Detroit River INTERNATIONAL CROSSING STUDY

DETROIT RIVER INTERNATIONAL CROSSING STUDY

MAG Meeting

September 5th, 2006

Detroit River INTERNATIONAL CROSSING STUDY

Agenda

1. Study Update
2. Construction Staging for Tunneling
3. Other Business

Deep Borehole Program

Status Update - Engineering

Deep Drilling Program:

- 12 deep boreholes @500m depth;
- Cross-borehole Seismic Tomography;
- Notification Program

Foundation Investigation Program:

- For Bridges, retaining walls, tunnel – Huron Church & Hwy 3

Conceptual Long Span Bridge Alternatives:

- 14 Conceptual Alternatives for 3 Crossing Locations

Traffic Analysis

- In Progress

Pavement Design

Detroit River INTERNATIONAL CROSSING STUDY

Status Update – Environmental

Natural Environment:

• In Progress; Focusing on Rare & Endangered Species

Archaeology:

• First phase completed

Social Impact Assessment:

• In Progress;

•Workshops Planned for mid-October

Economic Study

•In Progress;

Detroit River INTERNATIONAL CROSSING STUDY

Status Update – Environmental

Vibration Monitoring:

• Completed.

Noise Assessment:

• In Progress.

Air Quality Modeling:

• In Progress;

Air Quality Monitoring:

•Installation of 2 Air Quality Monitoring Stations

•Traffic Counts

Detroit River INTERNATIONAL CROSSING STUDY

CSS Workshops

Dates: June 23 and 24, 2006

Location: St. Clair College

Attendees: 189 Members of the Public

Purpose:

Gather input from the public regarding the look and fit of the crossing, plaza and access road alternatives in the context of neighbourhood land uses and environmental features.

Detroit River INTERNATIONAL CROSSING STUDY

CSS Workshops

Components of CSS Workshops:

1. Crossing Alternatives:

- Cable Stayed & Suspension Bridges;
- Colours, Lighting, Motifs.

2. Plaza Alternatives:

- Edges, Interior, Buildings, Motifs.

3. Access Route Alternatives:

- Landscaping;
- Noise Walls / Retaining Walls;
- Lighting, Connections, Motifs.

4. Tunneling Option:

- Tunnel Design, Ventilation Buildings;
- Landscaping, and Gateway Features.

Detroit River INTERNATIONAL CROSSING STUDY

Upcoming Events

VALUE ENGINEERING STUDY - Sep 6 to 15

CSS WORKSHOPS (Access Routes and Plazas) – Sep 27 & 28

CSS WORKSHOPS (Bridge) – Nov 15

PIOH #4 – Early December 2006

.

Canada | Federal Highway Administration | Ontario | MDOT | URS

Detroit River INTERNATIONAL CROSSING STUDY

Other Meetings

Binational Coast Guard Meeting - Sep 13

School Council Advisory Meeting – Sep 19

Meetings with Members of the Public and other Groups

– As Required

.

Canada | Federal Highway Administration | Ontario | MDOT | URS

Detroit River
INTERNATIONAL CROSSING
STUDY

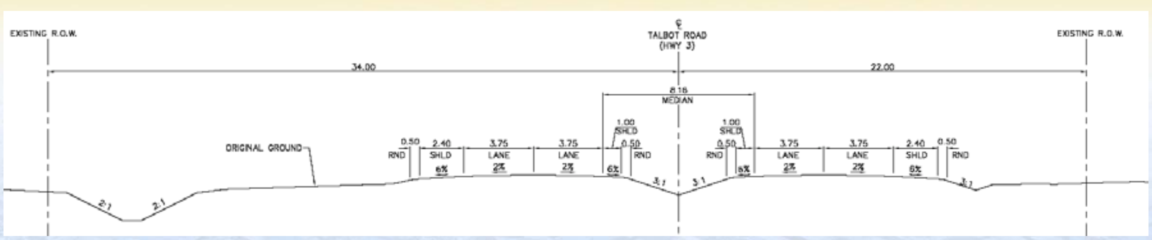
Presentation on Tunneling

1. Summary of Existing Conditions
2. Design Criteria for Tunnel
3. Tunneling Methods (Bored vs. Cut and Cover)
4. Proposed Tunnel
5. Construction Staging
6. Criteria for Evaluating the Tunnel Alternative
7. What's Next

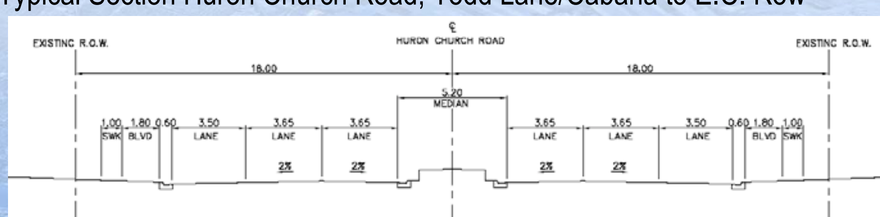
Detroit River
INTERNATIONAL CROSSING
STUDY

Existing H-C / Hwy 3

Typical Section Highway 3, Howard to Cousineau



Typical Section Huron Church Road, Todd Lane/Cabana to E.C. Row

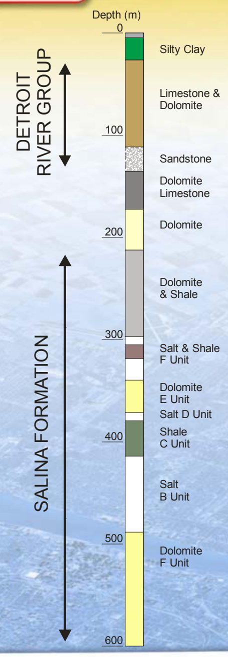


Existing ROW Widths:

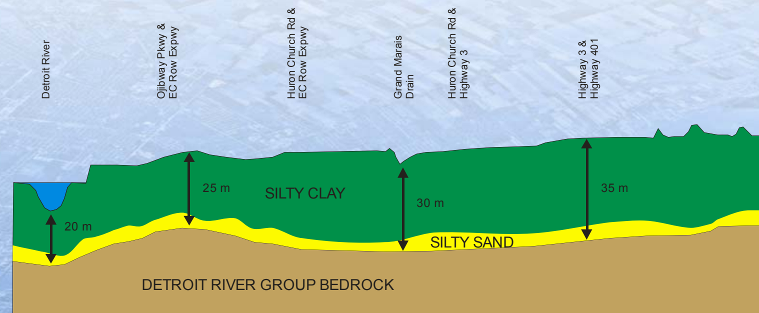
Hwy 3 from Highway 401 to Cousineau	**±56 m**
Highway 3 from Cousineau to Todd Lane/Cabana	**±48 m**
Huron Church from Todd Lane / Cabana to EC Row	**±36 m**

Detroit River
INTERNATIONAL CROSSING
STUDY

Soil and Groundwater Conditions



- Soft silty clay overburden
- Sedimentary rock formations with deep salt beds
- High groundwater (0.5m – 6m below ground)
- Hydrogen sulphide & methane



Detroit River
INTERNATIONAL CROSSING
STUDY

Existing Municipal Drains

Detroit River INTERNATIONAL CROSSING STUDY

Existing Utilities

Utilities Located <u>Within</u> the HC-Hwy 3 Corridor:

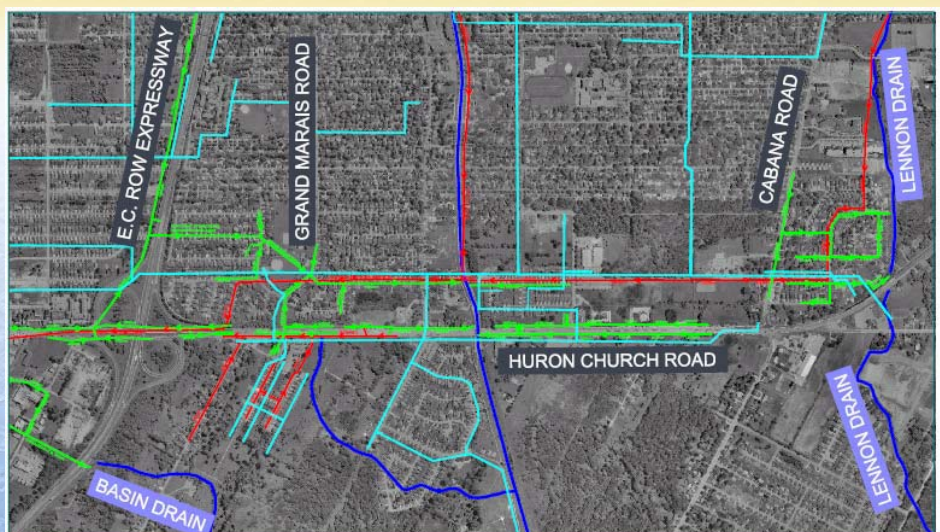
- Hydro (Hydro One, Enwin, Essex Power);
- Communications (Bell, Maxess Network);
- Gas (Union Gas);
- Municipal (Sanitary, Storm, Watermain).

Major Utilities <u>Crossing</u> HC-Hwy 3 Corridor:

- 600 mm watermain (100m N. of Howard);
- 250 mm watermain & 375 mm sanitary (300m N. of Cabana/Todd);
- 375 mm sanitary (N. side of Pulford);
- 300 mm sanitary (at Norfolk);
- 300 mm watermain, high pressure gas, 300 mm and 225 mm sanitary (at Grand Marais);
- 1050 mm storm sewer & 200 mm watermain (Labelle); and
- 200 mm watermain (225 m N. for Labelle).

Detroit River INTERNATIONAL CROSSING STUDY

Plan of Sewer and Watermain



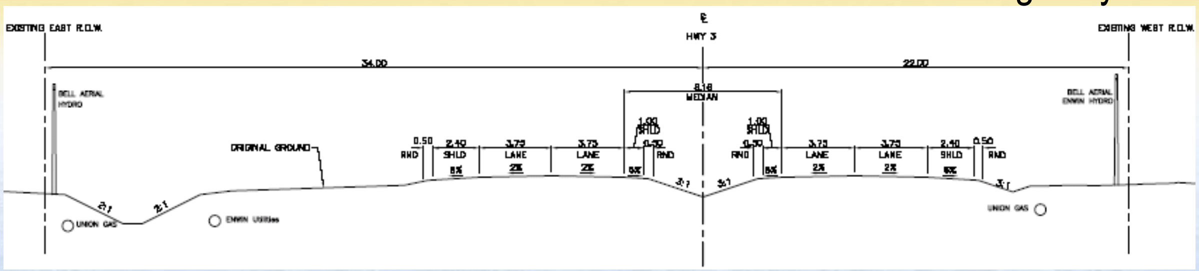
LEGEND:

- Sanitary
- Storm
- Watermain
- Municipal Drain

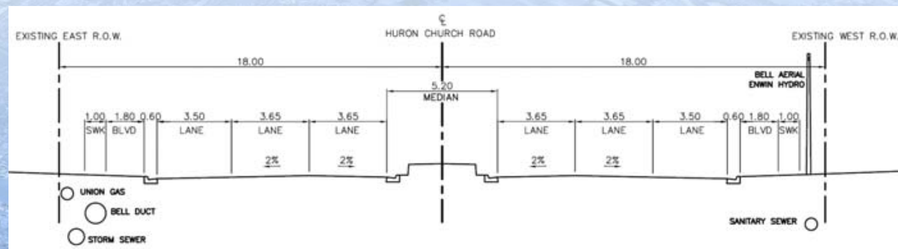
Detroit River
INTERNATIONAL CROSSING
S T U D Y

Typical Section - Utilities

Highway 3



Huron Church Road



Detroit River
INTERNATIONAL CROSSING
S T U D Y

Design Criteria for Tunnel

	DESIGN STANDARDS FREEWAY	PROPOSED STANDARDS FREEWAY TUNNEL
HIGHWAY CLASSIFICATION	UFD 120	UFD 120
MIN STOPPING SIGHT DISTANCE	245 m	160m *
EQUIVALENT MIN 'K' FACTOR - Crest	120	500
EQUIVALENT MIN 'K' FACTOR - Sag	60	80
GRADES MAXIMUM	3%	0.3%
MINIMUM RADIUS	650 m	650 m
LANE WIDTH	1x3.50 m, 2x3.75 m	1x3.50 m, 2x3.75 m
SHOULDER WIDTH (Outside)	3.00 m	3.00 m
SHOULDER WIDTH (Inside)	3.00 m	3.00 m
SHOULDER ROUNDING	1.0	N/A
MEDIAN WIDTH	6.8 m	N/A
R.O.W. WIDTH	90-110 m	65 m
POSTED SPEED	100 km/h	80 km/h

* 160m stopping sight distance satisfies requirements for a design speed of **90 km/h** which exceeds proposed posted speed of 80 km/h.

