MS, BS in Civil Engineering
Master of Business Administration
P.E. & CPA for forty years

Engineering & Financial Consultant to
Construction, Real Estate, and Law Firms

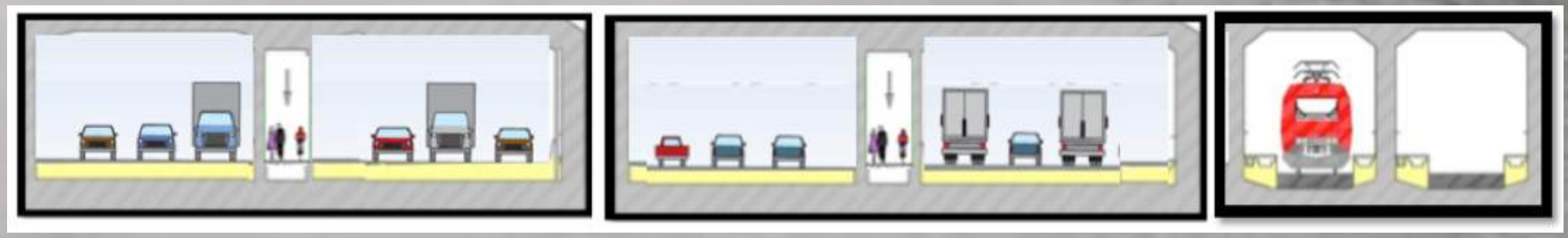
Teach the History of Infrastructure
at the University of Washington

