Modeling an Operations-Oriented Industry

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Would You like an Industry that Requires the Following Operations?

- Incoming
  - Raw Materials – up to 20 cars per day
  - Coal/Coke: 5.3 hoppers (70-ton) per day
  - Limestone: 2.7 hoppers/gondola cars per day
- Outgoing
  - Finished products: 2-4 box cars (50-ton)per day
  - Bulk product: 1-2 covered hoppers per day
  - Liquid product: 1-2 tank cars per day

The Sugar Beet Industry in the US

- History of Sugar Beet Industry
- The Process and Facilities to be Modeled
- Equipment and Operations

Sugar Beets

Sugar Beets

The Crop
Farmer with Sugar Beet

Table of Contents

- History
  - US Locations
- Processing
- Facilities
  - Loader
  - Mill Complex
    - Main Mill
    - Boiler/Lime Kiln
    - Storage - Warehouses/Silos
- RR Equipment
- Operations

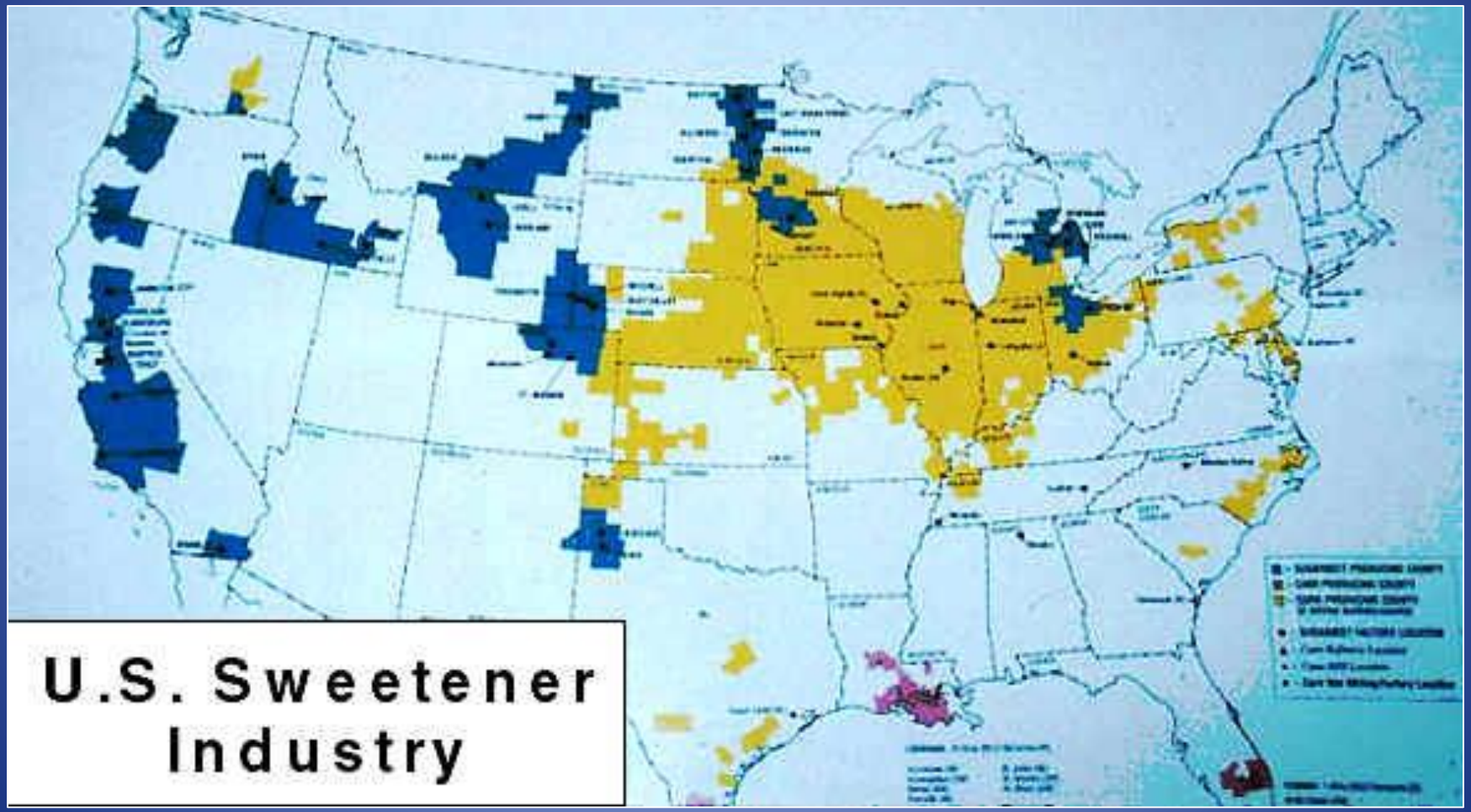
History of Sugar Beets in the US

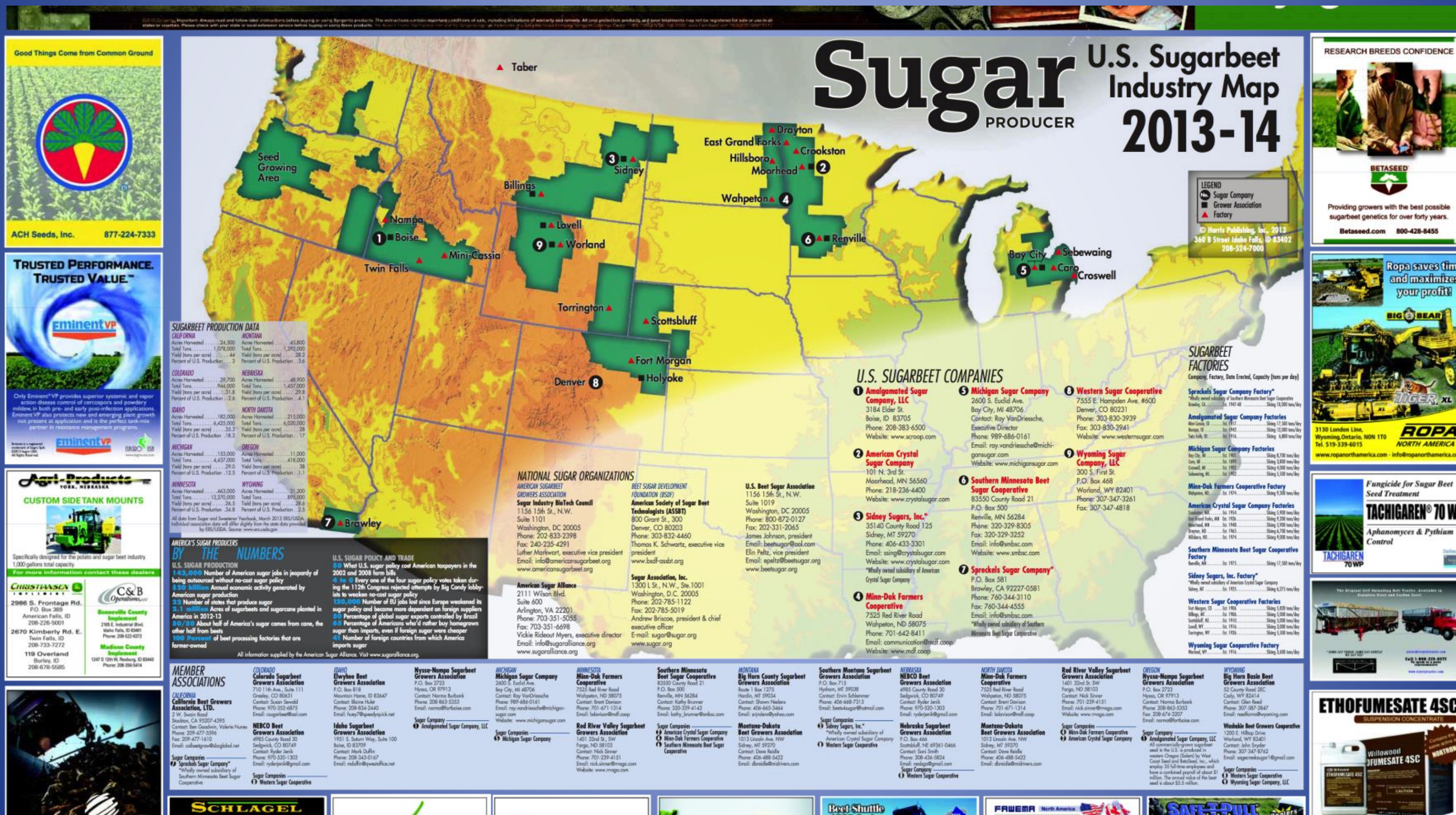
- Began in mid-18th century Silesia, Prussia
- Process of extraction introduced in US in mid-19th century
  - US Production started in 1879 in Alvarado, California
- By early 1960s there were over 60 factories in 22 states, including Ohio

