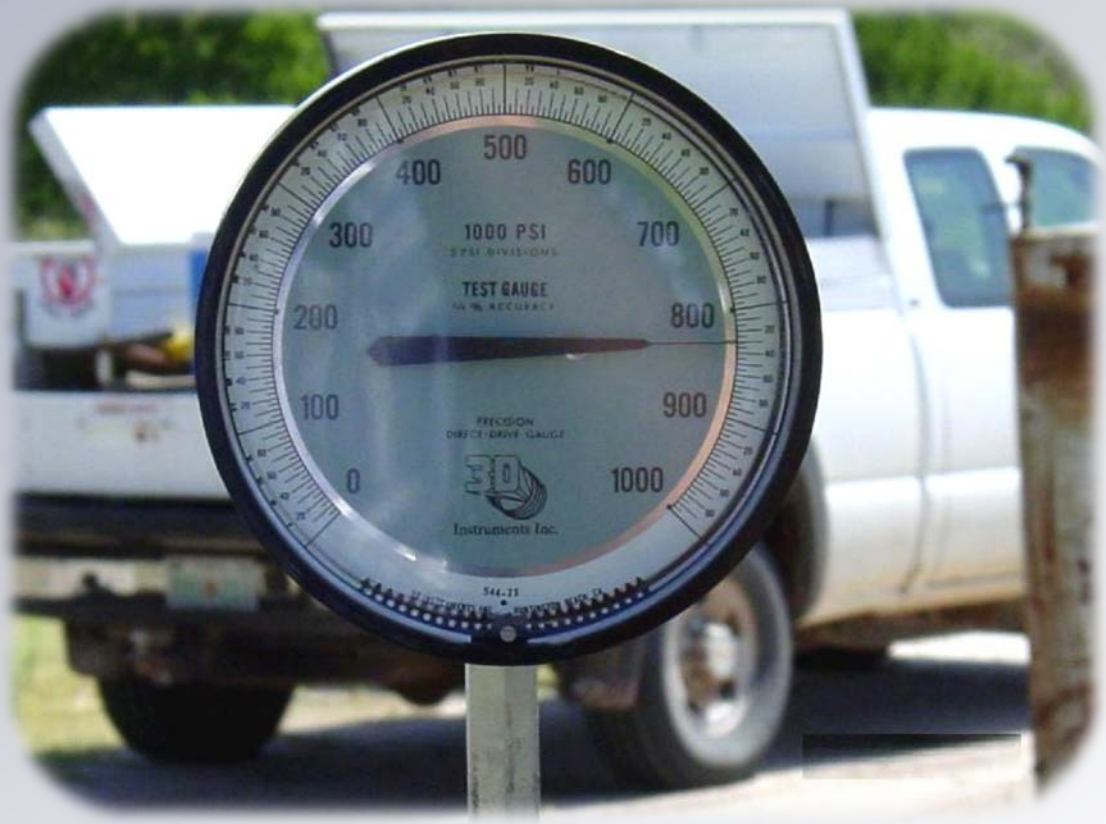
PHMSA
U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration

Maximum Allowable Operating Pressure for Natural Gas Pipelines

MAOP
Found In Sub Parts



- ✓192.619
- ✓192.621
- ✓192.623

Pressures

MAOP

MOP

OP

MAOP

"Maximum Allowable Operating Pressure" means the maximum pressure at which a pipeline or segment of a pipeline may be operated under this part.

§192.3

MOP

"Maximum Actual Operating Pressure" means the maximum pressure that occurs during normal operations over a period of one year.

§192.3

OP

"Operating Pressure" means the pressure on the pipeline at any given time.

Usually the set pressure of the Regulator

Class Location Definition §192.5

The *class location unit* is an onshore area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline.

The class location is determined by the buildings in the *class location unit*. For the purposes of this section, each separate dwelling unit in a multiple dwelling building is counted as a separate building intended for human occupancy.

Class Location Unit

- A *Class 1* = 10 or less buildings intended for human occupancy or an offshore area.
- A *Class 2* = Greater that 10 but less than 46 buildings intended for human occupancy.
- A *Class 3* = 46 or more buildings intended for human occupancy; or

Class Location Unit

Class 3 - where the pipeline lies within 100 yards of either a building or a small,

- **Well-defined Outside Area**
  - **Playground**
  - **Recreation Area**
  - **Outdoor Theater**
- **Occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period**

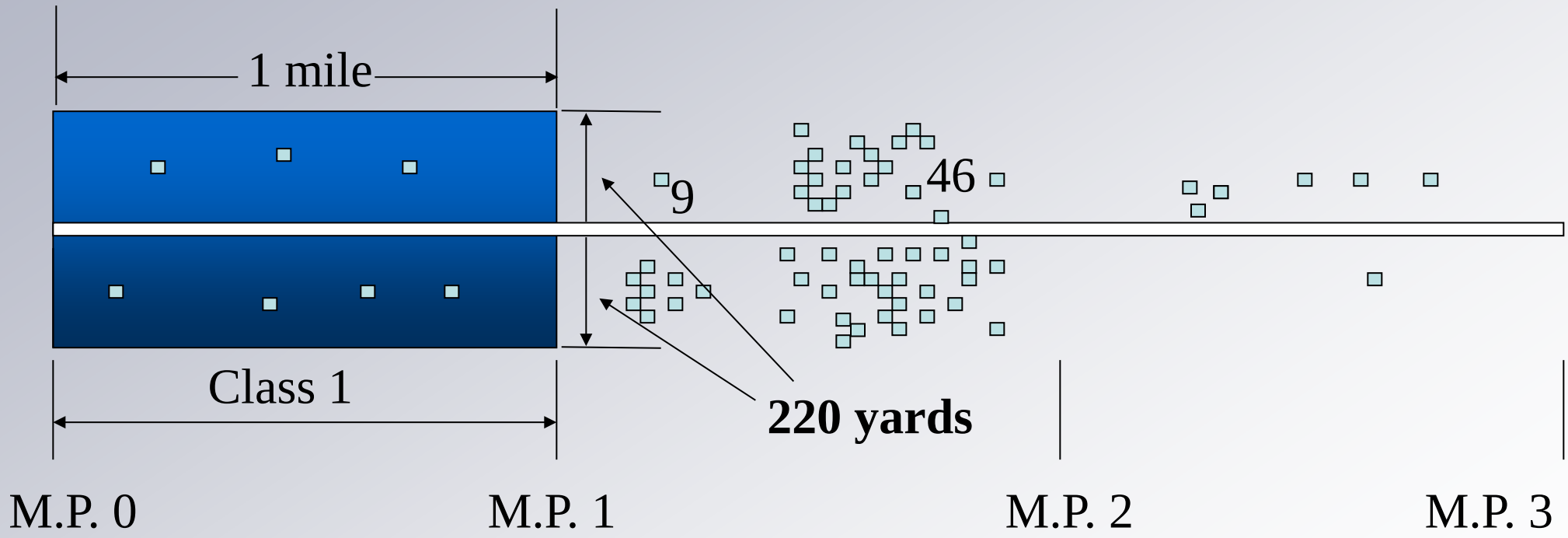
Class Location Unit

Class 4 - where buildings with four or more stories aboveground are prevalent.

"Prevalent" means

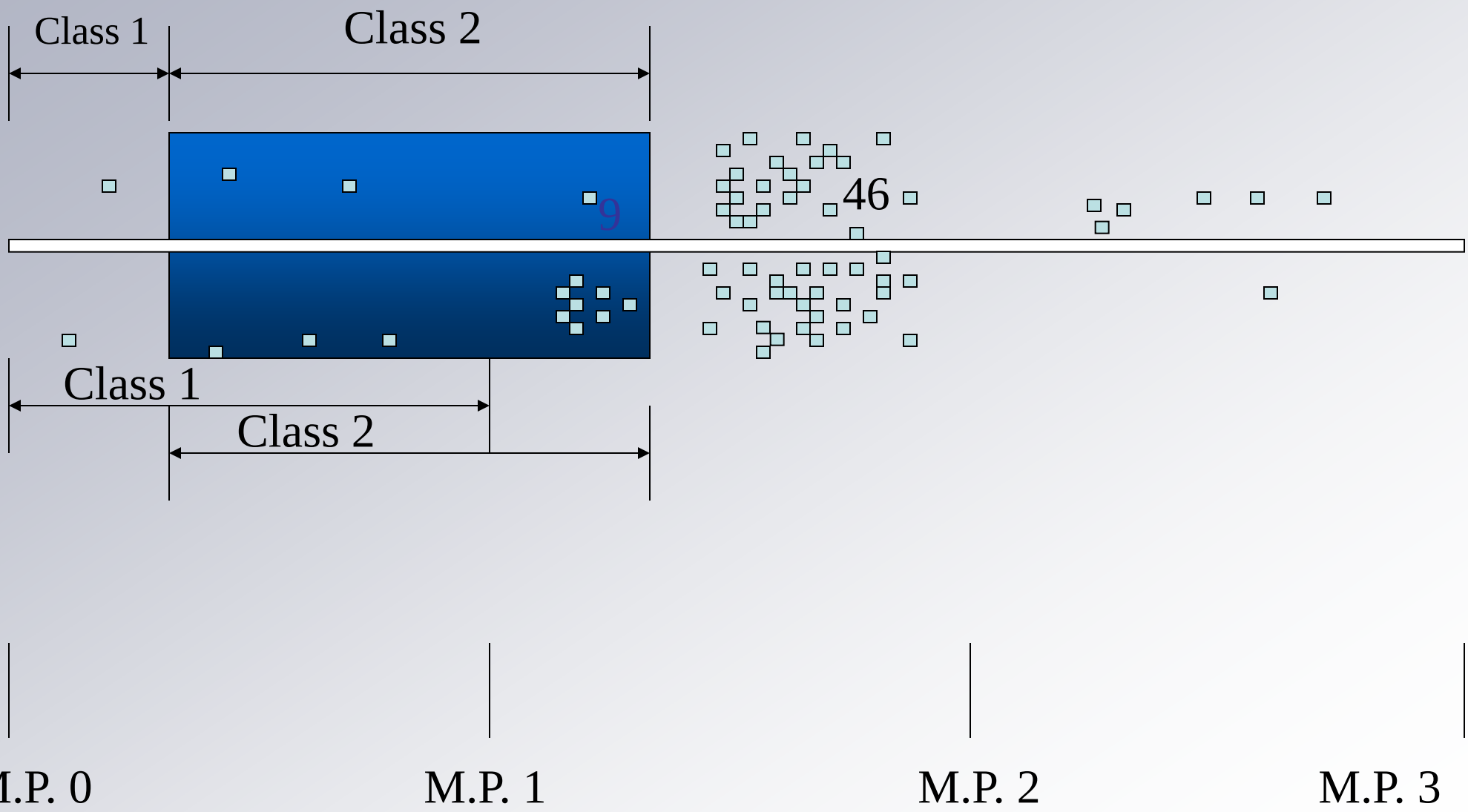
"widely existing"