Studied infrastructure on all seven continents and over fifty countries

1. Columbia Immersed Tube Tunnel (ITT)

2. Advantages; Economic, Safety & Environmental

3. Worldwide Examples



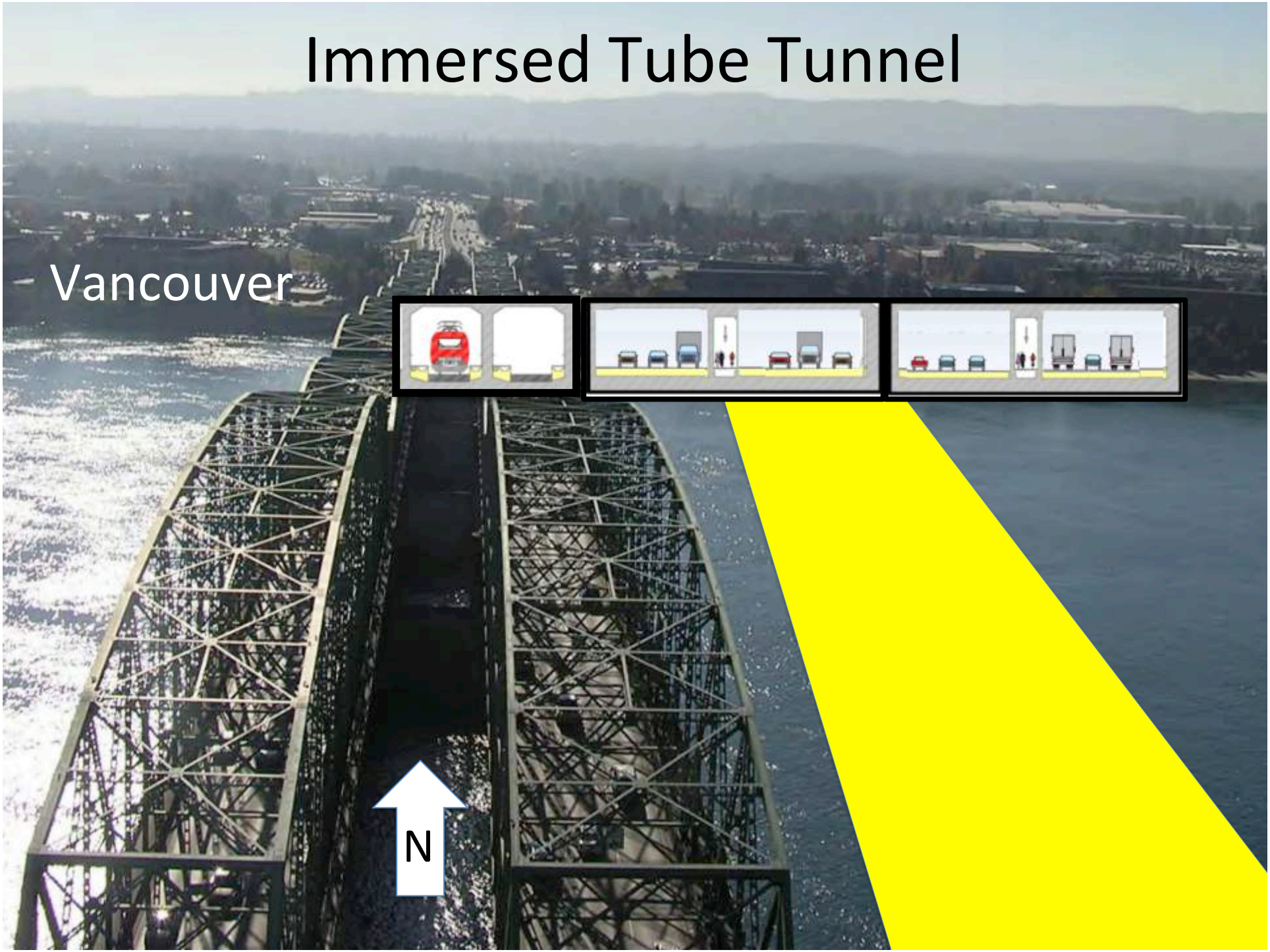

1. Cast

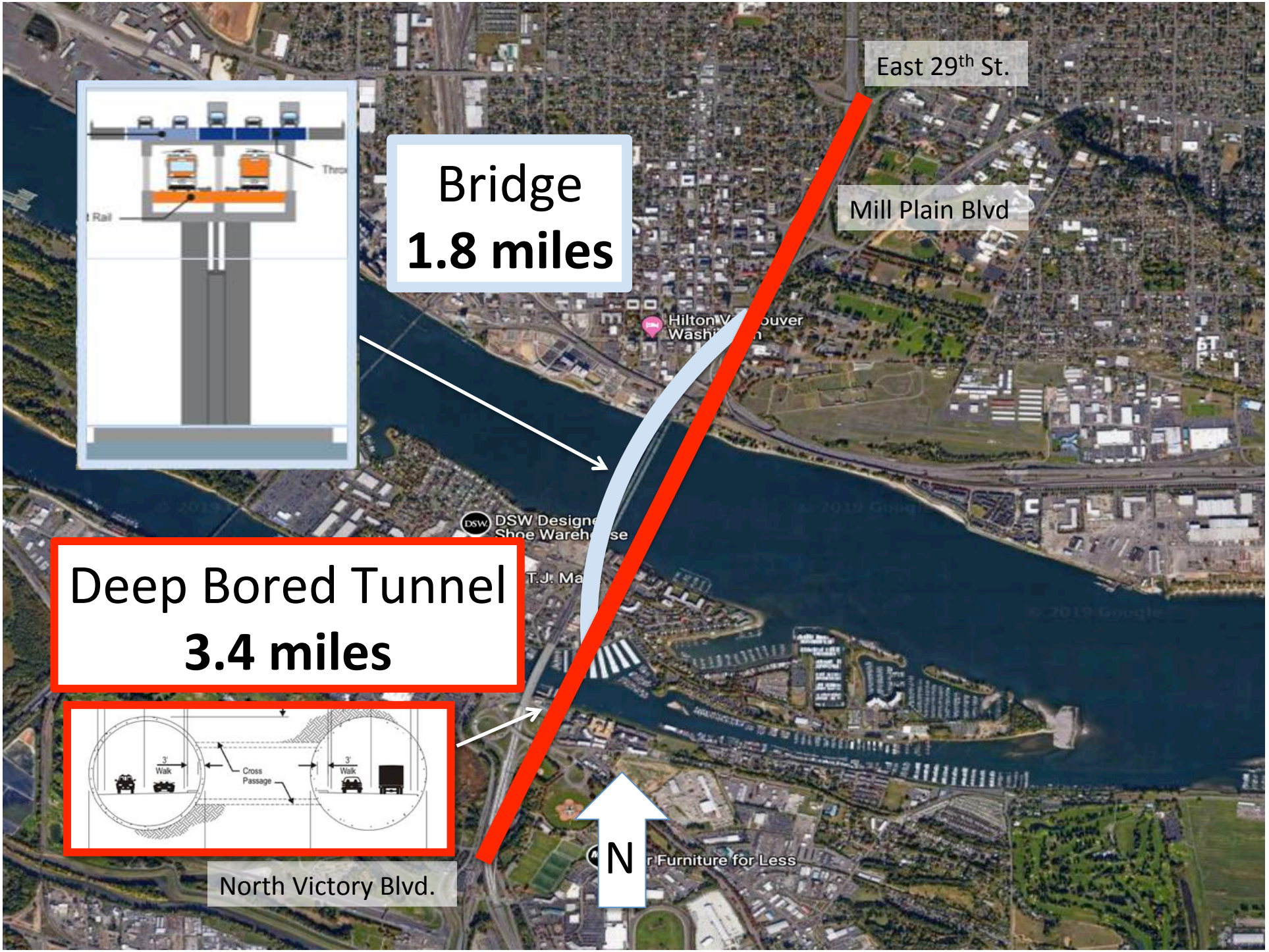

3. Immerse


2. Transport

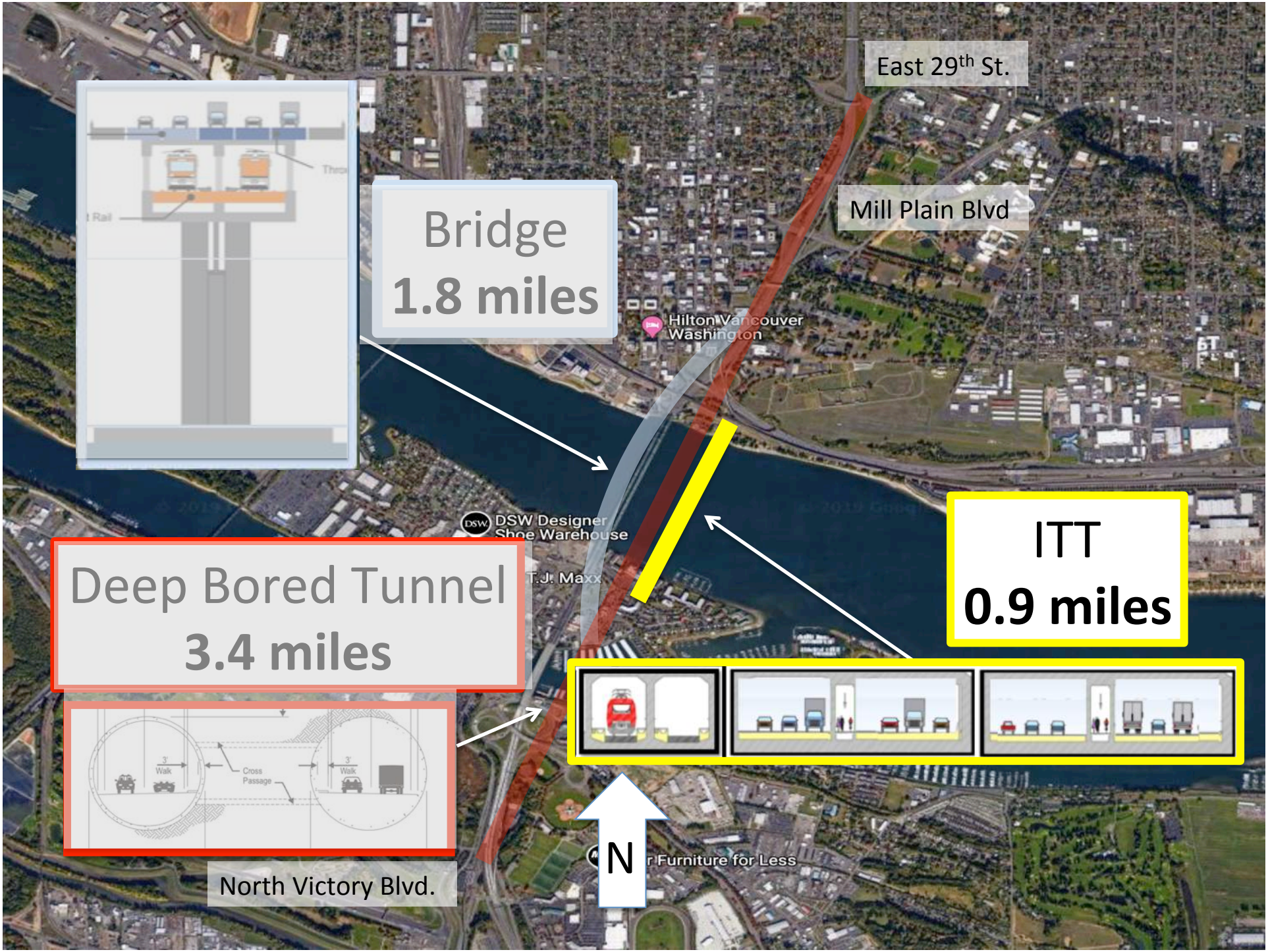

