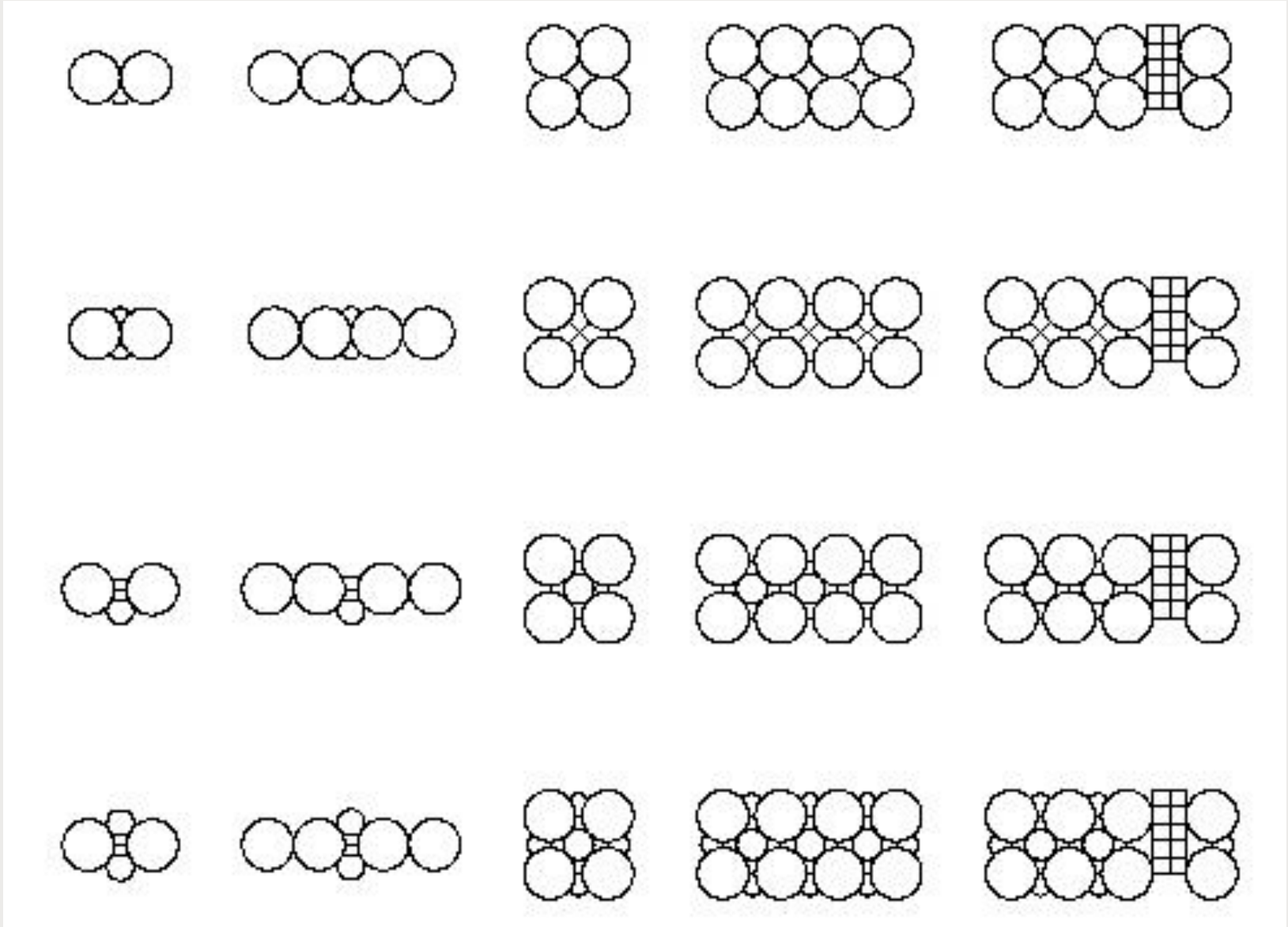
Start of Part 2

STORAGE

- Concrete silos & steel bins
  - Most common types of commercial grain storage structures
    - Store large quantities of grain
    - Relatively low cost
  - Building life
    - Up to & more than 100 years
  - Variety of sizes & configurations
    - Heights: 100 to 150 ft
    - Diameters: 20 to 100 ft
    - No such things as a “standard elevator”
      - Each client has different
        - Needs, requirements, opinions

STORAGE

- Number of grains
- Material movement through facility
- Dust
- Segregation
- Identify preservation
- Flexibility