Class Location Determination

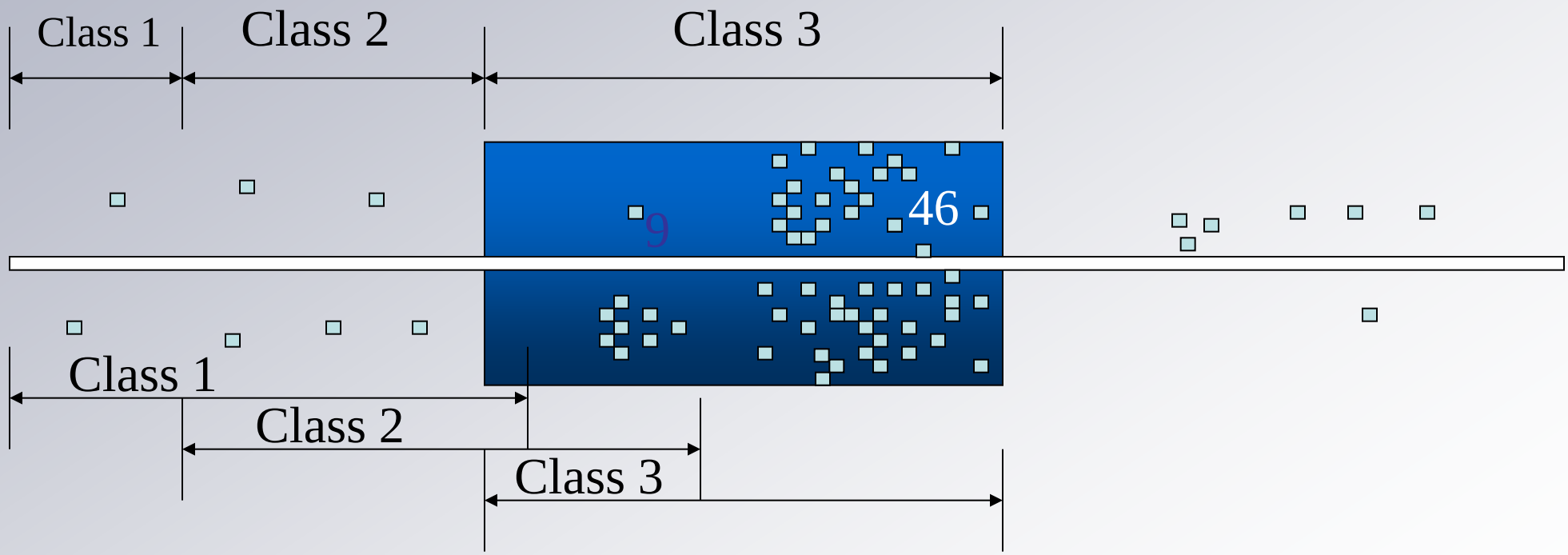


M.P. = Mile Post

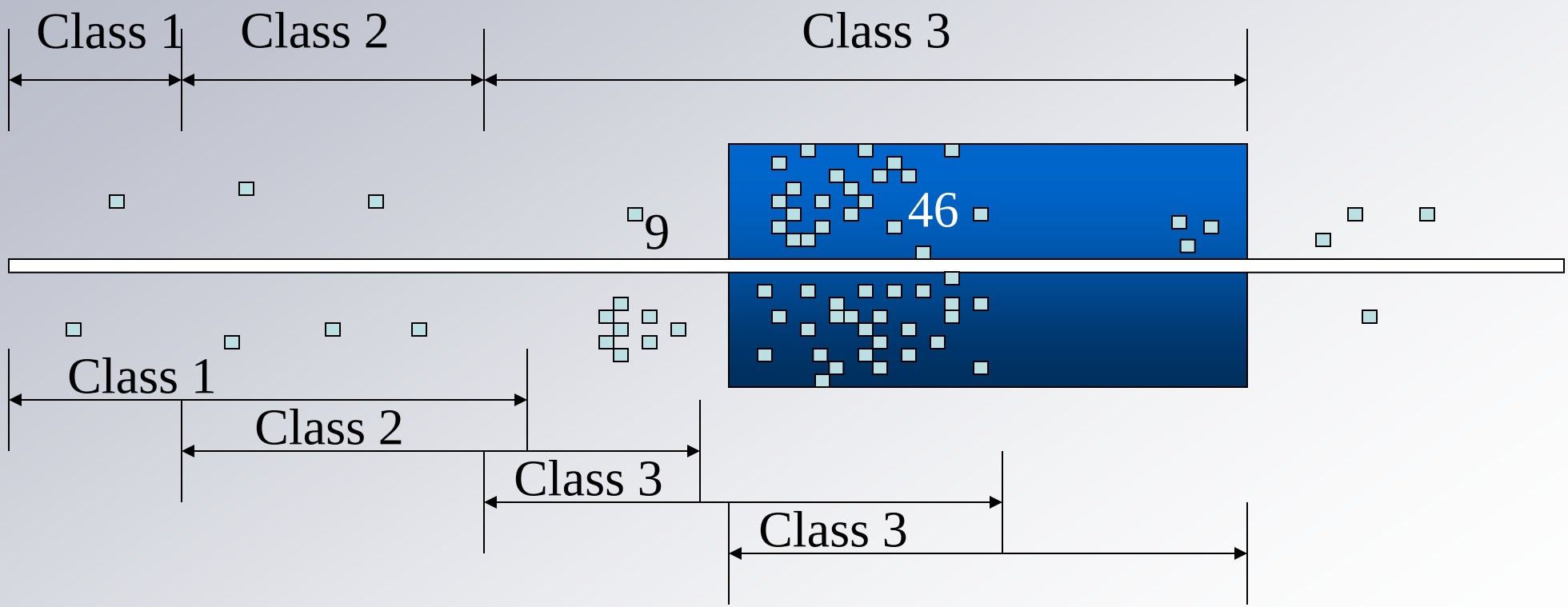
Continuous Sliding Mile



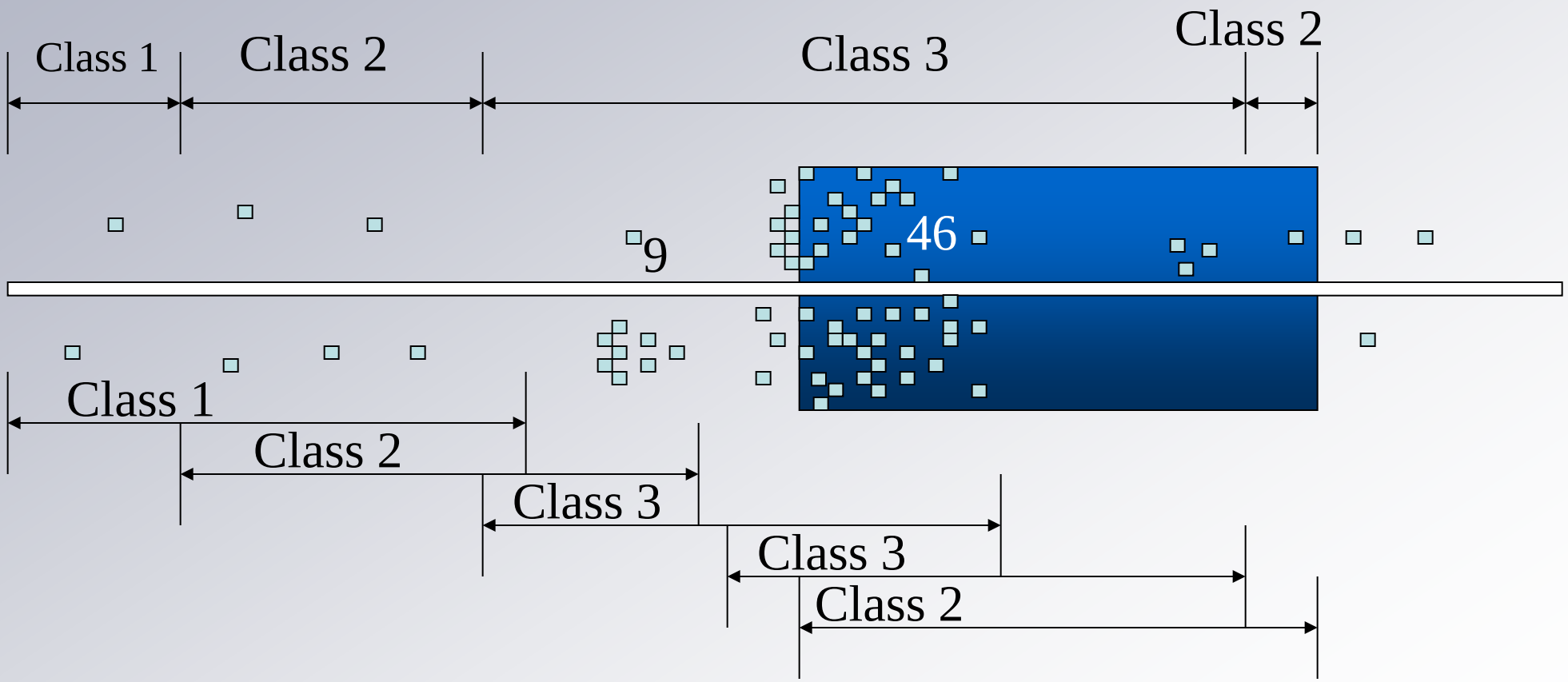
Continuous Sliding Mile



