An aerial, black and white photograph of an industrial city. In the center, a large railway yard is filled with numerous freight trains and tracks. To the left, a large, multi-story industrial building with a prominent chimney stack is visible. In the foreground, a street scene shows several vintage cars from the mid-20th century. A building on the left has a sign that reads "LYNN & BOYLE CO". In the background, a hillside is covered with residential houses. The overall scene depicts a bustling industrial and urban environment.

# Prototype Structure Modeling

Research and Development

Nelson P. Moyer

# Introduction

- Retired in 2008 and joined the Hawkeye Model Railroad Club in 2009
- Worked in the NMRA Achievement program to earn MMR in 2011
- Introduced to prototype modeling during the process
- Chose to model the CB&Q Burlington, IA yard and the branch line from Burlington to Washington, IA
- Started building my layout in 2012
- Finished benchwork, track, wiring, lighting, and control panels in 2019
- Acquired motive power, built 188 resin kits, and uncounted plastic kits from Accurail, Branchline, Intermountain, Proto 2000, and Red Caboose in the interim
- Time to build structures

# Structure Progress

- Started planning and construction of the grain elevator in Burlington and posted a few in progress photos on the Proto-Layouts io Group in March and April
- Lonnie Bathurst saw them and asked me to do a clinic at the St. Louis RPM
- Doctor scheduled cataract surgery July 19<sup>th</sup>
- Canceled RPM clinic and lay the elevator aside
- Built several Cornerstone kits for branch line grain elevators and oil jobbers
- Started the Burlington coal pocket, sand drying house and sand tower, freight house, water treatment plant, and storehouse

# Naperville RPM Invitation

- August 13<sup>th</sup> Steve Hile asked me to do a clinic here and we choose Prototype Structure Modeling – R&D as the title since I was building so many structure at the same time
- Surgery went well but there was a long delay before I could get new glasses
- Used a x4 Optivisor for closeup work until September 18<sup>th</sup> , which really slowed me down
- Result – none of the yard structures are finished

# Agenda for Today

- Limit talk to yard structures in progress
- Discuss research and development phases
- Show prototype and model yard design
- Discuss decision points
- Talk about planning and design processes
- Briefly mention selection of materials
- Give a short history of the prototype structures
- Show pictures of prototype structures
- Show in progress pictures of the models

# Prototype Modeling

- Creation of structures that exist or once existed in your scale of choice
- You don't have to be a prototype modeler to want a prototype structure on your layout, so this talk applies to everyone
- Prototype modeling takes many forms
  - Kits based upon a generic prototype, e.g. Tichy water cranes and water towers
  - Kits based upon a specific railroad prototype, e.g. AMB Laserkits for CB&Q Wood interlocking tower and the West Burlington depot
  - Kits that are close to a prototype and can be enhanced or kitbashed to conform
  - Scratchbuilt structures

# Prototype Modeling

- Creation of structures that exist or once existed in your scale of choice
- You don't have to be a prototype modeler to want a prototype structure on your layout, so this talk applies to everyone
- Prototype modeling takes many forms
  - Kits based upon a generic prototype, e.g. Tichy water cranes and water towers
  - Kits based upon a specific railroad prototype, e.g. AMB Laserkits for CB&Q Wood interlocking tower and the West Burlington depot
  - Kits that are close to a prototype and can be enhanced or kitbashed to conform
  - Scratchbuilt structures

# Information Sources

## ➤ Publications

### ➤ Railroad Historical Societies

#### ➤ Burlington Route Historical Society Burlington Bulletins

➤ BB#23 Burlington, Iowa

➤ BB#30 The Burlington & Western and the Burlington Northwestern Narrow Gauge Branch Lines, also a pictorial titled Charles Franzen's Washington

### ➤ Historical Society Web sites

#### ➤ BRHS

➤ Alignment charts

➤ Photographs

➤ Paint Standards

### ➤ Photographs

➤ Those you take

➤ Those you buy

➤ Those given to you by friends



# Information Sources (cont.)

- Books
  - Railroad histories
  - Railroad Cyclopedias
  - Railroad Manuals
  - AAR and ARA publications
  - Morning Sun and other color books
- Periodicals
  - Hobby magazines
  - Professional railroad magazines
- Sanborn Insurance Maps
- Prototype Drawings
- Museums
- Libraries
- The World Wide Web
- Facebook

# Quality of Information

- Railroad drawings and plans – High
- On-site measurements – moderately high
- Photograph scaling – moderate to low
- All other sources – It depends upon the source
- Your model will be only as good as you're information
- Additional information always becomes available after you've built the model

# Limitations of Photographs

- View angles – more are better, when sides of a structure are missing, place the unknown sides toward the backdrop if possible
- Poor images
  - Structure image in background behind primary subject
  - Structure partially obscured by rolling stock, vegetation, other structures, etc.
  - Blurry, grainy, and low resolution images
  - Overexposed and dark images
- Grayscale images – no information about color
- Type of film – Kodachrome vs. Ektachrome
- Lighting – weather, time of year, time of day

# Ravages of Time

- Structures deteriorate, roofing material may be changed, windows and doorways may be boarded over, or other structural changes alter the original configuration.
- Structures that have been moved to another location will be altered in some way, especially for the foundation
- Structures will be modified by new owners
- CB&Q standard paint schemes were overpainted with white paint after the Burlington Northern merger.
- You can only measure and photograph what remains

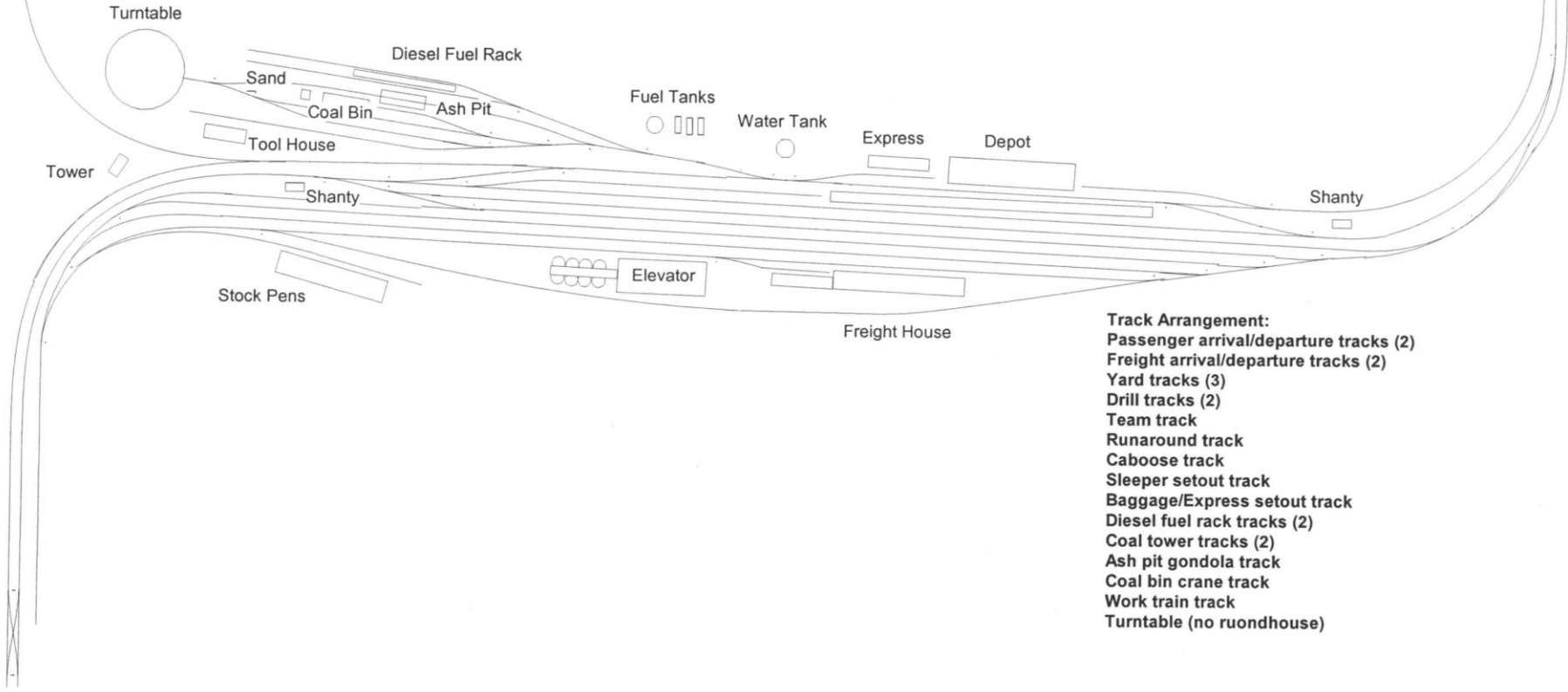
# Structure Compromises

- The elevator
  - All dimensions, especially width
  - Space limitations
- The freight house
  - Both width and length
  - Space limitations
- The water treatment plant
  - Poor images
  - Limited information from Sanborn map
- The storehouse
  - Obscured image
- The depot
  - Space limitations – cut in half longitudinally and against the backdrop
- The stock yard
  - Space limitations – only the loading chutes modeled, the pens are in the aisle