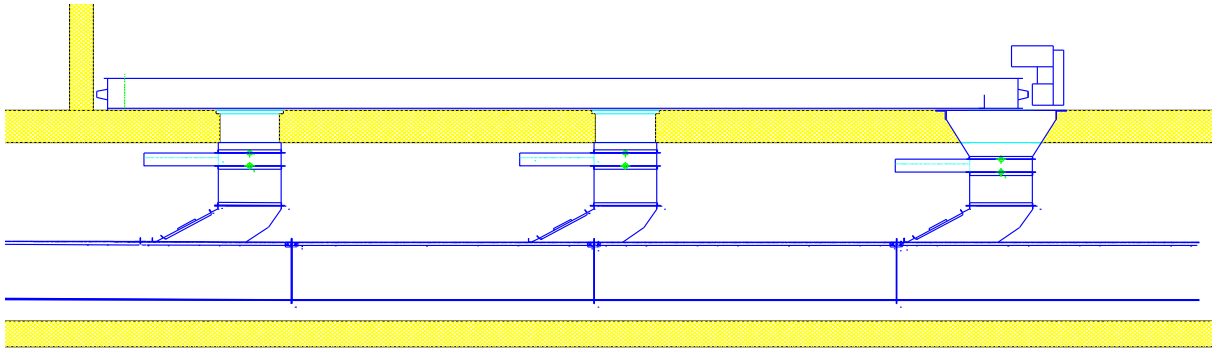
RECLAIM SYSTEMS

- Purpose
  - Remove grain from storage locations and transfer to shipping system (loadout)
- Design considerations
  - Equipment must be sized to meet loadout requirements
    - Typically ≥ 50,000 bu/hr
  - Bin-bottom & discharge design
    - Hopper-bottom (auto-cleanout)
      - Side draw vs. eccentric discharge vs. central discharge
    - Flat floor
      - Multiple discharges + final cleanout
        - Bin sweep augers vs. skid-steer loaders

RECLAIM

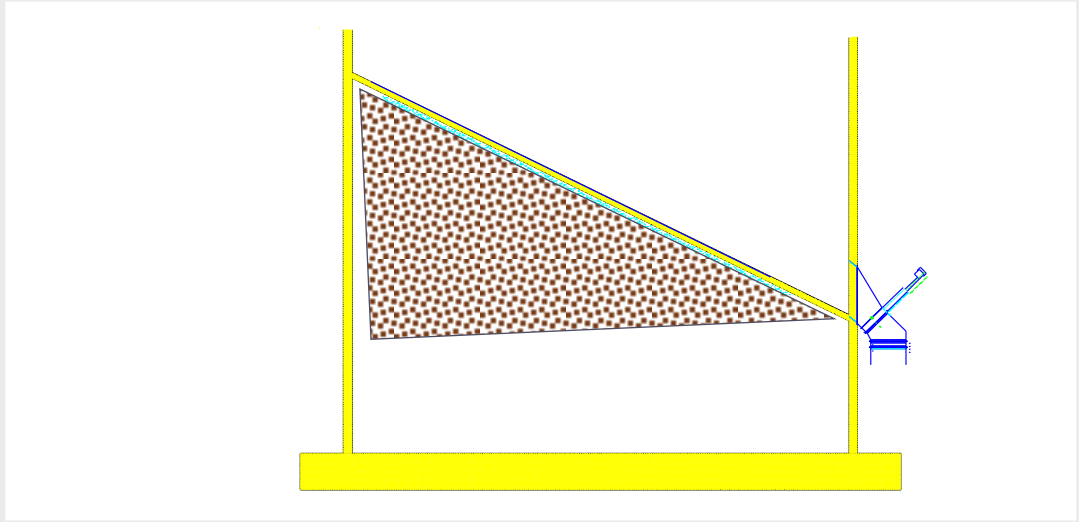
RECLAIM SYSTEMS

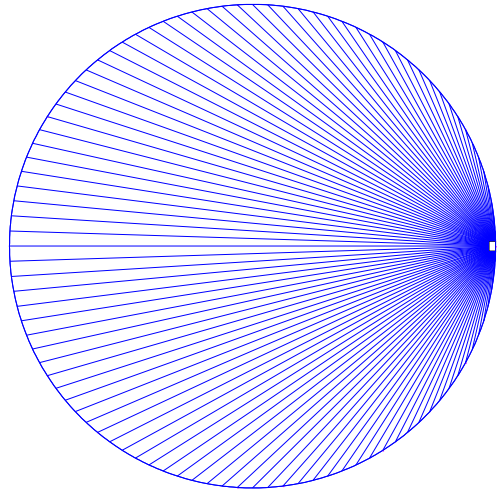
- Effective storage volume
  - Affected by silo bottom
    - Cylindrical flat floor