Detroit River INTERNATIONAL CROSSING STUDY

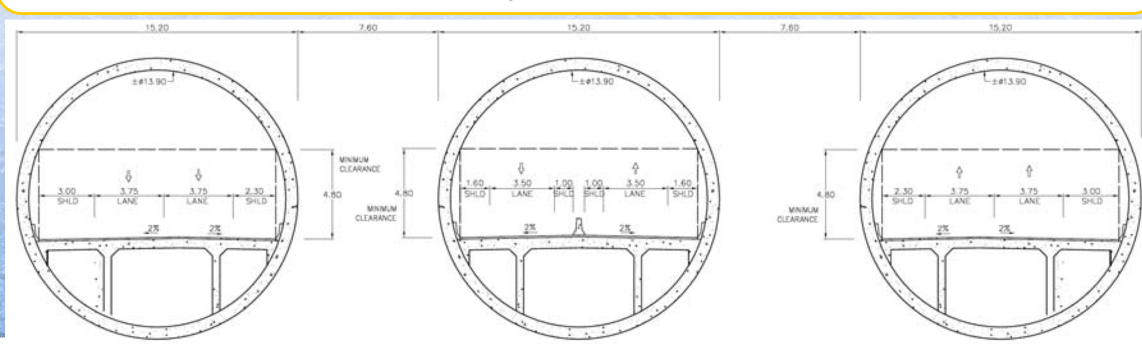
Tunneling Methods: Bored vs Cut and Cover

Bored Tunnels

- The layer of soft ground available for boring is generally 25 m to 30 m, which is not thick enough for a 3-lane bored tunnel.

  Bored Tunnel Requirements:
  - Ground to top of tunnel 15 m
  - Tunnel 15 m
  - Bottom of tunnel to bedrock 5 m
- The new freeway would have some sub-standard shoulder areas.
- Access/egress by ramps would be difficult because of tunnel depth:
  - Constructability concerns at tunnel portals;
  - Risks associated with dewatering and groundwater;
  - Risks with respect to stability.

Conclusion: **Bored tunnels are not considered practical.**



CONCEPTUAL

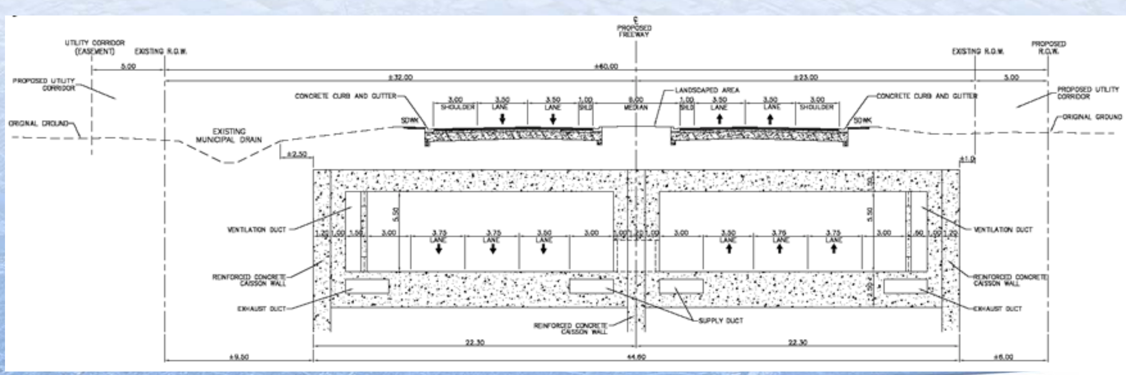
Detroit River INTERNATIONAL CROSSING STUDY

Tunneling Methods: Bored vs Cut and Cover

Cut and Cover Tunnels

- Generally feasible at depths up to 15m. Special controls will be required at depths greater than 7m;
- Risks with respect to dewatering and groundwater, utility conflicts and community disruptions;
- Complex construction staging is required.

Conclusion: Tunneling using cut and cover techniques will be analyzed and evaluated. Several methods of cut and cover tunneling are possible.



Cut and Cover Tunnel

Detroit River INTERNATIONAL CROSSING STUDY

Canada | Federal Highway Administration | Ontario | MDOT

URS

Alternative 3 - Tunnel Plan

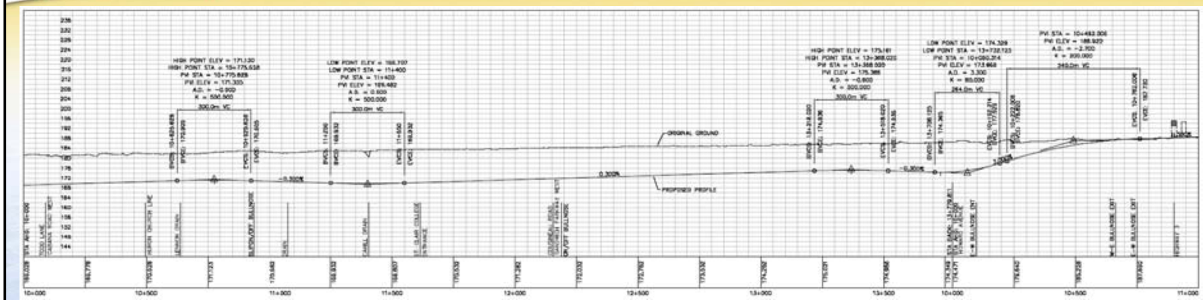
Detroit River INTERNATIONAL CROSSING STUDY

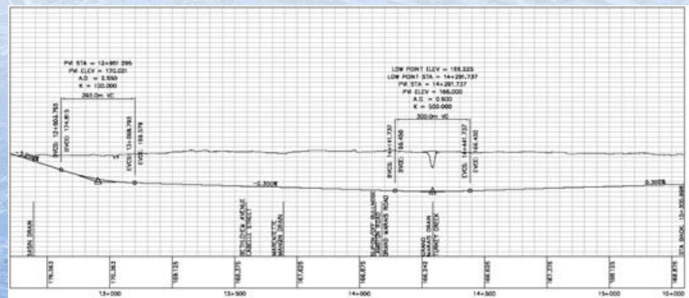
Canada | Federal Highway Administration | Ontario | MDOT

URS

Detroit River
INTERNATIONAL CROSSING
STUDY

Alternative 3 - Tunnel Profile





Detroit River
INTERNATIONAL CROSSING
STUDY

Construction Methods

The following types of cut and cover construction were reviewed:

1) Conventional (2:1 slopes)
   - Extensive excavation and backfill requirements;
   - Not recommended due to severe property impacts (Note: 3:1 will be required in many areas);
   - Will be considered in localized areas where vacant property is available.

