Stockton Intermodal Facility at Stockton, California

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ABSTRACT

This paper will discuss the planning, design and construction of the Burlington Northern Santa Fe Railway's (BNSF) Stockton Intermodal Facility located just east of the City of Stockton, California within the County of San Joaquin. The facility consists of two 7,700-foot long strip tracks, 20,000 square feet of administration and maintenance buildings, 900 trailer parking spaces, various support mechanical facilities, 13.6 miles of new trackwork, and a 55-acre wetland preserve.

INTRODUCTION

Planning for the new BNSF intermodal facility began in 1997 and construction ended in the summer of 2001. The intermodal facility is located just south of the city of Stockton in the County of San Joaquin (Figure 1). The Stockton Intermodal Facility (Figure 2) was placed in service on April 24th, 2001. The 423-acre facility is operational 24 hours per day, has three inbound and outbound checkpoint lanes, and 900 container (COFC) and trailer (TOFC) parking places. The loading and unloading areas consist of two 7,700-foot strip tracks with a total capacity of 144 intermodal car spots. In addition to the strip tracks, the facility has two 9,000-foot storage tracks, a 10,000-foot runaround track, and a 3,000-foot setout track. The facility has a capacity of 300,000 lifts per year using four rubber tire gantry cranes (RTG).
An office and maintenance area is located on the south at the center of the facility. The office and maintenance area consists of a number of buildings and areas used for the purposes of administration and maintenance of equipment. These buildings and areas consist of the yard office administration building, hostler maintenance building, crane maintenance building, fueling facility, and the gate complex.
CONCEPTUAL DESIGN STAGE

Project Site Location

The BNSF started searching for a location for an intermodal yard in the Stockton Area in 1997. Aerial surveys were performed of the surrounding Stockton area. The intent of the surveys was to find the largest open area for construction between grade crossings. Eventually, the BNSF selected a site just east of the Stockton city limits between the Mariposa Road and the Jack Tone Road grade crossings. The usable length for construction between these grade crossings was over 11,000 feet.

Configuration Planning

The configuration planning stage of this project consisted of developing several yard layout options. All layouts included five major components. These components were the strip tracks, trailer parking, storage tracks, office and maintenance complex, and the gate facility. In developing the various options, the location of each one of the major components was varied to create a unique option.

Each option developed was to be designed to the following minimum criteria:

- The project site was bounded on the north by the BNSF mainline, on the west by Austin Road, on the east by Little Johns Creek, and room for expansion to the south
- Six 7,700 foot long strip tracks
- Strip track loading and unloading will initially be performed by RTG cranes but must be designed to accommodate reach packers in the future
- Maximize number of storage tracks and trailer parking places
- Centralized location of the office and maintenance complex
- Six lane reversible gate complex
In general, two basic yard configurations were studied. These two configurations consisted of center linear parking and block parking arrangements. The centerline parking arrangement was eliminated early in the conceptual design stage at the direction of the BNSF. Several options of the block parking configuration were developed. In all of the block parking options, the parking was centered about the facility along with all maintenance and office buildings. In general, the options were developed by varying the location of the strip tracks and parking south of the mainline. The Phase 1 final configuration is shown in Figure 3 on the following page.

It is anticipated that the full buildout of the facility will be completed in several phases of construction. The phases will be constructed as business demands dictate the need for an expanded facility.

A typical section of the loading and unloading configuration is shown on Figure 4.
Figure 3. Phase I Final Configuration
Operations Analysis

An operations analysis was conducted to prepare for the final design of the facility. The operation analysis considered the following topics:

- Facility Demand
- Existing Operations
- Checkpoint Operations
- Yard Circulation and Train Loading Operations
- Truck Maneuvering Space Requirements
- Overall Facility Programming

Checkpoint operations for the facility were analyzed using a simulation model. The checkpoint model was a robust discrete event simulation model of checkpoint operations. The following operations were considered:

- Truck movements along the Access Road
- Truck use of queuing lanes
- Processing time at the pre-check, if applicable
- Processing time at the checkpoint canopy (by-passing of bob-tails)
- Problem resolution
- Time trucks are on facility
- Processing time at the checkpoint canopy (by-passing of bob-tails)
- Discrimination by truck characteristics (load, empty, chassis, bob-tail, and truck sizes)
The model was run for various scenarios to analyze the range of anticipated throughput as well as one-step method versus two-step method. The criteria established to determine checkpoint adequacy are that no queuing is accepted beyond the queue lanes, and the truck waiting time was considered on the inbound or outbound move.