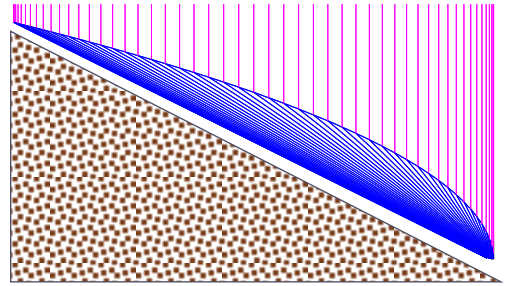


RECLAIM

- Effective storage volume
  - Affected by type of silo bottom
    - Flat floor
    - Central discharge vs. side draw
    - Conical
    - CAD solid modeling essential







RECLAIM SYSTEMS

40,000 BPH

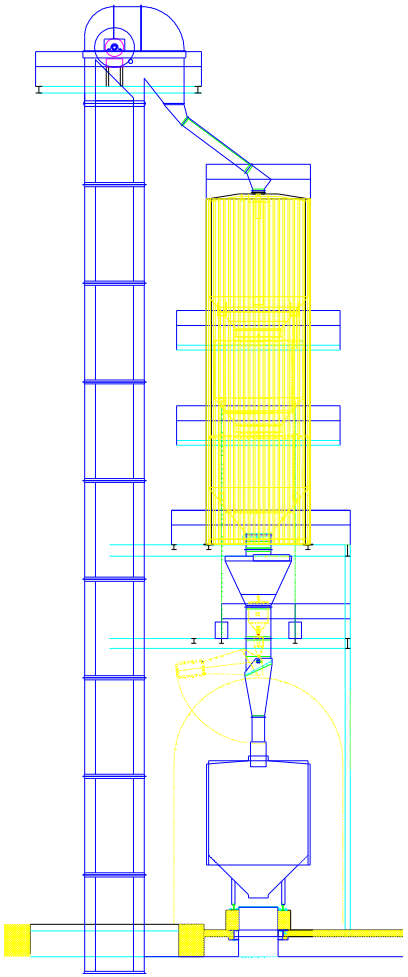

40,000 BPH

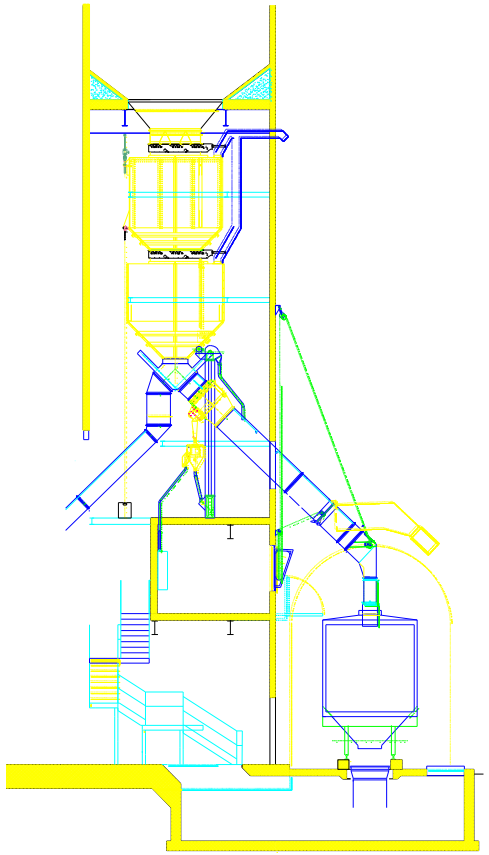
LOADOUT SYSTEMS

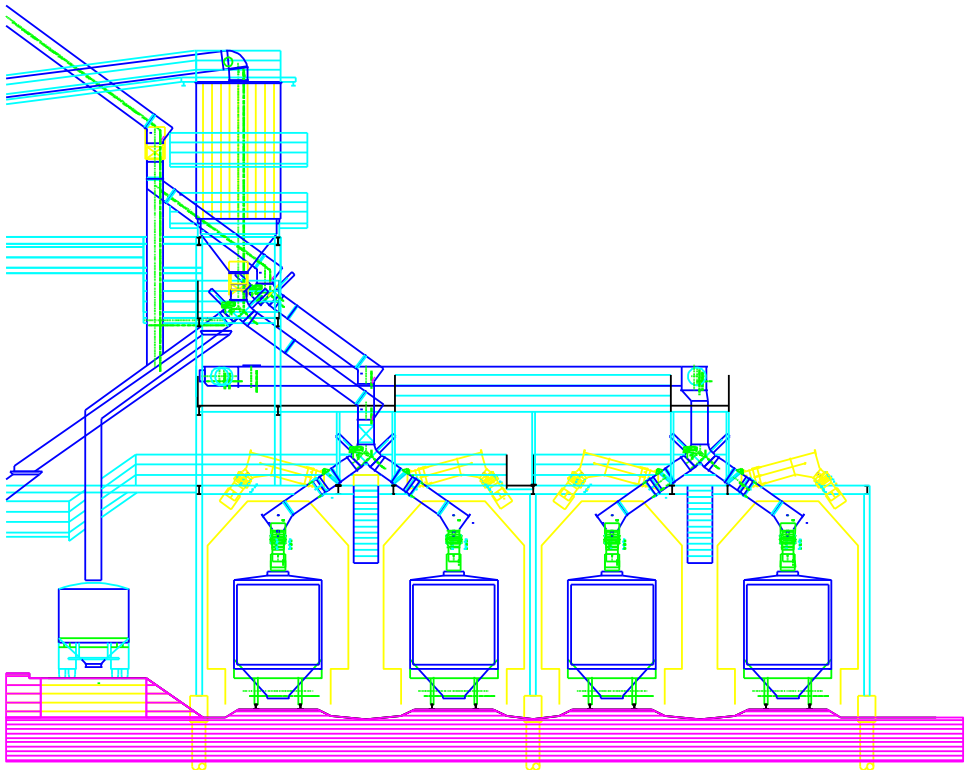
- Purpose
  - Transfer grain to shipping containers
    - Typically rail cars (sometimes trucks)
- Design considerations
  - Equipment sized for speed and labor efficiency
    - Typically ≥ reclaim rate (≥ 50,000 bu/hr) – prevent delays
    - 110-car unit trains loaded in <15 hr; < 24 hr (railroad regulations & incentives)
  - Typical equipment used
    - Overhead surge bins with support structures vs. mechanical fill
      - Can be system bottleneck
    - Bulk weigh scales
    - Spouting with sampler & diverter
    - 3 common options

LOADOUT SYSTEMS

- 3 common types







LOADOUT SYSTEMS

Gravity

Mechanical

Combination

LOADOUT SYSTEMS

- Unit train loading
  - Bulkweigher, spouting, reclaim/recycle from train
  - Size system to meet railroad requirements