Continuous Sliding Mile



Continuous Sliding Mile



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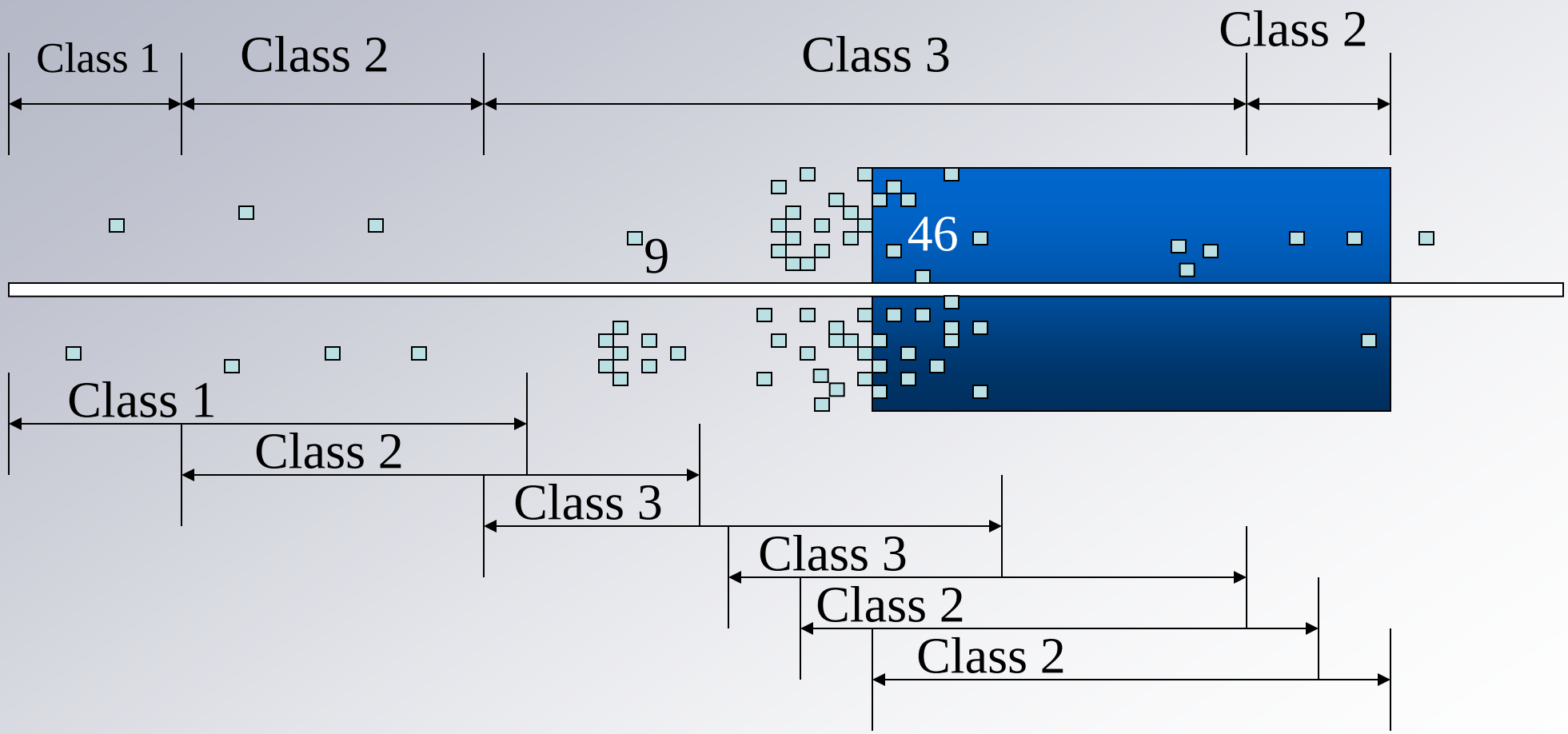
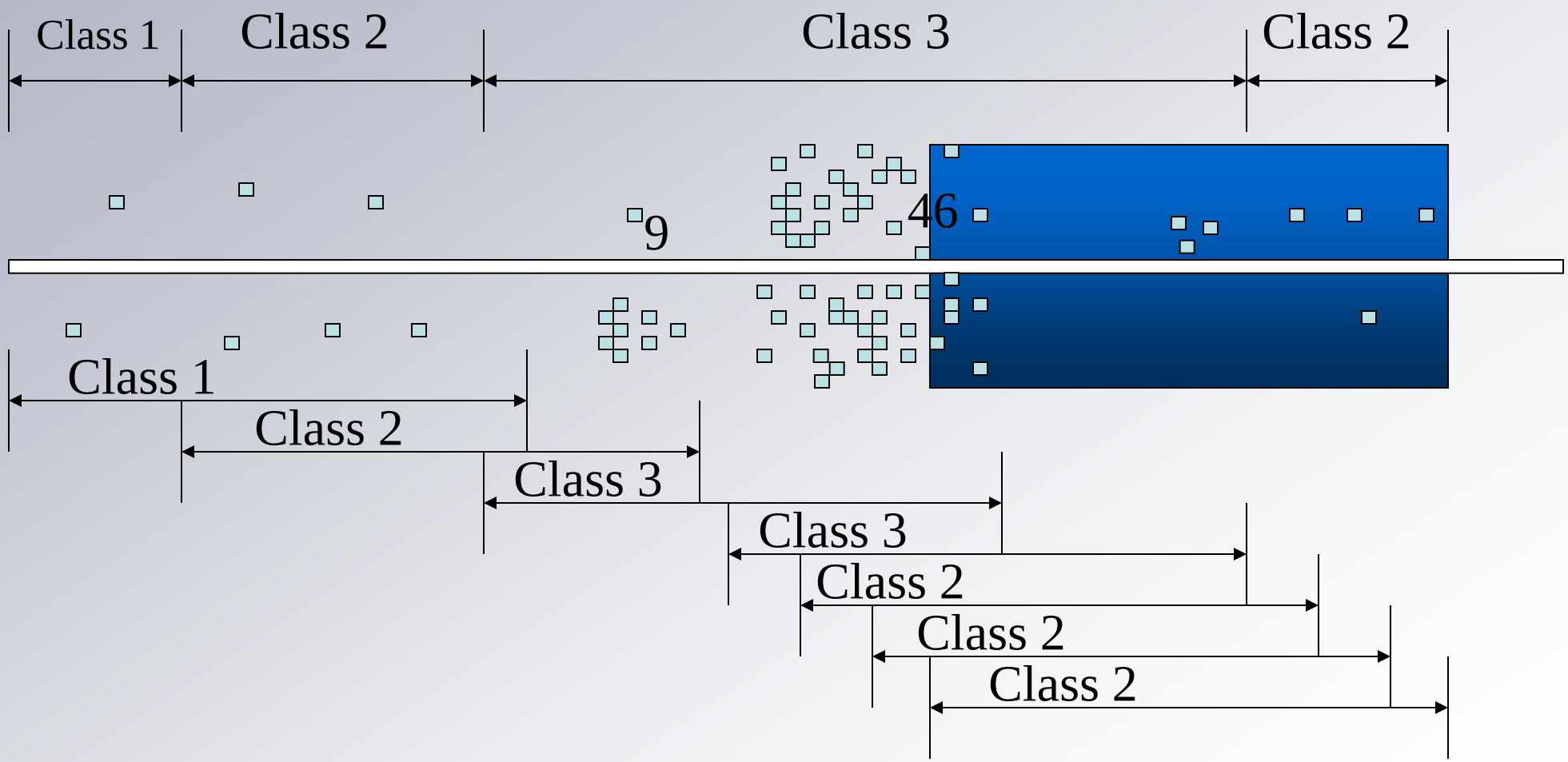
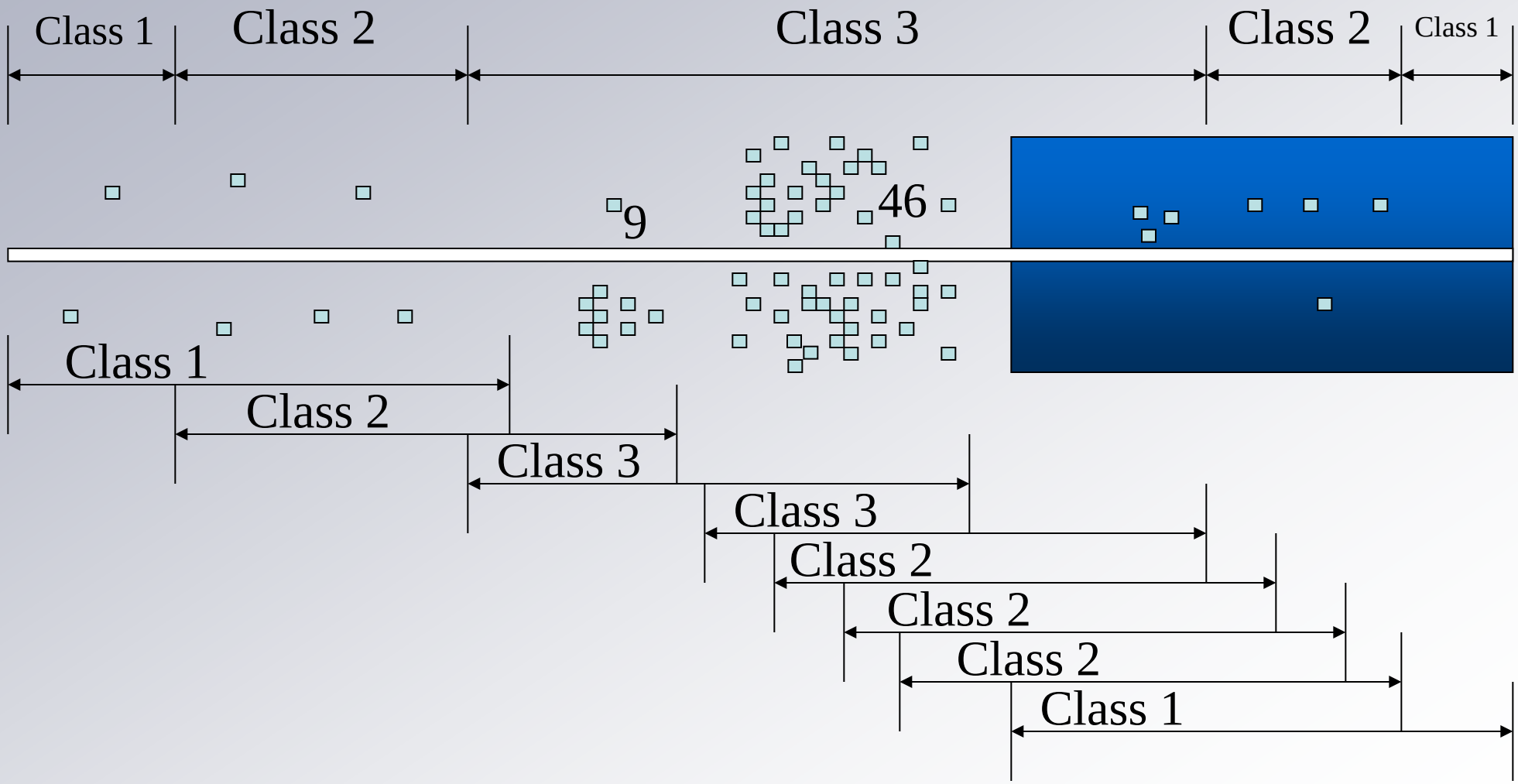