# Burlington Yard – Hard Choices



# Burlington Yard Track Plan



- Track Arrangement:**
- Passenger arrival/departure tracks (2)
  - Freight arrival/departure tracks (2)
  - Yard tracks (3)
  - Drill tracks (2)
  - Team track
  - Runaround track
  - Caboose track
  - Sleeper setout track
  - Baggage/Express setout track
  - Diesel fuel rack tracks (2)
  - Coal tower tracks (2)
  - Ash pit gondola track
  - Coal bin crane track
  - Work train track
  - Turntable (no ruondhouse)

# Hillsboro Depot Example

- Depot moved to the Old Thrashers Reunion grounds in Mt. Pleasant, IA
- The depot was modified by boarding up one window and building a raised picnic and resting area in place of the freight platform
- I measured and photographed the depot, then drew HO scale plans and templates for parts construction, then scratchbuilt the model using styrene and stripwood.
- I scratchbuilt the model using styrene and stripwood. The operator's bay windows are scratchbuilt, but the other windows and the doors are from Tichy, and the chimney is from Campbell Scale models.
- The paper shingles are from GCLaser







RAILWAY EXPRESS AGENCY

CASE

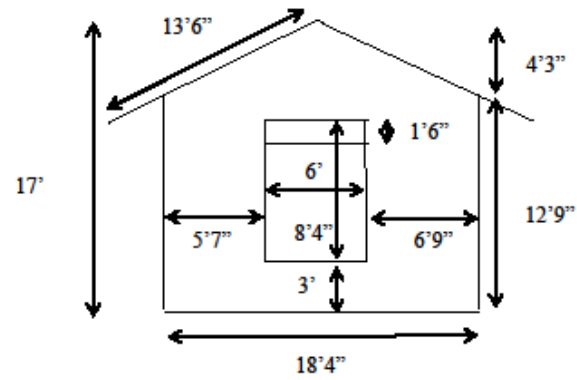
TICKET

# Research and Design Methods

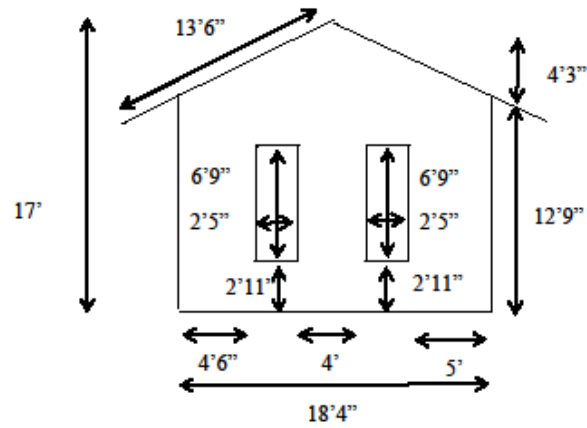
- The depot survived, was preserved, was accessible
- Prototype photos at original location available
- Alignment chart shows position relative to tracks
- No Sanborn map available (town too small)
- Site visit to measure and photograph accomplished

**Hillsboro Depot Elevation Measurements**  
(not drawn to exact HO scale)

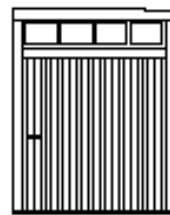
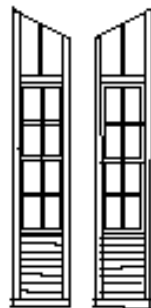
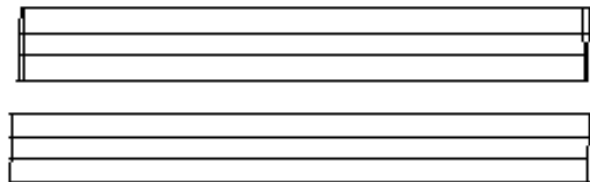
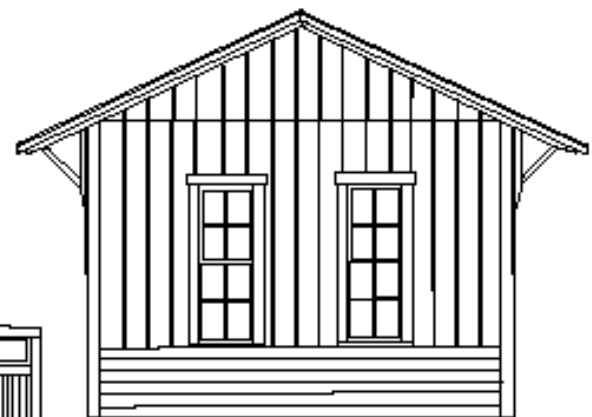
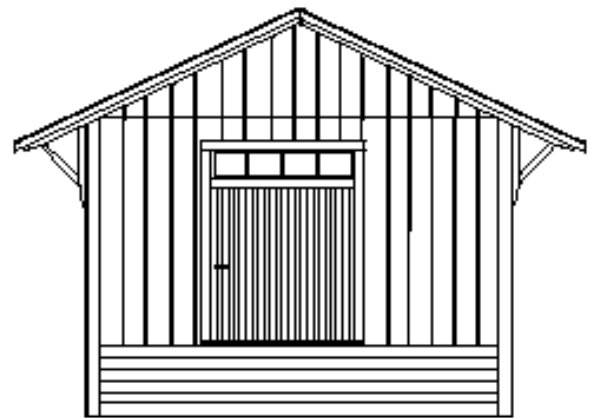
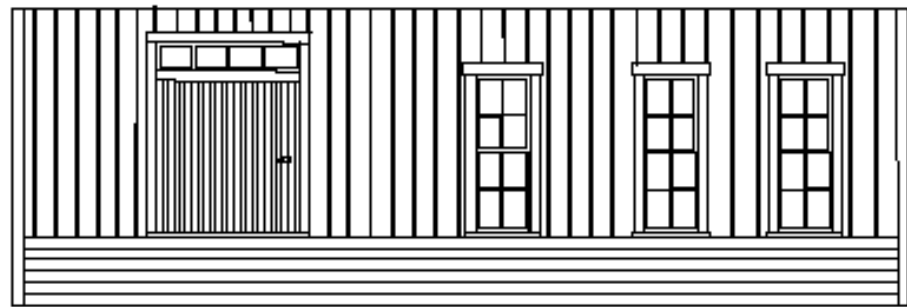
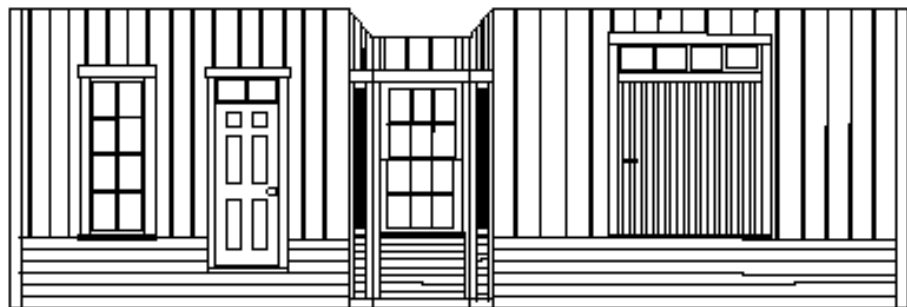
**Freight Door End Wall**