4. Cut & Cover

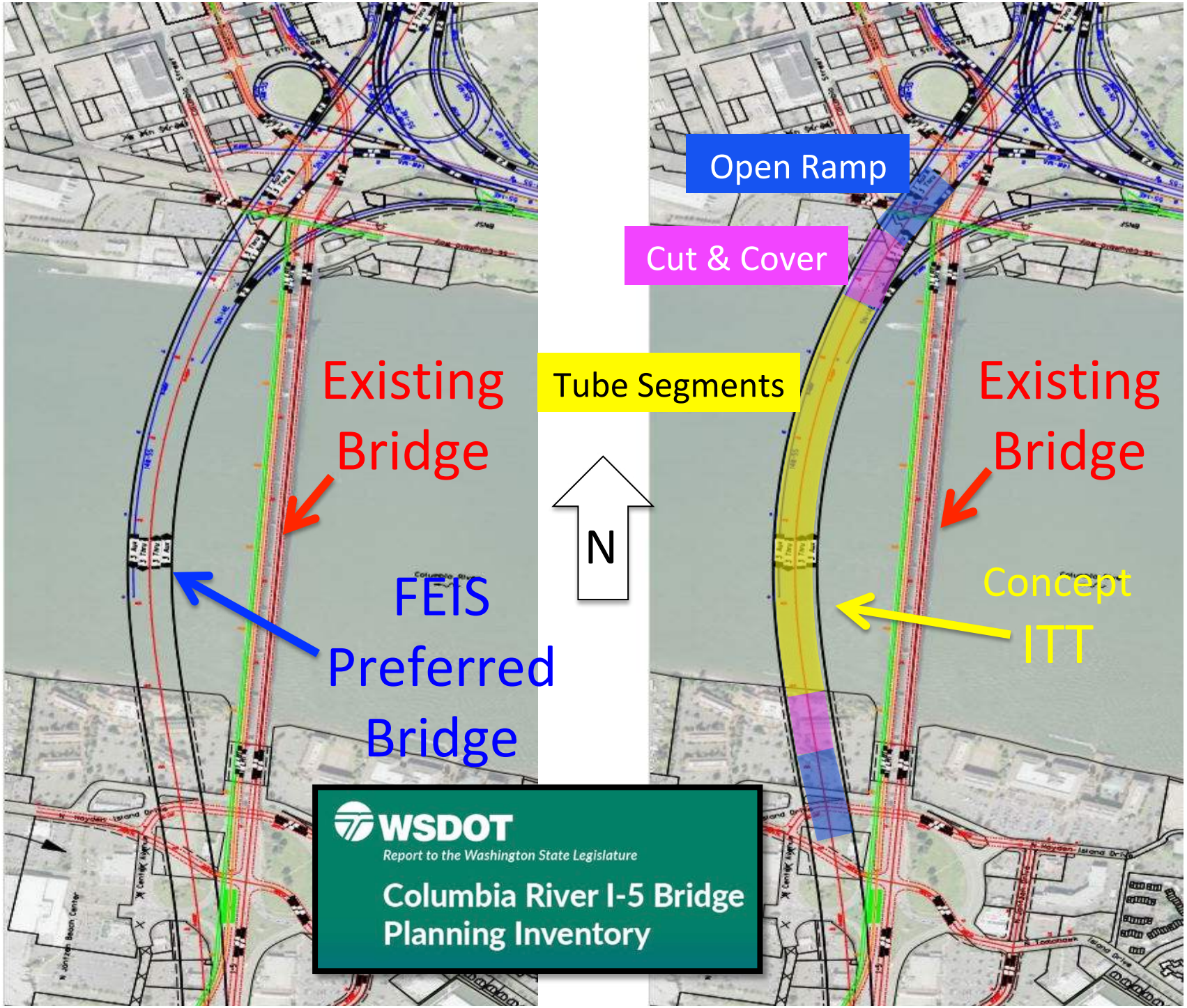
Immersed Tube Tunnel

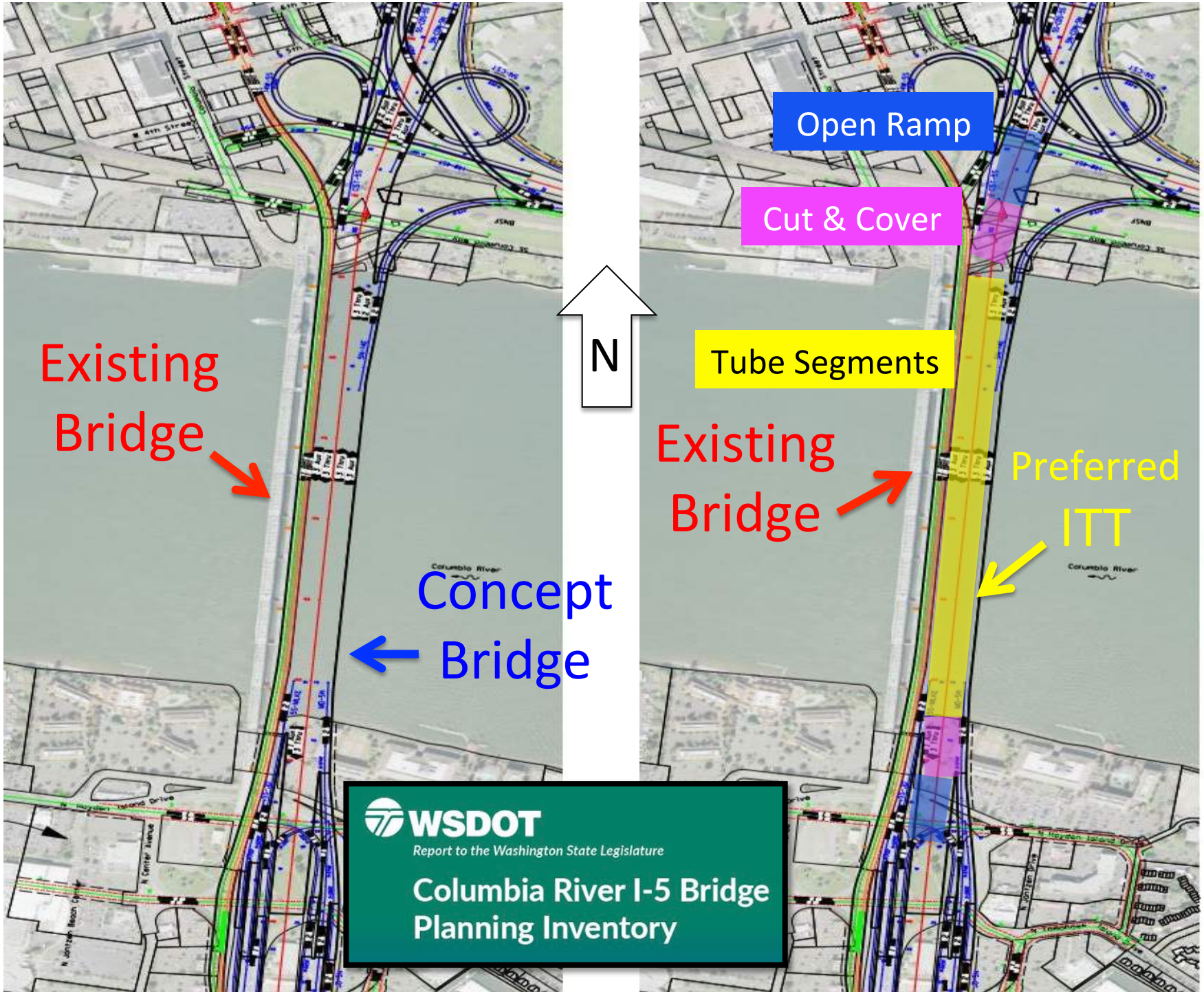


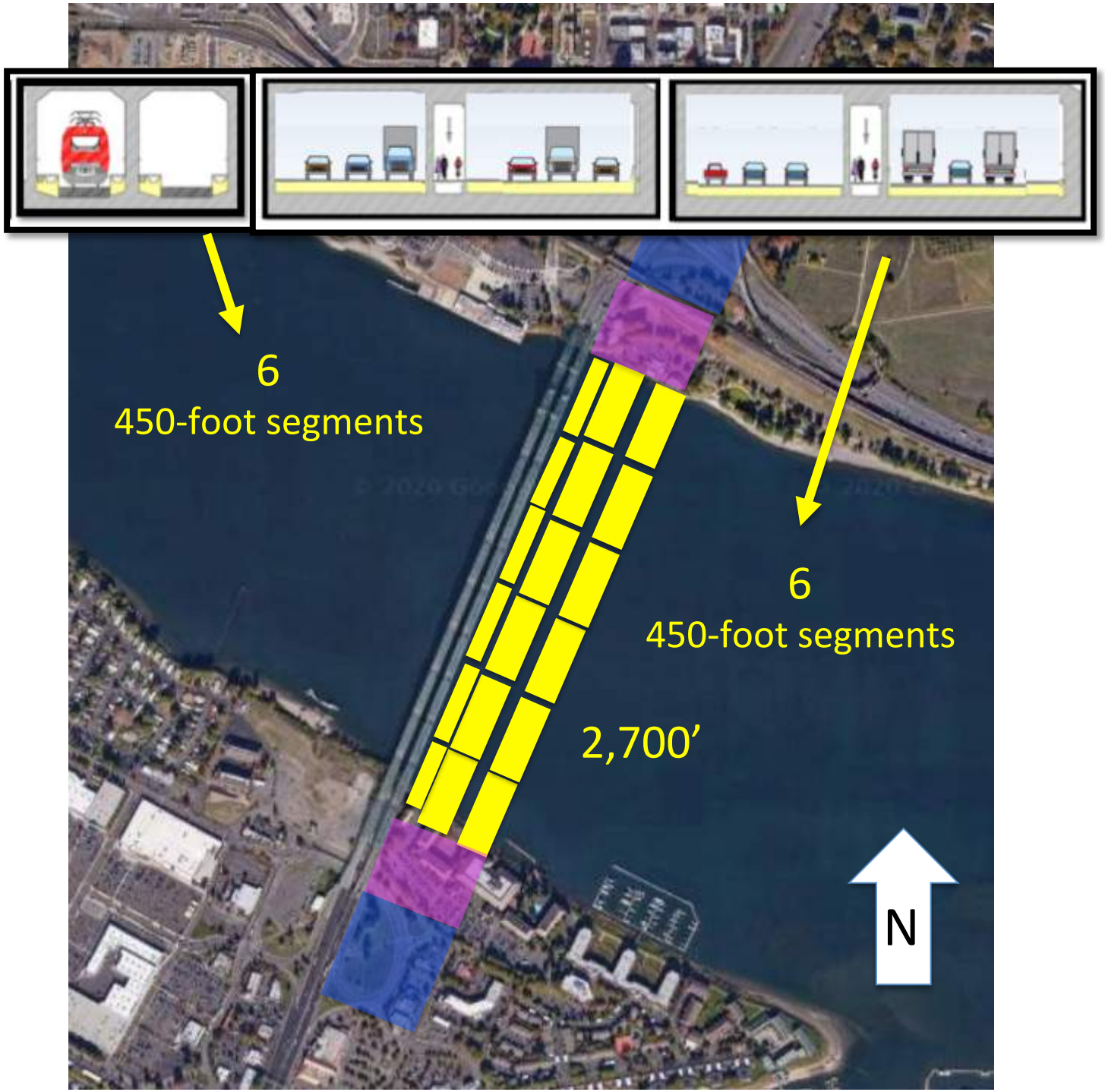

East 29th St.
Mill Plain Blvd
Bridge
1.8 miles
Deep Bored Tunnel
3.4 miles
3' Walk
Cross Passage
3' Walk
North Victory Blvd.
N

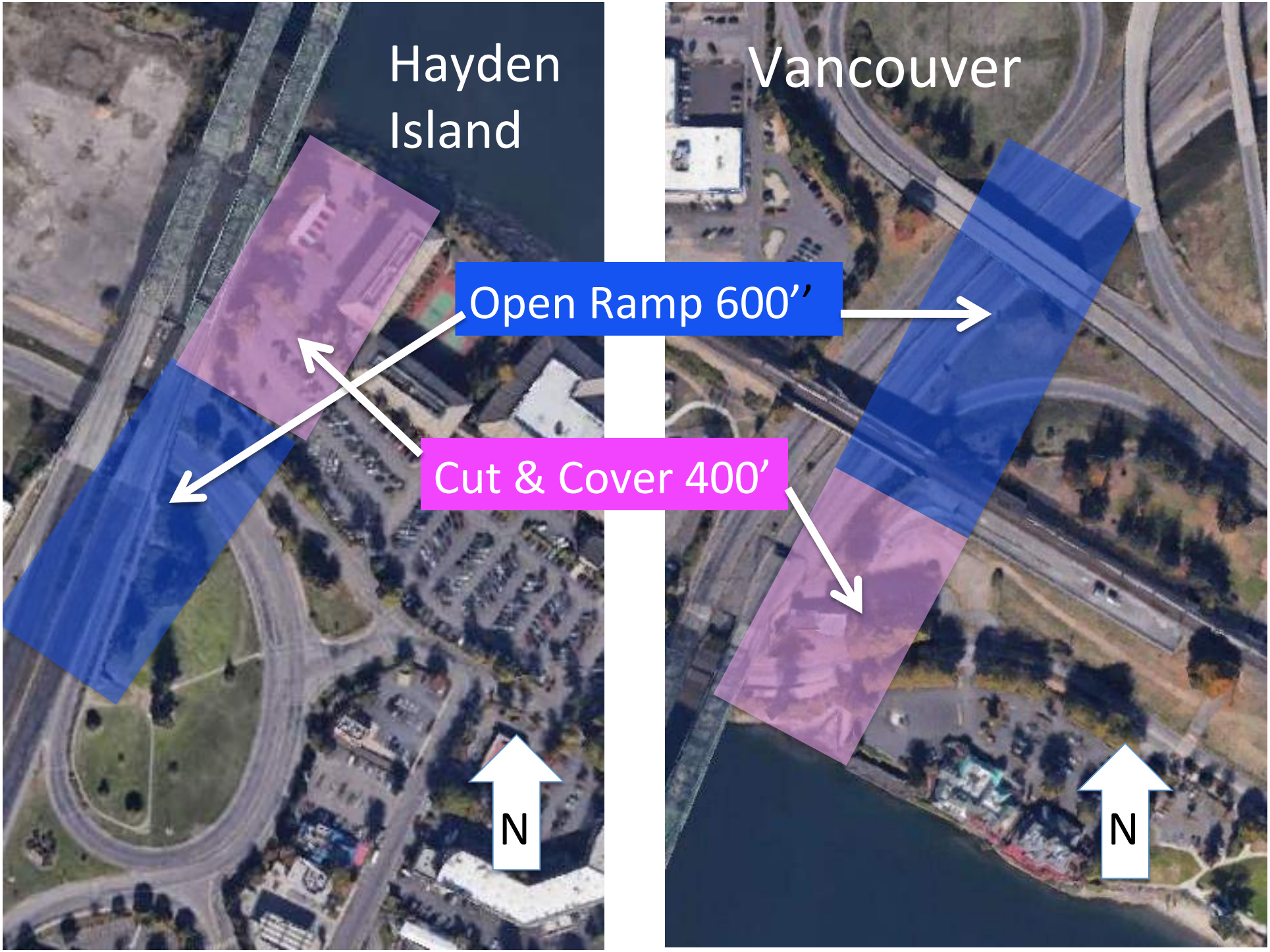

East 29th St.
Mill Plain Blvd
Bridge
1.8 miles
Deep Bor
3.4 r
North
3'
Walk
Cross
Passage


East 29th St.
Mill Plain Blvd
Bridge
1.8 miles
Hilton Vancouver Washington
DSW Designer Shoe Warehouse
T.J. Maxx
ITT
0.9 miles
Deep Bored Tunnel
3.4 miles
3' Walk
Cross Passage
3' Walk
N
Furniture for Less
North Victory Blvd.