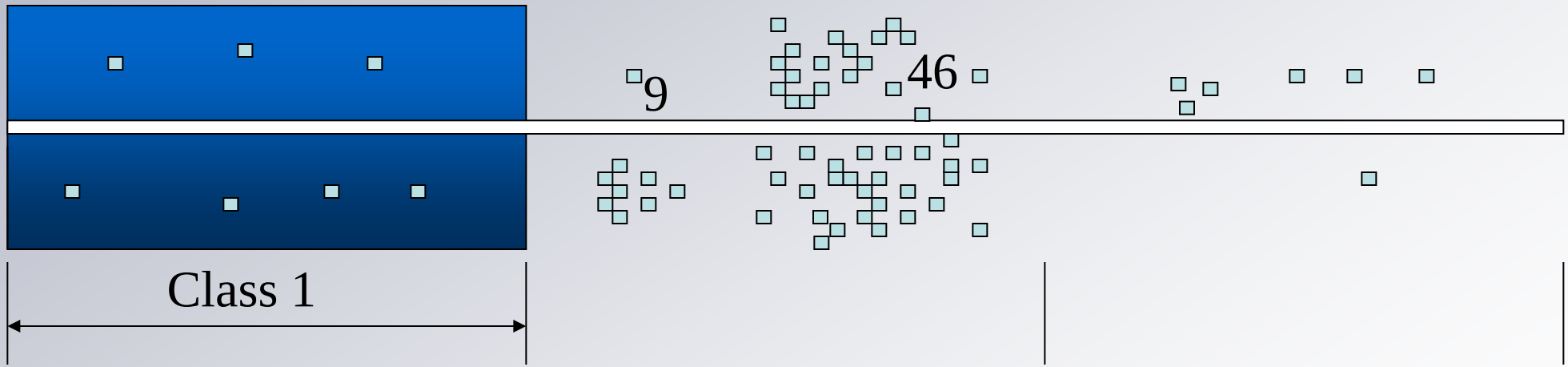
Continuous Sliding Mile



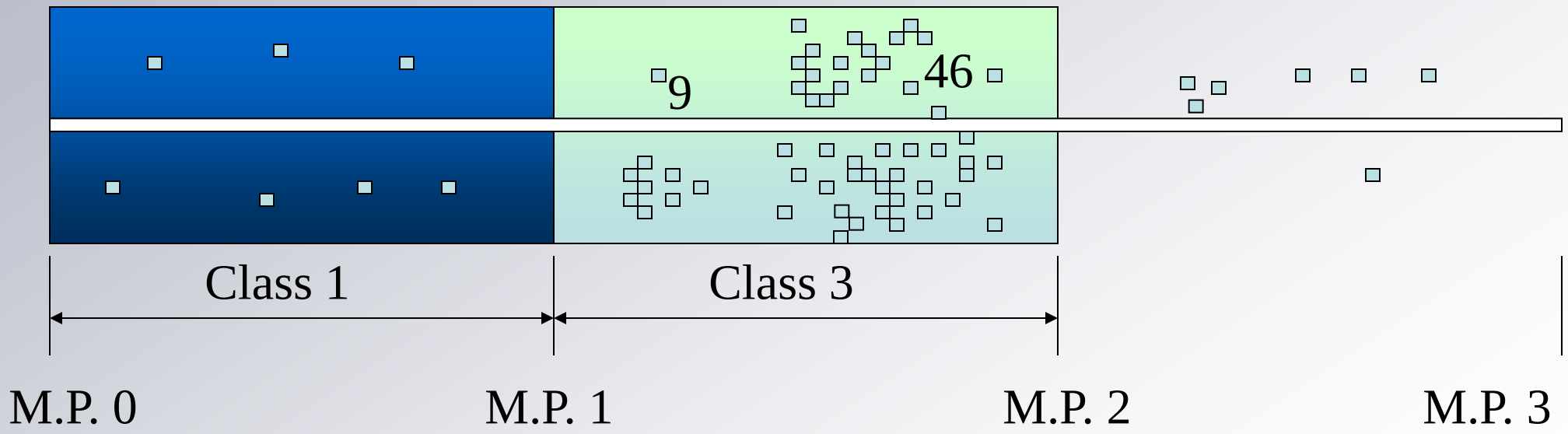
Continuous Sliding Mile



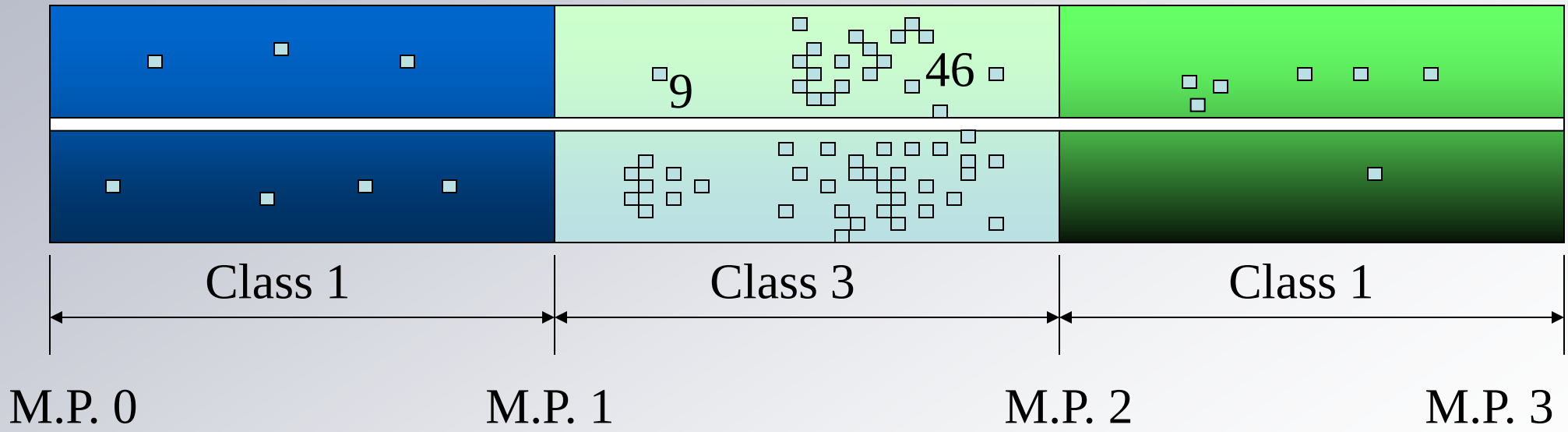
Class Location Determination



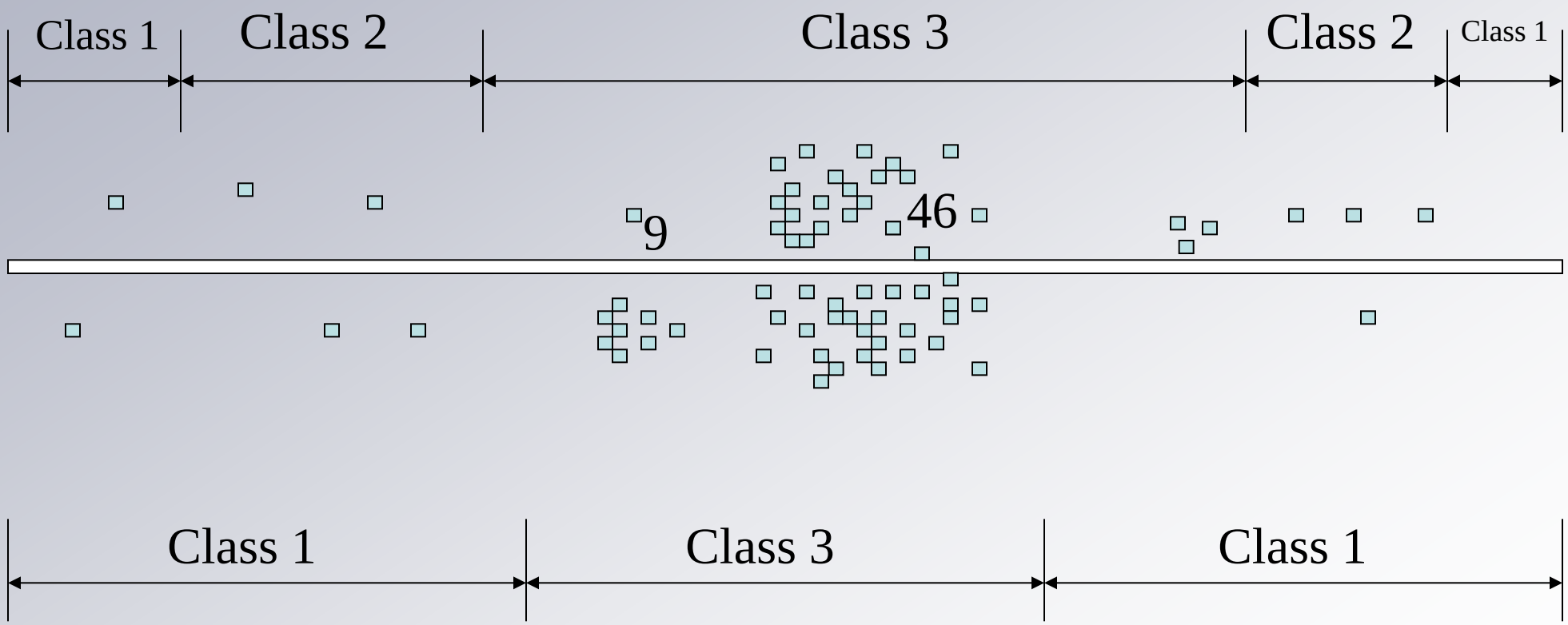
Class Location Determination



Class Location Determination



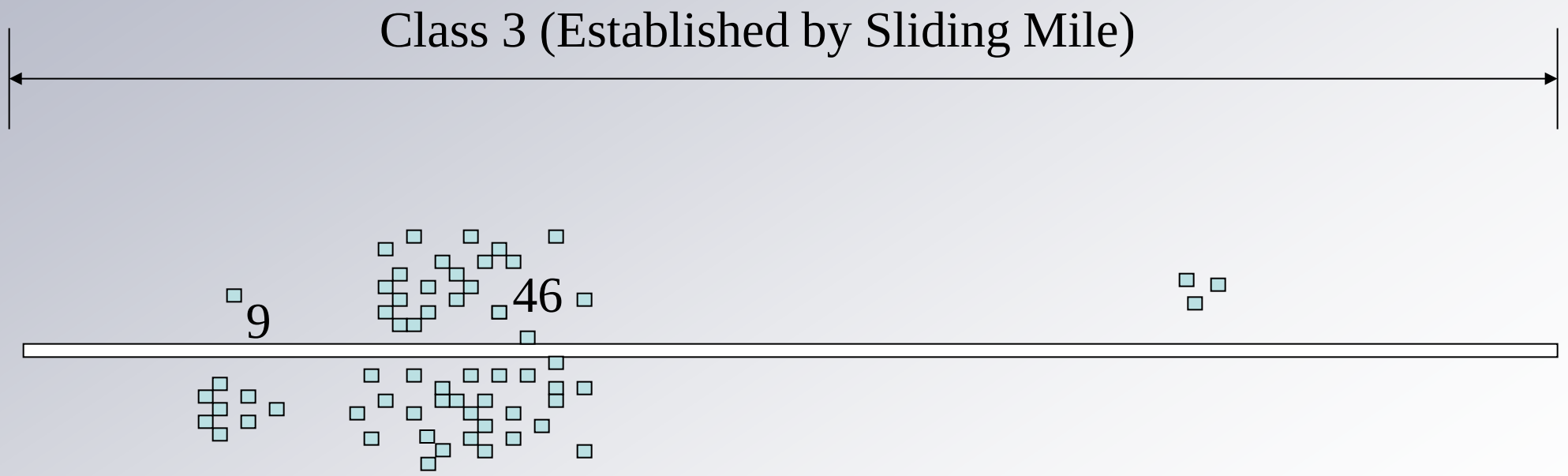