**Waiting Room End Wall**

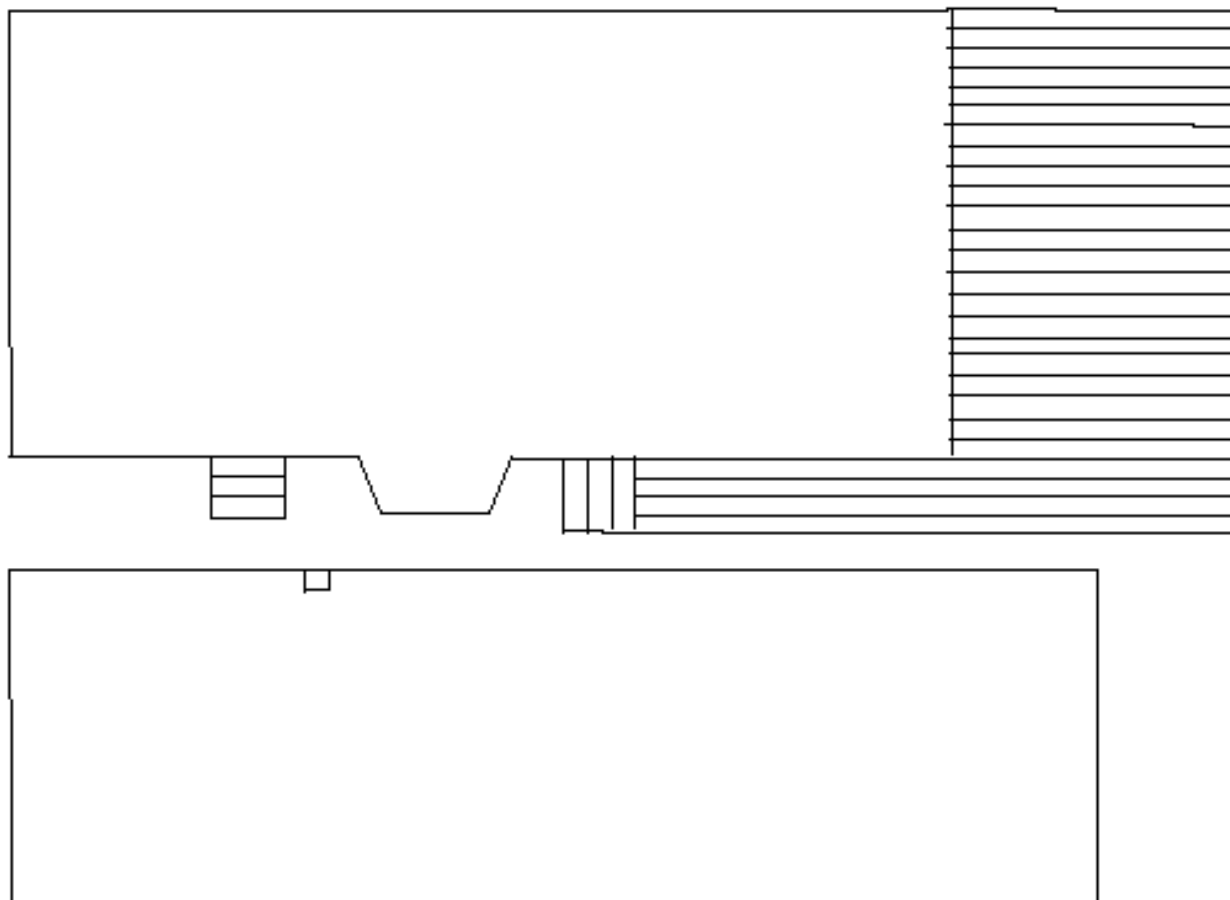


# CB&Q Hillsboro Depot



HO Scale - 3.5 mm = 1 ft. 

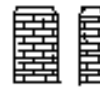
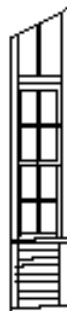
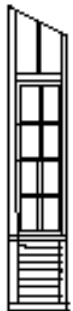
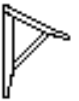
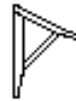
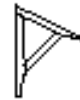
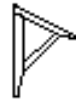
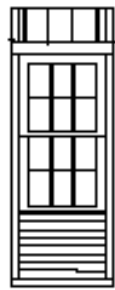
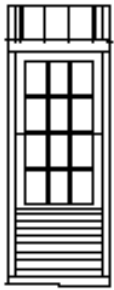
# CB&Q Hillsboro Depot




HO Scale - 3.5 mm = 1 ft.



# CB&Q Hillsboro Depot



HO Scale – 3.5 mm = 1 ft. 

# Hillsboro Depot – Front View





# Hillsboro Depot – Back View



# Burlington Yard – Track Level



**Burlington  
Route**

*Photos courtesy of Chicago Burlington & Quincy Railroad Company Archives, The Newberry Library, Chicago.  
Call Numbers: MS CB&Q GR566, Top Left – MS CB&Q GR201 and Top Right – MS CB&Q GR826.*

# Norris Grain Company

- Export elevator built in 1881, owned by CB&Q
- Sold to Mississippi Grain Co. first decade of 20<sup>th</sup> century
- Sold to Bartlett Frazer sometime in the 1930s
- Sold to Norris Grain Co. sometime after that
- Sold to Archer Daniels in the late 1960 or early 1970s. Photo from 1972 shows ADM ownership
- Elevator originally painted Q standard mineral red with bronze green trim, roof green asphalt shingles
- ADM painted the elevator white

## **Dimensions from 1900 Sanborn map revised in 1952**

Elevator plan 89 ft. x 198 ft., 75 ft. to the eaves

Head house 40 ft. x 186 ft., 142 ft. to the eaves

Power plant on North end of the elevator plan is 40 ft. x 69 ft.

Smoke stack 136 ft. (shortened after the elevator was electrified)

Smoke stack base 12 ft. x 12 ft.

Silo diameter 22 ½ ft.

Silo height 105 ft.

Silo head house 20 ft. x 135 ft.

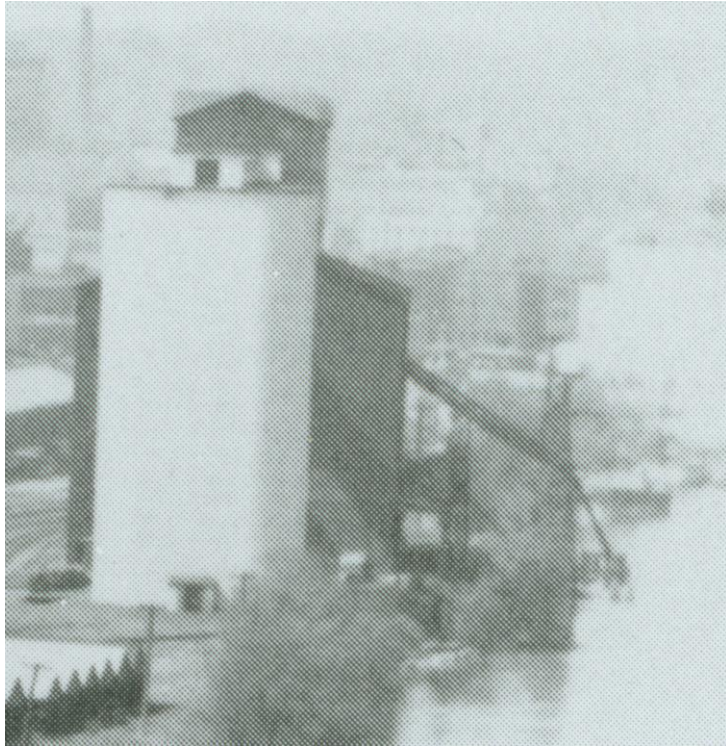
Conveyor house 9 ½ ft. wide and 77 ft. long (height not given, estimated at 10 ft. from length)

Dryer house 17 ft. x 28 ft. 6 in. (scaled from Sanborn map, height not given, estimated at 47 ft. based upon elevator height to the eaves)

# Model Compression Data

<b>Component</b>	<b>Dimension</b>	<b>Ratio</b>
Elevator Length	102 ft.	55%
Elevator Width	40 ft.	45%
Elevator Height to Eves	61 ft.	81%
Head house Length	102 ft.	55%
Head House Width	21 ft.	53%
Head House Height to Eves	94 ft.	67%
Total Elevator Height	98 ft.	65%
Silo Diameter	18 ft.	80%
Silo Height	65 ft.	62%
Silo Head House Length	61 ft.	68%
Silo Head House Width	16 ft.	80%
Conveyor House Length	33 ft.	43%
Conveyor House Width	6 ft.	63%
Conveyor House Height	8.5 ft.	85%
Dryer House Length	13 ft.	46%
Dryer House Width	8 ft.	47%
Dryer House Height	38 ft.	80%
Smoke Stack	68 ft.	50%