2) Caisson Wall, Cut and Cover
   - Drilling (auger) rig required to install caissons;
   - More bracing required than Diaphragm Wall Method;
   - Reduced property requirements relative to Conventional Method.

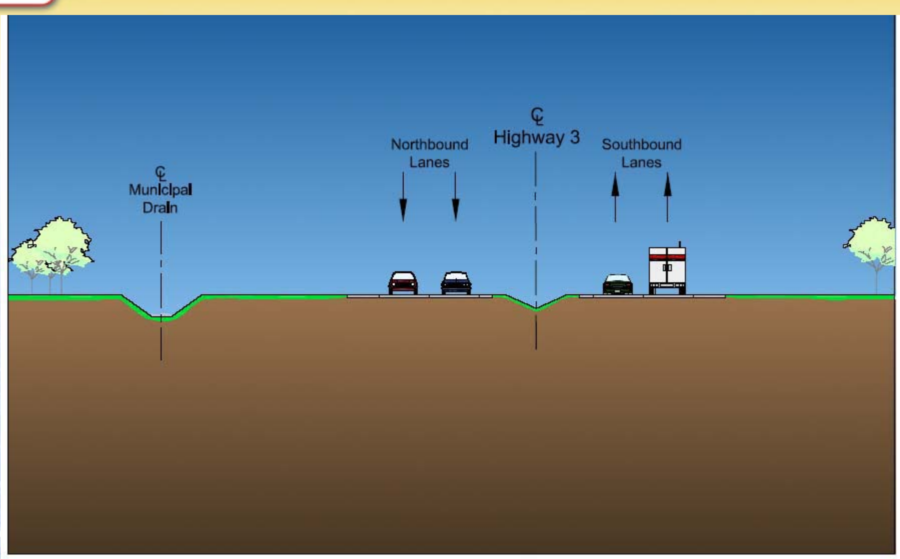
3) Diaphragm Wall, Cut and Cover
   - Trench cutter for installation of concrete walls using bentonite slurry to stabilize trench;
   - Higher production rate than caisson wall system;
   - Reduced property requirements relative to Conventional Method.

Note: All three methods may be used at given locations.