Continuous Sliding Mile



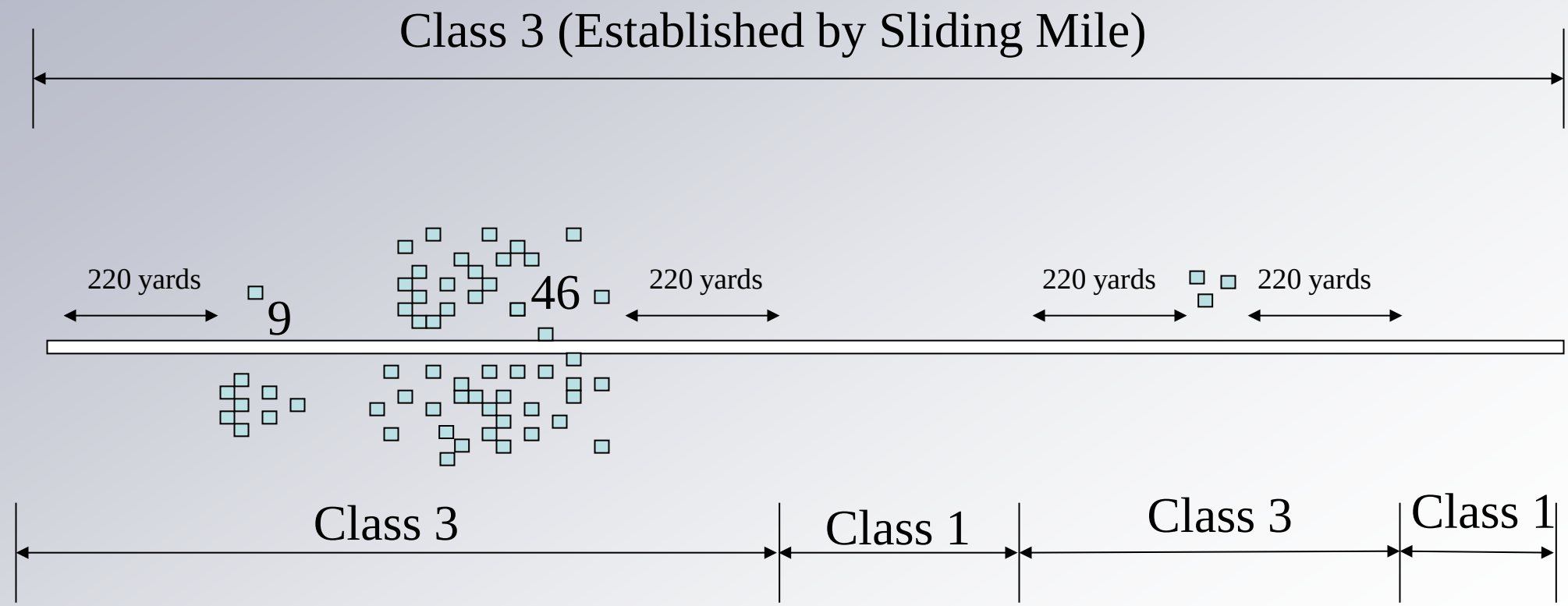
End-to-End Mile

Clustering

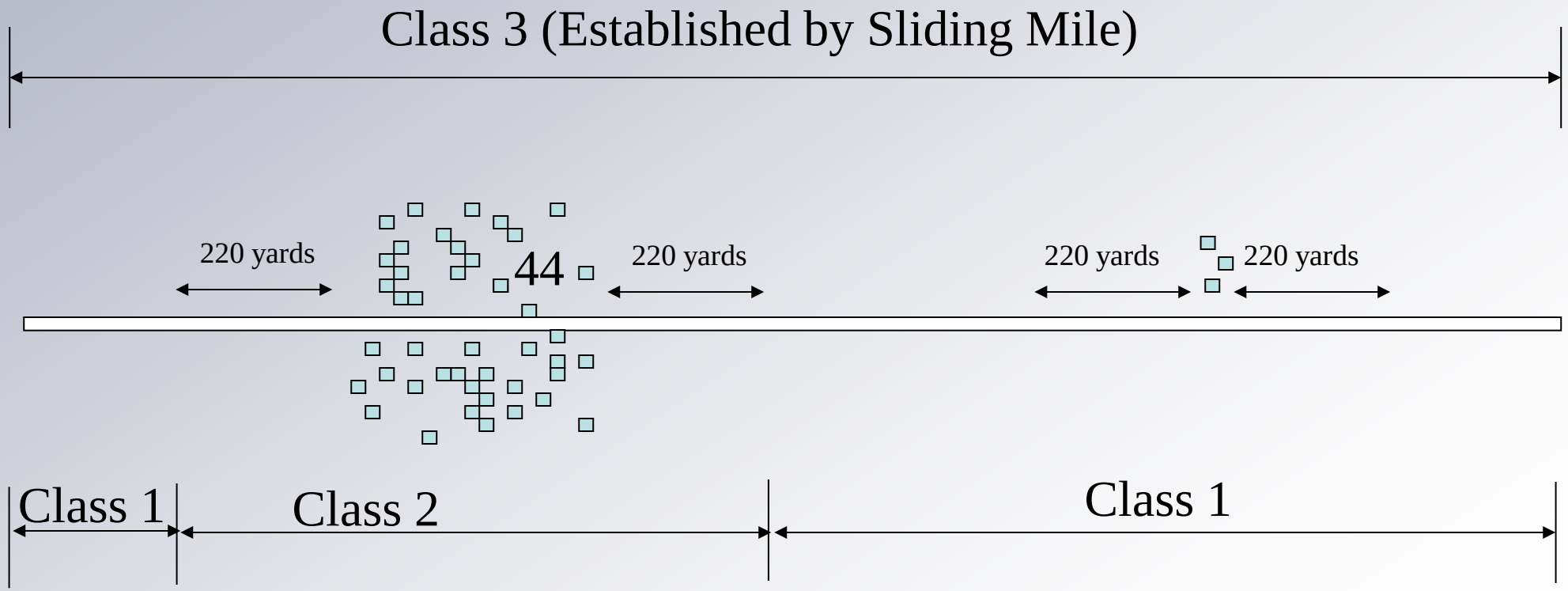
Clustering



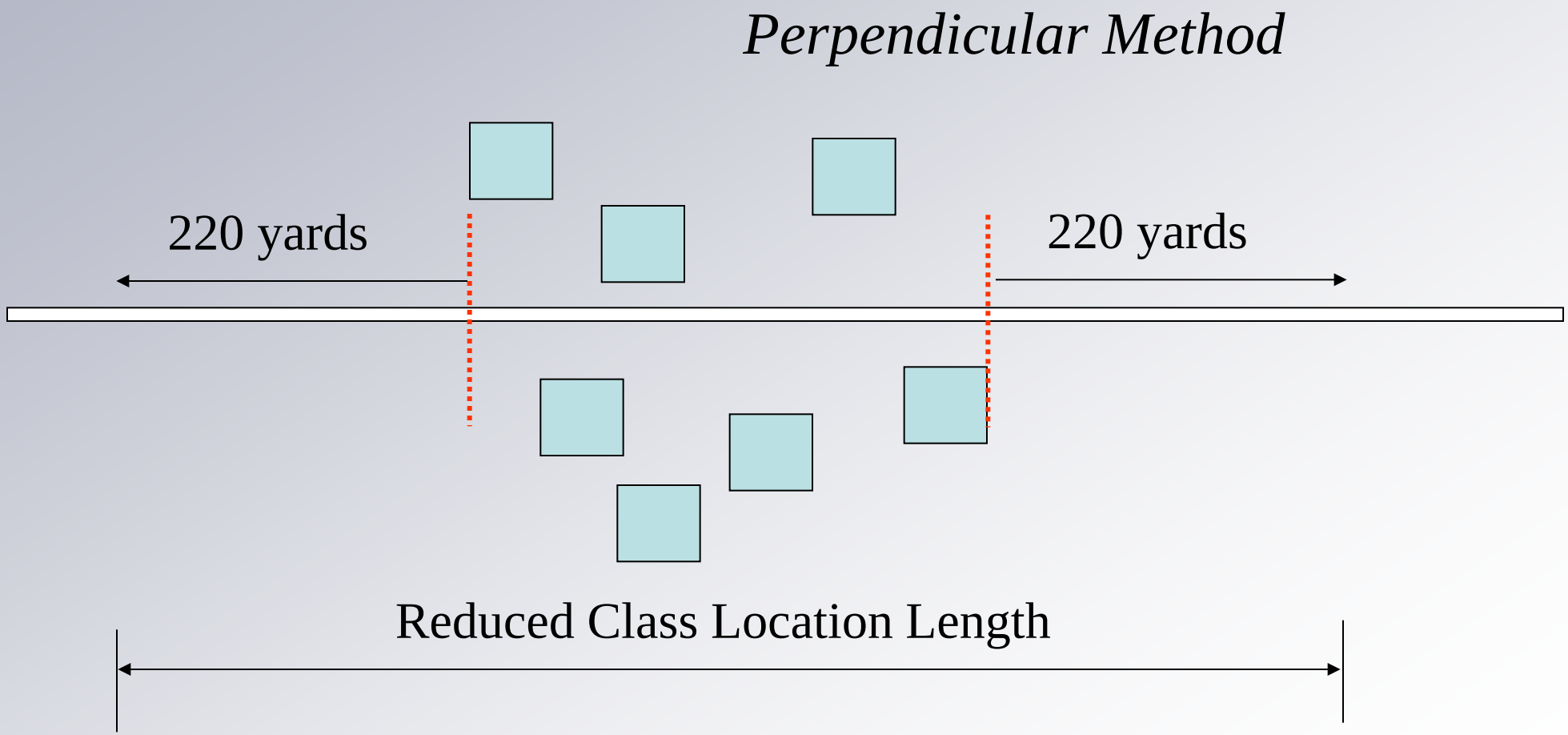
Clustering


Class 3 (Established by Sliding Mile)
220 yards
9
46
220 yards
220 yards
220 yards
Class 3
Class 1
Class 3
Class 1

