

TRANSPORTATION HIGHWAY ENGINEERING CONFERENCE – 2017

URBAN LIDS

FINAL DESIGN EXPERIENCES AND HIGHLIGHTS FROM THE SR520
EASTSIDE HOV AND TRANSIT PROJECT, KING COUNTY, WASHINGTON

LOCHNER



SR520 CORRIDOR BACKGROUND

- SR520 BRIDGE REPLACEMENT AND HOV PROGRAM FROM I-405 TO I-5
 - SR520 Eastside Transit and HOV
 - SR520 Floating Bridge and Landings
 - SR520 Westside
 - \$4.56B TOTAL PROGRAM/\$2.4B SPENT TO DATE



GRAPHIC COURTESY OF WSDOT

LOCHNER

EASTSIDE PROJECT BACKGROUND

- SR520 EASTSIDE TRANSIT AND HOV PROJECT - TIMELINE
 - 2008 - EA Issued
 - 2010 - Environmental Process Complete
 - 2010 - Design-Build Procurement and Award
 - 2011 – Design and Construction Begins
 - 2014 - Major Improvements Complete
 - 2015 - All Construction Complete
 - 2016 - Project Close Out Activities

EASTSIDE PROJECT BACKGROUND

- SR520 EASTSIDE TRANSIT AND HOV PROJECT – DELIVERY METHOD & COSTS
 - Design-Build Procurement – 2 Step Process, Best Value Selection
 - Project Costs:
 - \$306M Winning Bid by Eastside Corridor Constructors with Lochner as Prime D-B Design Consultant
 - Final Cost of Construction with Additions – \$364M +/-
 - \$422M Engineers Estimate
 - Co-Location of Constructor, Owner and Designer Staff in Project Office

SR520 EASTSIDE BACKGROUND

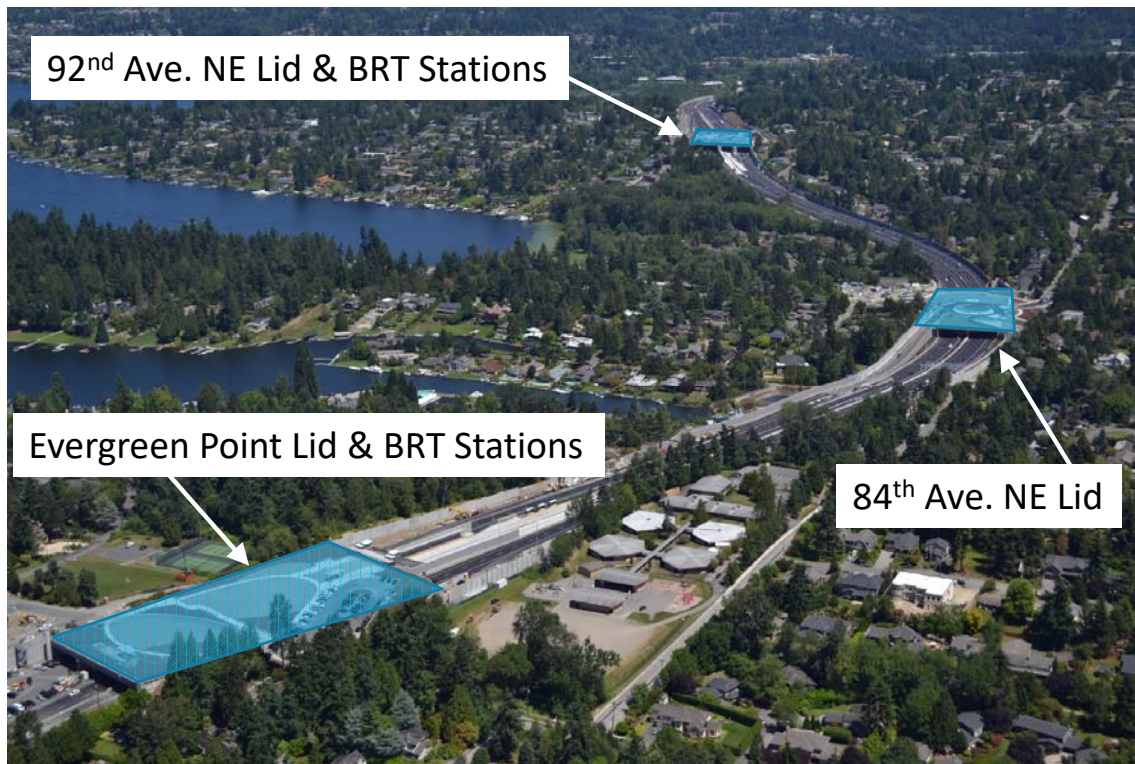
- SR520 EASTSIDE TRANSIT AND HOV PROJECT - PARTICULARS
 - Corridor Originally constructed in the 1960's
 - Evergreen Point Floating Bridge open in 1963
 - 2 General Purpose Lanes in Each Direction
 - Narrow Shoulders
 - Complete Reconstruction under Staged Traffic Required
 - Basic Configuration and Requirements Defined in WSDOT D-B Procurement Documents
 - Elements of the D-B Basic Configuration & Required Design Elements:
 - 2 General Purpose Lanes Lanes
 - 1 HOV and Transit Lane in Each Direction to Facilitate Movement of Traffic and Center BRT Function
 - Various Safety Improvements to the Corridor
 - 3 Urban Lids
 - 2 Major Bridges, 3 Pedestrian Tunnels
 - Noise Walls, Trails and Corridor Aesthetics
 - 4 Bus Rapid Transit Stations
 - 150 +/- Retaining Walls
 - ITS Components and Structures

