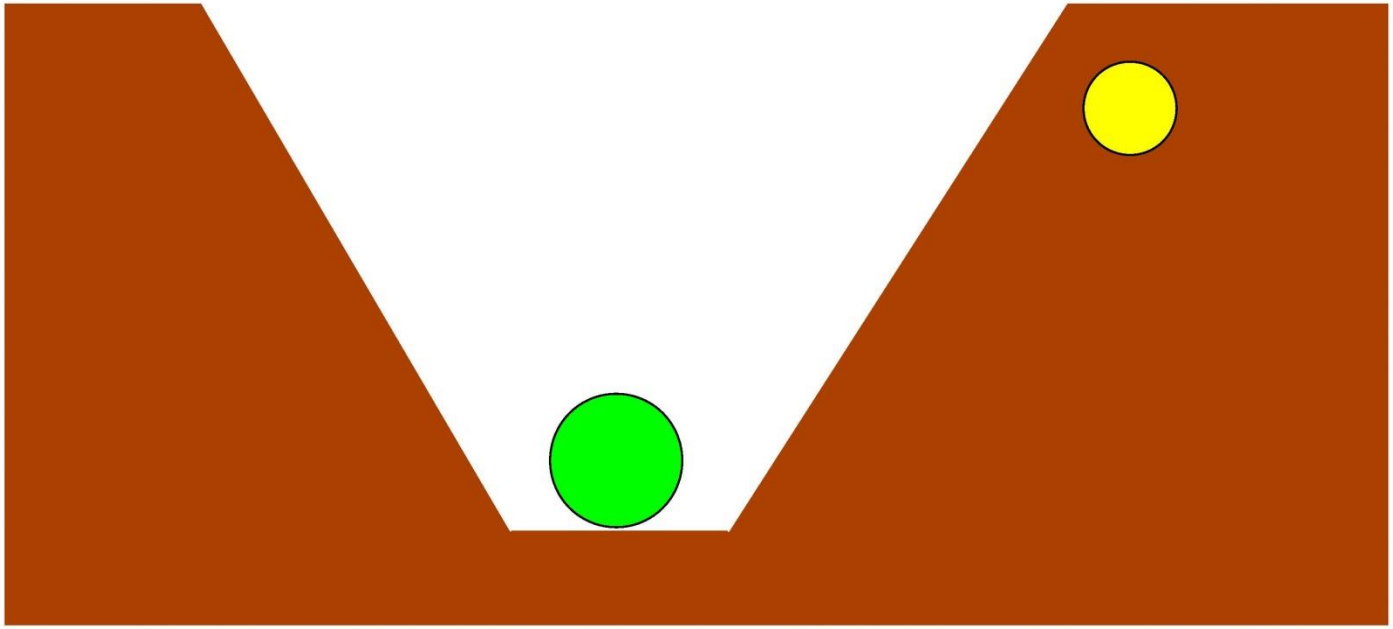


Granular Soils

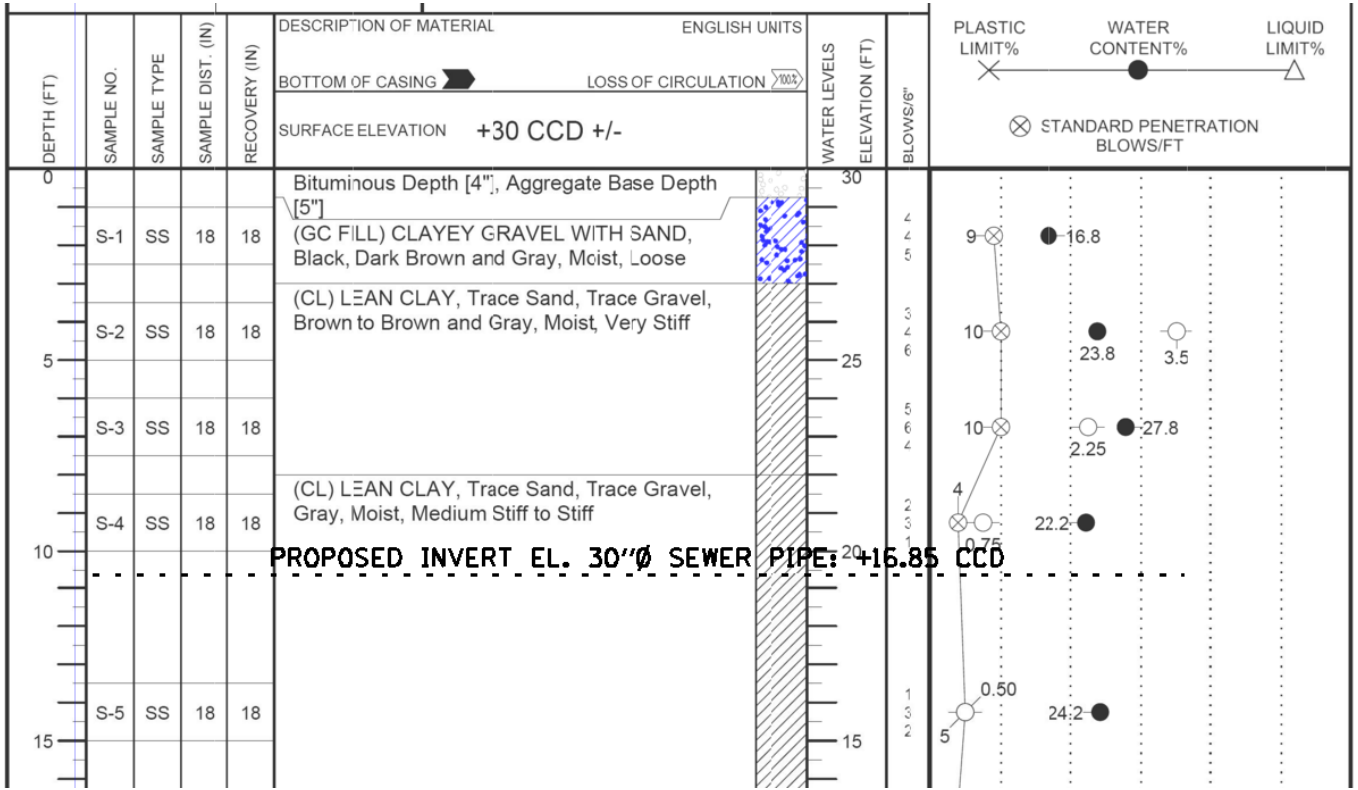
Soil Type	Symbol
Well graded gravels	GW
Poorly graded gravels	GP
Silty gravels	GM
Clayey gravels	GC
Well graded sands	SW
Poorly graded sands	SP
Silty sands	SM
Clayey sands	SC