Example of Construction Staging

CUT AND COVER CONSTRUCTION

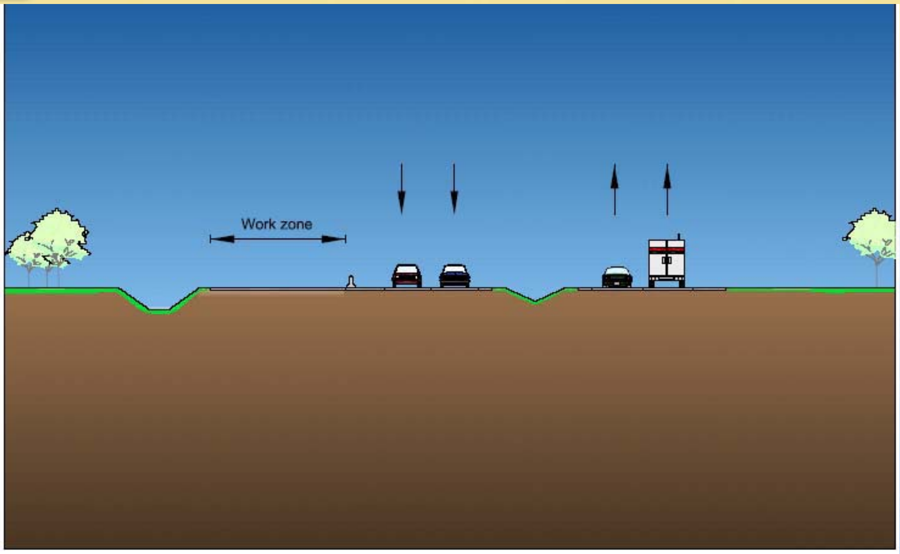
Cut and Cover Construction



Existing Conditions

Detroit River
INTERNATIONAL CROSSING
STUDY

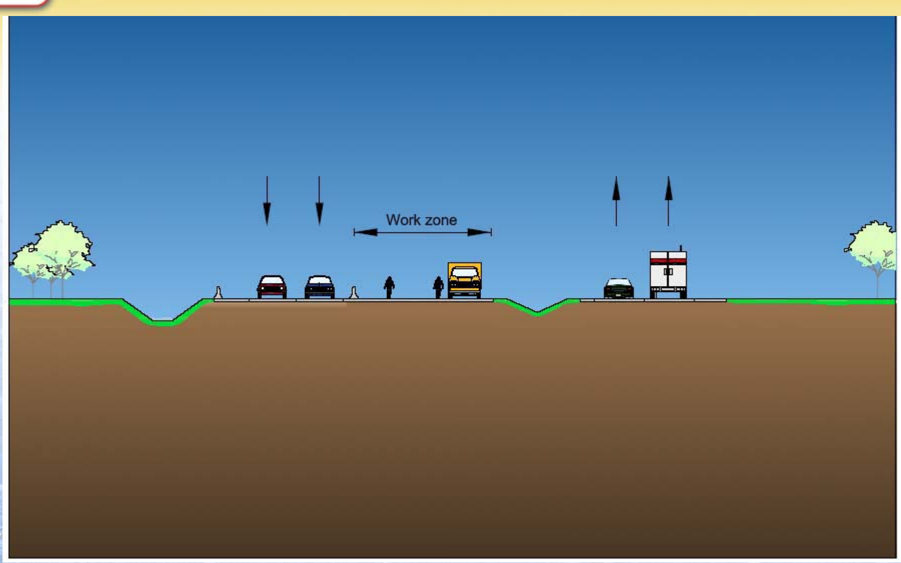
Cut and Cover Construction



Temporary Paving

Detroit River
INTERNATIONAL CROSSING
STUDY

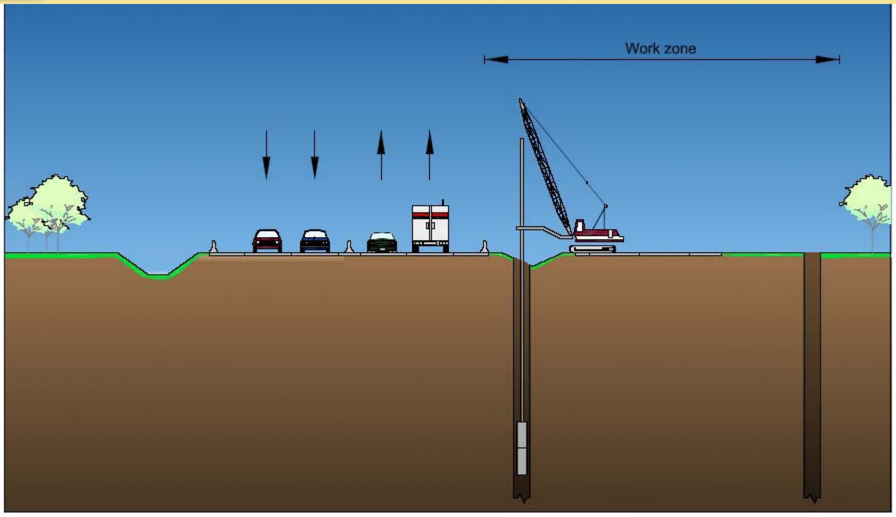
Cut and Cover Construction



Relocate NB Traffic & Adjust Existing Roadway

Cut and Cover Construction

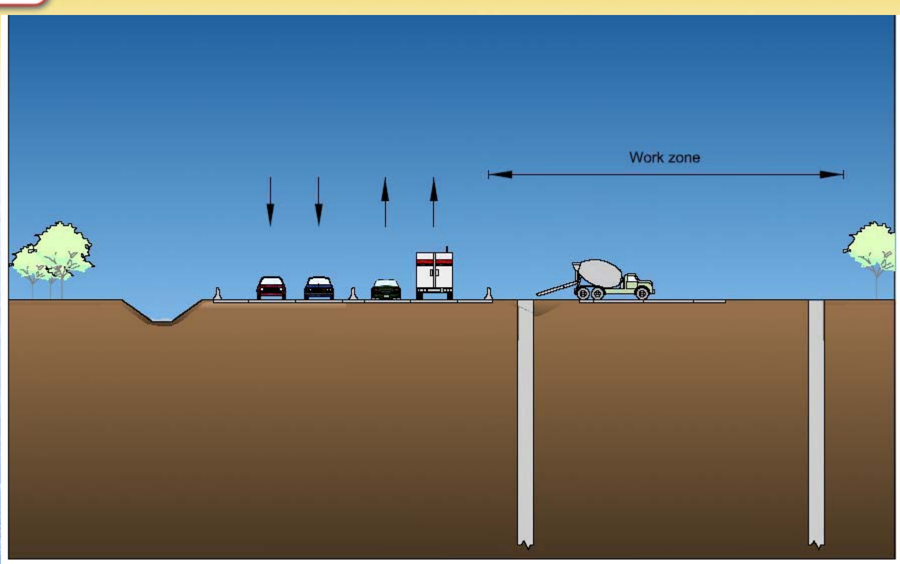
Detroit River
INTERNATIONAL CROSSING
STUDY



Relocate SB Traffic & Excavate Trench
for Diaphragm Wall for SB Tunnel

Cut and Cover Construction

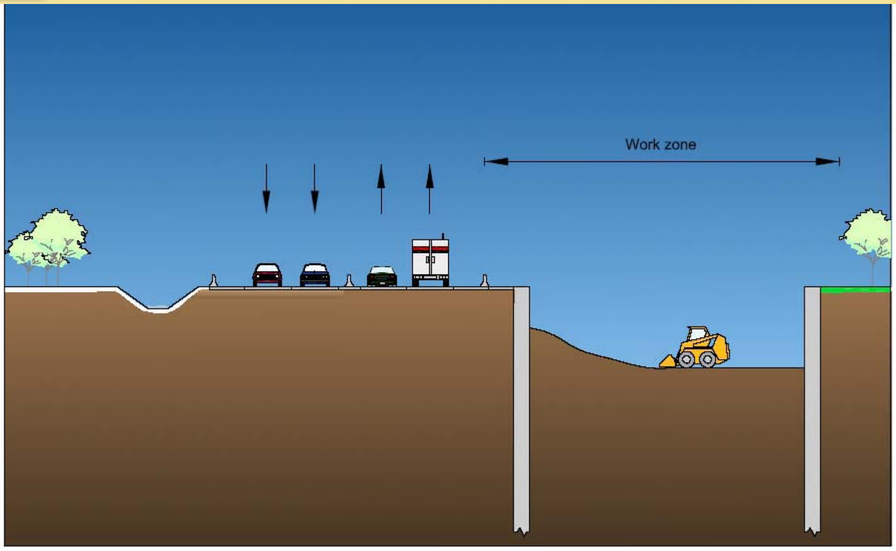
Detroit River
INTERNATIONAL CROSSING
STUDY