Open Ramp
Cut & Cover
Existing Bridge
Tube Segments
Existing Bridge
N
FEIS Preferred Bridge
Concept ITT
WSDOT
Report to the Washington State Legislature
Columbia River I-5 Bridge Planning Inventory


Existing Bridge
Concept Bridge
N
Open Ramp
Cut & Cover
Tube Segments
Existing Bridge
Preferred ITT
WSDOT
Report to the Washington State Legislature
Columbia River I-5 Bridge Planning Inventory


6
450-foot segments
6
450-foot segments
2,700’
N


Hayden Island
Vancouver
Open Ramp 600’’
Cut & Cover 400’
N
N

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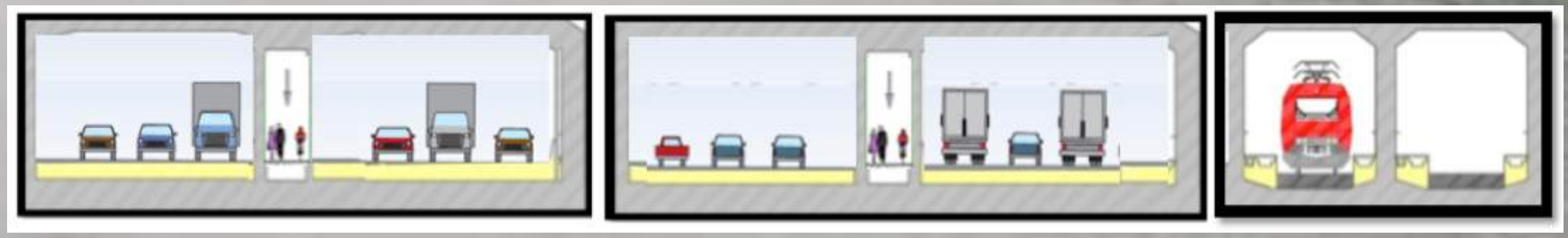
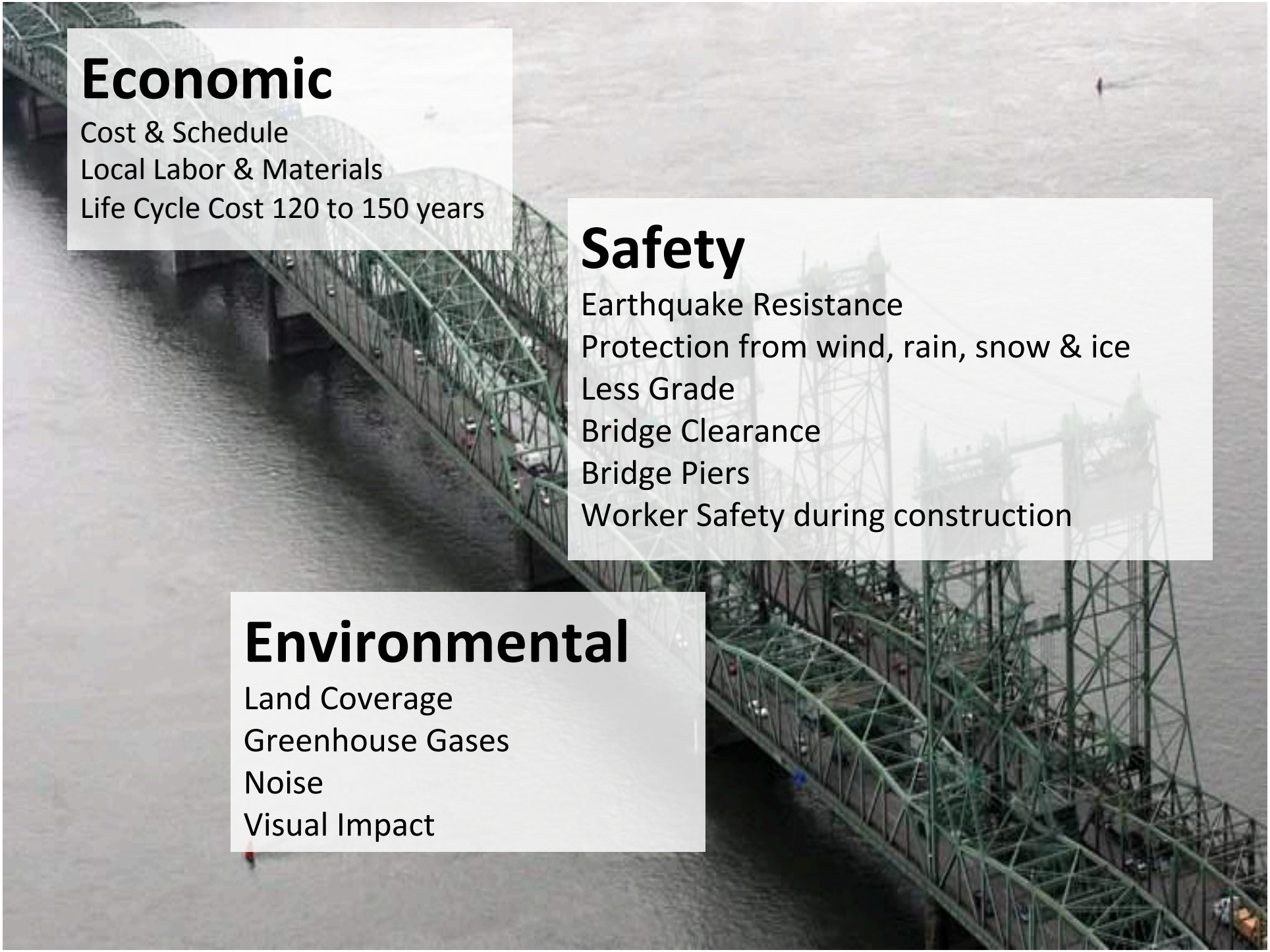




Economic

Cost & Schedule
Local Labor & Materials
Life Cycle Cost 120 to 150 years

Safety

Earthquake Resistance
Protection from wind, rain, snow & ice
Less Grade
Bridge Clearance
Bridge Piers
Worker Safety during construction