SR520 EASTSIDE BACKGROUND PROJECT LOCATION



LOCHNER

SR520 EASTSIDE BACKGROUND



ORGANIZATION OF LID DESIGN TEAM

-HIGH LEVELS OF INTERDISCIPLINARY COLLABORATION-

- Constructors
- Urban Architecture & Lighting
- Landscape Architecture
- Transit Architecture
- Structures / Bridge Engineering
- Roadway Geometrics Design & Engineering
- Drainage Engineering & Design
- Geotechnical Engineering

LOCHNER

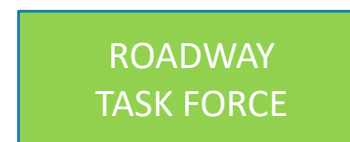
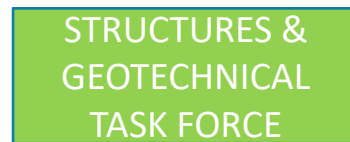
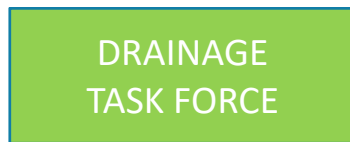
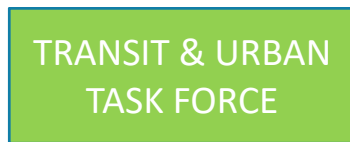


LID DESIGN TEAM ORGANIZATION

DESIGN
MANAGEMENT
LEVEL



DISCIPLINE
MANAGEMENT
LEVEL



URBAN FINAL DESIGN DEVELOPMENT PROCESS

URBAN DEVELOPMENT PROCESS PLAN (UDPP)

- PURPOSE

- ENGAGE THE STAKEHOLDER COMMUNITIES IN THE FINAL DESIGN PROCESS FOR THE URBAN LIDS

- GOALS

- PROVIDE MEANINGFUL OPPORTUNITY FOR DESIGN INPUT BY STAKEHOLDERS
- ENSURE NO SURPRISES IN RELEASED FOR CONSTRUCTION DESIGN
- FOCUS ON INDIVIDUAL COMMUNITY NEEDS WHILE MAINTAINING A CONSISTENT CORRIDOR
- IDENTIFY CHANGES NEEDED