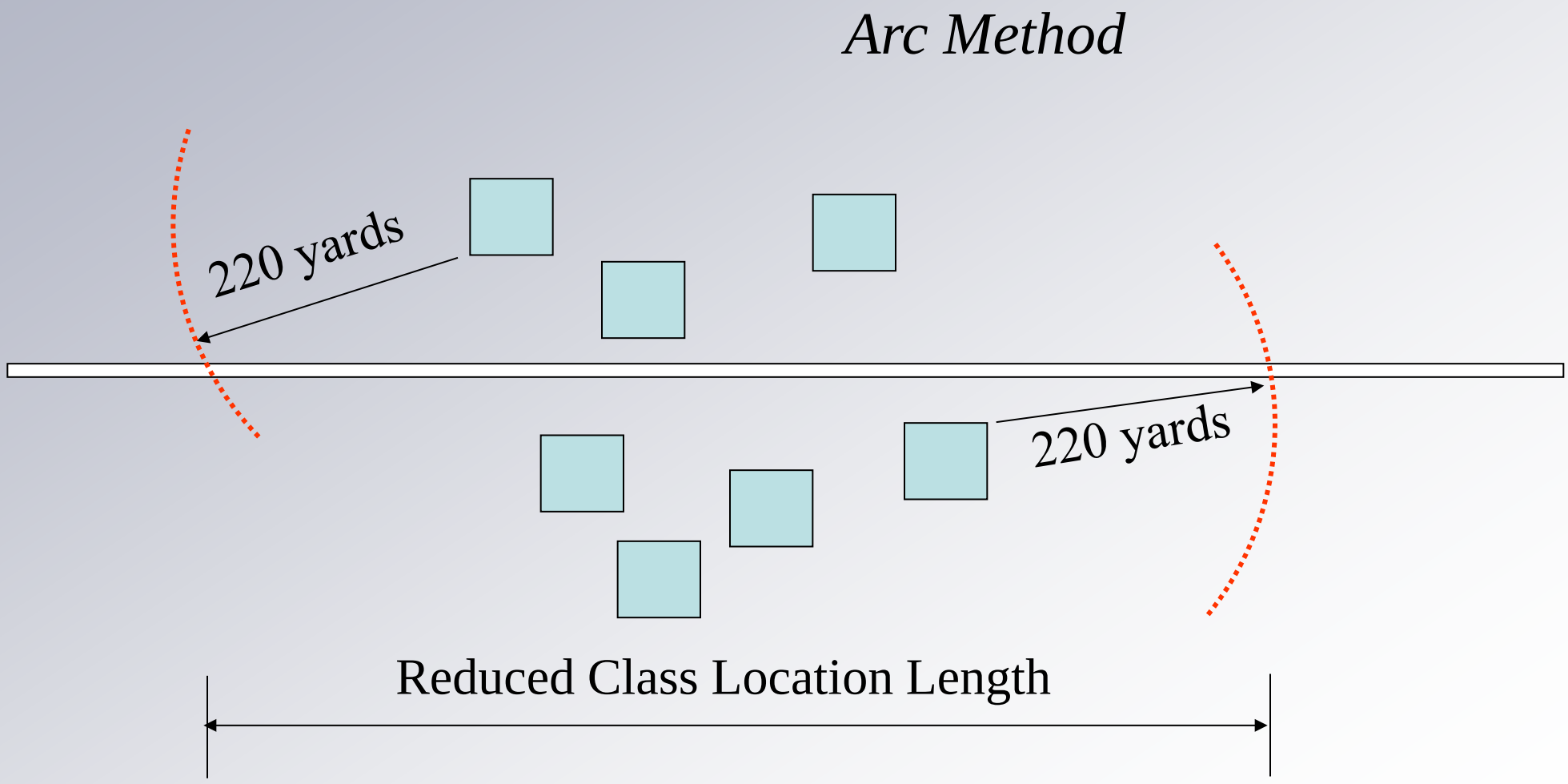
Incorrect Clustering Application



Clustering Limits

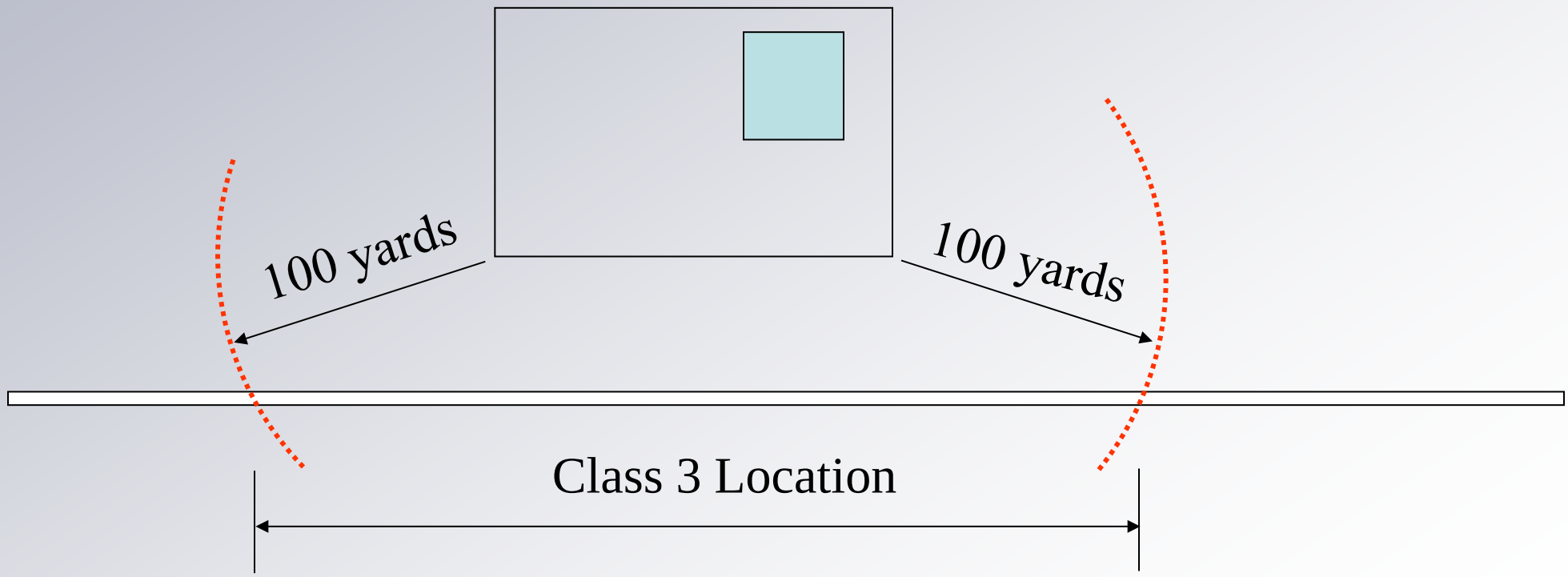


Clustering Limits



Class 3 – Small Well Defined Area

School with Playground



§192.619 - All Pipelines

Lowest **of the following:**

(a)(1) Design

(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator
(For de-rating only)

§192.619 - All Pipelines

Lowest **of the following:**

(a)(1) Design

(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator

(For de-rating only)

Design of Pipe and Components

Pipe

- For Steel - §192.105
- For Plastic - §192.121

Components

- Manufacturers Rating

§192.105 - Design of Steel Pipe

$$P = (2St/D)(F)(E)(T)$$

P = Design Pressure
S = Yield Strength
D = Outside Diameter
t = Wall Thickness
F = Design factor - §192.111
E = Longitudinal joint factor - §192.113
T = Temperature de-rating factor - §192.115

Converted or Uprated Lines

- If any variable necessary to determine the design pressure under the design formula is unknown, one of the following is used;
- Eighty percent of the first test pressure that produces yield under N5.0 of ASME B31.8; or
- If the pipe is 12.750 or less and is not tested to yield, 200 psig.

§192.619(a)(1)

Pipe Specifications

API 5L
Grade B
8"
.322" wt.

Design Pressure Calculation

$$P = 2St / D$$

$$P = (2)(35{,}000)(.322) / 8.625$$

$$P = 2613\#$$

Equivalent Pressure at 100% SMYS

§192.111 - Design Factor (F) for Steel Pipe

$$P = \frac{2St}{D}(F)$$

Class location	Design factor (F)
1	.72
2	.60
3	.50
4	.40

§192.111 - Design Factor (F) for Steel Pipe

In Class 3

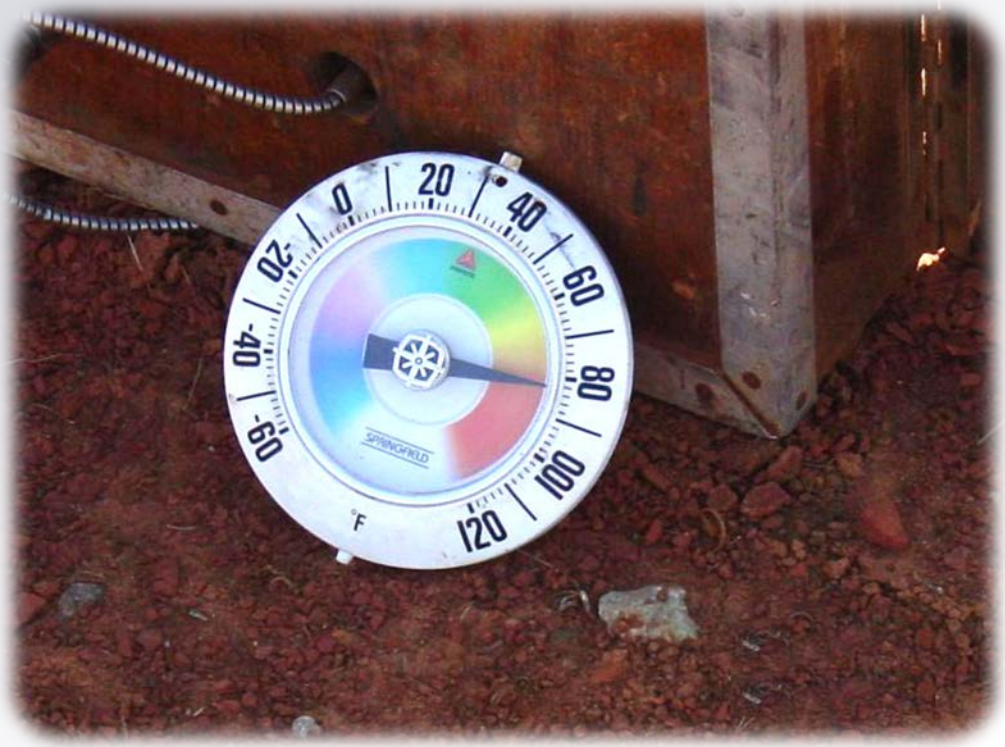
$$P = \frac{(2)(35{,}000)(.322)\ (0.50)}{8.625}$$

$$P = 1307\#$$

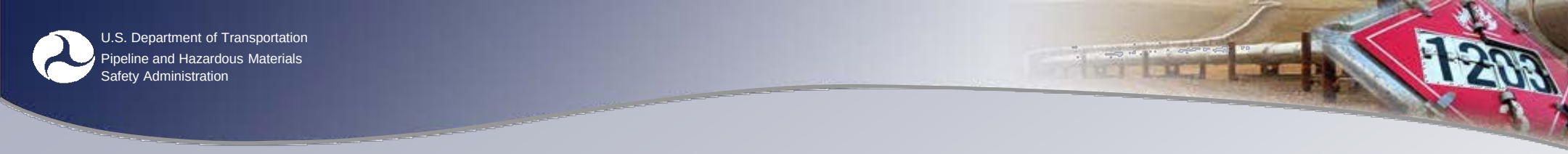
E = Longitudinal Joint Factor - §192.113

T = Temperature De-rating Factor - §192.115

Usually Not a Factor
Be Sure to Check!!