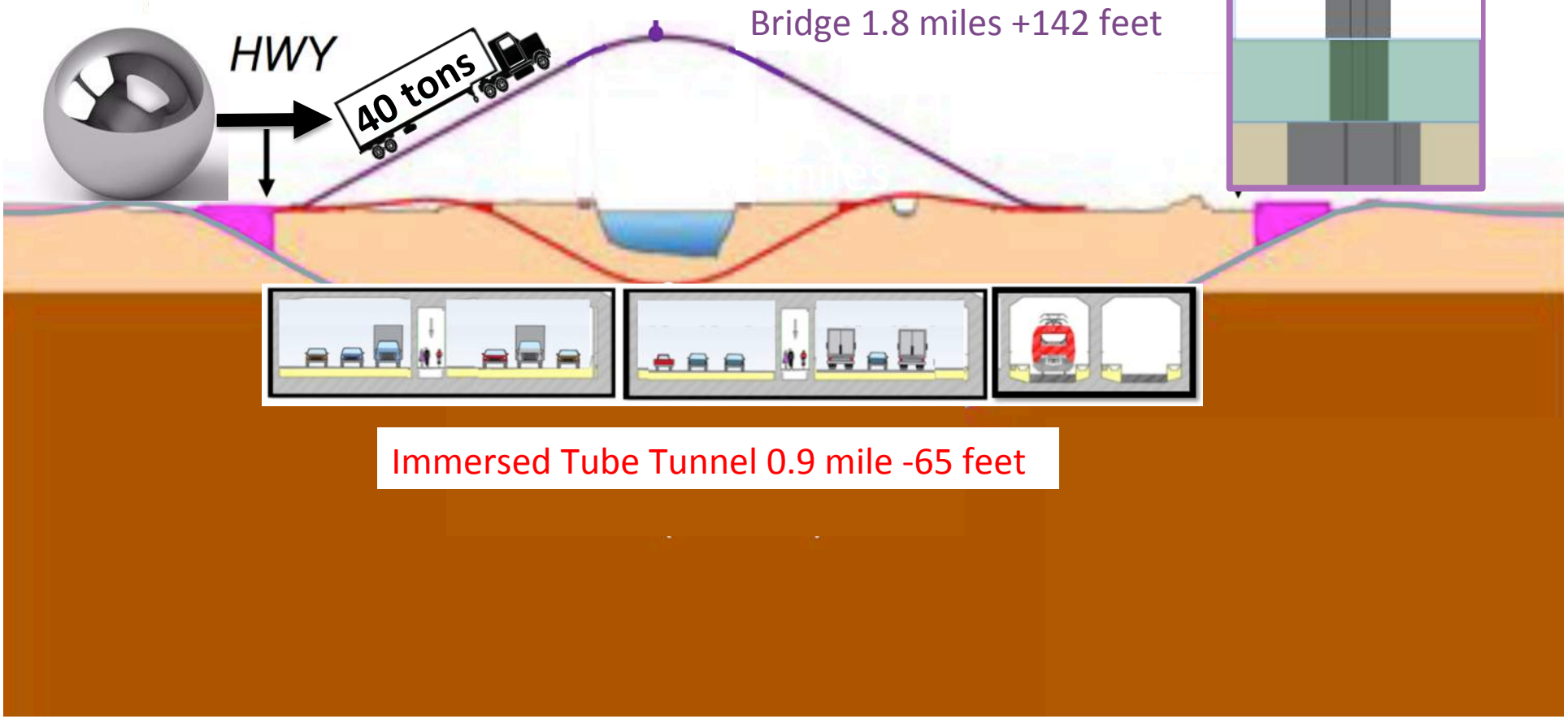
Environmental

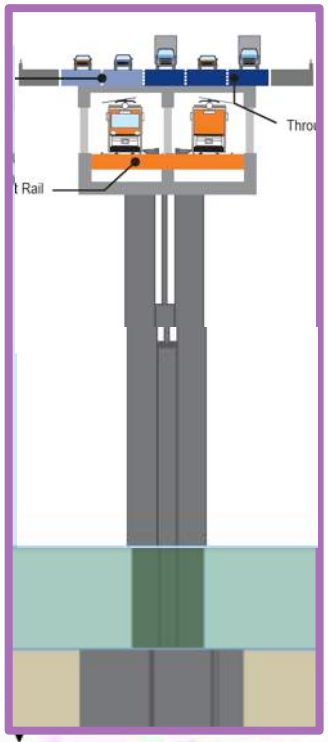
Land Coverage
Greenhouse Gases
Noise
Visual Impact

Grade +Advantage

Immersed tubes can be place immediately beneath the river allowing approached to be shorter and flatter

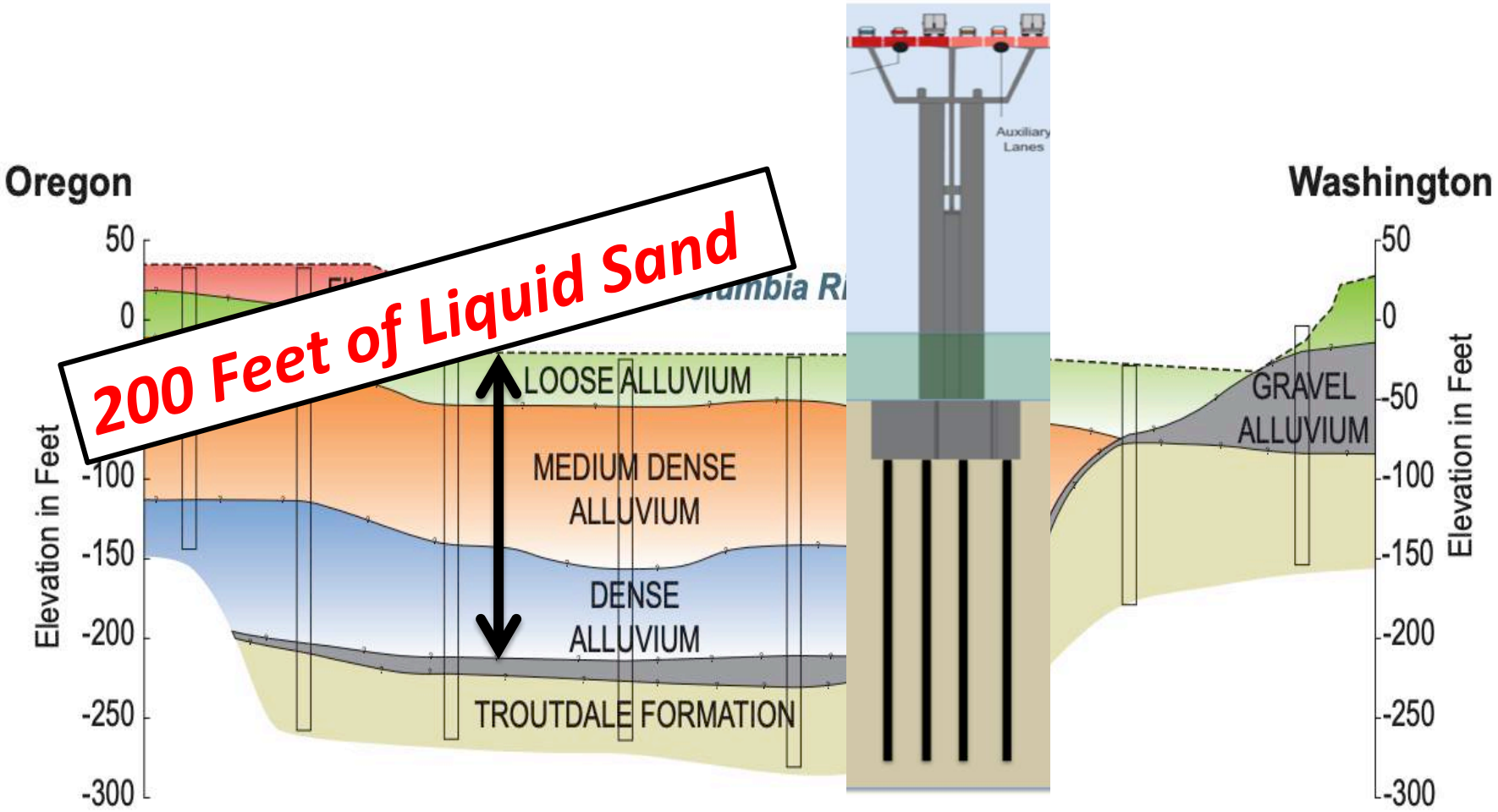
Initial downhill grade giving uphill momentum for trucks

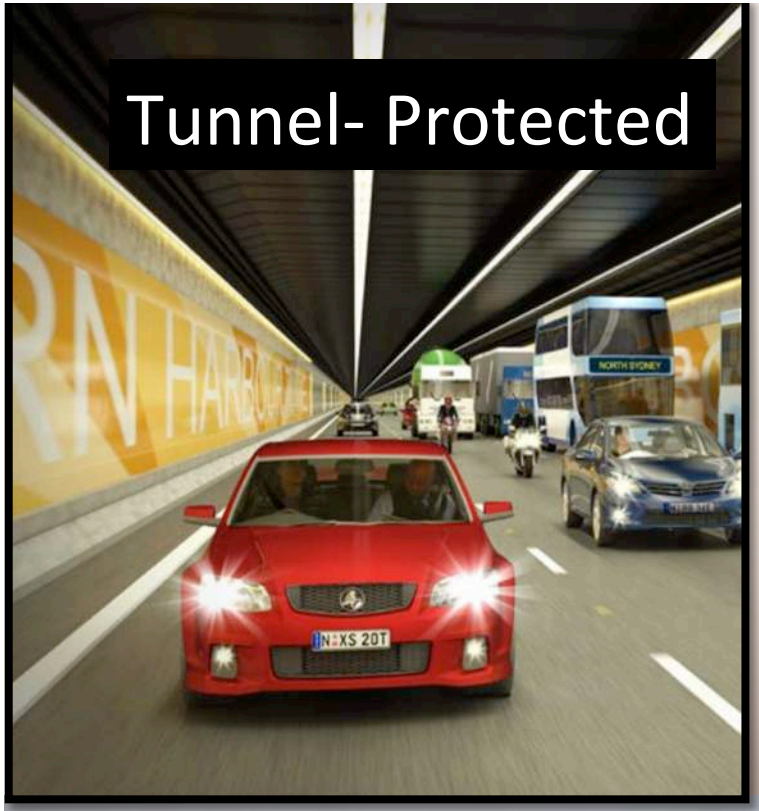




Columbia River CROSSING

EARTHQUAKE RISK: The Interstate Bridge pilings sit in sandy river soils which could behave like liquid during an earthquake, causing the bridge to fail.