- ORGANIZATION OF STAKEHOLDER WORKING GROUPS

- TWO MAIN GROUPS

- POINTS COMMUNITIES: MEDINA, HUNTS POINT, YARROW POINT AND CLYDE HILL
- CITY OF BELLEVUE AND CITY OF KIRKLAND

URBAN FINAL DESIGN DEVELOPMENT PROCESS

URBAN DEVELOPMENT PROCESS PLAN (UDPP)

FOCUS ON ELEMENTS OF URBAN DESIGN AND LANDSCAPE

- HARDSCAPE FEATURES
- PLANTINGS AND PLANT PALLET
- TREE SPECIES AND LOCATIONS
- TRAIL AND PATH CONNECTIONS
- CIRCULATION PATTERNS
- LAYOUT OF URBAN SPACES
- MAINTENANCE REQUIREMENTS
- RECOMMENDATIONS FOR CHANGES

UDPP PROCESS FLOW



92ND AVENUE NE. LID DESIGN

- 90,000 SF +/- (445'x202')
- Bus Rapid Transit (BRT) Stations
- BRT Drop Off Area
- Great Lawn
- Urban Features and Trail Connections

92ND AVENUE NE. LID DESIGN



LOCHNER

84TH AVENUE NE. LID DESIGN

- 74,000 SF +/- (476'x156')
- Round About
- Urban Features
- Regional and Local Trail Connections

84TH AVENUE NE. LID DESIGN



LOCHNER

EVERGREEN POINT LID DESIGN

- 100,000 SF +/- (485'x210')
- Bus Rapid Transit Stations
- Parking for BRT
- Great Lawn
- Olympic Mountain Range Overlook
- Urban Features and Trail Connections

EVERGREEN POINT LID DESIGN



LOCHNER

LID FEATURES – TRANSIT ACCESS



LOCHNER

LID FEATURES – TRANSIT ACCESS



Photo Credit: Jim Mataresse

LOCHNER

LID FEATURES – TRANSIT ACCESS



LOCHNER

LID FEATURES – TRANSIT ACCESS



LOCHNER

LID FEATURES – URBAN SPACES



Photo Credit : Jim Matarrese

LOCHNER

LID FEATURES – CONNECTIONS



LOCHNER

LID FEATURES – LATERAL VIEWS



LOCHNER

DESIGN HIGHLIGHTS - STRUCTURES

ATYPICAL CONDITIONS:

- SCALE AND SIZE OF BRIDGES
- LOADINGS – DEAD AND LIVE
- TOP OF DECK GRADING DRIVEN BY DRAINAGE
- MULTIPLE DISCIPLINES INVOLVED

DESIGN HIGHLIGHTS - STRUCTURES

- SOIL FILLS ON LID UP TO 4 FEET IN DEPTH
 - FULL SATURATION OF SOIL PRESUMED POSSIBLE
 - PLANTINGS INCLUDING TREES CAPABLE OF REACHING 30-40 FEET IN MATURE HEIGHT
- LIVE LOAD FOR ASSEMBLY TYPE LOADS AT 100 PSF, WITHOUT AREA REDUCTION
- HIGH SEISMICITY CORRIDOR
 - SDC D
 - PGA OF UP TO 61% OF GRAVITY
 - PEAK SPECTRAL ACCELERATION OF 120% OF GRAVITY
 - PUSH-OVER REQUIREMENTS & MINIMUM LATERAL STRENGTH CONTROLLED DESIGN TO LARGE EXTENT
- NFPA 502 AND PROJECT REQUIREMENTS (>300' - ROADWAY TUNNEL)
 - ENTRY CONTROL
 - FIRE PROTECTION REQUIRED FOR GIRDERS
 - NON-COMBUSTIBLE MATERIALS PROHIBITED UNDER LID