# Burlington Elevator Through the Years



**South End 1944**



**North End 1972**

# Cropped and Enlarged Closeup of Norris Grain Co.



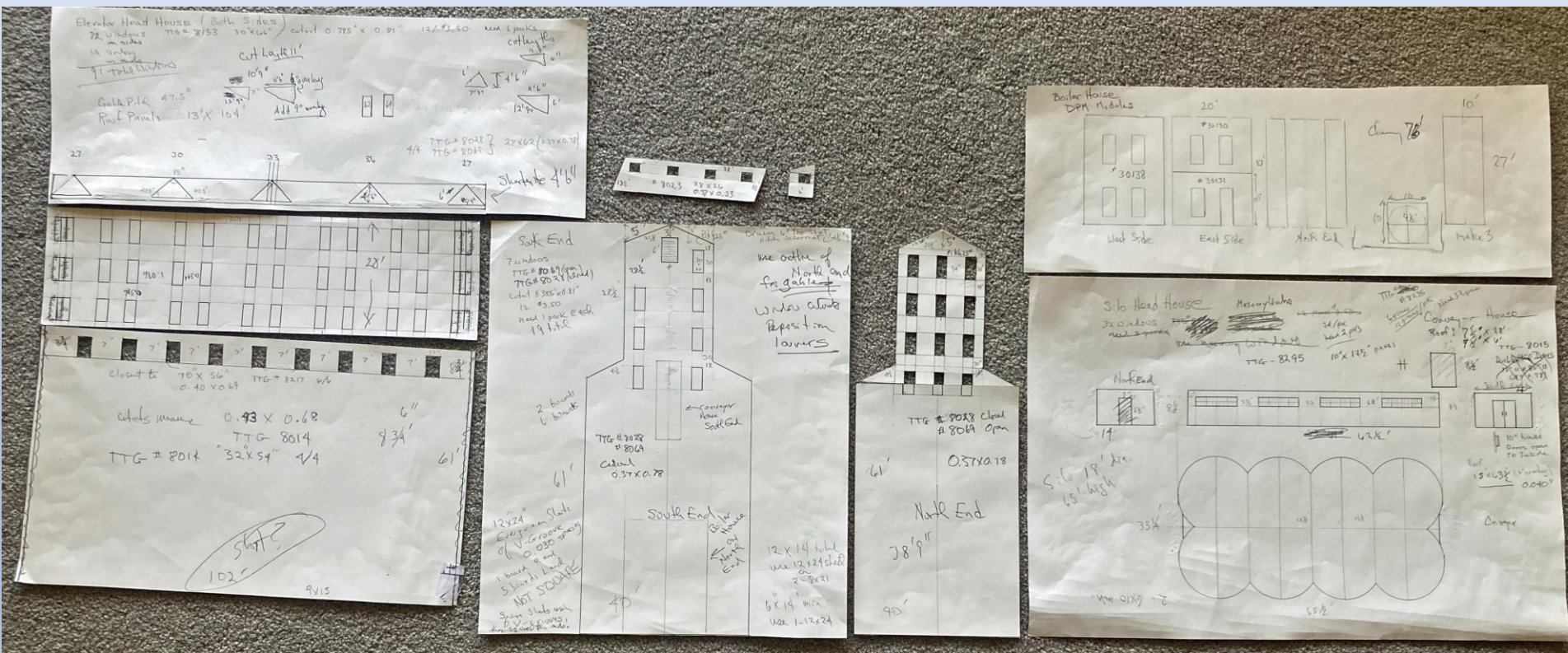
# ADM Elevator in May 1976







# Elevator Drawings in HO Scale Used for Conctruction

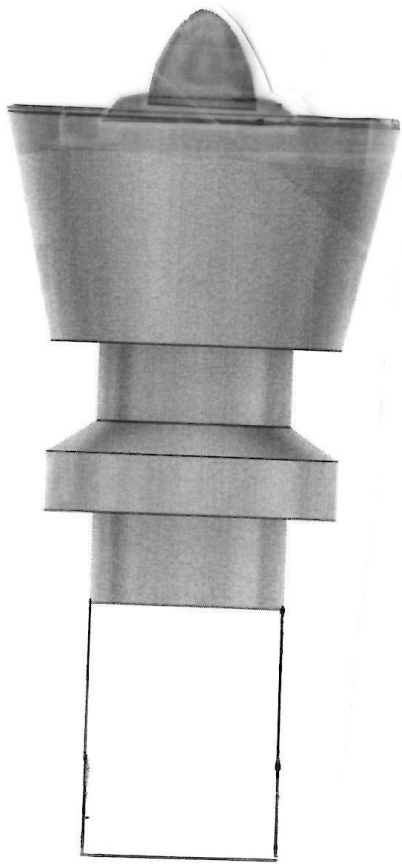


West Side  
Window  
and Vent  
Test Fit



# South End Exhaust Vent, Roof Vent, Window, and Door Test Fit

Vents Drawn and 3D Printed by Scott McDonald



# Norris Grain Company Complex



# The Burlington Freight House

- Built in the 1890 by the Burlington & Missouri River
- Rebuilt and enlarged at point in the teens or twenties
- Wood platform at South end and truck dock with canopy on East side were added at some point
- There was no dock on the West side
- An office building was added to the North end at some point
- The entire structure was brick with a corrugated metal roof
- The freight house had at least 16 bays, but no clear West side photos are known to exist

# West Side of Freight House



# Freight House Office on North End





# South End of Freight House





# Freight House South End with Platform



# Freight House South End with Dock



# Water Treatment Plant

- Little information is available for the water treatment plant, and only two photos are known to exist
- Water was pumped from the Mississippi River for treatment
- The plant consisted of two water towers, the plant building, a boiler house, a 100K treatment tank, a 300K finished water tank, and a 10K fuel oil tank
- Originally, a coal fired boiler supplied steam to the water pumps
- Later, the boiler was converted to use fuel oil