States Where Sugar Beets are Processed

- California -- Numerous
- Colorado -- Brighton, Longmont, Loveland, Eaton, Ft Morgan, Ft Collins, Greeley, Johnstown, Ovid, Sterling, Windsor
- Illinois -- Chicago - Bulk Terminal
- Iowa – Mason City - Factory
- Kansas -- Goodland - Kemp Factory
- Louisiana – Godchaux
- Montana – Missoula, Billings
- Missouri -- St. Louis
- Minnesota – Red River Valley
- Nebraska – Scottsbluff
- North & South Dakota -- Henderson Factory
- Michigan -- Bay City, Ottawa Lake
- New York - Yonkers
- Ohio – Findlay, Fremont
- Oregon
- Utah – Ogden, Salt Lake
- Washington
- Wyoming – Lovell, Wheatland

Sugar Beet Industry Circa 1958




Sugar PRODUCER
U.S. Sugarbeet Industry Map
2013-14
U.S. SUGARBEET COMPANIES
NATIONAL SUGAR ORGANIZATIONS
SUGARBEET FACTORIES
MEMBER ASSOCIATIONS
BY THE NUMBERS
Taber
Seed Growing Area
Nampa
Boise
Twin Falls
Mini-Cassia
Billings
Lovell
Worland
Sidney
Torrington
Scottsbluff
Fort Morgan
Denver
Holyoke
Brawley
East Grand Forks
Drayton
Crookston
Hillsboro
Moorhead
Wahpeton
Renville
Bay City
Sebewaing
Caro
Croswell
RESEARCH BREEDS CONFIDENCE
TRUSTED PERFORMANCE. TRUSTED VALUE.
CUSTOM SIDE TANK MOUNTS
ETHOFUMESATE 4SC
TACHIGAREN® 70 WP
Fungicide for Sugar Beet Seed Treatment
Ropa saves time and maximizes your profit!
SCHLAGEL
Beet Shuttle
SAFE-T-PULL

The Process

- Harvesting
- Transporting to Mill
- Processing
- Products
- Shipping

Harvesting

- Usually begins in fall, September - January
- Steps:
  - Topper removes foliage (used as silage)
  - Pinch wheel harvester (lifter) pulls the beets from the ground and dumps them into trucks

Harvesting

The Process

- Harvesting
- Transporting to Mill
  - Beet Dump
    - Beets transported to dump via trucks
    - Weighed and samples taken
    - Beets loaded into railcars
  - Off-loading at the Factory
    - “Drop-Bottom” railcars unload on high lines
    - Other cars are unloaded manually or using crawlers
      - Piled for later use

Loading at the Beet Dump

Beet Loader
San Ardro, California

Modeling a Beet Dump

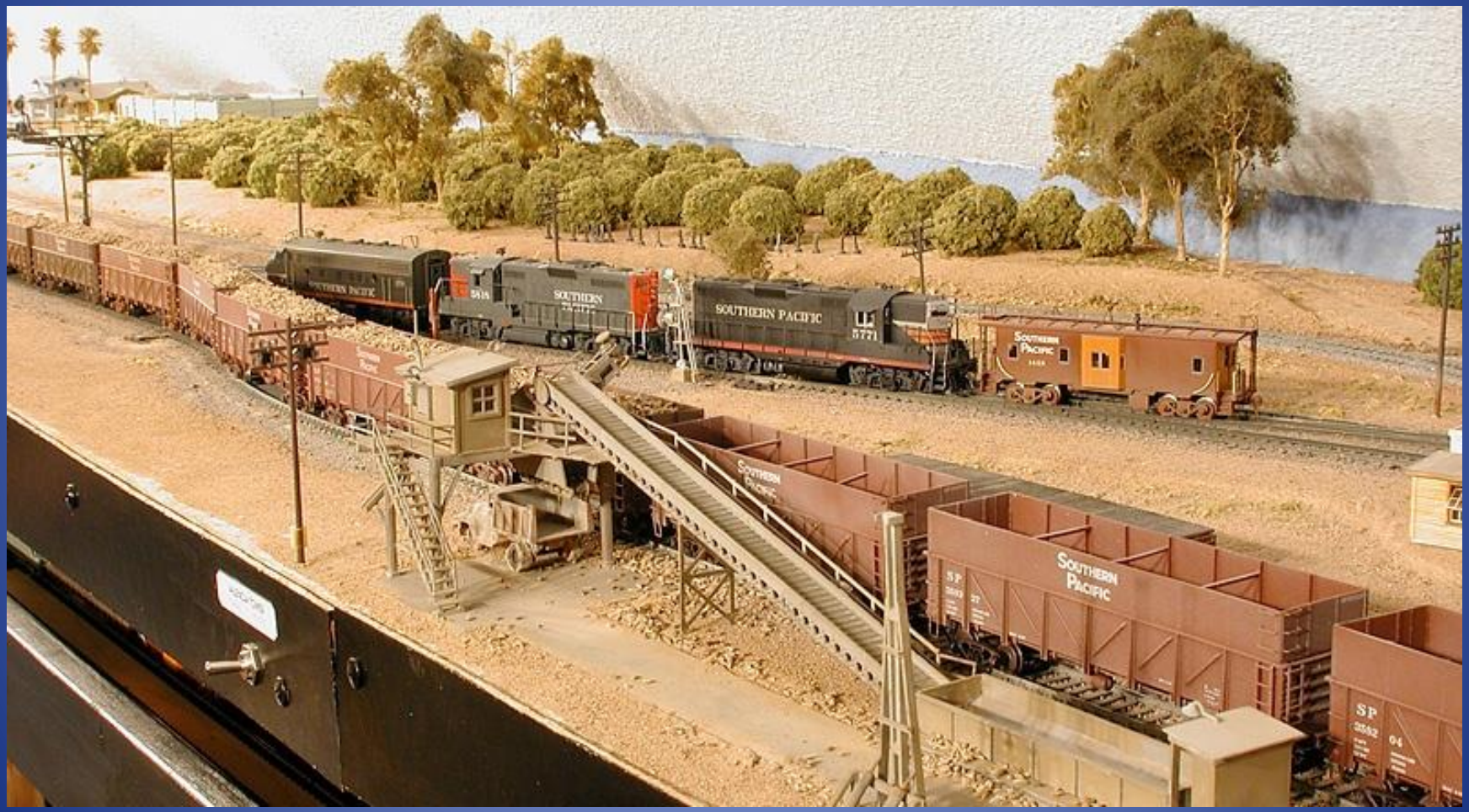
- Scratch build or kit-bash?
- Drawings of San Ardo Beet Loader are available from RMC, Nov 2008[1]
- Simple conveyor system using kit parts