**Land Use**

The Stockton Intermodal Yard is located in a rural farm area east of the City of Stockton and south of the existing BNSF mainline. The entire facility was constructed primarily on land that consisted of six parcels held by four property owners. On-site land uses consisted primarily of agricultural lands, a crop dusting airstrip and service facility, and two residential structures. All six parcels were purchased by the BNSF for this project.

**PERMITTING**

The facility was permitted under the guidelines of San Joaquin County Community Development Department. An environmental impact report was developed by the County of San Joaquin for the facility as part of the permit process. The impact report analyzed impacts and recommended mitigation measures on such issues as:

- Earth Resources
- Water Resources/Drainage
- Land Use
- Traffic and Circulation
- Air Quality
Upon approval of the environmental impact report, the San Joaquin County Community Development Commission approved the project with various conditions of approval. Two of the major conditions of approval were, the Mariposa Road Grade Separation and the creation of a wetland preserve which will be discussed further in this paper.

**PHASE I DESIGN**

**Track**

A track schematic of Phase I of the facility is shown on Figure 5. Turnouts within the facility are #15’s. Lead track turnouts are powered # 24’s. Derails protect the strip tracks and are located on the east and west extent of the yard and at the center crossing in the strip tracks. Phase 1 track layout includes two 7,700 feet long strip tracks, two 9,000 feet long storage tracks, a 10,000 foot long running track, and a 3,000 foot long setout track.
Figure 5. Phase I
**Geotechnical**

Prior to construction, the site consisted primarily of farmland planted with various crops. The crops consisted of mainly tomatoes, alfalfa, sugar beets, and wheat located on several separate fields. The various fields were separated by numerous dirt roads and surrounded by irrigation lines, open irrigation ditches and paved roads.

In general, the site soil conditions are relatively consistent and are typical of the eastern portion of Stockton. The surface and near surface soils consist of black/brown silty clays that extend to depths varying from approximately 1 to 7 feet below existing ground surface. The average depths of the black/brown silty clays are approximately 3 to 3½ feet. Beneath the near surface black/brown silty clays, alternating layers of light brown, generally stiff to hard and partially cemented silty and sandy clays and sandy silts are present. Clean sand is present beneath the clay in some areas. A typical boring log is shown on Figure 6.

**Pavement and Track Subgrade**

One of the key elements of the design of the pavement sections is the need to withstand the heavy loads induced by the loading and unloading equipment and the large volume of truck traffic. As mentioned in the above paragraph, the site is blanketed with expansive clay soil that has poor subgrade quality. The approach to the pavement design for this project, as is the approach of most of the heavy pavement projects in the Stockton area, is to lime treat the surface clay soils in place. The lime treated soil will form the subgrade of the pavement section.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample</th>
<th>Blows/ft</th>
<th>Dry Density (lb/ft³)</th>
<th>Moisture Content (%)</th>
<th>Compress. Strength (kPa)</th>
<th>Other</th>
<th>Tests</th>
<th>Pen (kcf)</th>
<th>DESCRIPTION</th>
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<td>10</td>
<td>10</td>
<td>99</td>
<td>21</td>
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<td>5</td>
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<td></td>
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<td></td>
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<td></td>
<td>(CL) SANDY CLAY - Brown, Fine Grained, Moist</td>
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<td></td>
<td>Grades with Less Sand, More Silt, Stiff</td>
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<tr>
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<td>96</td>
<td>26</td>
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<td></td>
<td></td>
<td></td>
<td>(SC) SILTY CLAYEY SAND - Brown, Fine to Medium-Grained, Medium-Dense, Moist</td>
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<td></td>
<td></td>
<td></td>
<td>(ML) CLAYEY SILT - Brown, Fine Grained, Moist</td>
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<td>20</td>
<td>16</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td>(SC) CLAYEY SAND - Brown, Fine to Medium-Grained, Medium-Dense, Moist</td>
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<td></td>
<td></td>
<td></td>
<td>END OF BORING</td>
</tr>
</tbody>
</table>