Relative Density
Very Loose
Loose
Medium Dense
Dense
Very Dense
Extremely Dense

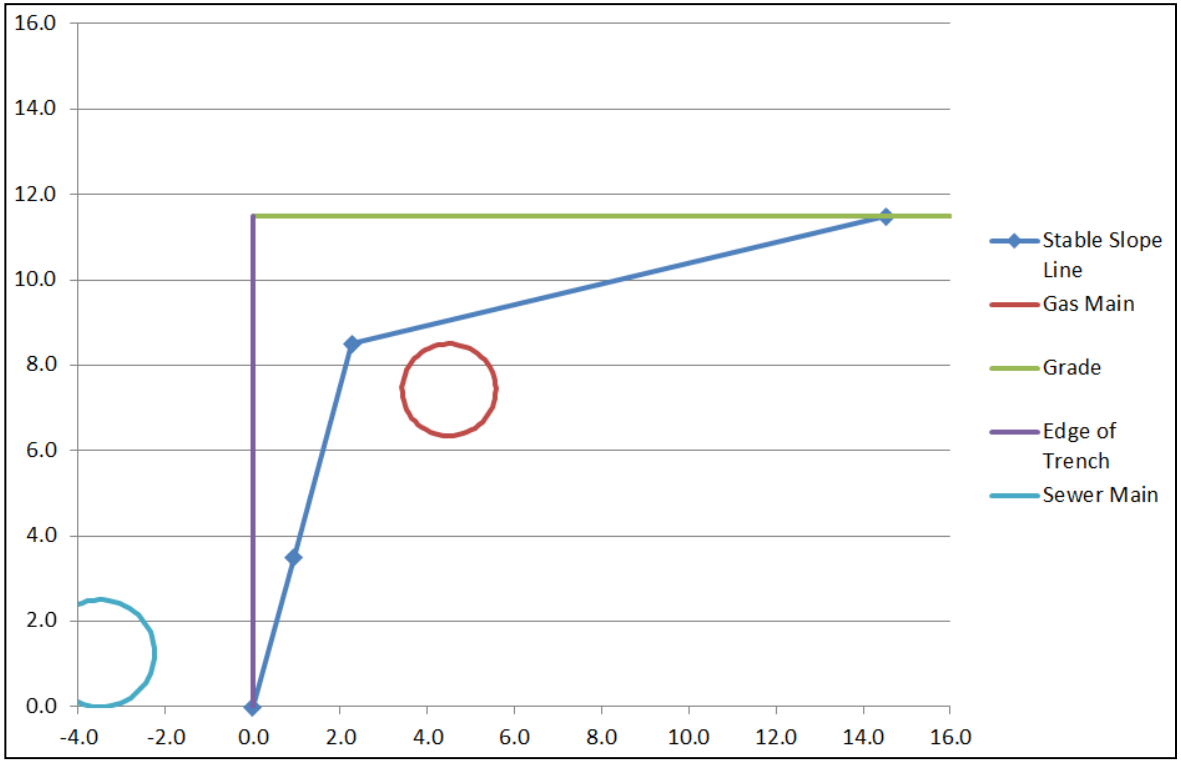
Cohesive Soils

Soil Type	Symbol	Consistency
Inorganic Silts and very fine sands	ML	Very Soft
Inorganic clay, low to medium plasticity	CL	Soft
Organic silts, low plasticity	OL	Medium Stiff
Inorganic silts	MH	Stiff
Inorganic clays, high plasticity	CH	Very Stiff
Organic clays, medium to high plasticity	OH	Hard
Peat and other organic soils	PT	Very Hard

Soil Bore



Slope Stability Analysis



Questions?

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