“7 Disciplines of Engineering at Union Pacific Railroad”

Eric Gehringer
Assistant Vice President of Track Programs,
Union Pacific Railroad

Date: Friday, April 28, 2017
Time: Seminar Begins
Location: Newmark Lab, Yeh Center, Room 2311
Student welcome and encouraged to attend!
The Ties That Bind a Nation: Union Pacific
2016 Fast Facts

$19.9 B Revenue
8.5 mil Carloads of Freight
10,000 Customers
32,100 Route Miles in 23 States
42,900 Employees
$4.1 B Annual Payroll
8,000 Locomotives
Union Pacific Hauls . . .
Creating Value the UP Way
Rails Are One of America’s Safest Industries
Injuries and illnesses per 100 Full-time Employees, 2015

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Safety is Top Priority

↓ 60% EMPLOYEE

↓ 29% RAIL EQUIPMENT

↓ 16% CROSSING

Reportable Rail Equipment Incidents Per Million Train Miles

GOOD

Crossing Accidents Per Million Train Miles

Reportable Injuries Per 200,000 Employee Hours

1.95

.78

2006 2016

2006 2016

2006 2016

2006 2016
Armour Yellow Outside
Green Inside

• One train takes several hundred trucks off congested highways

• Rail is almost four times more fuel efficient than trucks

• UP can haul one ton of freight 452 miles on one gallon of diesel fuel
Strengthening the Franchise

~$3.1 BILLION 2017 CAPITAL PLAN
(IN MILLIONS)

10% POSITIVE TRAIN CONTROL
$1,860

60% INFRASTRUCTURE REPLACEMENT

8% CAPACITY/COMMERCIAL FACILITIES
$255

14% LOCOMOTIVES & EQUIPMENT

8% TECHNOLOGY / OTHER
$300

8% other
$240

*In millions. Includes cash capital, leases and other non-cash capital.
OUR MISSION
The men and women of Union Pacific are dedicated to serve.

OUR VALUES
Passion for performance
High ethical standards
Work as a team
7 DISCIPLINES OF ENGINEERING
UNION PACIFIC RAILROAD

Eric Gehringer – Assistant Vice President
Engineering
Material Management/Design

Strategic Focus Areas

• Tie treatments
• Composite ties
• Concrete ties
• Concrete OTM (pads & insulators)
• Elastic fasteners
• Tie spacing
• In-track condition monitoring
• Asset life cycle modeling
Engineering
Transportation – Consistent System Performance

Capital Cycle

New Track
Inspection & Defect Removal
Track Degradation
Renewal Event

UP Standard
Intervention Zone
Minimal Safety Standard

Slow Order

Traffic Load MGT, Time, Environment
Engineering Transportation
Minimize Footprint

Risk Identification

Solar Panels & GPS Antenna
Battery Energy Storage
Sensor Head with Camera & Lasers
On-Board Image Processing & Computation
Engineering
Structures

Strategic Focus Areas
• Condition monitoring sensors
• Critical event monitoring sensors
• Drone technology
• Fire detection
• Fire prevention
• Laminated wood products
• Predictive life cycle asset modeling
Engineering
Environmental

**Strategic Focus Areas**

- Define environmental aspects, requirements, & required training
- Prevent, prepare for & respond to incidents that can harm human health & the environment
- Monitor environmental performance
- Evaluate compliance & risk
**Engineering**

**Geotechnical**

**Strategic Focus Areas**
- Application of GPR data sources
- Expansive clays
- Effectiveness of shoulder cleaning
- Underlayments (geo-web, HMA)
- Effectiveness of shear key strategies
- Effectiveness of soil nails
Engineering
Construction Management

• Adding track capacity
  – 2nd Main tracks
  – Sidings
  – Siding extensions

• Promoting commercial development
  – Intermodal yards
  – Automotive yards
  – Industrial parks
  – Industrial lead tracks
  – Switch installation

• Yards
  – Classification
  – Storage in Transit (SIT)
  – Local customer support

• Facilities
  – Yard offices
  – Crew change locations
  – Border security
  – Fueling
  – Gatehouse admin buildings
  – Waste water treatment
  – Automatic Gate Systems
ILLINOIS HIGH SPEED RAIL
Multimodal Improvement Project
IL High Speed Rail
Project Scope

- Passenger and Freight joint-use corridor
- Primarily single track with 13+ sidings
- Upgrades for passenger speeds of up to 110mph
- Reduced travel time
- Improvements for reliable service
IL High Speed Rail
Infrastructure Investment

- 262 miles of track rehabilitation
- 57 miles 2\textsuperscript{nd} Main Line construction
- 15 new or improved sidings
- 234 improved grade crossings
- 38 major structures
- Advanced signaling system (PTC)
SANTA TERESA
Run Through, Intermodal Yard & Fueling Facility Project
Santa Teresa
Project Scope

• 45 trains per day capacity
• 30 mph speed through fueling facility
• Track design to utilize wood, steel and concrete ties
• 2 tracks must be in service at all times during construction
Santa Teresa
Cross Functional Facility w/ Extensive Foot Print

West Fueling Facility

East Fueling Facility

Intermodal Yard

Block Swap Yard
TOWER 55 – FT. WORTH, TX
Multimodal Improvement
System Velocity
Tower 55 – Ft. Worth, TX

Flow Pattern Drives Project Demand

Project Challenges:
- Confined work area
- Overhead and pier obstructions
- Coordination with stakeholders
- Subgrade condition
- Working under traffic
- Neighborhood relationships
Tower 55 – Ft. Worth, TX

Project Scope

- 3rd north/south mainline
- Four slots north of tower
- Reduced curvature
- Switch Improvements
- Widened bridges
- Signal Improvements
- Increased mainline speed

17 Months of Construction Drove 25% Increase in Train Speed
Construction Management
Responsibilities

• Manage all aspects of construction including
  – Grading
  – Track work
  – Bridges
  – Culverts
  – Pavement
  – Building
  – Electrical systems
  – Drainage systems
  – Utilities

• Professional management of various contractors including invoice payment

• Insure compliance with federal, state and local laws

• Insure compliance with environmental permitting requirements
Construction Management
Responsibilities (cont.)

• Provide onsite engineering expertise to both internal and external customers

• Manage the work in progress inventory for all track material by ensuring arrival and installation

• Assure construction is delivered at the lowest cost and results in the highest quality product

• Minimize local customer service disruptions and through-freight train delays.