(250ºF or less)



Components

- 1000# WOG Valve
- ANSI Class 300# Flange
- ANSI Class 600# Valve

(WOG = Water, Oil, Gas)

Components Pressure Ratings

- 1000# WOG Valve - 1000#
- ANSI Class 300# Flange - 720#
- ANSI Class 600# Valve - 1440#

Manufacturer's Rating

Design Pressure of the Weakest Link

Components = 720#

Pipe = 1307#

§192.619 - All Pipelines

Lowest **of the following:**

(a)(1) Design = 720#

(a)(2) Test Pressure ←

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

§192.619 (a)(2)(ii)

Test Pressure / Factor

Testing Steel
≥ 100# PSIG

Class location	Installed before (Nov. 12, 1970)	Installed after (Nov. 11, 1970)	Covered under §192.14
1	1.1	1.1	1.25
2	1.25	1.25	1.25
3	1.4	1.5	1.5
4	1.4	1.5	1.5

Test Pressure / Factor

Test Pressure - 1964 = 1500#

For Class 3 - 1500/1.4 = 1071#

§192.619 - All Pipelines

Lowest **of the following:**

(a)(1) Design = 720#

(a)(2) Test Pressure = 1071#

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator
(For de-rating only)

MOP – Transmission and Distribution Lines

- 5 years preceding the applicable date in §192.619 (a)(3)

Unless:

- Tested in accordance §192.619(a)(2) after July 1, 1965
- Uprated in accordance with Subpart K of this part.

192.619 (a)(3)

Pipeline segment	Pressure date	Test date
—Onshore gathering line that first became subject to this part (other than §192.612) after April 13, 2006. —Onshore transmission line that was a gathering line not subject to this part before March 15, 2006.	March 15,2006, or date line becomes subject to this part, whichever is later.	5 years preceding applicable date in second column.
Offshore gathering lines.	July 1, 1976.	July 1, 1971.
All other pipelines.	July 1, 1970.	July 1, 1965.

MOP

Operating Charts for 1968 - 850#

§192.619 - All Pipelines

Lowest **of the following:**

(a)(1) Design = 720#

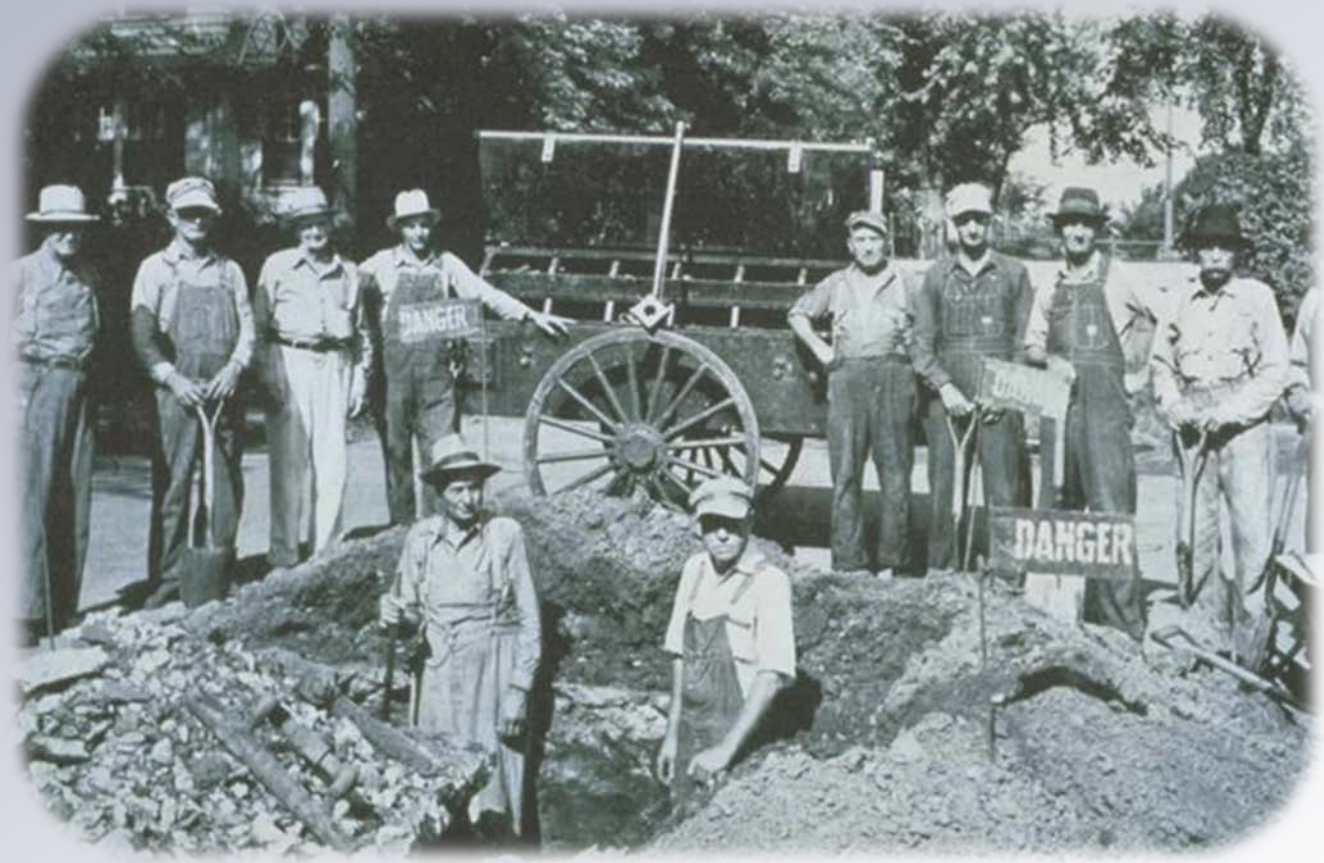
(a)(2) Test Pressure = 1071#

(a)(3) MOP = 850#

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

Maximum Safe Pressure

Considering:



- **History**
- **Corrosion**
- **Actual Operating Pressure**

(For de-rating only)

§192.619(b)
Maximum Safe Pressure

If used:

Must provide Overpressure Protection as required by §192.195

§192.619(c) *Grandfather Clause*

The requirements on pressure restrictions in this section do not apply in the following instance.

An operator may operate a segment of pipeline found to be in satisfactory condition, considering it's operating and maintenance history, at the highest actual operating pressure to which the segment was subjected during the 5 years preceding the applicable date in the second column of the table in paragraph (a)(3) of this section.

§192.619(c)

Design = 720#

Test Pressure = 1500#

MOP = 850#

§192.619 - All Pipelines

Plastic Pipeline

Lowest **of the following:**

(a)(1) Design

(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

§192.619 - All Pipelines

Plastic Pipeline

Lowest **of the following:**

(a)(1) Design ←

(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator **(For de-rating only)**

Design of Pipe and Components

Pipe

- For Steel - §192.105
- For Plastic - §192.121

Components

- Manufacturers Rating

§192.121 - Design of Plastic Pipe

$$P = \frac{2S \times 0.32}{(SDR - 1)}$$

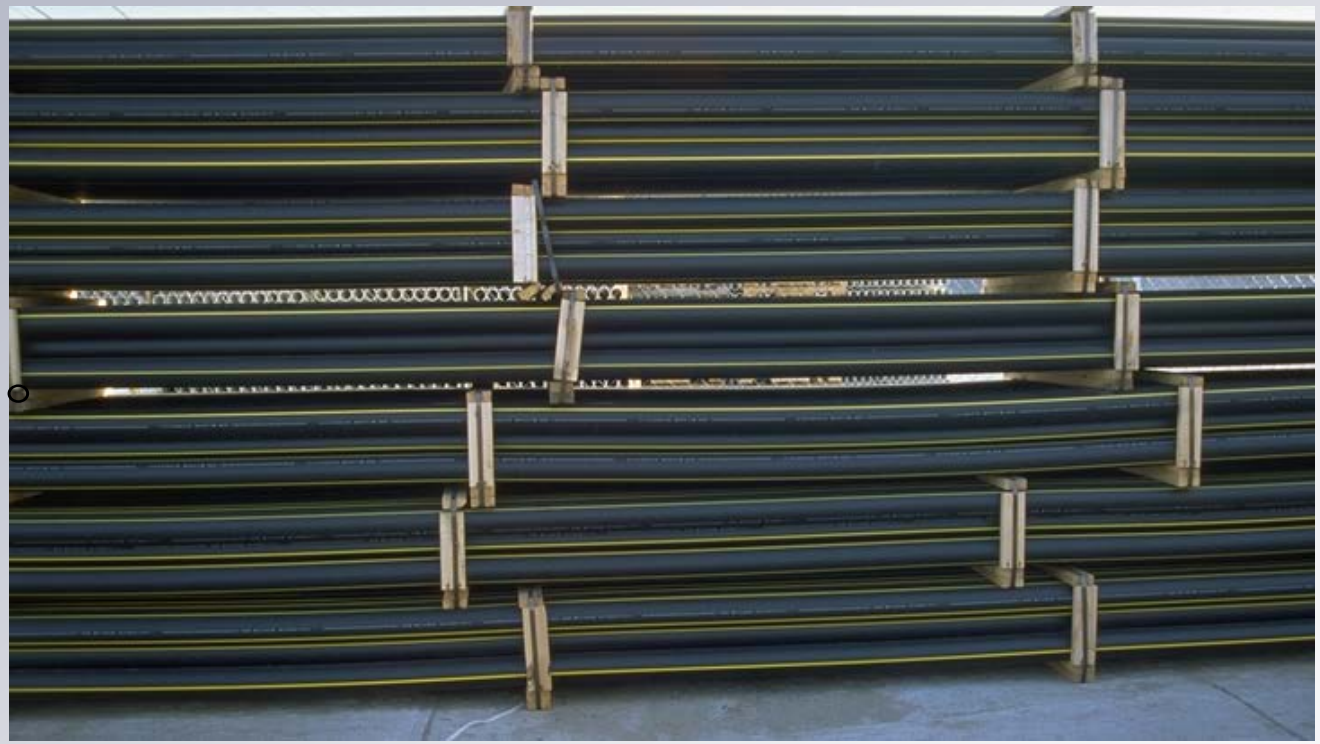
- P = Design Pressure
- S = Long Term Hydrostatic Strength - estimated tensile hoop stress that when applied continuously failure of the pipe at 100,000 hours (11.43 years) - *(HDB - Hydrostatic Design Base)*
- SDR = Standard Dimension Ratio = outside diameter /wall thickness