Figure 6. Typical Boring Log
A main parameter in the pavement design process is the strength of the lime treated subgrade. An intensive shallow and deep boring program was performed for the purpose of mapping the clay layer and obtaining random samples. The samples were tested for strength by mixing the samples with 4 to 4½ percent high calcium quick lime. The test produced an average R-Value of 82 and an Unconfined Compressive Strength of 375 psi. For design purposes an average R-Value of 60 and an Unconfined Compressive Strength of 250 psi was used.

The major paved areas of this project are:

- Strip track loading and unloading area
- Center aisle
- Trailer parking area
- Various roadways with the project

The pavement was designed to accommodate the heavy loading and unloading equipment. The governing equipment for the strip track area and center aisle was the Mi-Jack 45H52 Reach Packer. This piece of equipment imposes an individual wheel load of almost 60 kips and a maximum ground pressure of approximately 135 psi. Governing truck loading used for the parking and roadways are the Cammando 50 and the HS-45 truck. Repetitions for the four areas are shown below:

1. Track Loading Area: 12 cycles/day loading equipment + 180 cycles/day trucks
2. Center Aisle: 5 cycles/day loading equipment (empty) + 2,000 cycles/day trucks
3. Parking & End Aisles: 800 cycles/day trucks
4. Roadway: 500 trucks/day loaded + 500 trucks/day empty each direction
Cost analyses were performed on various pavement types for the major paved areas. Ridged concrete pavement was selected for the strip track and center aisle. The pavement was reinforced along the edge of the strip track to carry the heavy edge loads. Asphalt pavement was selected for all other areas. A summary of the pavement sections is shown in the following table.

<table>
<thead>
<tr>
<th>Pavement Area</th>
<th>Minimum Thickness of Concrete (inches)</th>
<th>Minimum Thickness of Asphaltic Concrete (inches)</th>
<th>Minimum Thickness of Class II Aggregate Base (inches)</th>
<th>Minimum Thickness of Lime-Treated Soil (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area 1 – Track Loading</td>
<td>12</td>
<td>-</td>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td>Area 2 – Center Aisle</td>
<td>12</td>
<td>-</td>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td>Areas 3 &amp; 4 – Parking End Aisles &amp; Roadway</td>
<td>-</td>
<td>6*</td>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td>Automobile parking (assumed TI = 4.0)**</td>
<td>2</td>
<td>4</td>
<td>12 (min)</td>
<td>-</td>
</tr>
<tr>
<td>Kaiser Road (TI = 6.0)**</td>
<td>2½</td>
<td>4</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>Kaiser Road (TI = 5.5)**</td>
<td>2</td>
<td>4</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Unpaved Fire Access Road</td>
<td>4</td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Unpaved maintenance road for light vehicles</td>
<td>4</td>
<td>14</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Empty Trailer Storage</td>
<td>4</td>
<td>12</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Lead Tracks</td>
<td></td>
<td></td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>Storage Tracks</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

* Reinforced at mid-section with “Petromat®”, or equivalent.

** TI = Traffic Index
The track roadbed was also designed to be supported by lime treated subgrade. The track roadbed within the yard consisted of a 15-inch lime treated section with 4 inches of subballast. The lead track roadbed was similar.

**Off-Site Drainage**

The project site is bounded on the Northeast by the existing BNSF mainline. The general topographic slope within the project is from the east to the west with an approximate downhill slope of 0.13%. The only offsite flows are those from the north under the existing railroad tracks through culverts or under bridges. There are twelve drainage structures under the existing BNSF mainline. The structures consist of nine culverts and three bridges.

All culverts and bridges located on the lead track alignment were extended. Most of the culverts located within the bounds of the facility drain to a ditch on the south side of the mainline, which in turn drains to Weber Slough. The Slough crosses the east side of the site.