[1] Signor, John R, Modeling California's sugar beet industry, Railroad Model Craftsman, November 2008, pages 58.

Simplest - Walthers Truck Dump (933-4058)

Walthers Photo

Challenging - Model Beet Loader



Source: Signor, John R, Modeling California's sugar beet industry, Railroad Model Craftsman, November 2008, page 69.

Beet Dump Model

Transporting the Beets to the Factory

- Preferred method is with open-top cars such as gondolas and hoppers, but any available car-type can/would be used
- Older drop-bottom gondolas and composite hoppers are preferred
  - Composite hoppers and gondolas are “easier” on the beets
  - Black, steel sided hoppers are not desired as the heat from elements destroys the sucrose

Transporting to the Mill
(Beet Gondola)

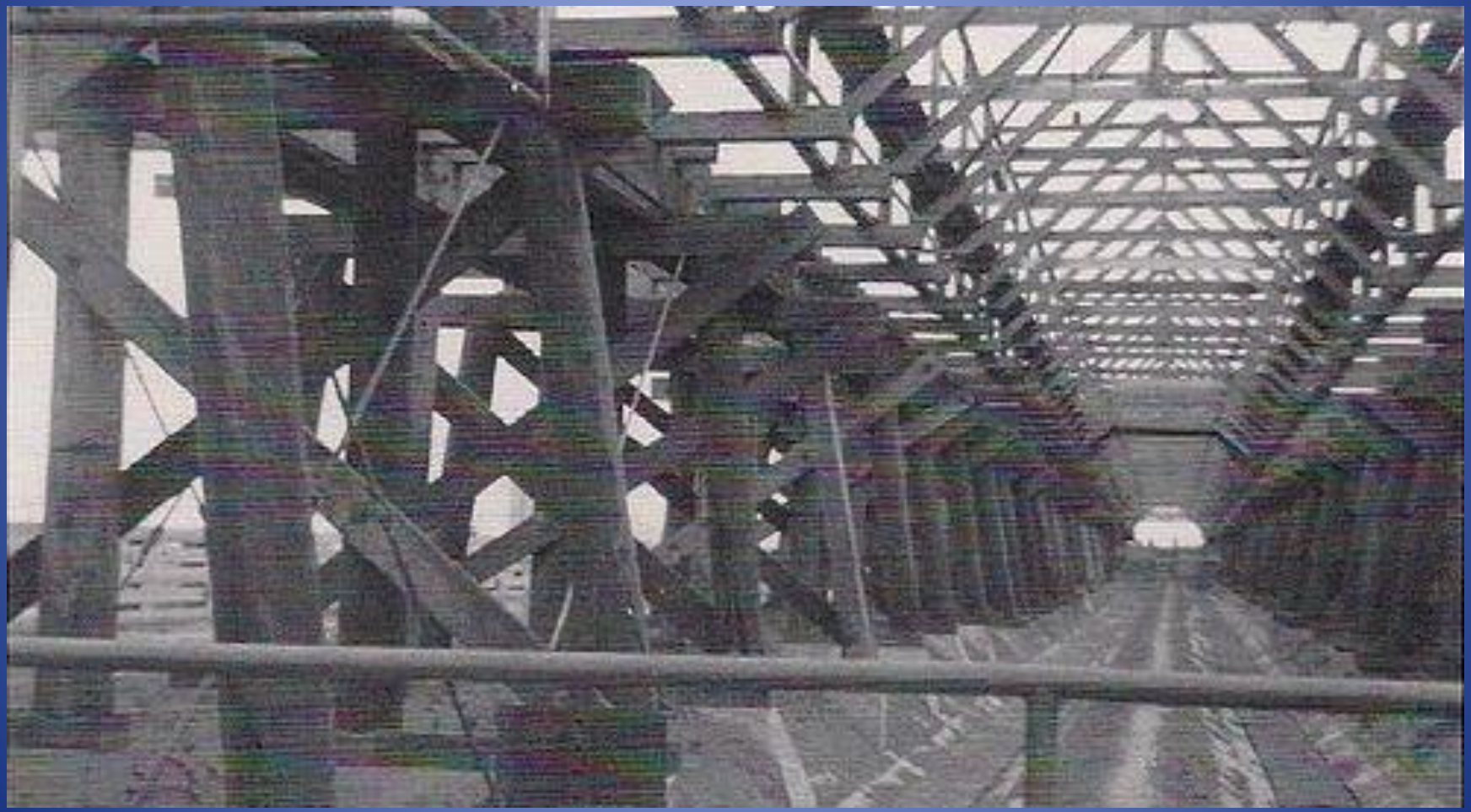
Potential Models

- Drop bottom gondolas
  - Red Caboose has high-sided gondolas through Intermountain
  - Walthers, drop bollom gondolas
- Composite hoppers
  - Athearn “Blue Box,” readily available at train shows