# Water Treatment Plant



# Water Treatment Plant



# Industrial Water Tanks



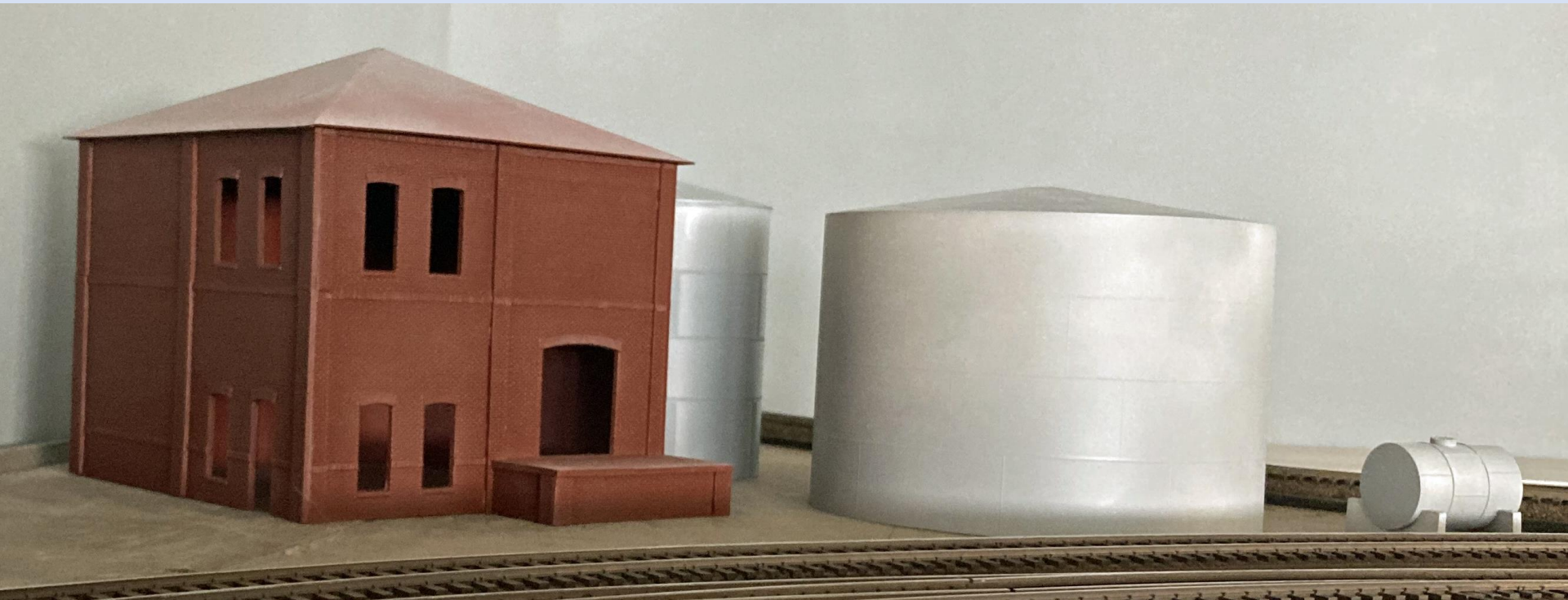
**Roundhouse Water Tank**



**Tichy Model**



# Water Treatment Plant Complex



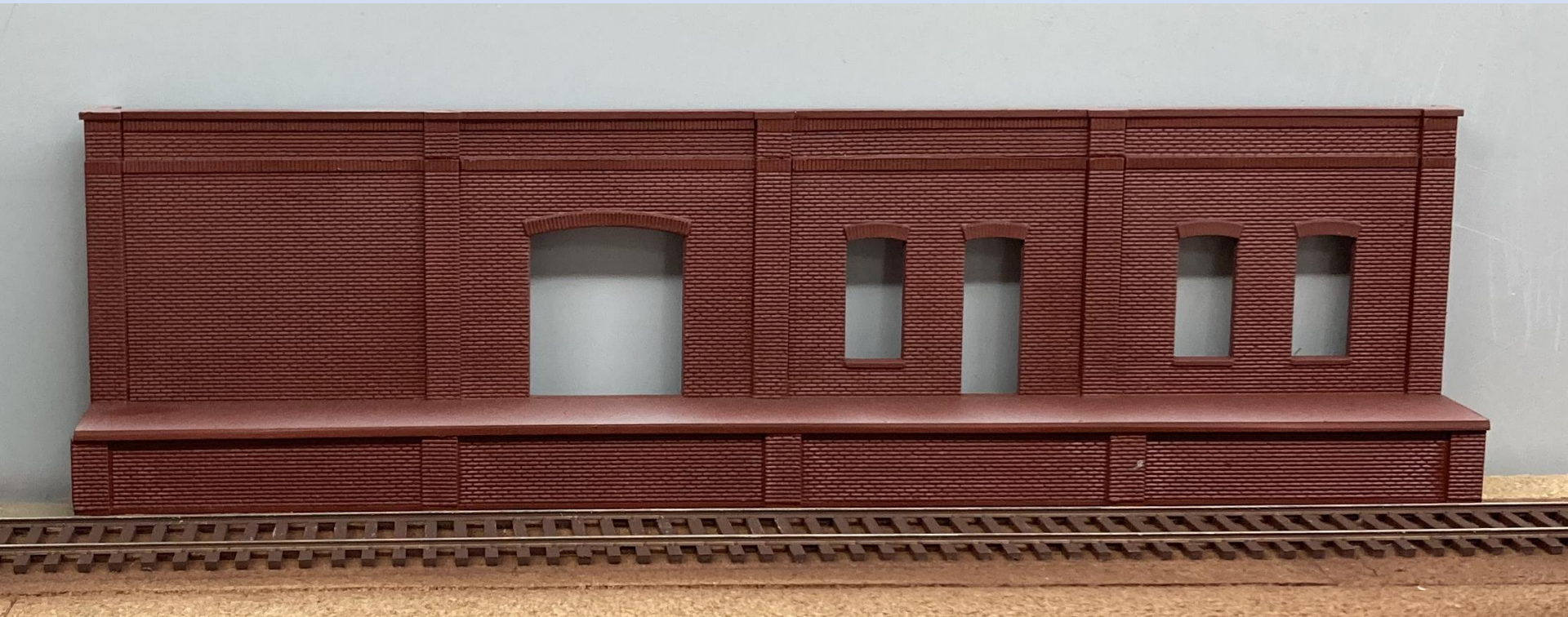
# Burlington Yard Storehouse

- Nothing is known about the storehouse
- One color picture taken in the 1970s is known
- The building was brick with a loading platform with a ramp to grade level ran along the full length of the front
- Most of the structure is obscured behind a converted troop kitchen spotted at the storehouse
- Location and dimensions were taken from a Sanborn map
- The structure was constructed as a background build using DPM panels

# Burlington Yard Storehouse



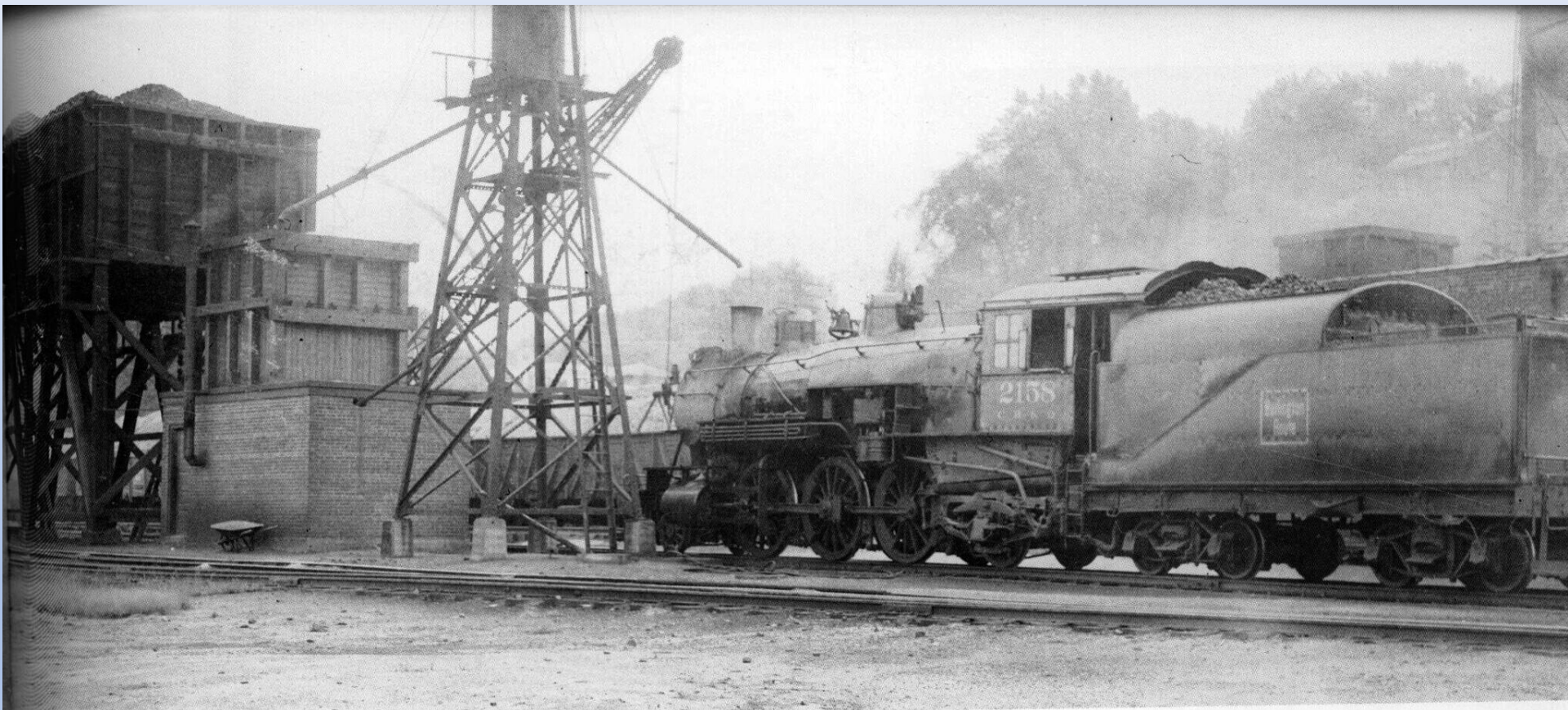
# Burlington Storehouse Model



# Sand Drying House and Sand Tower

- The first photo of the sand tower is dated 1944
- The sand storage and drying facilities were located across the tracks from the sand tower, and no photos have surfaced
- The a small sand drying house with a wood sand hopper on the roof was built between the coal pocket and the sand tower by 1952
- The sand drying stove burned coal
- Sand was loaded into the hopper with a crane and clamshell bucket
- Sand was gravity fed to the dryer, then air pressure moved the dry sand to the storage tank atop the tower
- Sand was delivered to motive power by gravity flow