Bridge

Fog

Wind

Rain

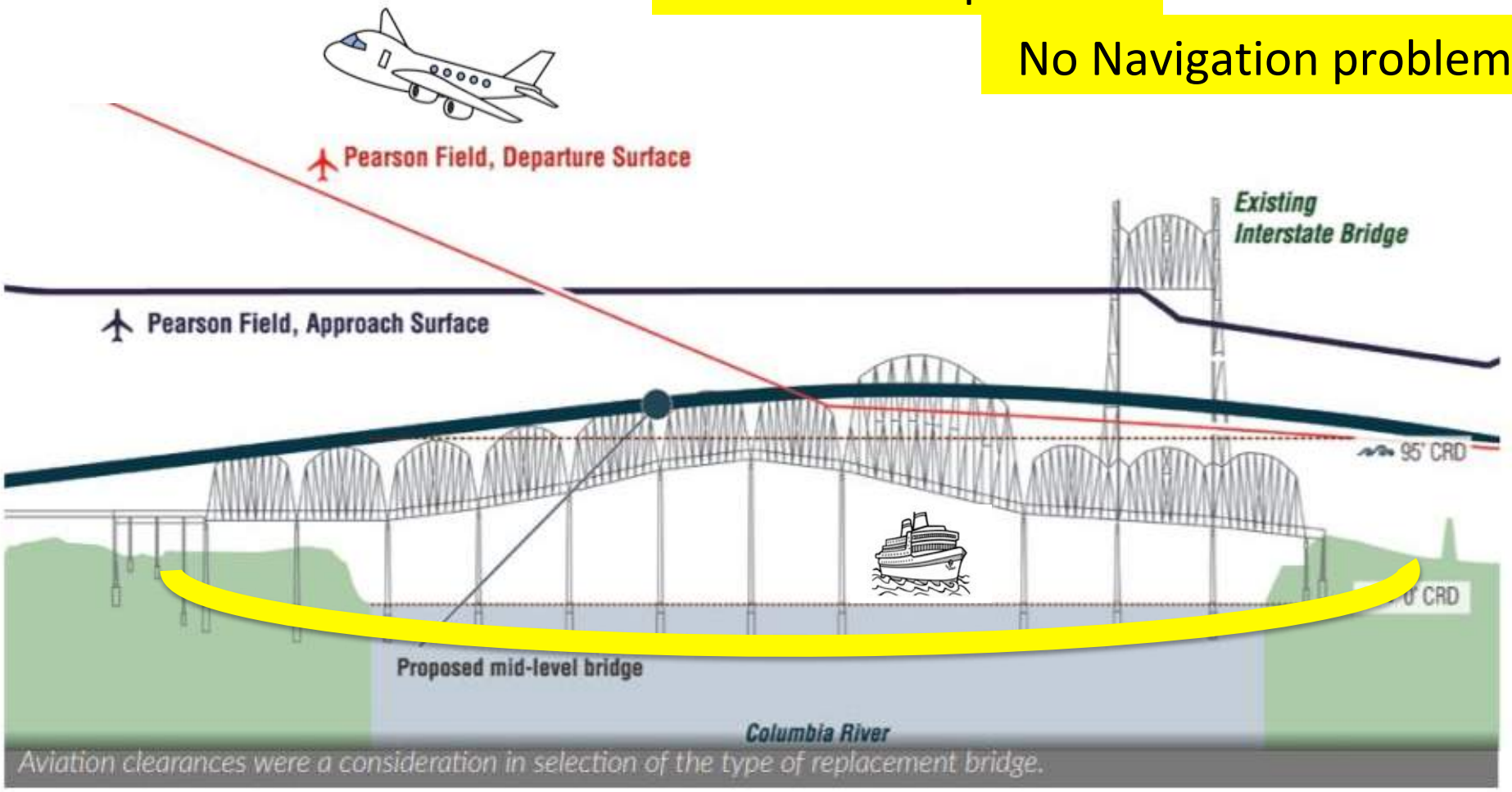
Black Ice

Federal Aviation Administration

No Height problem

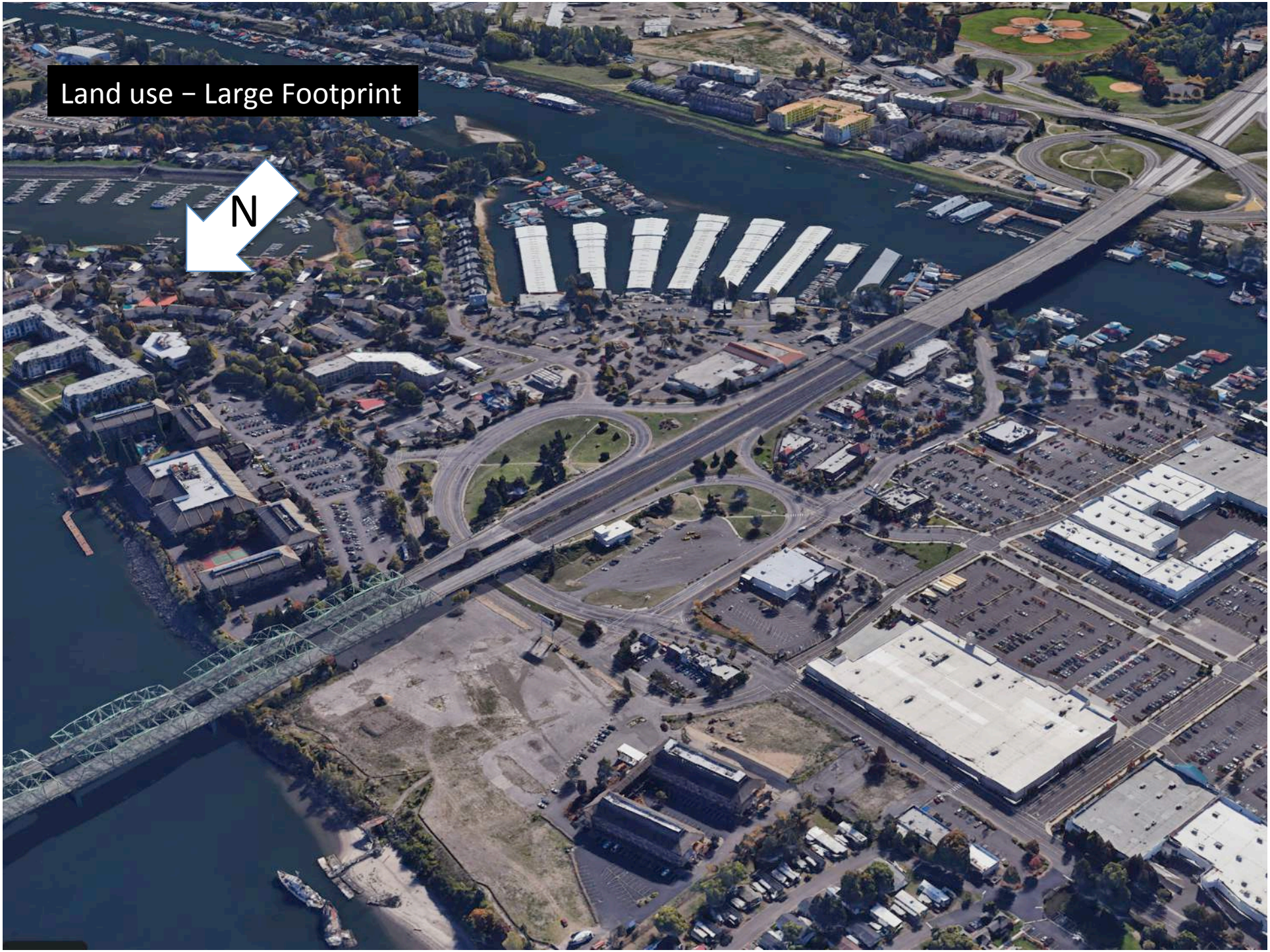
No Clearance problem

No Navigation problem




Land use – Large Footprint
N


Land use – Large Footprint
N


Land use – Large Footprint
N


Land use – Large Footprint
N


Visual & Sound Impact
ITT

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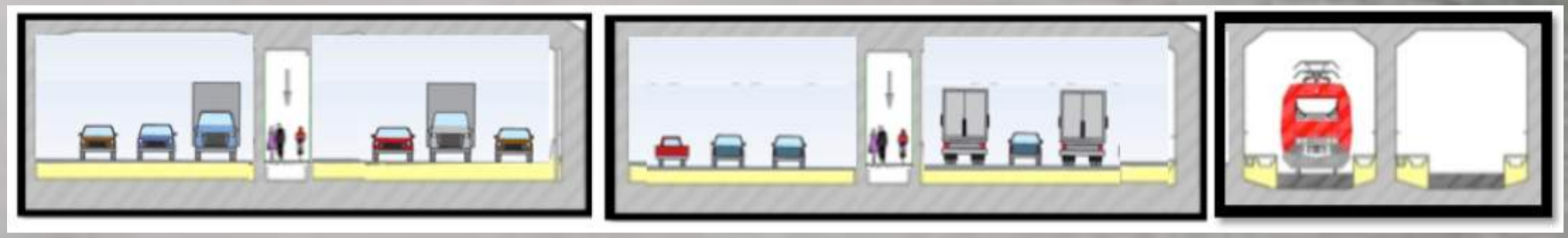
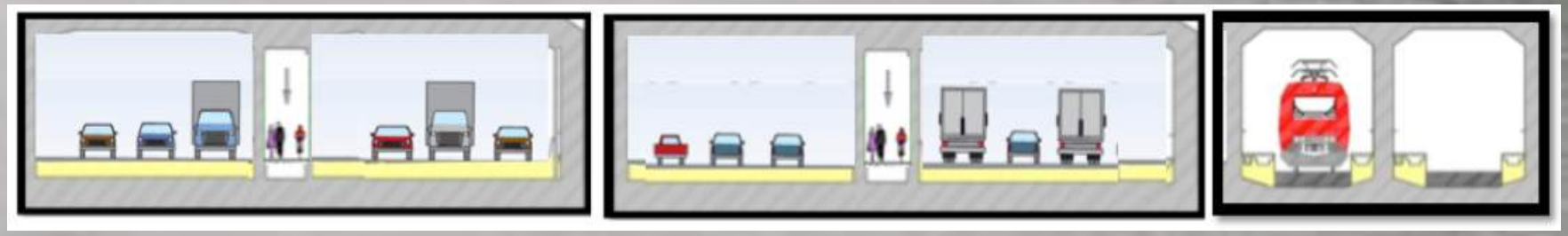
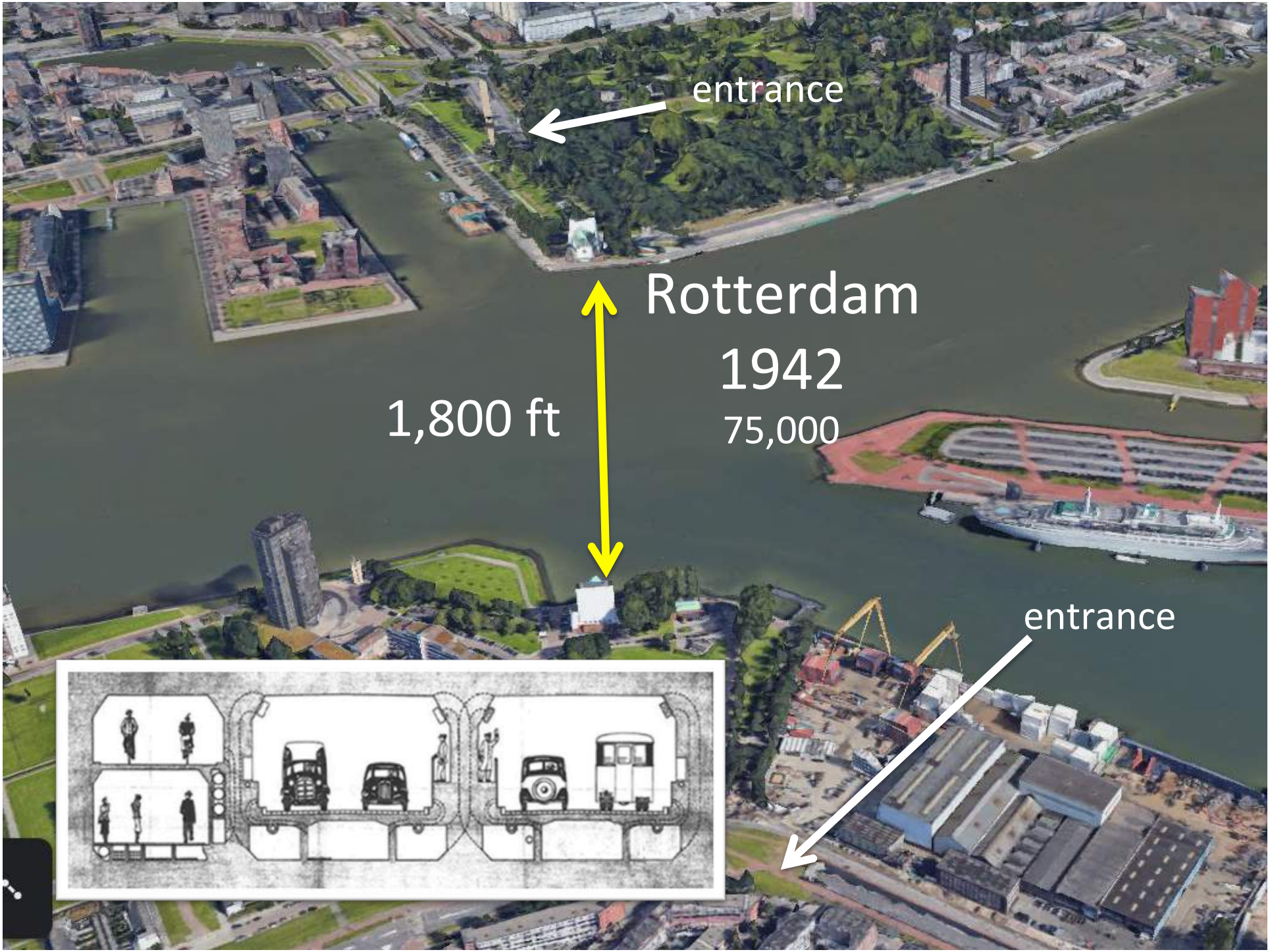


Rotterdam	1942
Vancouver, BC	1959
Osaka	1996
Hong Kong	1972
Sydney	1992
Denmark	1999
Norfolk, VA	2017
Germany	2020
Belgium	2020