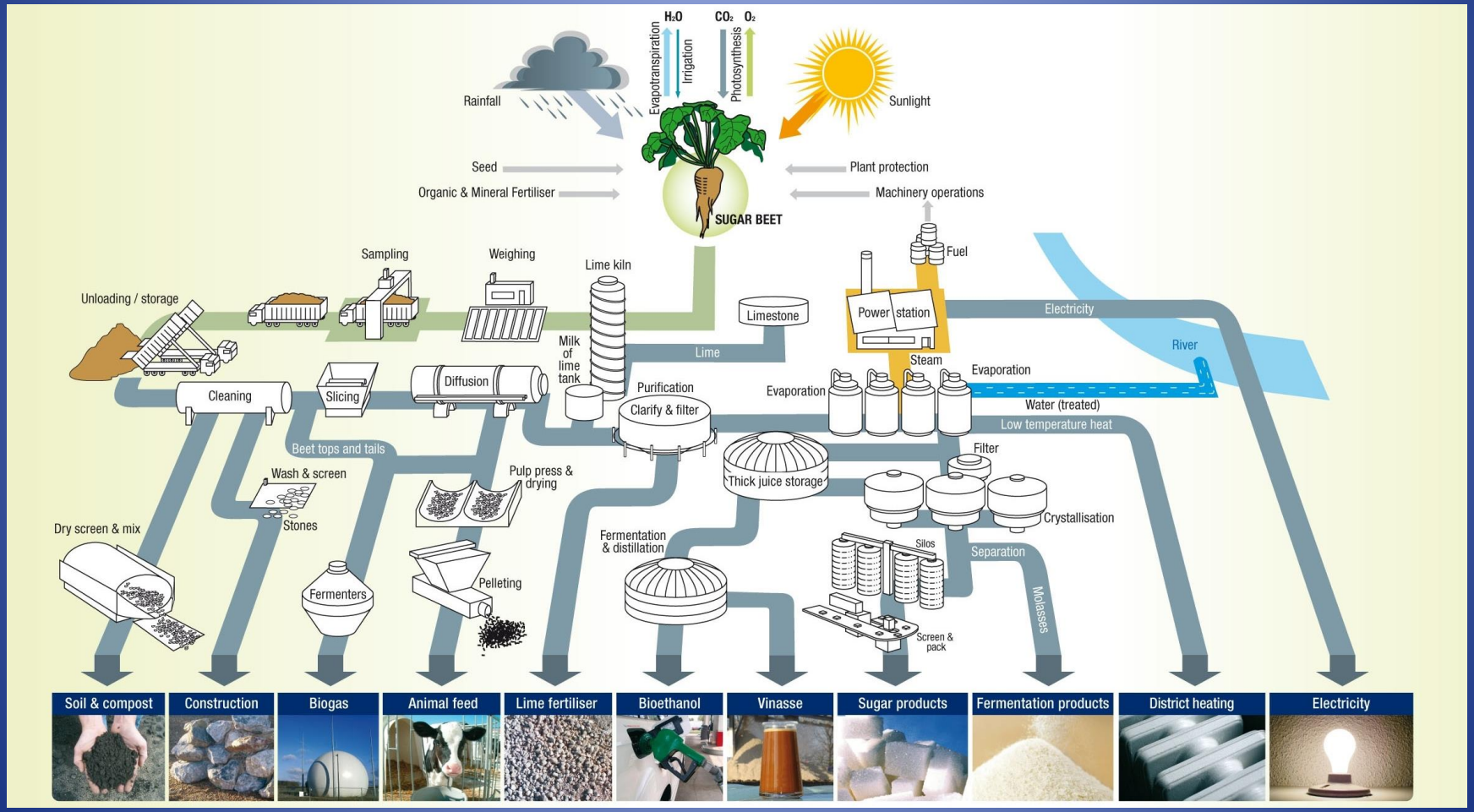
The Process

- Harvesting
- Transporting to Mill
- Beet Processing (simplified)
  - Carried into factory via flumes or sluices
  - Washed
  - Sliced into *cossettes*; long, thin strips (french fries)
  - Soaked in hot water in a diffuser to remove the sugar
  - “Spent” *cossettes* are dried and sold as animal feed
  - Sugar solution is purified and run through a centrifuge
  - Remaining solutions are sold as molasses
  - Sugar crystals are either bagged or sold as a bulk commodity

High Line & Flumes



Sugar Beet Processing



Process at the Factory

- Moved from the storage piles via sluice or flumes
- Washed and sliced into *cossettes*
- Cossettes pass through diffusers where sucrose is extracted using hot water
  - Lime and CO_2 used in the extraction to purify the Syrup.
- Evaporation removes excess water
- Sugar syrup (raw juice) is processed through carbonatation to remove impurities
- Juice is the crystalized in centrifuges

Beet Cossettes

Pellets

Process at the Factory

- Moved from the storage piles via sluice or flumes
- Washed and sliced into cossettes
- Cossettes pass through diffusers where sucrose is extracted using hot water leaving *raw juice*
- Sugar syrup (raw juice) is processed through carbonatation to remove impurities
  - Lime and CO_2 used to extract and purify the Syrup.
- Evaporation removes excess water (*thick juice*)
- Juice is the crystalized in centrifuges

Process at the Factory
(Cont)

- Once crystallization has taken place white sugar is bagged or sent to bulk storage
- Juice that is not fully processed is reprocessed
- A final by-product is molasses
- Pulp from dried, spent cossettes in the initial stages of the process is pressed into pellets, and bagged as animal feed
  - Stored in warehouses or silos

Modeling the Industry (Mill/Factory Complex)

- Actual sugar beet factories are huge requiring larger amounts of space
  - Numerous buildings are required for variety of functions: Mill, boiler house, warehouses, administration, etc.
  - Using selective compression the industry can be modeled in your available space.

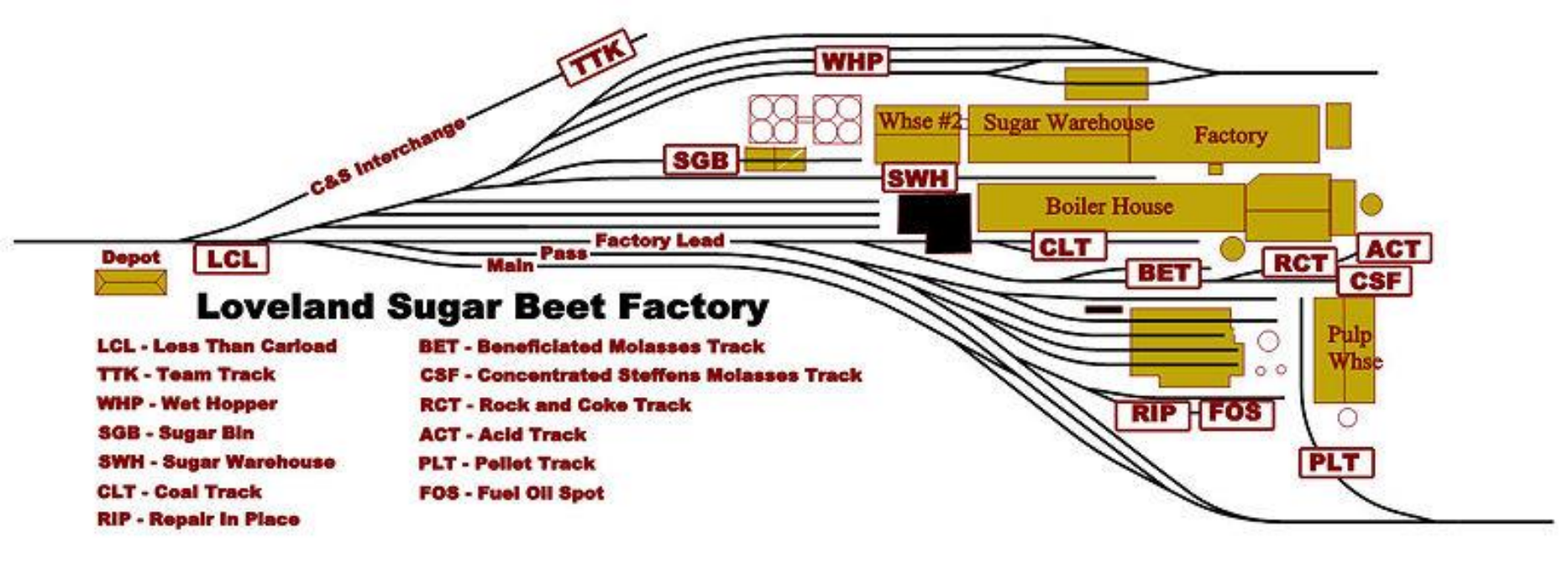
Brighton Factory - Approximate Dimensions