DESIGN HIGHLIGHTS - CONSTRUCTABILITY

- LIDS CONSTRUCTION OCCURRED IN TWO MAIN PHASES
- GIRDER ERECTION OCCURRED DURING SR520 WEEKEND SHUTDOWNS
- DETAILS REQUIRED TO MAXIMIZE ECONOMY
 - ACCELERATED BRIDGE CONSTRUCTION (ABC) ELEMENTS
 - PPC DECK PANELS
 - WSDOT WF PPC SUPER GIRDERS (24,000 +/- LF)
 - TUB FASCIA GIRDERS
 - MAXIMIZE DECK SPAN BY OPTIMIZING GIRDER DEPTH = EFFICIENT DECK & LESS OVERALL ELEMENTS
 - CIPC ABUTMENT AND PIER DETAILS SIMILAR ACROSS ALL THREE LIDS, BASED ON MODULE
 - SIMPLE REPEATABLE DETAILS = LEARNING CURVE LIMITED & HIGH PRODUCTION RATE

DESIGN HIGHLIGHTS –CONSTRUCTABILITY USE OF WSDOT SUPERGIRDERS



LOCHNER

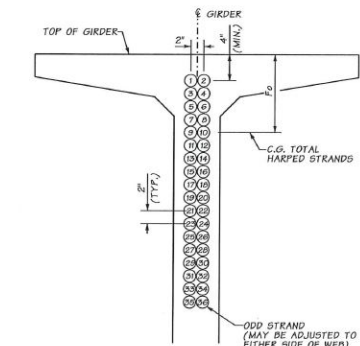
DESIGN HIGHLIGHTS – CONSTRUCTABILITY

A VIEW FROM BELOW 84TH AVE NE LID



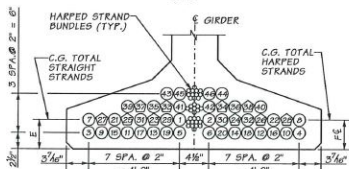
LOCHNER

DESIGN HIGHLIGHTS – CONSTRUCTABILITY USE OF WSDOT SUPERGIRDERS



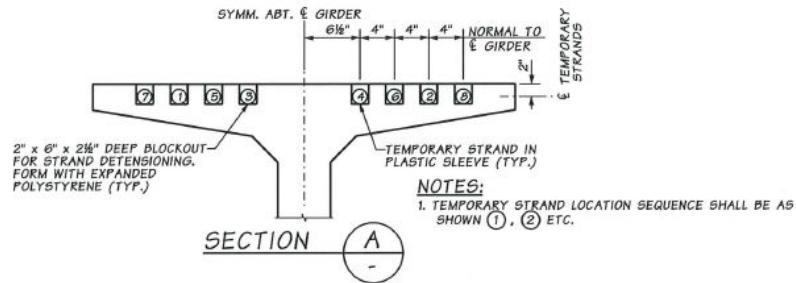
**STRAND PATTERN
AT GIRDER END**

HARPED STRAND LOCATION SEQUENCE SHALL BE AS SHOWN ①, ②, ETC.



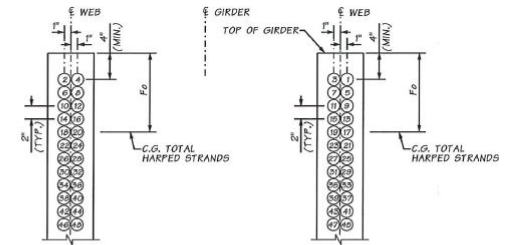
**STRAND PATTERN
AT \ominus SPAN**

STRAIGHT STRAND LOCATION SEQUENCE SHALL BE AS SHOWN ①, ②, ETC.