The Weber Slough drainage structure consists of northern and southern box culvert sections and a middle open channel section. The box culvert section consists of four barrels for a total width of 53’ and depth of 7’-6”. The discharge capacity of the structure for a 100-year flood event is 880 cubic feet per second. The box culvert structure was designed to carry railroad loading.
On-Site Drainage

Storm runoff contributing from the project facilities are directed to a storm drain system designed for a major storm event and consisting of a series of catch basins, storm drain pipes and subdrains. Storm runoff from paved areas drains directly to catch basins. The area between the strip tracks and the storage tracks was left unpaved for future development. This area was graded to a flow line in order to drain to inlet structures. Because there are no terminal drains available for the site, storm water runoff is retained in three retention ponds. Storm water runoff is temporarily stored in these ponds and emptied through percolation per San Joaquin County standards. The retention ponds have a total bottom surface area of 46 acres. Two ponds are located on the west side of the site and one pond is located on the east side of the site. The retention ponds are designed to have a capacity of two 10-year storms within a 24-hour period.

Fire Suppression System

The fire suppression system consists of a high capacity well, storage tank, fire pump, a distribution system, and fire hydrants. The firewater storage tank has a capacity of 320,000-gallons and was sized based on the required fire flow. The storage tank is served by a high capacity 500-foot deep water well. The well is not directly linked to the fire distribution system and only serves to maintain the water level in the tank. The well has a capacity of 670 gal/min and is capable of filling the tank within an 8-hour period.

A fire pump supplies pressure to the fire distribution system. The fire pump consisted of two systems: an electric jockey pump and a diesel driven main fire pump. The jockey pump supplies constant
pressure to the distribution system. Once a fire hydrant is opened the pressure drop triggers the main fire pump that supplies the required fire flow.

The fire distribution system provides for complete coverage inside the facility in the strip track, parking, and building and maintenance areas. The fire hydrants are placed throughout the facility. The maximum spacing of the hydrants is approximately 400 feet. Most fire hydrants were placed by light poles to enable them to be located easily. There are several fire hydrants located in the trailer parking area that could not be placed by a light pole. These hydrants were placed in blocked out stalls with striping to indicate the location.

**Domestic Water System**

The domestic water supply is obtained from two 225 feet deep-water wells which feed the pressurized tanks and in turn supply the facility with domestic water. A reverse osmosis membrane water treatment unit treats all domestic water.

**Sewer**

The sewer system consists of eight inch poly-vinyl chloride (PVC) piping serving all of the buildings. The sewer system terminates at a septic tank. The septic tank consists of two precast concrete boxes, each with 1,200-gallon capacity. The treated wastewater leaves the septic tank through an outlet into a leach field. The leach field consists of four, 4 inch PVC perforated drain pipes placed in a 14 inch aggregate bed.
**Industrial Waste Water**

The industrial waste water system is designed to contain any contaminated wastewater from entering the drainage system. All facilities that produce oily wastewater during the course of their normal operations are connected to the industrial waste system. The system drains the wastewater from the sources to a below ground oil water separator. This separator serves the entire facility. The oil from the separator is pumped into an above ground tank and emptied periodically. The clean water is diverted to a multi-layered lined evaporation pond (Figure 7). The capacity of the evaporation pond is approximately 83,000 gallons. The pond is equipped with a vadose zone monitoring system.

![Figure 7. Evaporation Pond Detail](image)

**Compressed Air System**

The compressed air system provides a regulated supply of clean dry air for charging the rail car pneumatic braking system. There are three rotary screw air compressors supplying compressed air for
the system. Each compressor produces approximately 150 SCFM of air at 140 psig. The air compressors are located in buildings located on the east and west extent of the facility and in the center of the facility.

There are four air pit stations per strip track and two per storage track. At the strip tracks, the stations are located on either end of the strip track and two stations are located near the center of the strip track on either end of the center aisle. The stations for the storage tracks are located on either end of the storage tracks.