Place Reinforcement & Pour Concrete

Detroit River INTERNATIONAL CROSSING STUDY

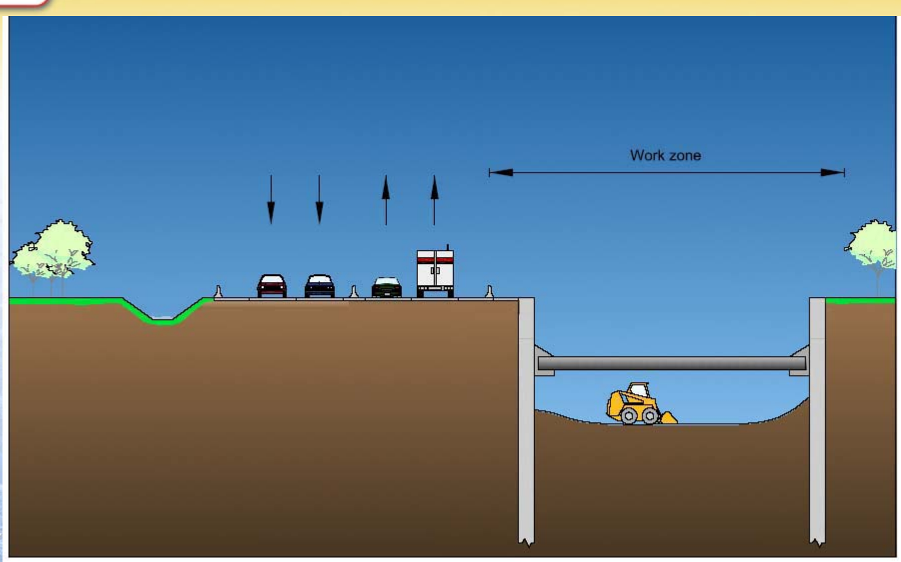
Cut and Cover Construction



Excavate 1st Level

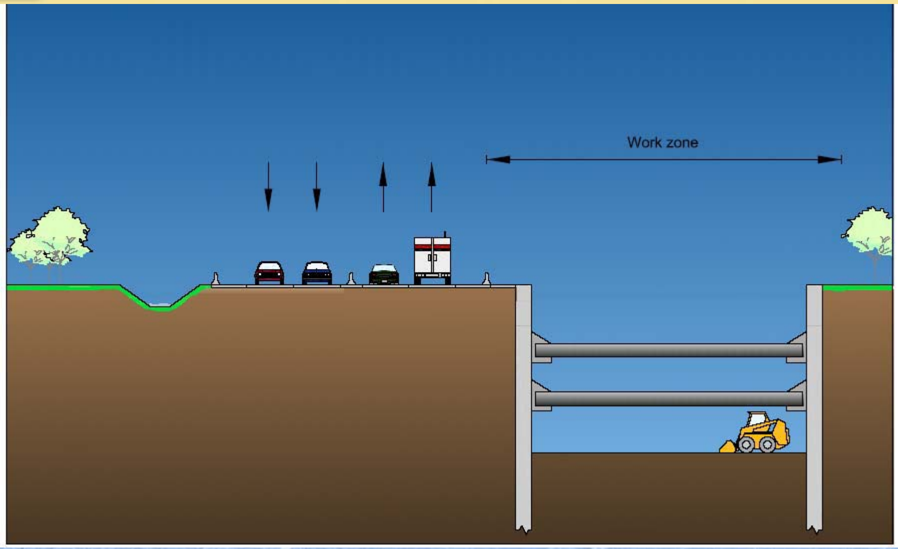
Detroit River INTERNATIONAL CROSSING STUDY