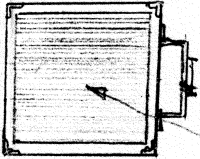
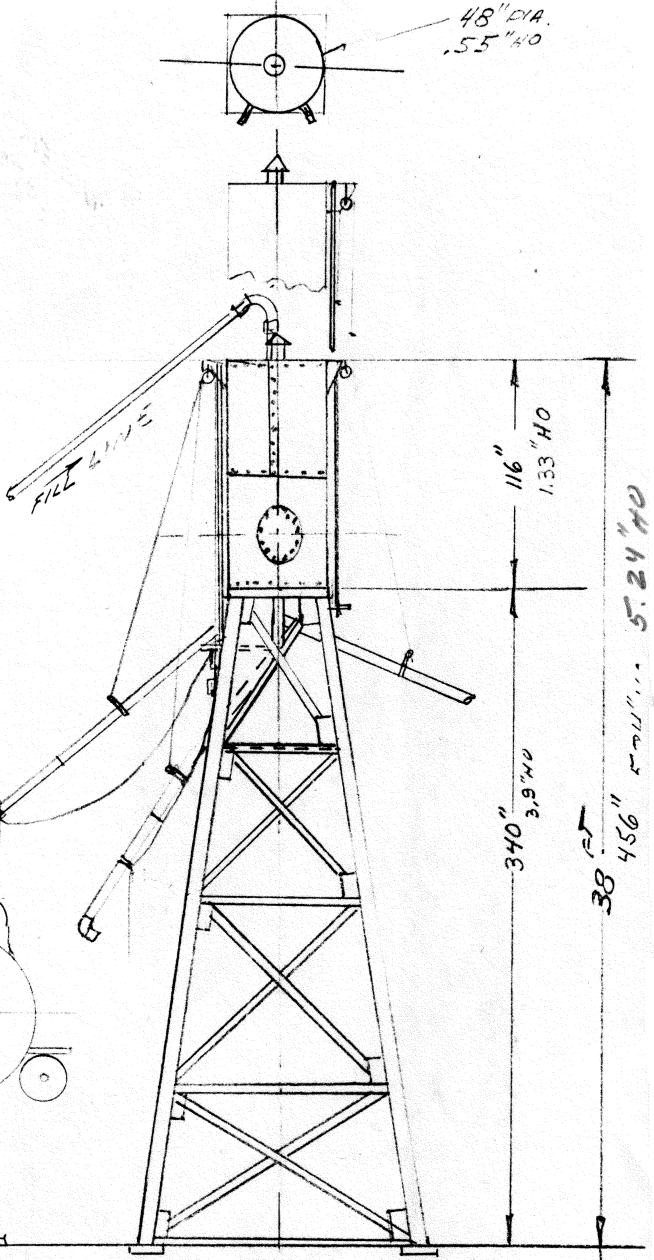
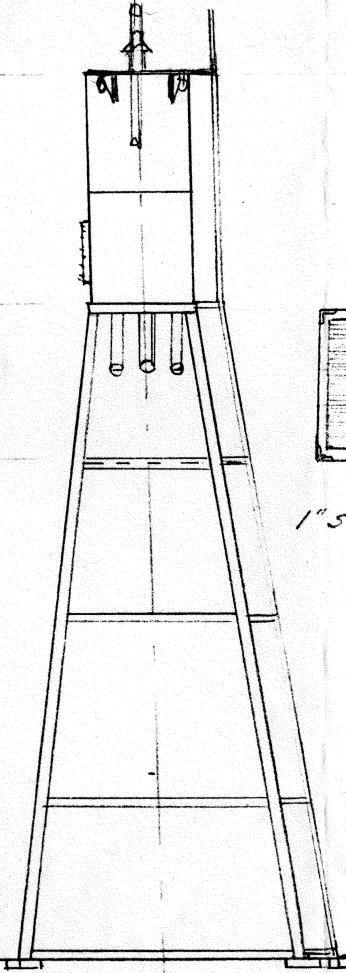
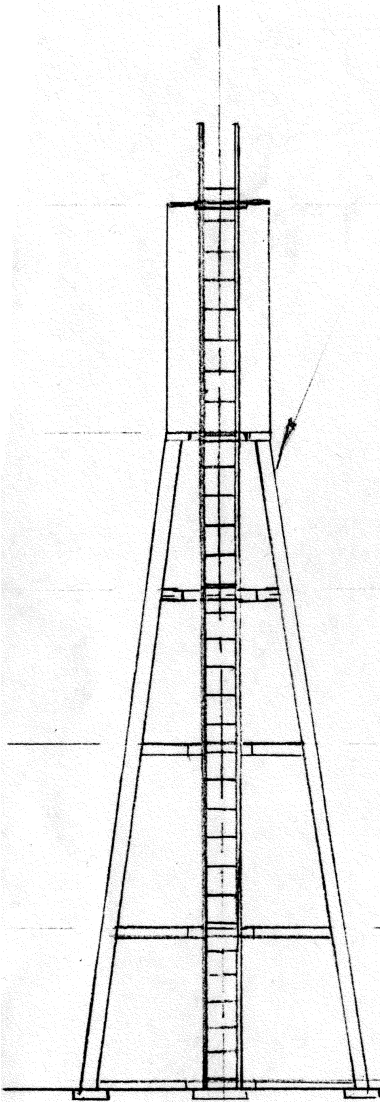
# Sand House and Sand Tower in 1952



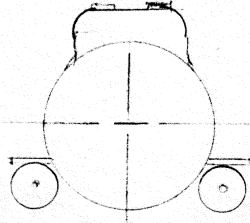
LEGS  
6x6 ANGLE IRON  
1070" x 1070" HO

CROSS BEARS  
AND  
DIAGONALS  
4" x 4" ANGLE IRON  
1045" x 1045" HO

48" DIA.  
1.55" HO



1" STEEL ROD FLOOR  
3RD LEVEL  
ONLY



SAND TOWER AT BURLINGTON TOWH  
HO SCALE  
PWF 1-96 Joe Cook

DIAGONAL BRACES &  
TE ON ALL 4 SIDES

# Sand House Drawings

## Sand Drying House

### Construction Steps

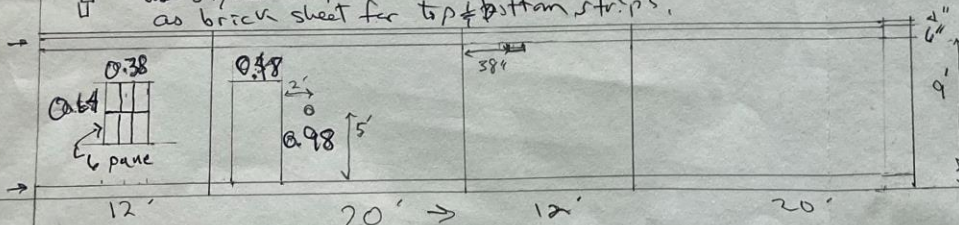
1. Cut brick sheet pieces, including window & door frames. Sides  $\approx 0.125"$  styrene.
2. Box structure, miter edges  $45^\circ$ .
3. Cut  $12 \times 20'$  floor in  $0.080"$  styrene.
4. Glue box floor.
5. Cut corner strips  $\approx 45^\circ$  ends.
6. Glue corner strips to sides.
7. Install window & door.
8. Glaze window (add 2 windows).
9. Add roof support strip inside sides. Roof is recessed  $10"$ .
10. Cut roof from  $0.040"$  styrene and drop roof onto wall supports.

### Styrene Sizes

4" = 0.040  
6" = 0.060  
8" = 0.080

or use 1/8 scale strips

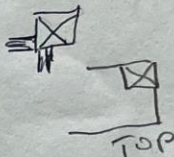
use styrene strips the same thickness as brick sheet for top & bottom strips.



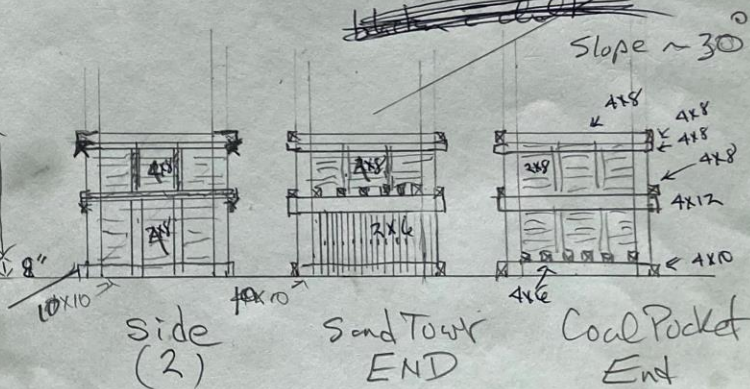
TTG # 1250  
30" X 52"

TTG # 817  
36" X 80"

11. Build bin boards by gluing the edges to edge and trimming to size.
12. Cut  $4 \times 6$  (or  $4 \times 4$ ?) with one  $30^\circ$  end and glue these angles on the two ends as shown in the drawing, supported by the  $4 \times 12$  at the top and the  $4 \times 10$  at the bottom.
13. Box ends and sides against corner pieces.
14. Add braces.