**Electrical Distribution**

Power distribution for the facility consists of a 12 kV high voltage service distributed throughout the facility in an underground electrical duct bank. The power is distributed from a centrally located substation and switchgear. Power from the underground distribution system is stepped down to 480V at each service location.

**Lighting**

High mast light poles are used to provide illumination for the strip tracks and the trailer parking area. Each high mast pole is 100 foot tall and uses a ring support structure to support the luminaries. The strip track is serviced from the south side. Each luminary is mounted on the ring bracket and aimed toward the strip track. In general, poles are spaced along the south side of the strip track at 400 feet and in a grid with a maximum spacing of 500 feet in the parking area. Lighting levels within the strip track and parking areas were designed to BNSF standards.
Lighting was also provided to the facility access road. Light poles were placed on either side of the roadway. Roadway light poles are 35 feet high with a four foot arm. Roadway light levels were designed to comply with IES Lighting Handbook Standards.

**Buildings**

There are nine buildings and appurtenant facilities located on the main facility. A list of the buildings and their approximate square footages are shown below:

- IBU Office Building (7,000 sf)
- Hostler Maintenance Building (Building 4,200 sf, Maintenance Bay 2,700 sf)
- Trailer Maintenance Area (3,600 sf)
- Crane Maintenance Area (Building 1,200 sf, Maintenance Pad 7,200 sf)
- Central Air Compressor Building (710 sf)
- East and West Air Compressor Building (710 sf)
- Fire Pump Building (710 sf)
- Fueling Facility (1,200 sf, 2-10,000 gallon diesel tanks)
- Trucker’s Convenience Facility (Phase 2)

All of the building structures except the east and west compressor buildings are of concrete block wall construction with steel truss and metal roofs. The east and west compressor buildings are off the shelf prefabricated metal structures.
Closed Circuit Television System

Pan tilt zoom security cameras are located at strategic locations throughout the facility and provide complete coverage. All but three of the cameras are mounted on light poles. Three additional cameras were required to be mounted on separate camera-only poles. These poles were located at the east and west extent of the strip lead tracks and at the facility entrance. In addition to the pole mounted cameras, there is an array of cameras located on the entrance canopy for viewing trucks entering and exiting the facility. All video is transmitted through fiber optic cable and terminates in the IBU office building. The video is recorded on a hard drive for possible future use.

MITIGATION

Environmental Mitigation

A major element of the environmental mitigation constructed as part of this project was the wetland preserve. The construction of the facility impacted approximately 1.72 acres of waters of the United States that are further classified as wetlands. The wetlands impacted also supported a State and Federal threatened snake species, the giant garter snake, in addition to other sensitive species. To compensate for impacts to waters of the United States and the giant garter snake, new wetlands were designed and built on a portion of the property purchased for the intermodal facility. A total of 5.16 acres of wetland was required to be mitigated. The total area of the preserve including wetlands and upland regions is 55 acres.
The new preserve, as shown on Figure 8, was constructed adjacent to the existing Little Johns Creek. Two primary mitigation channels were created by diverting the existing creek through a concrete weir structure. The primary mitigation channels run parallel to the existing creek. Each channel is approximately 11 feet deep and 35 feet wide. Four side pools were created by diverting water from the mitigation channels via diversion channels. The side pools were designed to fill during 5 to 10 year storm event flows. The side-pools will retain water until drying/dewatering occurs through vertical and lateral percolation, evapotranspiration, and evaporation.

A California native planting plan was implemented within the mitigation preserve to satisfy the mitigation requirements. The intent is to provide vegetated banks and uplands that can be used by local and migratory wildlife species. To insure the establishment of the California native planting plan, a temporary drip irrigation system was installed. The irrigation system will provide regular seasonal watering through a three-year establishment period. After this period the plants will be weaned from water and thereafter will be self-sustaining.
Traffic Mitigation

A major element of traffic mitigation for the facility is the construction of a new grade separation at Mariposa Road. The grade separation is required because of train switching that will occur across the existing grade crossing at Mariposa Road. The grade crossing will involve realigning Mariposa and a portion of Austin Road. The grade separation will pass over Austin Road, the BNSF mainline, the intermodal yard lead track and will allow for the construction of a future mainline.