From Google Earth

Over 1180 feet from silos to end of the warehouse

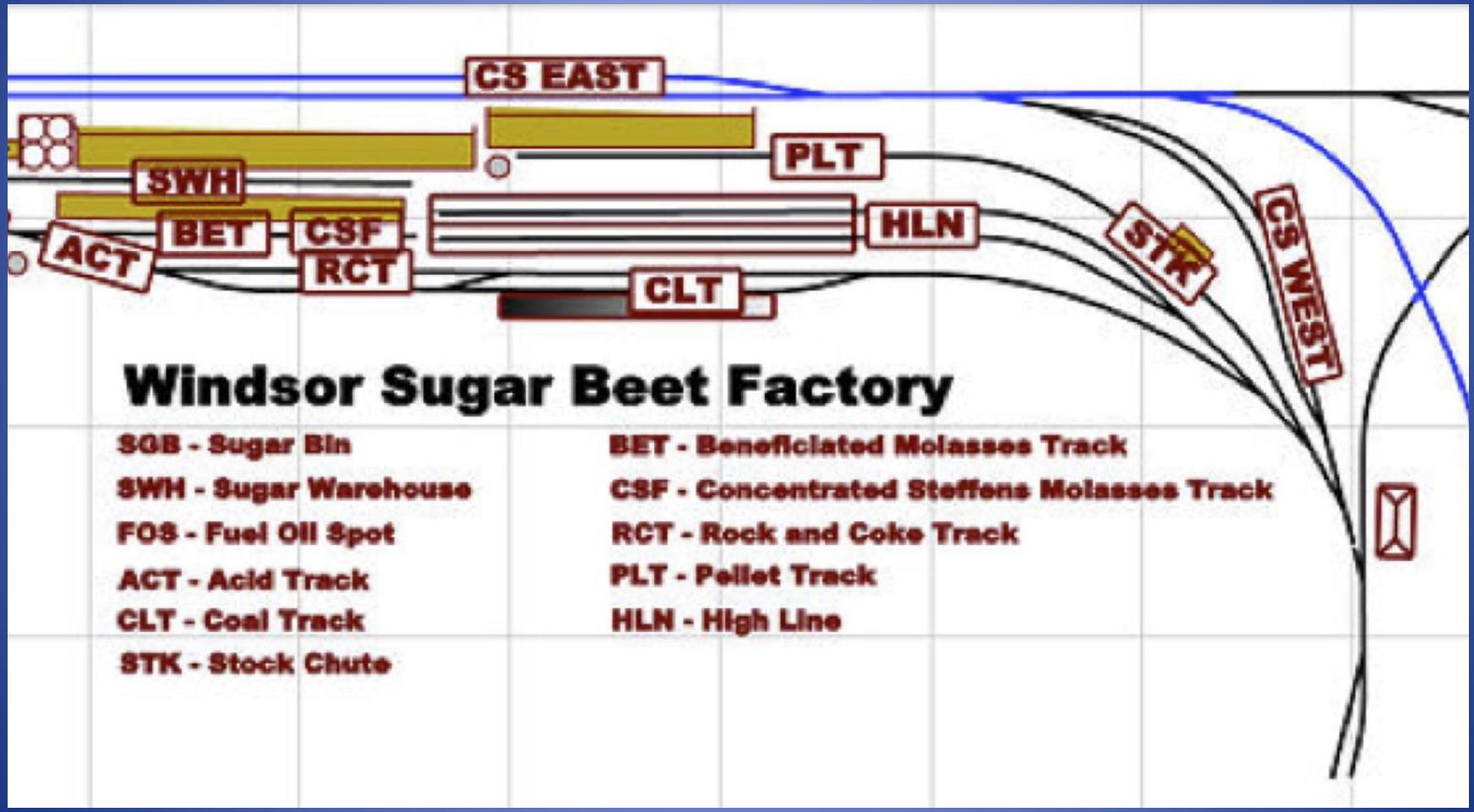
- Factory is ~ 275’ long by ~50’ wide
- Warehouses are ~ 300-450’ long by 55-75’ wide
- Boiler House ~200‘ x 85’
- Silos are up to 130’ tall by 32’