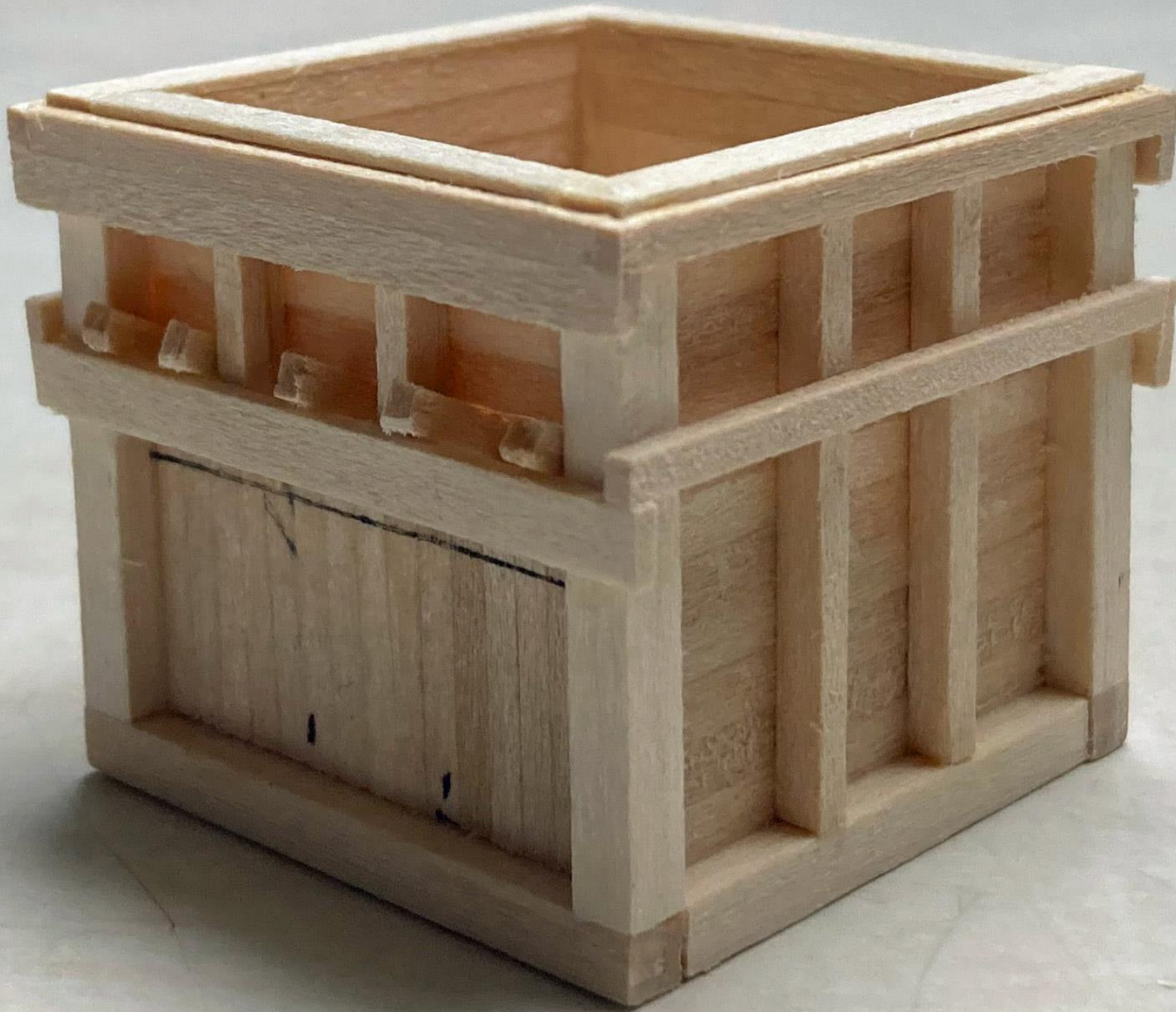


Brick Mortar - Gousch  
Wood Treatment - mineral seal wash over fire stand wood





# Sand Hopper and Sand Tower



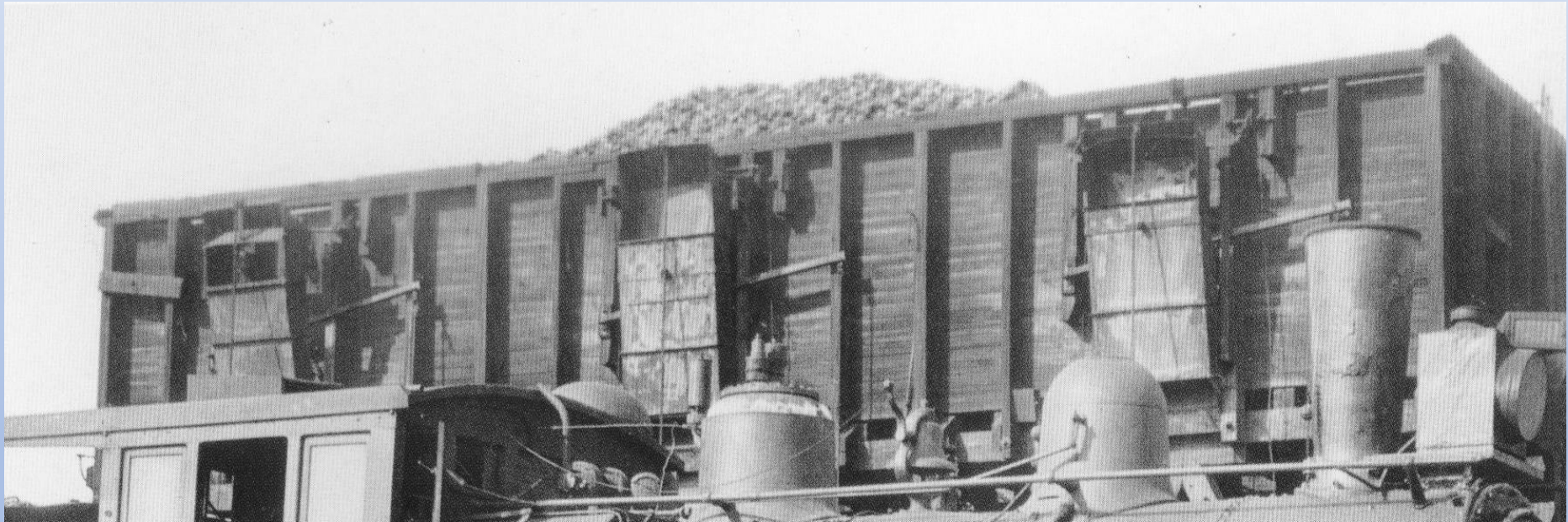
# Sand Drying House and Sand Tower Scene



# Burlington Coal Pocket

- CB&Q coal pockets were built to a standard plan
- Bins were 16x16 ft., and the number of bins varied depending upon usage
- Coal pockets were load using a crane with a 46 ft. boom and clamshell bucket
- Coal was delivered by gravity flow
- The Burlington coal pocket was rated at 70 tons
- The coal pocket was of wood construction with steel chutes
- The coal pocket was placed between two tracks leading to the turntable

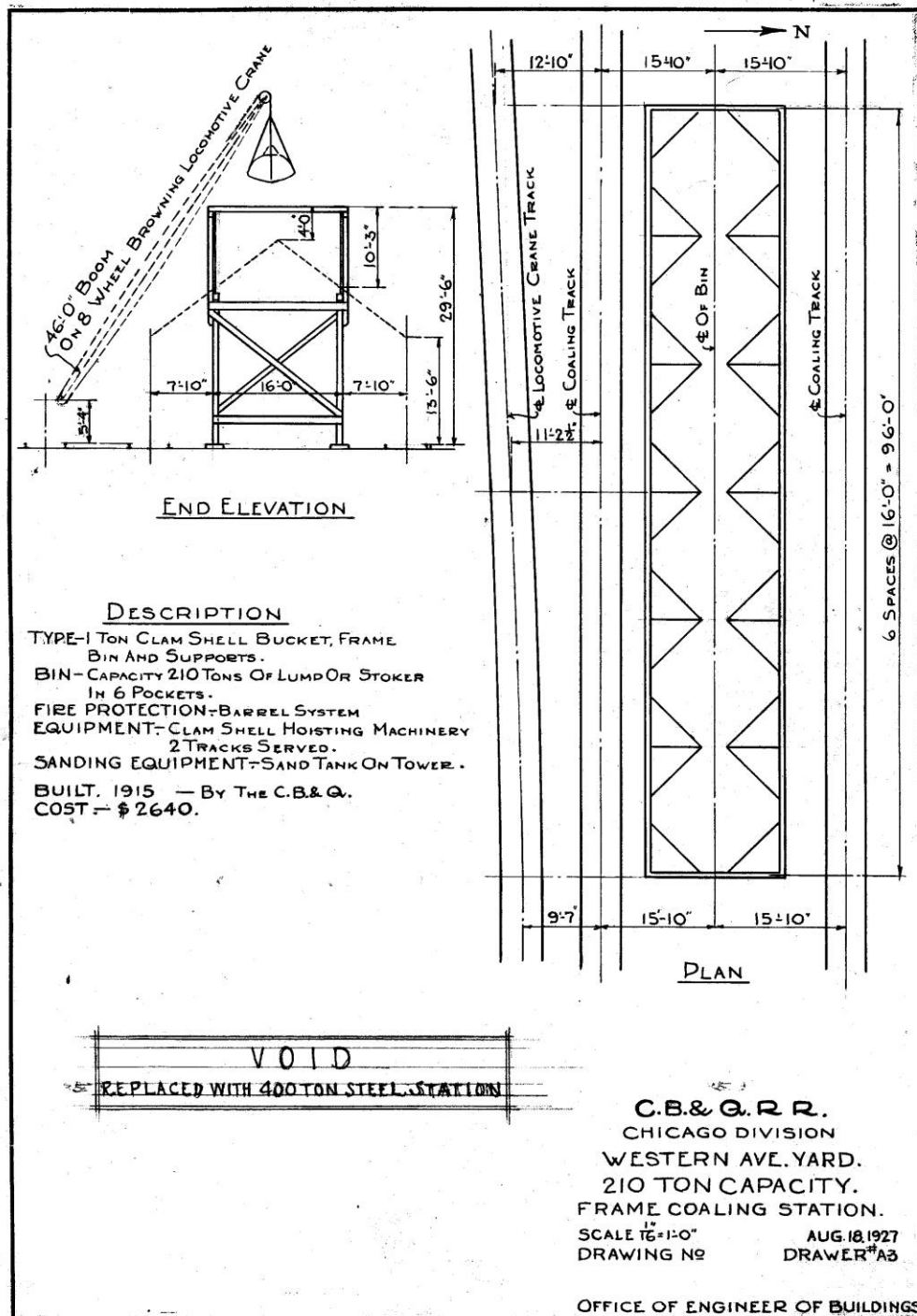
# Burlington Coal Pocket



Burlington  
Coal Pocket  
North End



# CB&Q Standard Plan for Coal Pockets – Six Bin Pocket at Western Yard in Chicago



# Burlington Coal Pocket Drawings

## Construction Steps

1. Build 4 frame pieces  $\bar{C}$  HBU centers.
2. Attach frames to top stringers.
3. Add V-braces.
4. Add side stringers.  $\bar{C}$  HBU centers.
5. Build ends  $\bar{C}$  HBU centers.
6. Build sides.
7. Box ends & sides.
8. Attach box to frame.
9. Build catwalks.
10. Build clut details.
11. Add clut details.