The bridge is to be constructed of a cast-in-place, post-tensioned concrete box section. The approach embankments will be constructed from excavation of the retention basins.

CONSTRUCTION

Schedule

Construction of the project began in late October of 1999. Excavation of the retention ponds and placement of fill material for track embankments and strip tracks, trailer parking and access road subgrades accounted for most of the nearly 1,000,000 cubic yards of total earthwork. Most subgrade fills were substantially complete in 4 months.

In late November, lime treatment of the subgrade fills began with the storage track embankments. One of the primary goals of the project was to use the facility's storage tracks as soon as possible. Therefore, the construction of yard lead and storage track embankments were staged in the first phase of the project. Since the earthwork was well ahead of schedule, in late December the contractor cut the workweek from 6-10 hour days to 5-10's. Their progress continued ahead of schedule until mid
January of 2000 when heavy rains slowed their work for nearly a month and a half. Despite the bad weather, the embankments were ready for trackwork by early April of 2000.

The rail for the project was delivered in early March of 2000. In April, turnouts for the facility began to arrive. By then, lead and storage track embankments were complete with subballast. BNSF forces began to assemble the turnouts and by the end of April began constructing track. By the end of July, the first storage track (11,000 track feet) was complete and in service.

Once the lime treatment of soil was complete in the storage track areas, access road and building areas, lime treatment for the strip track apron subgrade began in late April of 2000. Once the contractor was finished with the lime treatment in the strip track areas in June, an extensive testing program revealed several areas with insufficient depths of lime treated subgrade. Some areas were deficient by nearly 6 inches. The contractor eventually remedied the deficiencies found in the subgrade. For a more detailed discussion of the problems encountered with the lime treated subgrade, see the following Lessons Learned section. Once repairs on the south apron area were complete, the contractor was ready to pave.

The placement of the Portland cement concrete (PCC) for the strip track aprons began in early July of 2000. An onsite batch plant was setup to produce the nearly 180,000 cubic yards of concrete required for the strip track pavement. The water needed for the concrete batching was pumped from a temporary onsite well and stored in three large containers. In order to help counter the effects of the summer heat on the freshly placed concrete, the contractor maintained the nearly 40,000 gallons of stored water at 40 degrees Fahrenheit. The water was run through a refrigeration unit and cycled overnight through the water storage containers. All other materials used in the concrete mix, which
include cement, fly ash and aggregates, were trucked to the site daily. The contractor was able to place approximately 3,000 cubic yards of PCC pavement per day. However, the supplier of the medium sized aggregate could not keep up with the contractor's demand and therefore, reduced daily production at times. The contractor was able to place each 7,700-foot long, 40' wide pass for the north and south strip track aprons in just over a week (Figure 9). By the end of September, the PCC pavement was in place and substantially complete with control joint treatment and BNSF forces began to build the strip tracks.

The contractor’s original schedule showed the construction of the buildings starting in late January of 2000. However, the lime treatment of the main access road and building areas was not complete before the rainy season. In mid January, rains saturated the clays prevalent on the construction site which prevented building contractors from accessing the building pad areas. Once the rains stopped and the site soil dried to allow accessibility, construction in the building areas began. By May, the foundations for the three main buildings (20,000 square feet) were complete. The construction of the
concrete masonry unit (CMU) walls was completed in two months. By the end of October, the buildings were substantially complete with only minor interior finish work remaining.

The northern portion of the Weber Slough box culvert construction began at the beginning of May 2000. The northern portion was constructed first so as to allow the construction of the storage tracks to proceed. Once the earthwork and subgrade preparation was complete, the contractor began by placing the entire bottom slab of the northern section of the box culvert. Once the bottom slab was ready, traveling steel forms were used for the rest of the section. By using this method, the contractor was able to place a segment of the box, advance the steel form and begin placing concrete for the next section in a matter of days. By mid June, the contractor had completed enough of the northern section to allow the construction of storage tracks. All concrete work and backfill for the north section (281’ long, 53’ wide and 7’-6” in total depth) was finally completed by the beginning of July. By mid September, all of Weber Slough was complete and the water flows were redirected through the culvert.