Map of the Loveland Colorado Factory



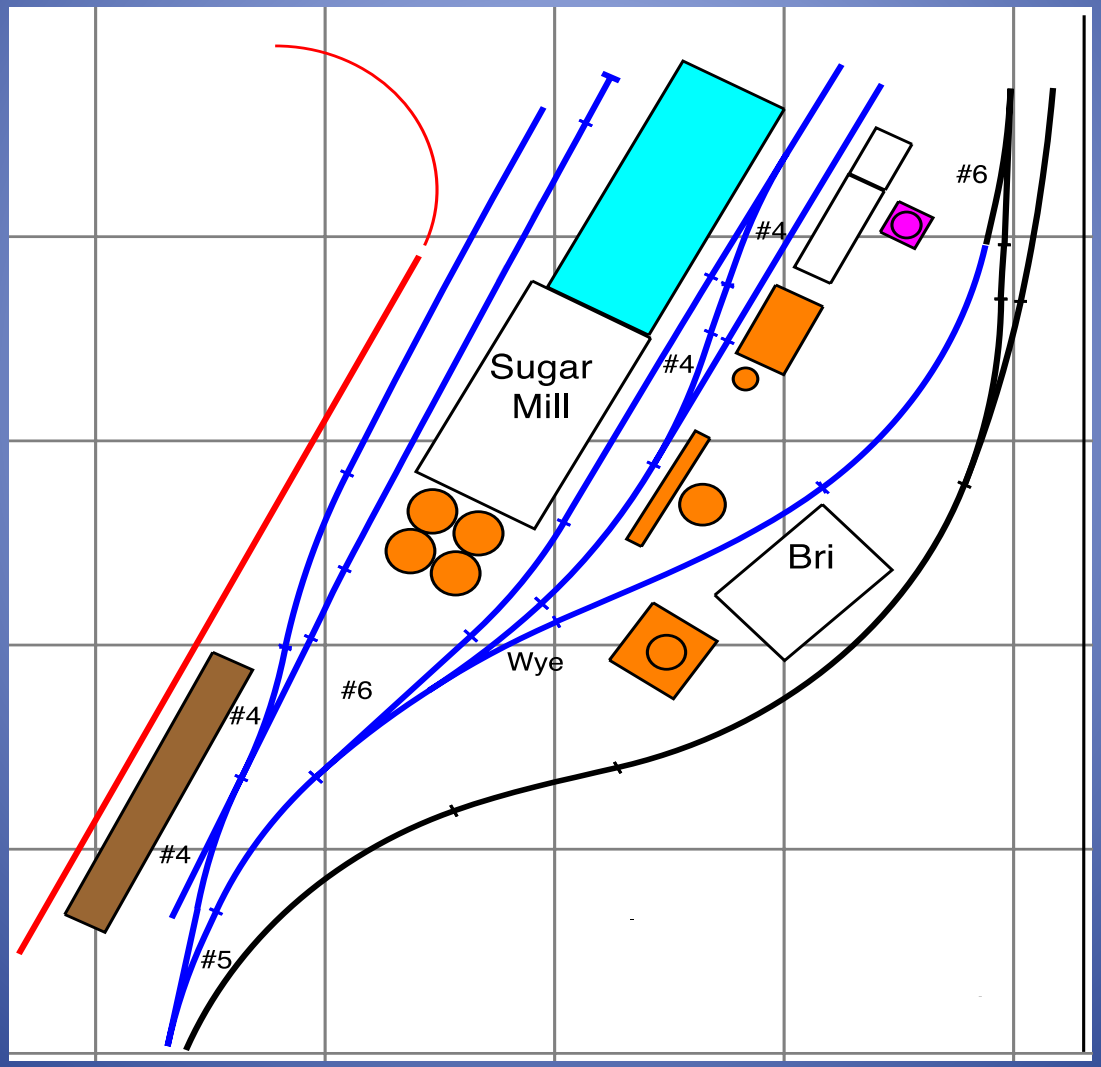
Source: George Booth, Model Railroads by George Booth - The New Great Western Railway (late 2009 to present)

Windsor Colorado



Source: George Booth, Model Railroads by George Booth - The New Great Western Railway (late 2009 to present)

Sugar Beet Factory at Brighton on My Colorado Central



How Do We Do It?

- Look for pictures of a facility
- Determine you available space
- Plan your track plan and building space
- Make or find representative models
- Start to create.
- Examples…

Great Western Sugar Co.
Brighton, Colorado

Aerial Shot of the Brighton Factory Today

From Google Earth

Brighton Factory Looking SW
(1977)

Looking NW
(1977)

Brighton Factory, Today
Looking NE Sept 2014

Great Western Factory, Scotts Bluff Nebraska

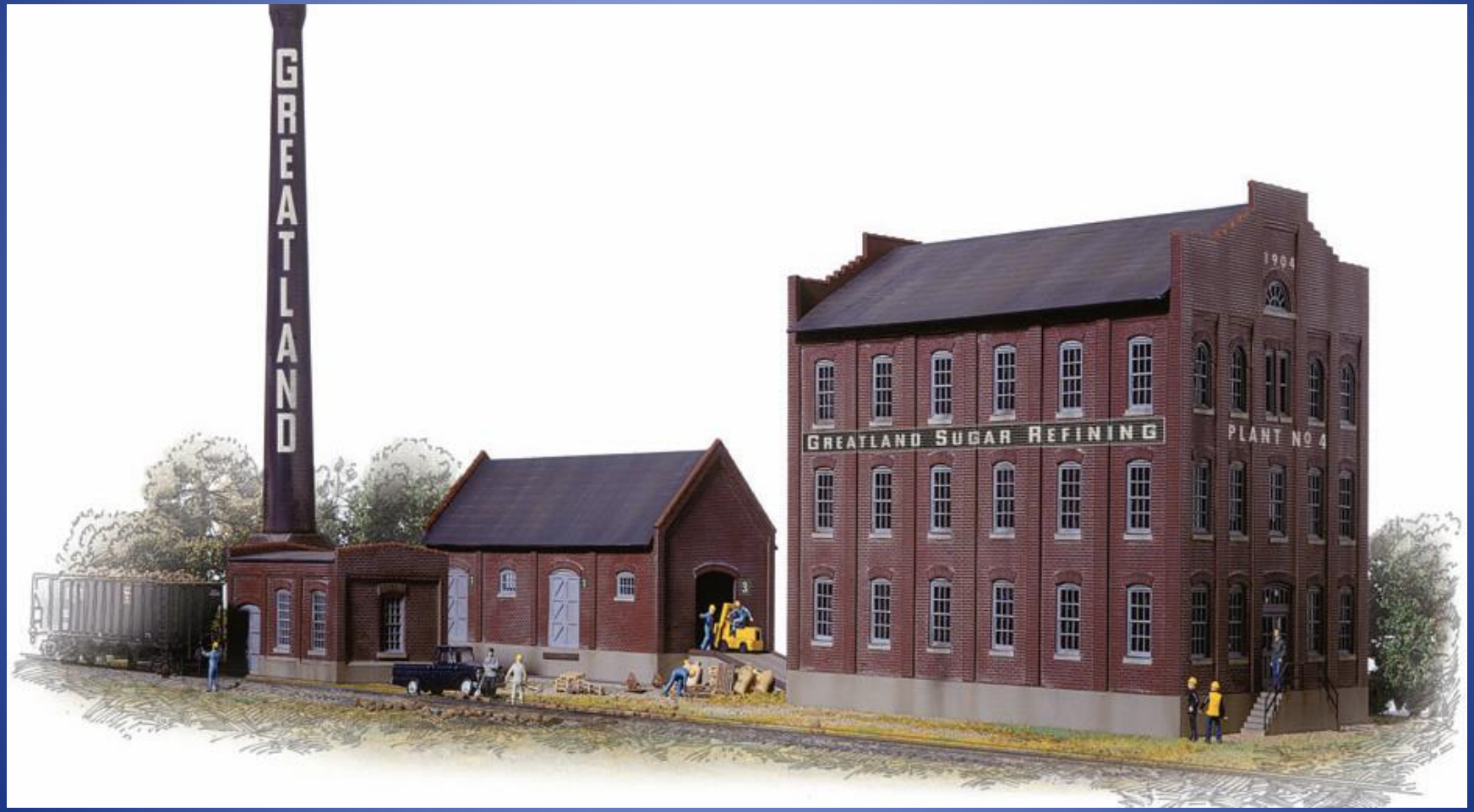
GW Sugar Company Factory, Ft Collins, Colorado