Cut and Cover Construction



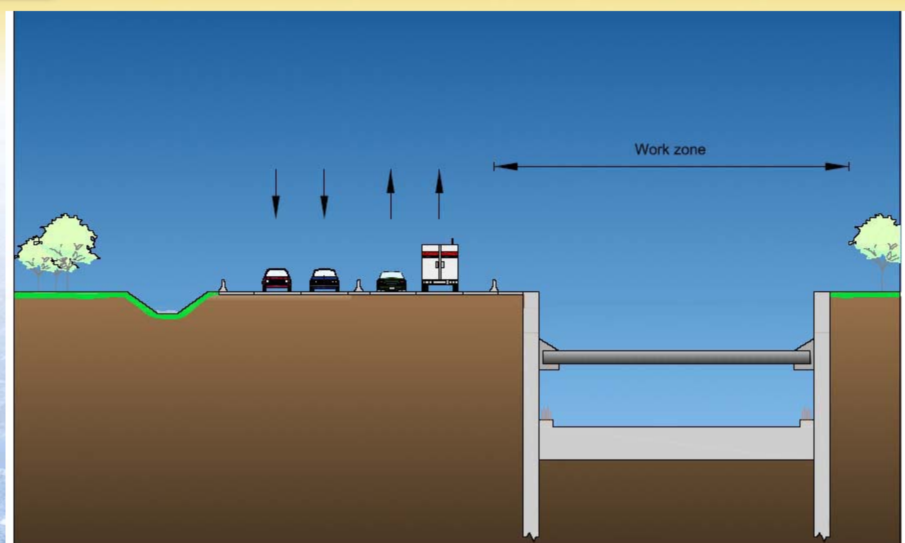
1st Level Struts & Excavate 2nd Level

Cut and Cover Construction



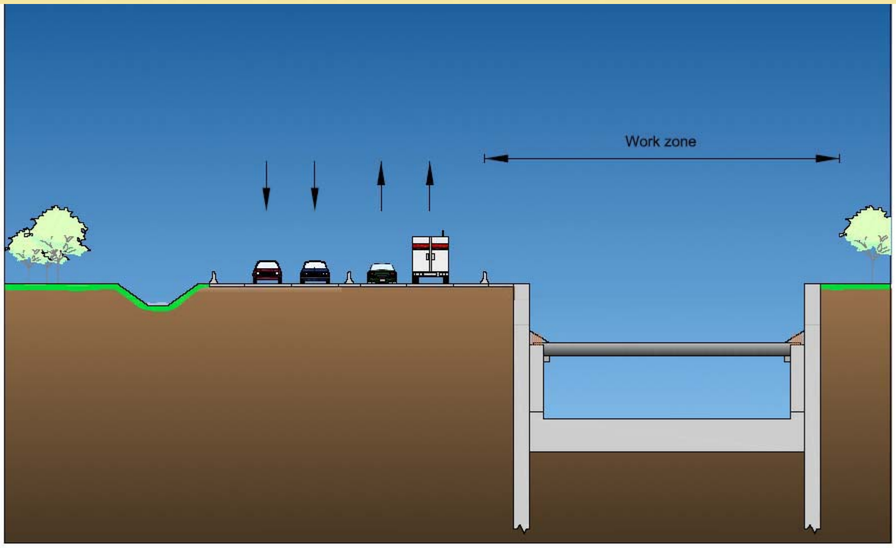
2nd Level Struts & Excavate 3rd Level

Cut and Cover Construction



Construct Base & Remove 2nd Level Struts

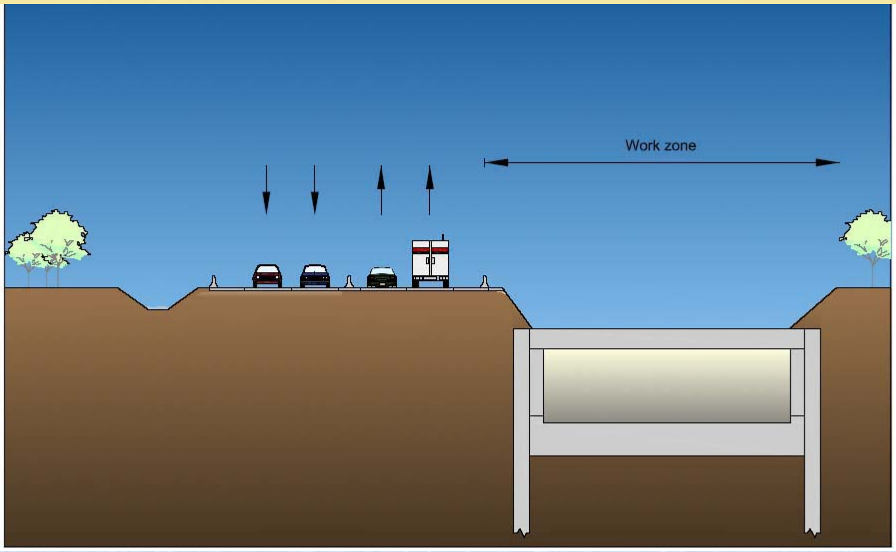
Cut and Cover Construction



Construct Side Walls

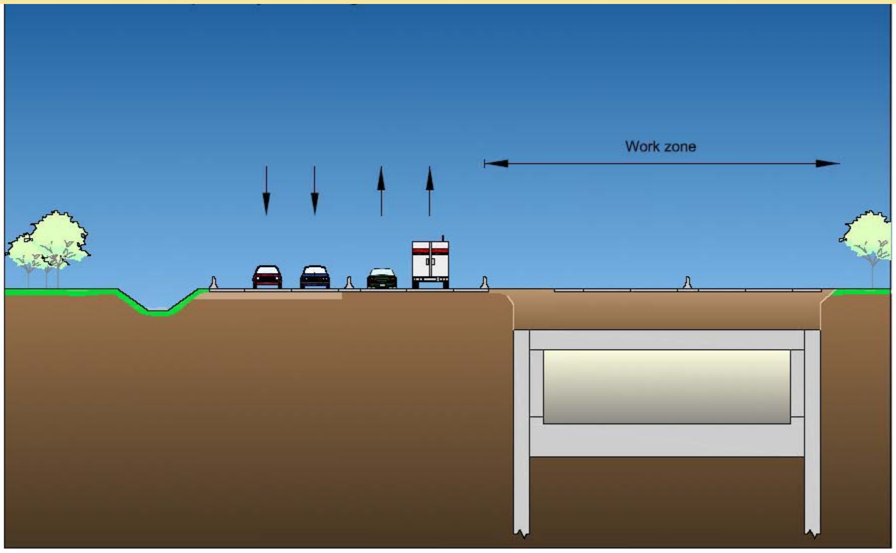
Detroit River INTERNATIONAL CROSSING STUDY

Cut and Cover Construction



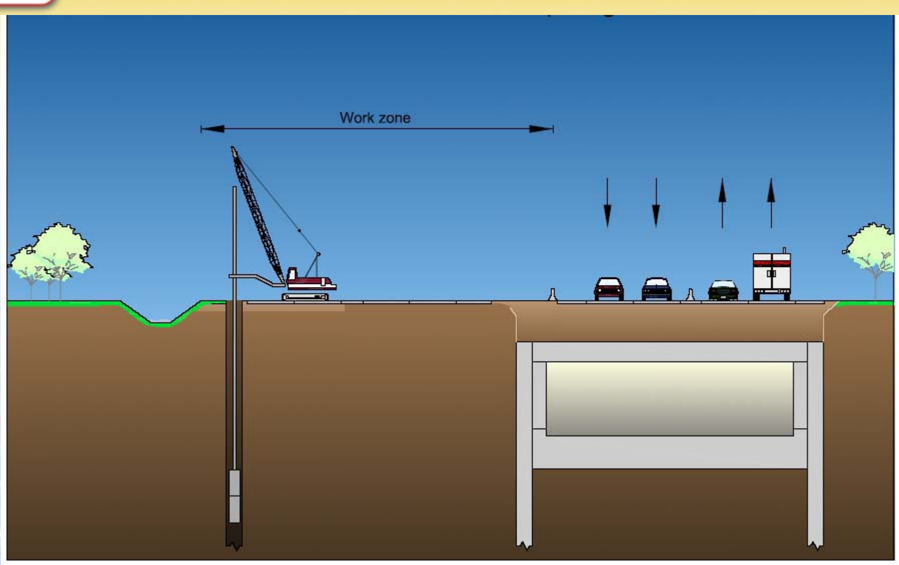
Construct Roof & Remove 1st Level Struts