Hydrostatic Design Base

Thermoplastic Pipe

Piping Material	73º F	100º F	120º F	140º F
2406	1250	1250	1000	800
3408	1600	1250	1000	800

Pipe Specifications



PE 3408
ASTM - D2513
4" Diameter,
SDR = 11
Ambient Temp. 84° F

§192.121 - Design Pressure

$$P = 2S/(SDR - 1) \times 0.32$$

$$P = \frac{(2)(1250)}{(11 - 1)} \times 0.32 = 80\#$$

P = 2S/(SDR -1) x 0.32

73 ºF

P = (2)(1600) / (11-1) x 0.32 = 102#

100 ºF

P = (2)(1250) / (11-1) x 0.32 = 80#

120 ºF

P = (2)(1000) / (11-1) x 0.32 = 64#

140 ºF

P = (2)(800) / (11-1) x 0.32 = 51#

Design Pressure

Plastic Pipe

Piping Material	73 °F	100 °F	120 °F	140 °F
2406	80	80	64	51
3408	102	80	64	51

SDR = 11

§192.619 - All Pipelines

Plastic Pipeline

Lowest **of the following:**

(a)(1) Design = 80#

(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

§192.619 - All Pipelines

Plastic Pipeline

For Plastic - Test Pressure / 1.5

Test Pressure - 1964 = 95#

95 / 1.5 = 63#

§192.619 - All Pipelines

Plastic Pipeline

Lowest **of the following:**

(a)(1) Design = 80#

(a)(2) Test Pressure = 63#

(a)(3) MOP during the 5 years preceding the applicable date

(a)(4) Maximum Safe Pressure determined by the Operator

(For de-rating only)

MOP

- **Highest actual operating history for the 5 years preceding the applicable date in §192.619 (a)(3)**

Unless:

- **Tested in accordance §192.619(a)(2) after July 1, 1965**
- **Uprated in accordance with Subpart K of this part.**

MOP

Operating Charts for 1968 - 45#

§192.619 - All Pipelines

Plastic Pipeline

Lowest **of the following:**

(a)(1) Design = 80#

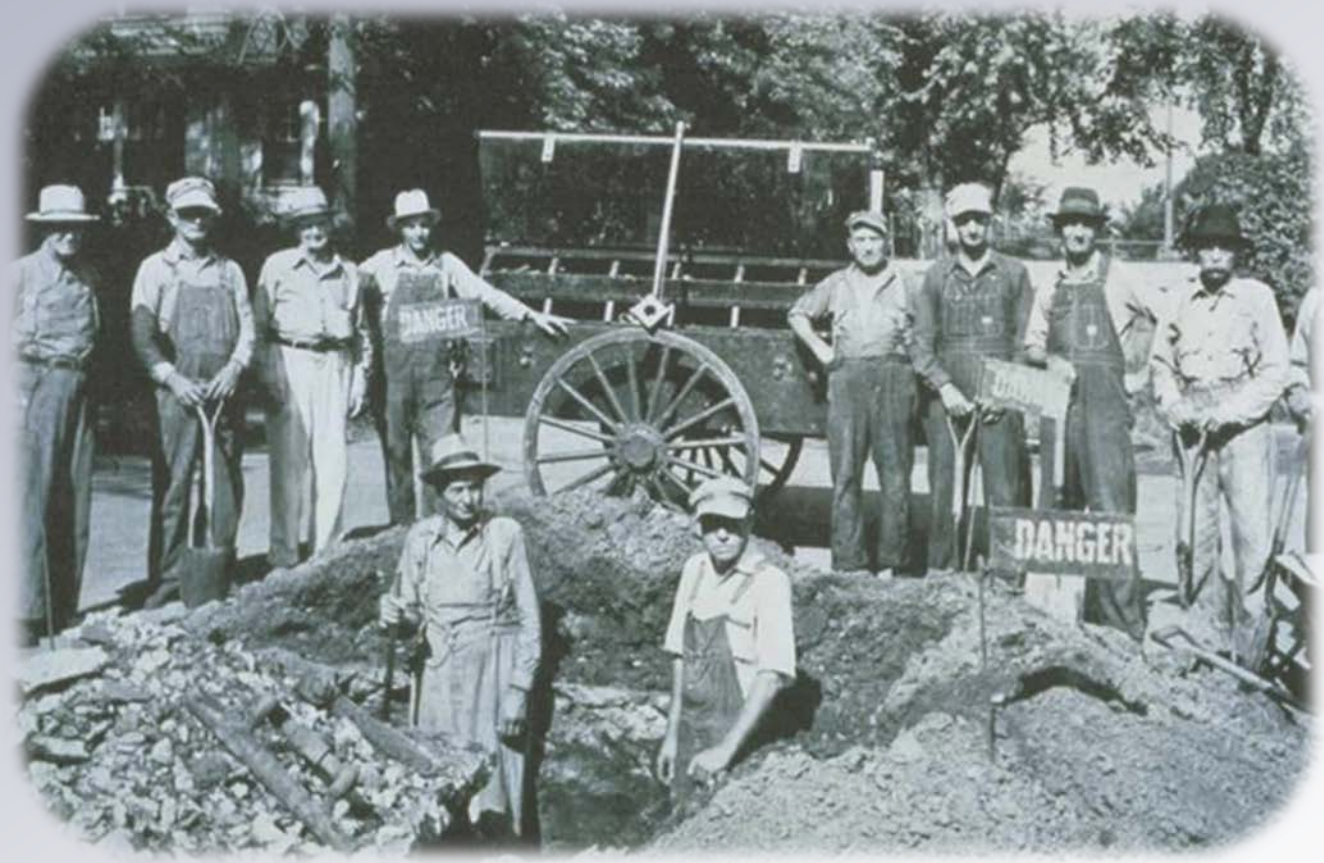
(a)(2) Test Pressure = 63#

(a)(3) MOP = 45#

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

Maximum Safe Pressure

Considering:



- **History**
- **Corrosion**
- **Actual Operating Pressure**

(For de-rating only)

For Distribution

From §192.619 carry over determined MAOP

Does §192.619(c) apply?

- **High Pressure Distribution - §192.621**
- **Low Pressure Distribution - §192.623**

High Pressure Distribution System

Means a distribution system in which the gas pressure in the main is higher than the pressure provided to the customer.

(Service Regulators)

§192.621 MAOP: High-Pressure Distribution Systems.

Lowest **of the following:**

(a)(1) Design

(a)(2) 60# - unless service lines equipped with pressure limiting devices meeting §192.197(c)

§192.621 MAOP: High-Pressure Distribution Systems.

Lowest **of the following:**

(a)(1) Design ←

(a)(2) 60# - unless service lines equipped with pressure limiting devices meeting §192.197(c)

§192.621 MAOP: High-Pressure Distribution Systems.

Lowest of the following:

(a)(1) Design = 80#

(a)(2) 60# - unless service lines equipped with pressure limiting devices meeting §192.197(c)

§192.621 MAOP: High-Pressure Distribution Systems.

Lowest **of the following:**

(a)(1) Design = 80#

(a)(2) 60# - unless service lines equipped with pressure limiting devices meeting §192.197(c)

§192.619(a)(3) ***45#***

((a)(3) MOP during the 5 years preceding the applicable date)

§192.621 MAOP: High-Pressure Distribution Systems
Additional Limitations

(a)(3) Cast Iron Pipe 25# if there are Unreinforced Bell and Spigot Joints

(a)(4) The Pressure Limits of Joints

(a)(5) Maximum Safe Pressure determined by the Operator (Must provide Overpressure Protection per §192.195)

Low Pressure Distribution System

Means a distribution system in which the gas pressure in the main is substantially the same as the pressure provided to the customer.

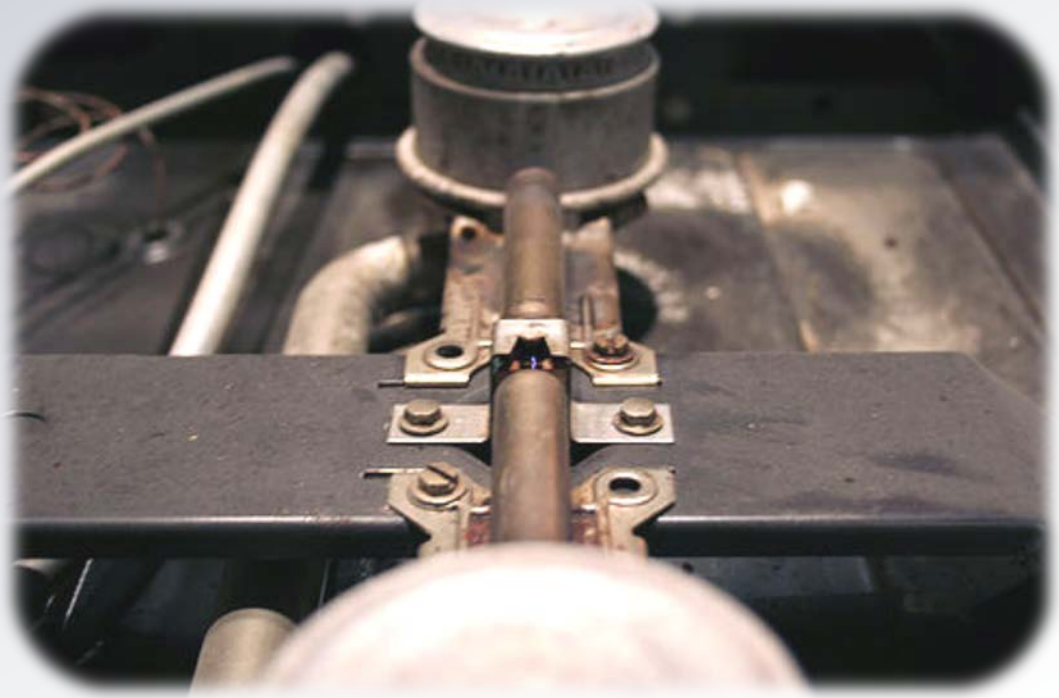
(No Service Regulators)

§192.623 Low-Pressure Distribution Systems: *Maximum* and Minimum Allowable Operating Pressure

Pressure high enough to make unsafe the operation of properly adjusted low-pressure gas burning equipment.

§192.623 Low-Pressure Distribution Systems: Maximum and *Minimum* Allowable Operating Pressure

Pressure lower than the minimum pressure at which the safe and continuing operation of any properly adjusted low-pressure gas burning equipment can be assured.



Information Websites

PHMSA Training and Qualification

http://www.phmsa.dot.gov/pipeline/tq

PHMSA Pipeline Safety Regulations

http://www.phmsa.dot.gov/pipeline/tq/regs