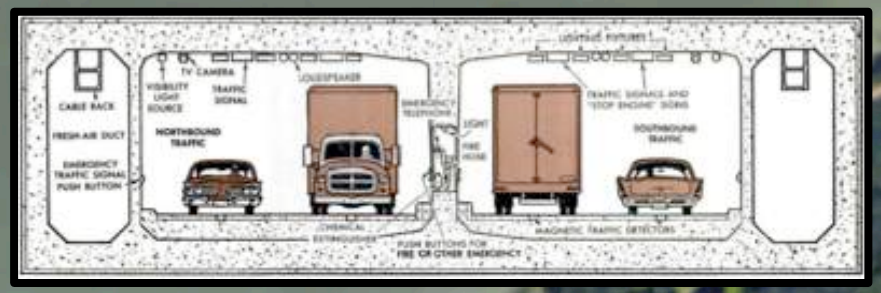

entrance
Rotterdam
1942
75,000
1,800 ft
entrance

Fraser River

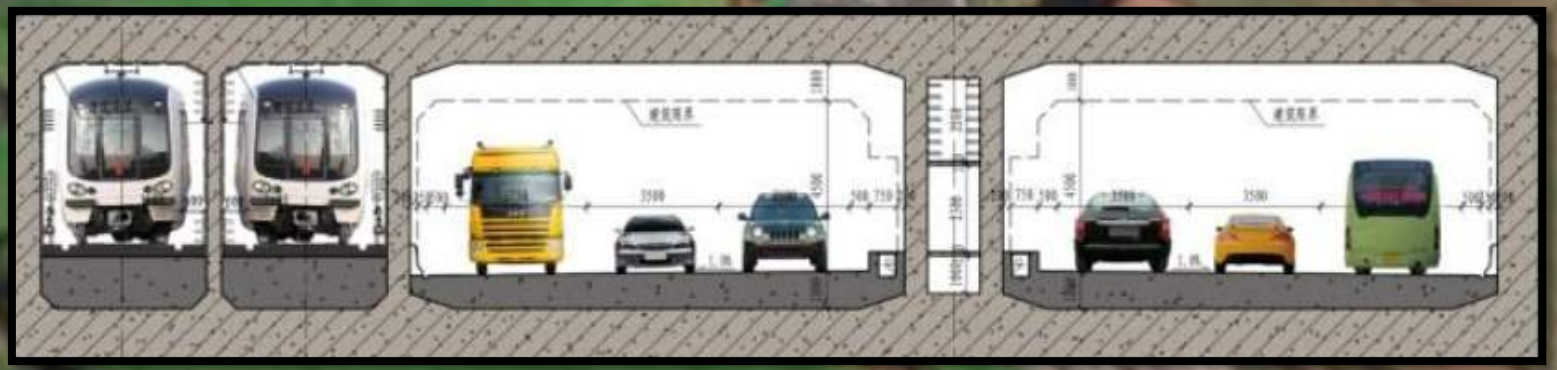
1959

80,000

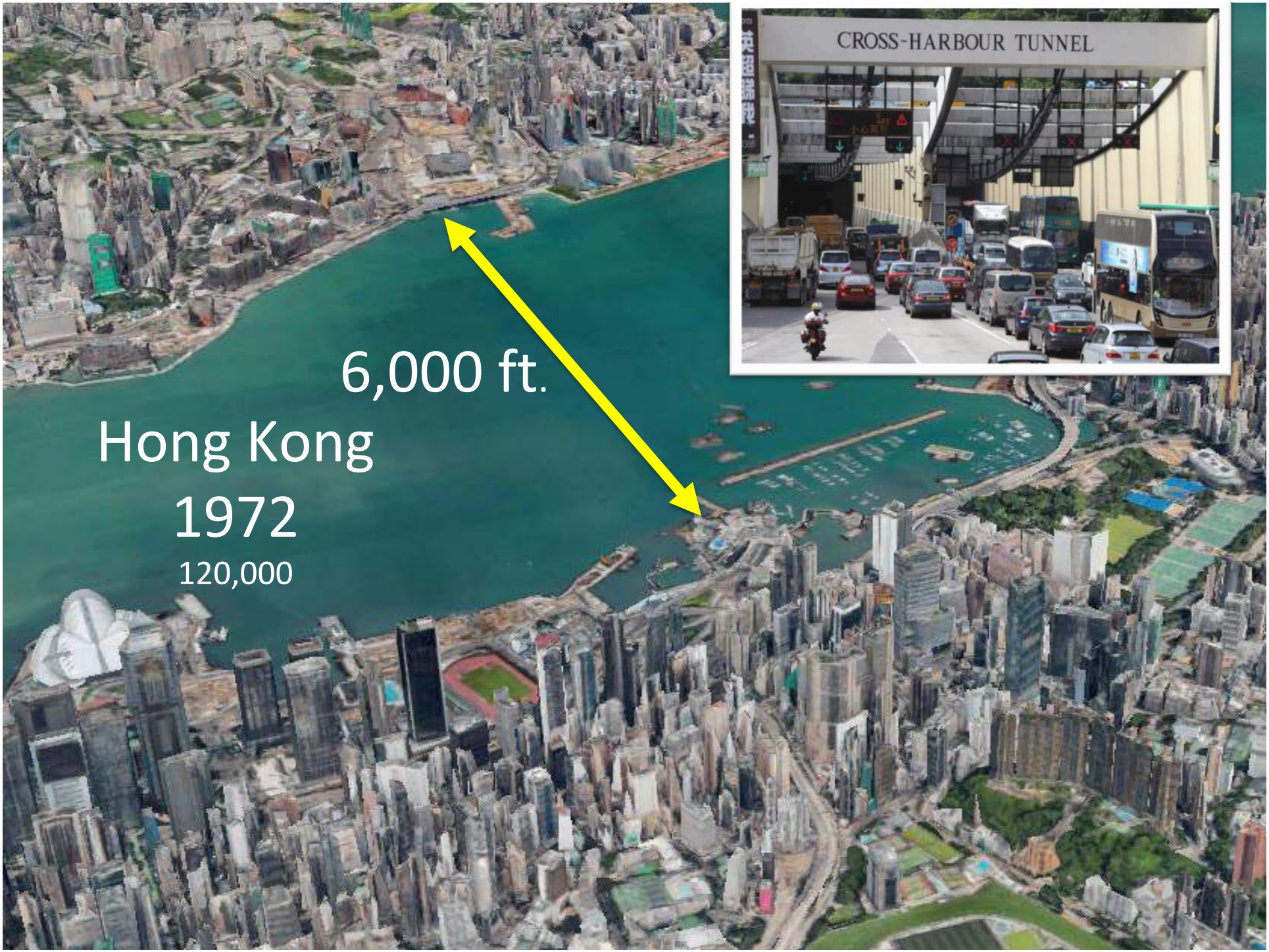
2,100 ft



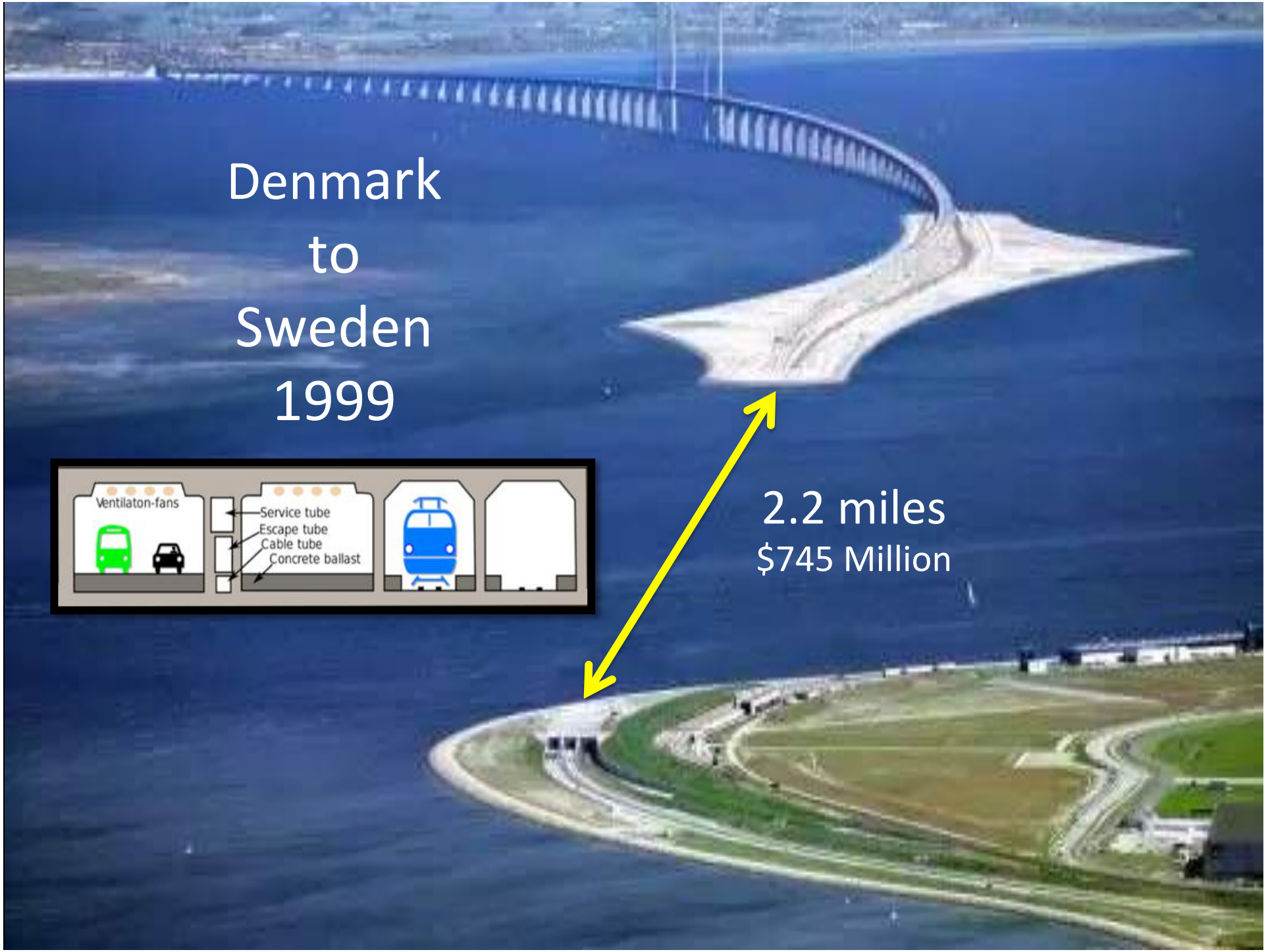
New George Massey Tunnel
Vancouver BC




2,500 ft
Osaka
1996
4 traffic
2 rail


CROSS-HARBOUR TUNNEL
6,000 ft.
Hong Kong
1972
120,000

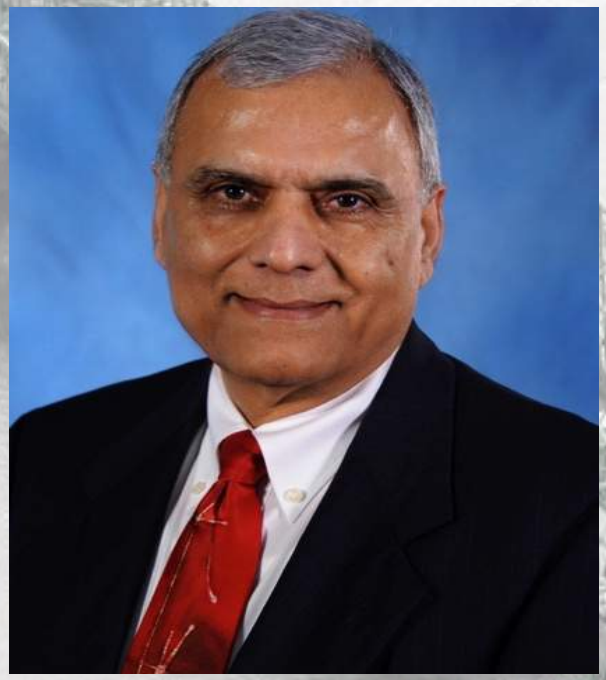

3,200 ft.
Sydney
1992
90,000
HARBOUR TUNNEL
NORTHBOUND


Denmark
to
Sweden
1999
Ventilaton-fans
Service tube
Escape tube
Cable tube
Concrete ballast
2.2 miles
$745 Million


Norfolk
1952 & 2017
50,000


5,600 ft.
Planned
Fehmarn Sound ITT
Germany
$785* million
* 2020 dollars est.


5,900 ft.
Under Construction
Scheldt ITT
Antwerp
$634 million
2020 dollars



MS, BS in Civil Engineering
Professional Engineer in 10 States
Co-Founder & President of INCA Engineers

Transportation Commissioner- WSTC

US Commissioner-International Navigation Association (PIANC)

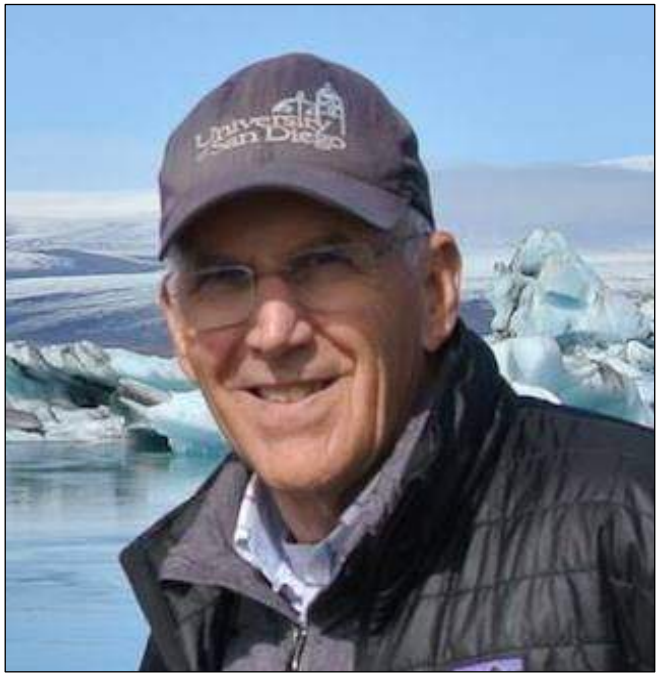
Past and Current Board Member of SAME, CECW, NWC, BDA, BCC

Worked on various L&D on Columbia, Ohio & Mississippi River Systems

JV Board Member for the D/B Panama Canal Project

Won ACEC Highest award in 2010 for IHNC Project

Thank You



TRUSS ME
I AM
CIVIL ENGINEER