Number of Train Cars	110				Car Size (ft3)	3500	4750	5160			
CAR YARD					Car Size (bu)	2812.464844	3816.916574	4146.376742	3500 ft^3	4750 ft^3	5160 ft^3
Bulkweigher Capacity (BPH)	Fill (BPM)	Start/End Tasks (min)	Switching (min)	Car Progression (min)	Car Slack (min)	Fill time/car (min)	Fill time/car (min)	Fill time/car (min)	Train Fill Time (h)		
50000	833.333333	60	30	2	2	3.37	4.58	4.98	15.02	17.23	17.96
60000	1000	60	30	2	2	2.81	3.82	4.15	13.99	15.83	16.44
70000	1166.66667	60	30	2	2	2.41	3.27	3.55	13.25	14.83	15.35
80000	1333.33333	60	30	2	2	2.11	2.86	3.11	12.70	14.08	14.53

Number of Train Cars	110				Car Size (ft3)	3500	4750	5160			
LOOP TRACK					Car Size (bu)	2812.464844	3816.916574	4146.376742			
Bulkweigher Capacity (BPH)	Fill (BPM)	Start/End Tasks (min)	Switching (min)	Car Progression (min)	Car Slack (min)	Fill time/car (min)	Fill time/car (min)	Fill time/car (min)	Train Fill Time (h)		
50000	833.333333	0	0	2	2	3.37	4.58	4.98	13.52	15.73	16.46
60000	1000	0	0	2	2	2.81	3.82	4.15	12.49	14.33	14.94
70000	1166.66667	0	0	2	2	2.41	3.27	3.55	11.75	13.33	13.85
80000	1333.33333	0	0	2	2	2.11	2.86	3.11	11.20	12.58	13.03