GW Sugar Company Factory, Garland, Utah

How to Model the Factory

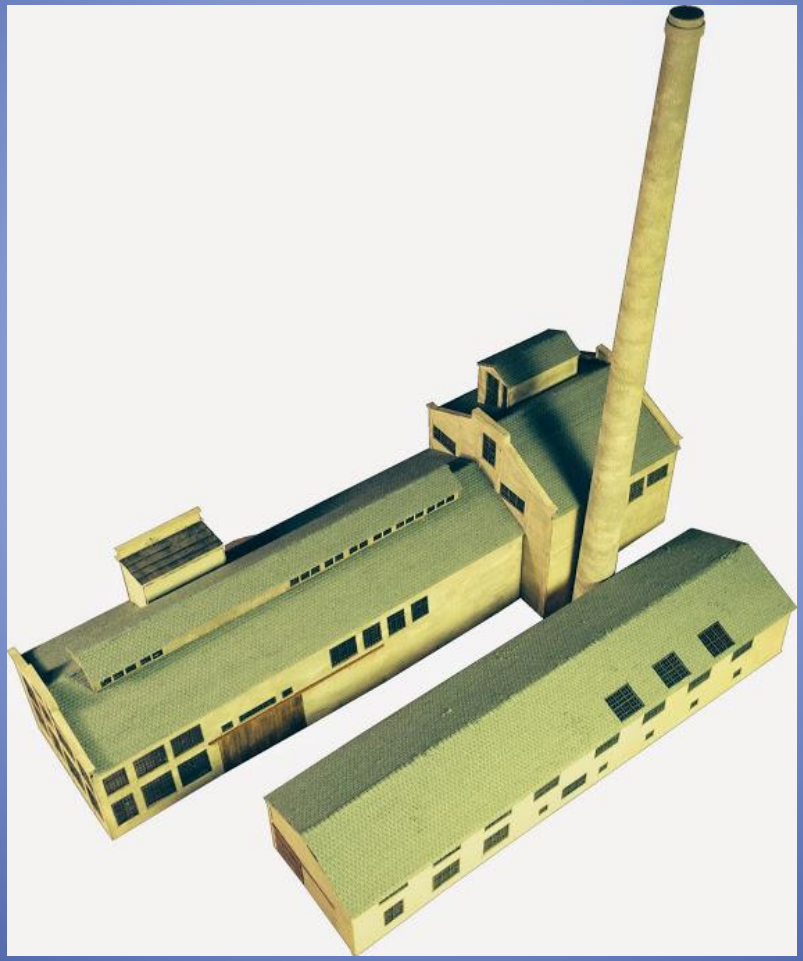
- Factory
  - Sugar Mill complex can be scratch-built or kit-bashed from available kits
  - Size of the factory is dependent on space available
    - Use background pictures if space is not available
  - Warehouse kits are also available, or easily scratch-built
  - Kiln and Boiler House easily scratch-built or kit bashed

Walthers Sugar Beet Mill
(933-3092)



Walthers Photo

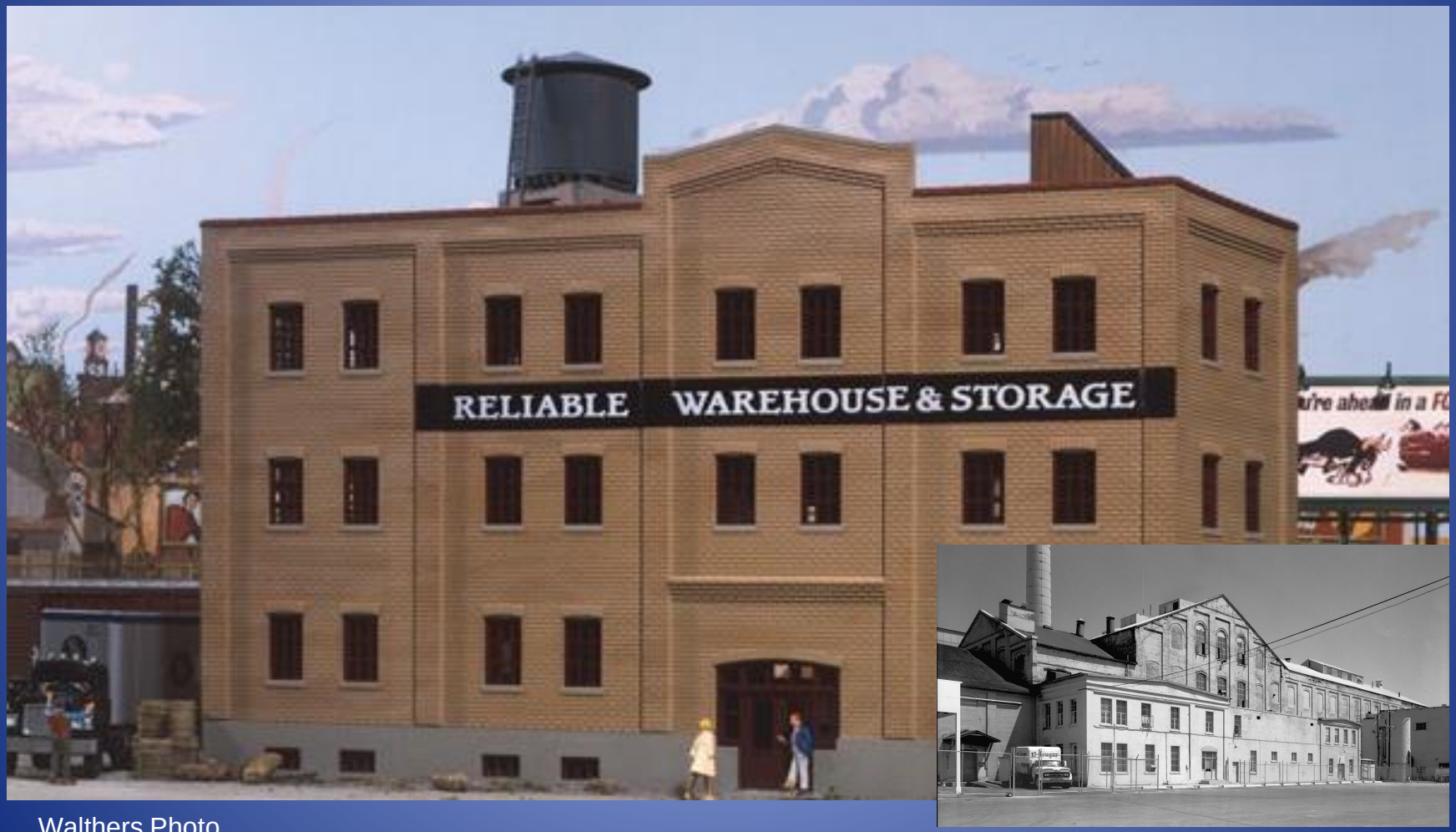
Beet Factory – N-Scale



Bergen National Laser

Used with Permission

Walthers Reliable Warehouse & Storage (933-3014)



Walthers Photo

Walthers Hardwood Furniture (933-3044)

Walthers Photo

Atlas Middlesex Manufacturing
(ATL-721)

Walthers Variety Printing
(933-3161)

Walthers Armstrong Electric Motors
(933-3172)

Life Like Moore & Company

Available (Sometimes) Via e-Bay

Pikestuff Prefab Warehouse
(541-4)

Walthers Photo

Pikestuff Yard Office
(541-16)
Potential Boiler House?