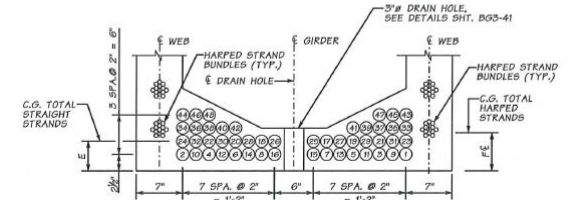
NOTES:

1. TEMPORARY STRAND LOCATION SEQUENCE SHALL BE AS SHOWN ①, ②, ETC.



**STRAND PATTERN
AT GIRDER END**

HARPED STRAND LOCATION SEQUENCE SHALL BE AS SHOWN ①, ②, ETC.



**STRAND PATTERN
AT \ominus SPAN**

STRAIGHT STRAND LOCATION SEQUENCE SHALL BE AS SHOWN ①, ②, ETC.

LOCHNER

DESIGN HIGHLIGHTS – CONSTRUCTABILITY DIAPHRAGM CONSTRUCTION/STAGING



LOCHNER

DESIGN HIGHLIGHTS –CONSTRUCTABILITY PPC DECK PANELS/STAGING



LOCHNER

DESIGN HIGHLIGHTS - CONSTRUCTABILITY



LOCHNER

DESIGN HIGHLIGHTS – LID DRAINAGE

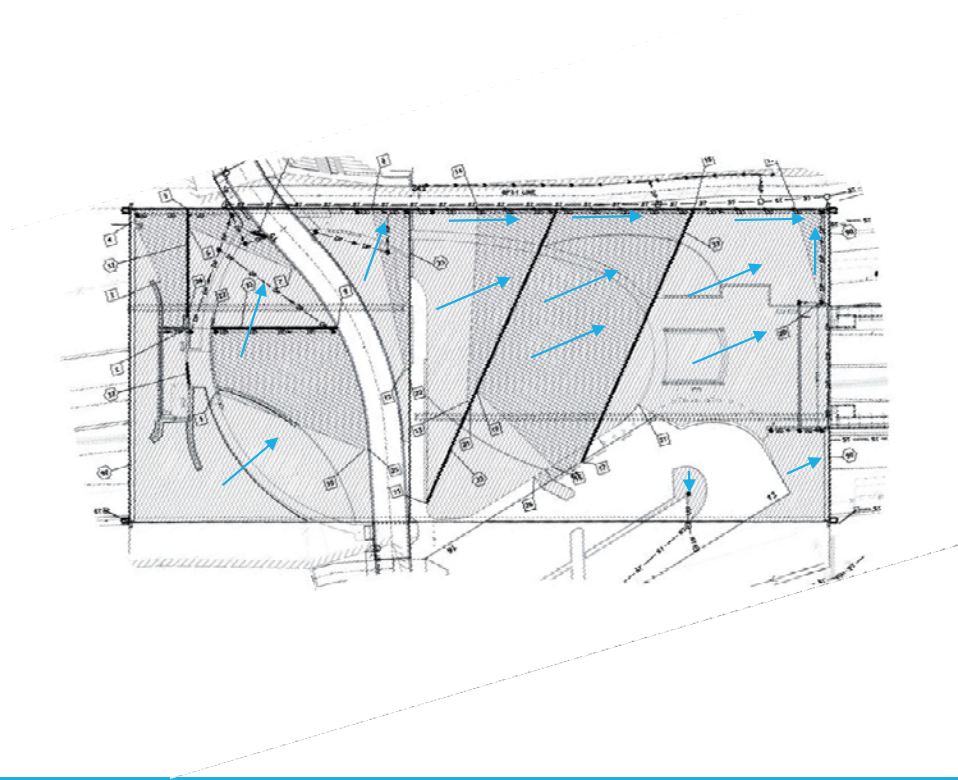
- DECK GRADING FOR DRAINAGE
 - MORE SIMILAR TO EARTHWORK THAN TYPICAL BRIDGE DECK
 - USE OF 0.3% MIN. AND $\geq 0.5\%$ DESIRABLE SLOPES
 - USE OF PREFABRICATED DRAINAGE MAT VARYING THICKNESS AND SAND FILL DRAINAGE LAYER
 - USE BELOW GRADE CHECK DAMS AND CRICKETS TO CONTROL AND DIRECT SUBSURFACE WATER FLOW
 - CONTROL PERMEABILITY OF ORGANIC PLANTING SOILS