## Wood Preparation

1. De fuzz if necessary
2. Stain mineral red.
3. Weather  $\bar{C}$  diluted Tolu Ink.

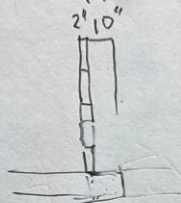
### Materials

2x12	-	80" ~ 7'
4x12	-	40" ~ 8'
3x12	-	22" ~ 2'
4x10	-	28" ~ 3'
4x6	-	40" ~ 4'
2x6	-	72" ~ 17'
2x12	-	200" ~ 17'
4x8	-	44" ~ 4'
2x4	-	~ 6'
4x4	-	~ 2'

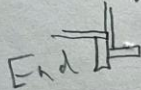
### Cut Pieces

- 1- 12x12x49' sides

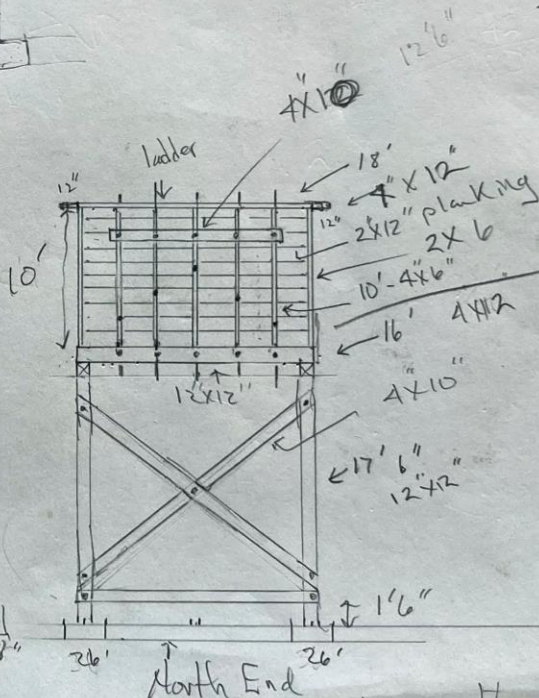
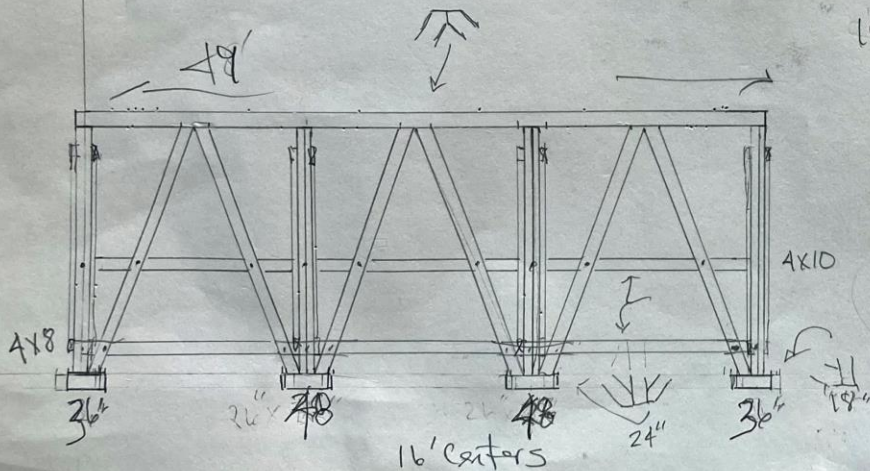
## Corner Detail



Side



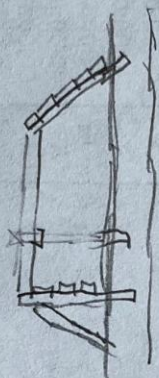
End



North End  
Metal ladder 15" wide  
16" rung space

South End Same  
w/o ladder

Shelter



rail

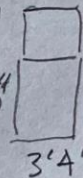
2x4

catwalk

Chute

3 1/2"

5'10"



9'

3'4"

30"

38" centers 8'-4" x 12"

38" centers 2'-4" x 12"

30" space

6" x 12"

4" x 12" - 12'

10'

Space 1"  
Timber 1"

catwalk

18"

↑  
Shelter

48

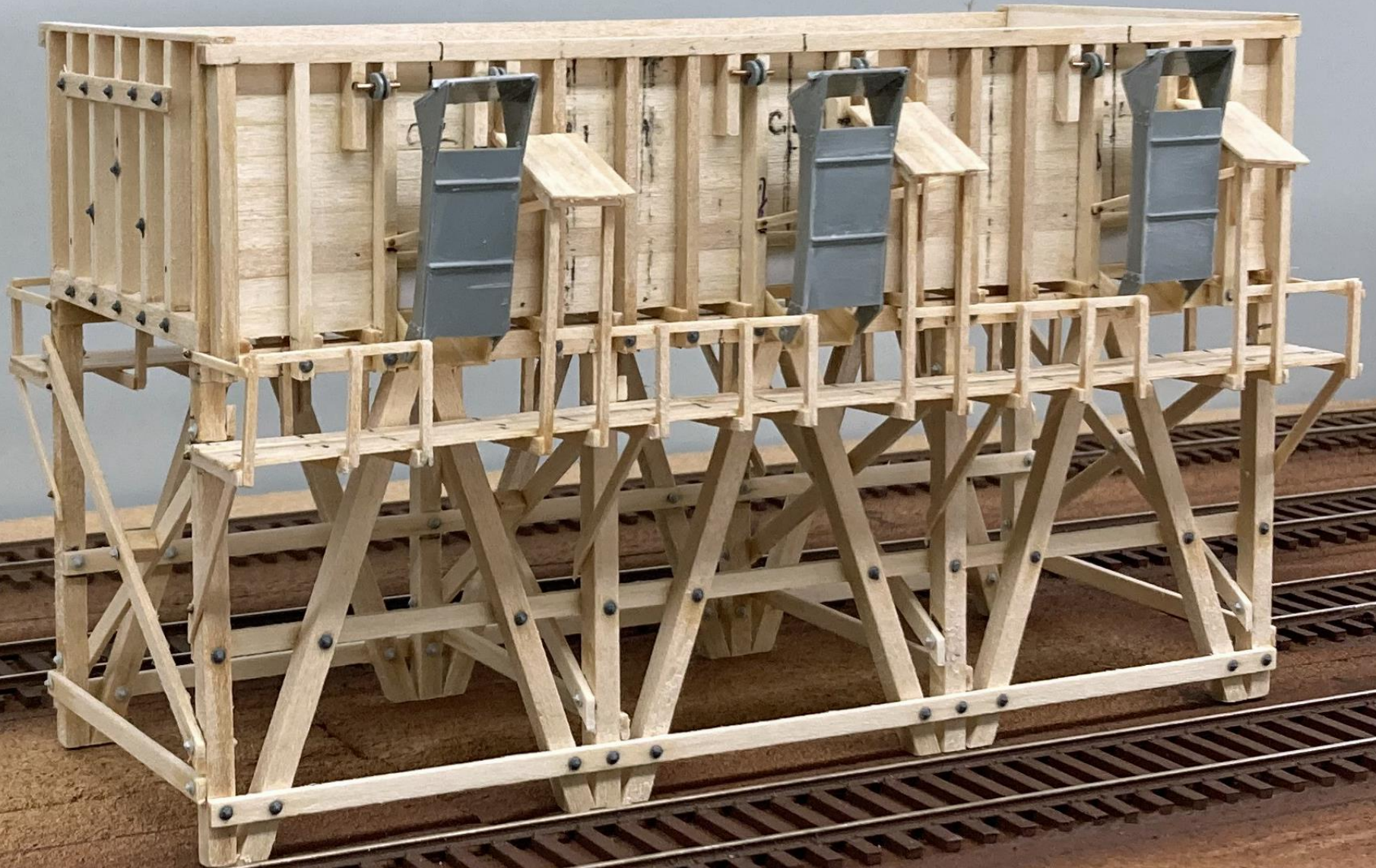
↑  
Shelter

2x4

↑  
Shelter



# Burlington Coal Pocket



# Coal Pocket Sheeves



**Prototype Sheeves**



**Drawn and 3D Printed by Mike Redden**

# Summary

- Prototype modeling is challenging
- Prototype modeling is rewarding
- Prototype modeling is worth the effort
- Every time you do something new, there's a learning curve
- Don't let scratchbuilding become a lost art