Walthers Photo

Silos, Stacks & Water Towers

- Silos are the skyscrapers of the prairie – large and imposing structures
- PVC piping proves the best solution
  - Various diameters allow the modeler to fit silos to the space available
- Smoke stacks can be scratch-built or commercially available
- Water towers are required to provide the water pressure necessary to operate the factory

Vertical Lime Kiln

- Lime is required to remove impurities from the sugar syrup
- Also produces CO_2 used in the process
- Kiln Requirements:
  - Limestone
  - Coke
- Model using 1-1.25” PVC

High Line Models

- Best if scratch-built

- Windsor Colorado High Line

George Booth Photo

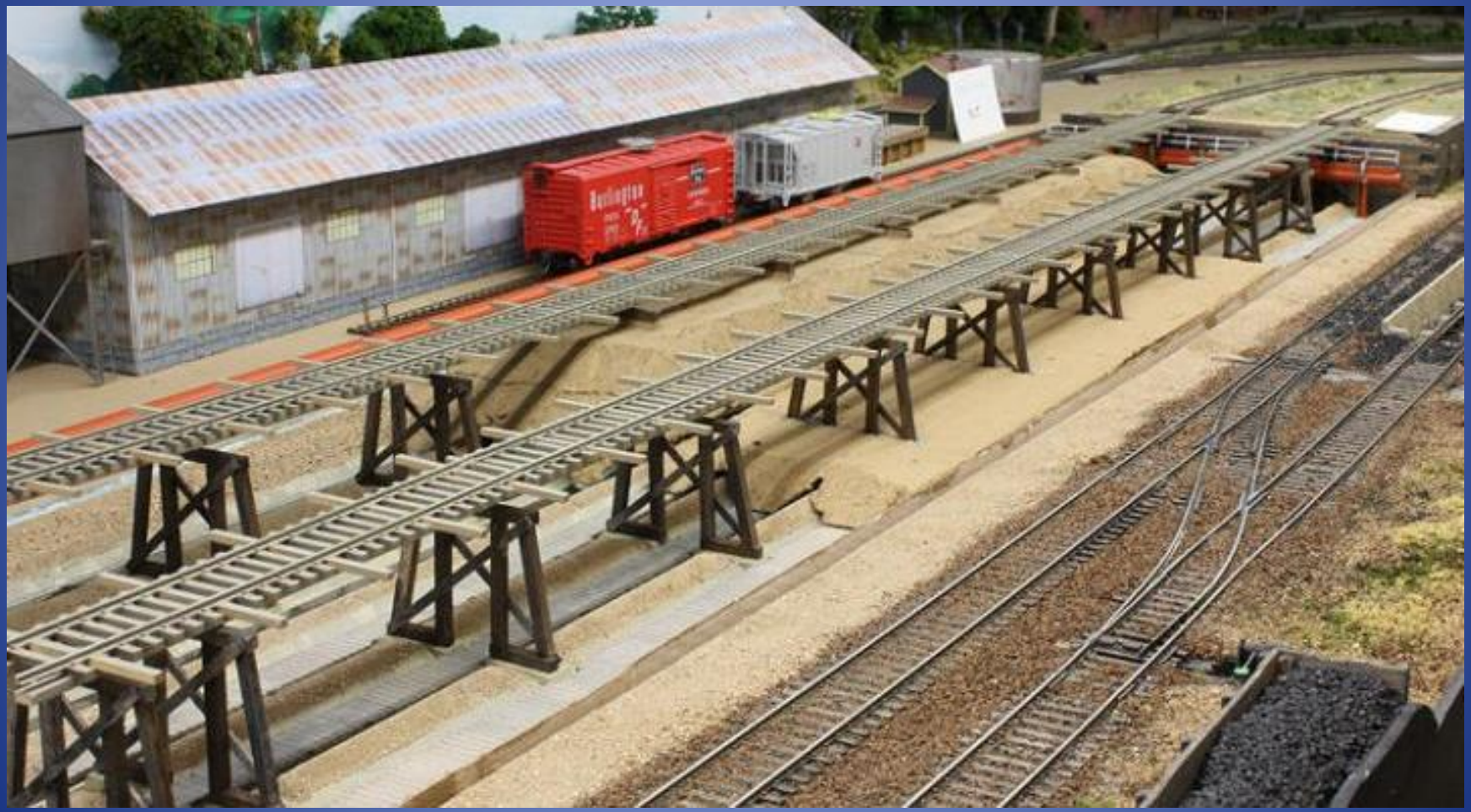
Windsor High Line

George Booth Photo

Preliminary View of High Lines

George Booth Photo

Early Construction of the High Line



George Booth Photo

Flumes and Trestles

George Booth Photo

High Line (Left) Ready to Receive

George Booth Photo

Water Inlets and Control Valves

George Booth Photo

Water In-Flow

George Booth Photo

Windsor High Line Loading

George Booth Photo

Floating Beets in Flumes to Factory

George Booth Photo

Cleaning the Flumes

George Booth Photo

George Booth's Windsor Beet Factory

Beets Diverted into Factory

George Booth Photo

High Line Discharging Beets

George Booth Photo

Locomotives

Products

- Inbound –
  - Sugar Beets
  - Coal, Coke
  - Limestone
  - Packaging supplies
- Out Bound –
  - Bagged or Bulk Sugar
  - Molasses
  - Bagged or Bulk Pulp

Modeling Sugar Beets

- Bulgur wheat
- Anise seeds
- Small packaging material
- Certain varieties of small grain rice
- Cracked wheat

Example: Bulgur Wheat

George Booth Photo

Example of Anise Seeds

Sesame Seeds

Shipping

- Before 1960
  - Most shipping was handled by rail, both inbound and outbound loads
- After 1960
  - Beets delivered to the factory by truck
  - Outbound loads mostly handled by rail

Typical Carload Averages (35,000 Tons-Per-Year - 1958)

- Incoming
  - Beets – 20 cars per day
  - Coal/Coke: 5.3 hoppers (70-ton) per day
  - Limestone: 2.7 hoppers/gondola cars per day
- Outgoing
  - Bagged sugar: 1-2 box cars (50-ton)per day
  - Bulk sugar: 1-2 covered hoppers per day
  - Beet pulp (animal feed): 1-2 box cars per day
  - Molasses syrup: 1-2 tank cars per day

Source: Wilson, Jeff, The Model Railroader's Guide to Industries Along the Tracks Vol 3, Kalmbach Publishing, 2008

Source Materials

- Booth, George, “Model Railroads by George Booth - The New Great Western Railway (late 2009 to present),” users.frii.com/gbooth/Trains/
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Questions?

Hawaiian Sugar Cane Refinery

Longmont Factory Post-2010

Great Western #73

GE 44-Tonner at Brighton