DESIGN HIGHLIGHTS - DRAINAGE



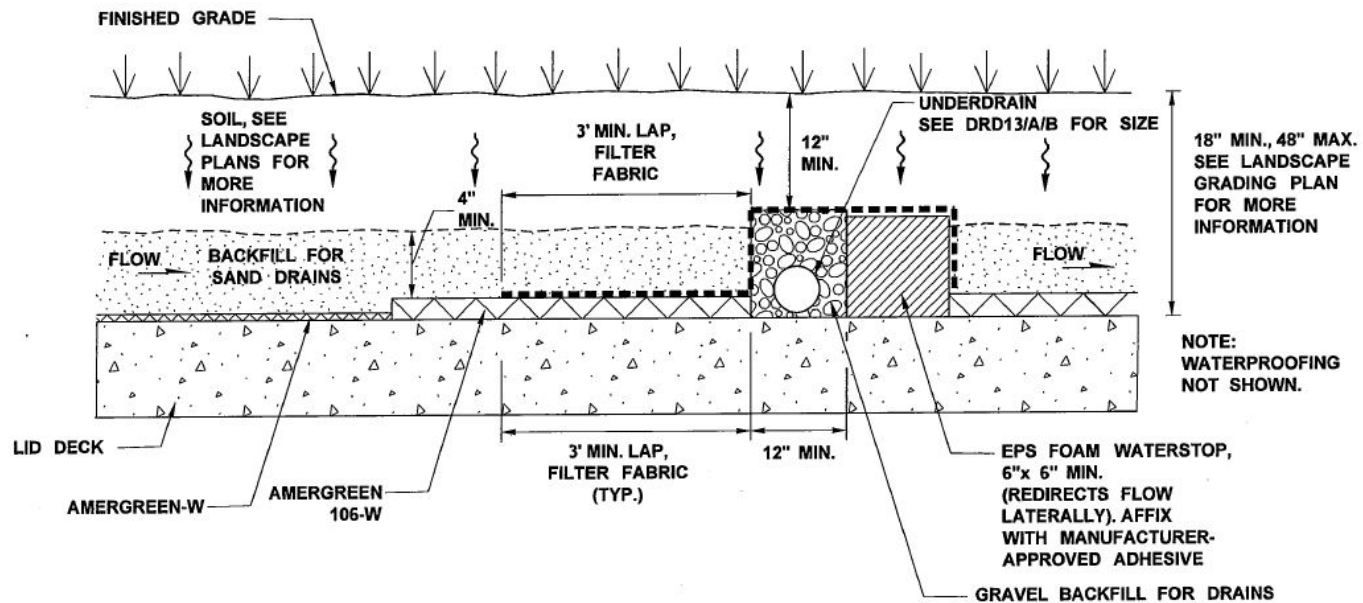
LOCHNER

DESIGN HIGHLIGHTS - DRAINAGE



LOCHNER

DESIGN HIGHLIGHTS - DRAINAGE



LOCHNER

OPPORTUNITIES FOR FURTHER INNOVATION

- ABC SUBSTRUCTURE ELEMENTS
- PRECAST DECK ELEMENTS AND CLOSURE POURS
- DIAPHRAGM MINIMIZATION OR ELIMINATION
- USE OF TURF SUBSTITUTES

THANKS TO ALL FOR ATTENDING
QUESTIONS?

LOCHNER

A solid blue horizontal bar spans the width of the slide, positioned below the Lochner logo.