Facility Commissioning and Setup

Commissioning of the project's major mechanical and electrical facilities occurred in March of 2001. The various systems were started and operated for a length of time to prove their working order. On April 24th, 2001, the facility was officially opened. Total construction time was eighteen months.

Cost Reduction Incentive Programs (CRIPs)

The contractor was encouraged to make value engineered recommendations under Cost Reduction Incentive Programs (CRIPs). Once approved, each CRIP would result in cost savings that would then be shared between the contractor and the BNSF. The first CRIP, proposed in October of 1999,
involved the site storm drain system. The contractor substituted all reinforced concrete pipe (RCP) for cast-in-place pipe (24” diameter and larger) and high-density polyethylene (HDPE) pipe (smaller sizes). The cost savings realized from the substituted materials was not as significant as the time saved to the construction schedule. Because of the relatively long lead time for RCP, the contractor was able to save considerable time by constructing the storm drain system with readily available materials. The total time saved to the schedule was estimated to be at least two months.

CRIP's 2 & 3 involved changes in the strip track drainage system and the jointing of the PCC pavement. The contractor proposed to move the strip track drain lines to the center of the two strip track aprons. The original plan, according to standard practice, was to build separate manholes and catch basins located within the paved areas. The catch basins were to be located in the center of the nearly 80' wide aprons. The drain lines were located several feet from the center to allow the catch basins to drain down at an angle to the storm drain pipe. The manholes would be placed directly over the drain lines for regular inspection and cleaning purposes. Based on the contractor's revised design, the catch basins were relocated directly over and built down to the drain lines. Essentially, the two structures were integrated into a single structure that functioned as both manhole and catch basin. In addition, the contractor was able to eliminate one longitudinal joint in each of the concrete aprons. Each of the concrete aprons was constructed with two 40' wide passes. This resulted in just one longitudinal joint at the center of each pass and one longitudinal construction joint at the center of the apron between the two passes. The contractor also proposed to use slightly smaller dowels so that the transverse dowels could be inserted automatically using the paving machine. Use of the Dowel Bar Inserter (DBI) was a quality enhancement that ensured the location of the dowels. Although none of the CRIPs saved a considerable amount of money, the overall quality of the project was improved.
LESSONS LEARNED

Once the contractor was finished with the lime treatment in the strip track areas, an extensive testing program revealed several areas with deficient depths of lime treated subgrade. Some areas were deficient as much as 6 inches. These deficiencies were most likely caused by the physical limitations of the lime treatment equipment and the failure to calibrate the equipment on a daily basis. The contractor was allowed to construct the lime treated subgrade using just two lifts to achieve the required 31 inch section. According to the manufacturer of the equipment used, the machines were pushed to the limits of their efficiency. The contractor eventually remedied the deficiencies found in the subgrade, however, the contractor lost time in the construction schedule due to the repairs. In the future, a similar lime treatment operation for the section used in this project should have been constructed using three lifts.

During the course of the project, the contractor and Construction Management Team identified a number of material procurements as long lead items. Delays were avoided by factoring these long lead items into the construction schedule. Some of these items included special trackwork such as turnouts, various mechanical equipment such as compressors and dryers, and prefabricated buildings. However, the 100' tall high mast poles used for lighting of the facility turned out to be a long lead item due to the increased demand and manufacturer's backlog at the time. In addition, delays in the approval of the proposed lighting fixtures caused delays in the approval of the light poles. Finally, at the end of October of 2000, the lighting fixtures and light poles were approved. The contractor then ordered the fixtures and poles, which eventually arrived on site in mid March 2001. Once field modifications to the poles were made to accommodate closed circuit television cameras, the poles
were installed complete with lighting fixtures by the end of April, two weeks before the contract completion date.

Most long lead items were correctly identified and factored into the schedule. However, as demonstrated with this project, any item can become a long lead item depending on current demand and/or availability. Therefore, all significant materials that could delay the project should be thoroughly tracked and delivery schedules should be checked on a regular basis.