ADDITIONAL THOUGHTS

- Maintenance
- Inspections
- Operational flexibility
- Cleaning

ADDITIONAL THOUGHTS

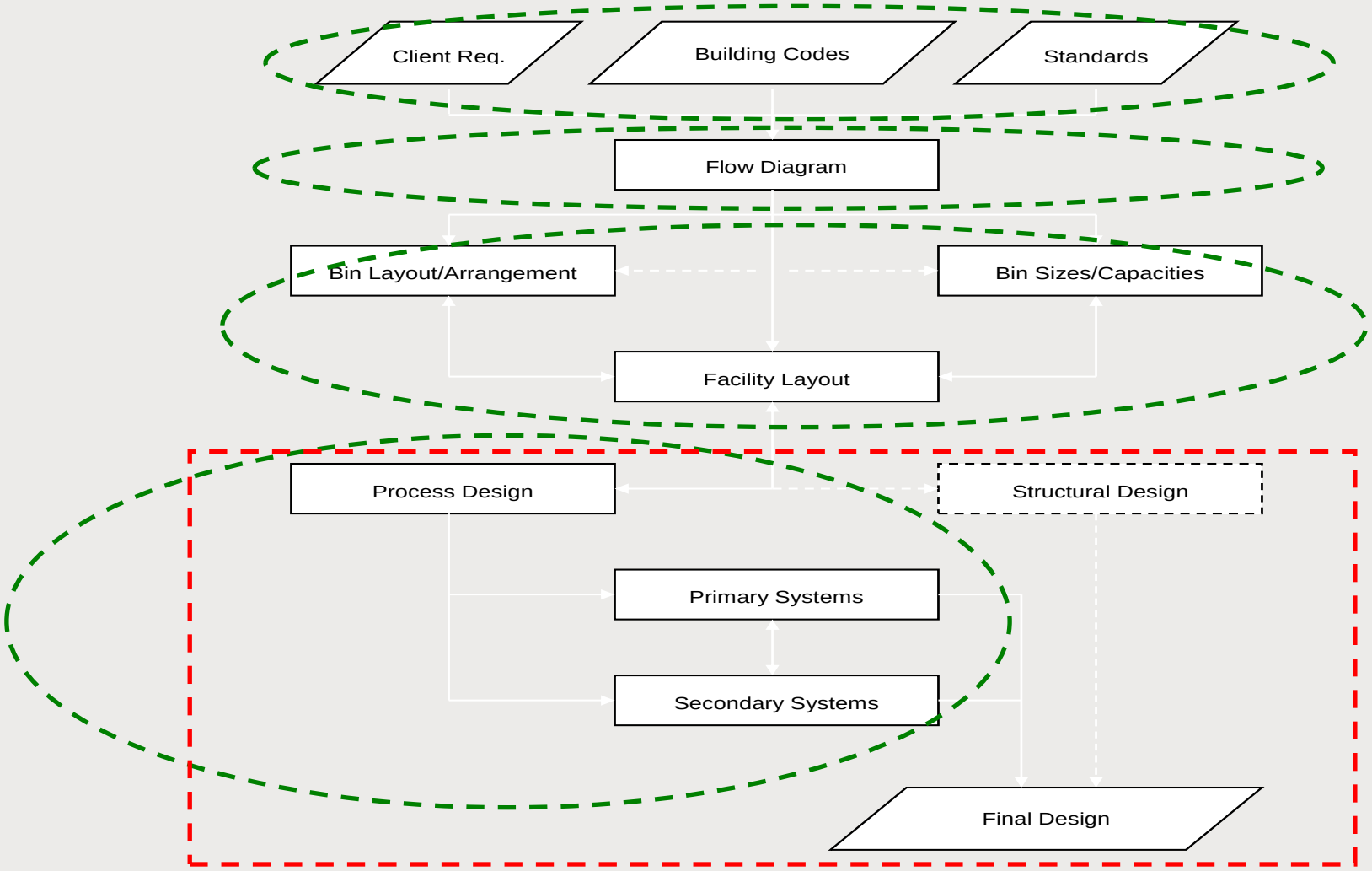
ADDITIONAL THOUGHTS


GSI
GSI
GSI


Boot area

FACILITY DESIGN

- Dynamic process
  - 5 main stages



FINAL THOUGHTS

- Brief overview of design & operation considerations
  - Each commercial facility is unique
    - Many styles, layouts, and options
    - Many common features and equipment

- Ultimately, design and operation based on owner preferences
  - But, knowledge of processes is extremely useful

THANK YOU!

Any questions?