Cut and Cover Construction



Backfill & Temporary Paving

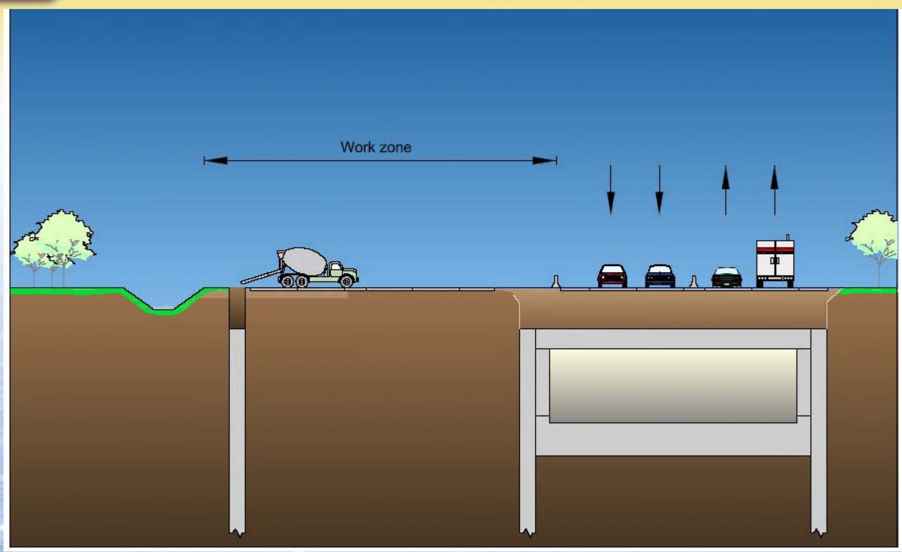
Cut and Cover Construction



Relocate Traffic & Excavate Trench for Diaphragm Wall for NB Tunnel

Detroit River INTERNATIONAL CROSSING STUDY

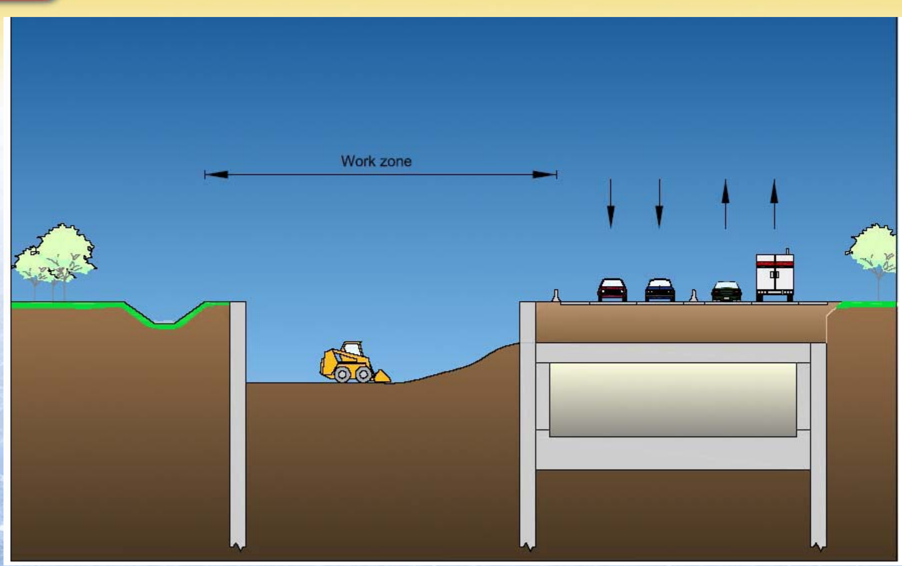
Cut and Cover Construction



Place Reinforcement & Pour Concrete

Detroit River INTERNATIONAL CROSSING STUDY

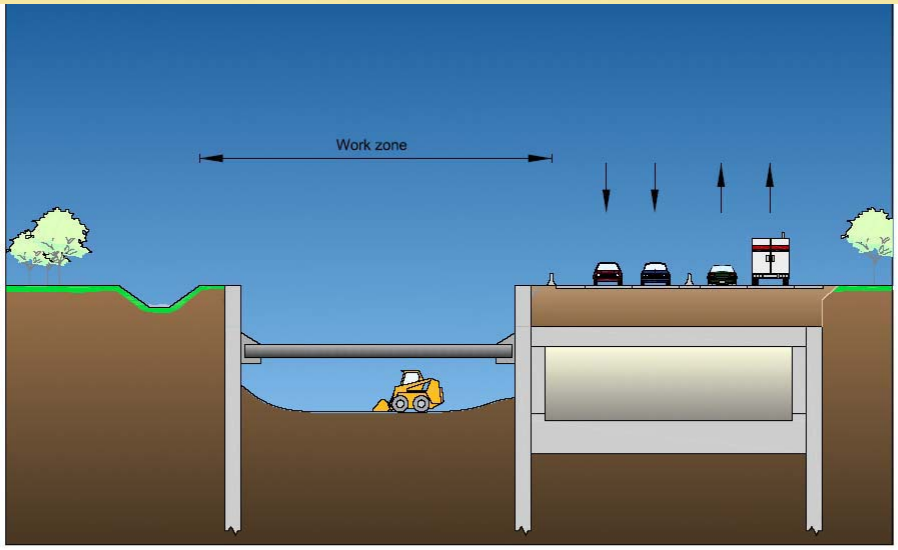
Cut and Cover Construction



Excavate 1st Level

Detroit River INTERNATIONAL CROSSING STUDY

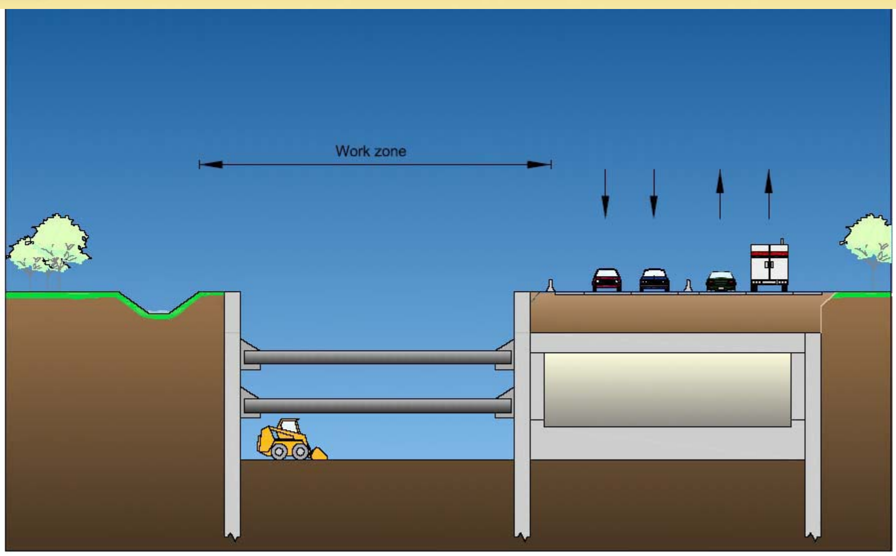
Cut and Cover Construction



1st Level Struts & Excavate 2nd Level

Detroit River INTERNATIONAL CROSSING STUDY

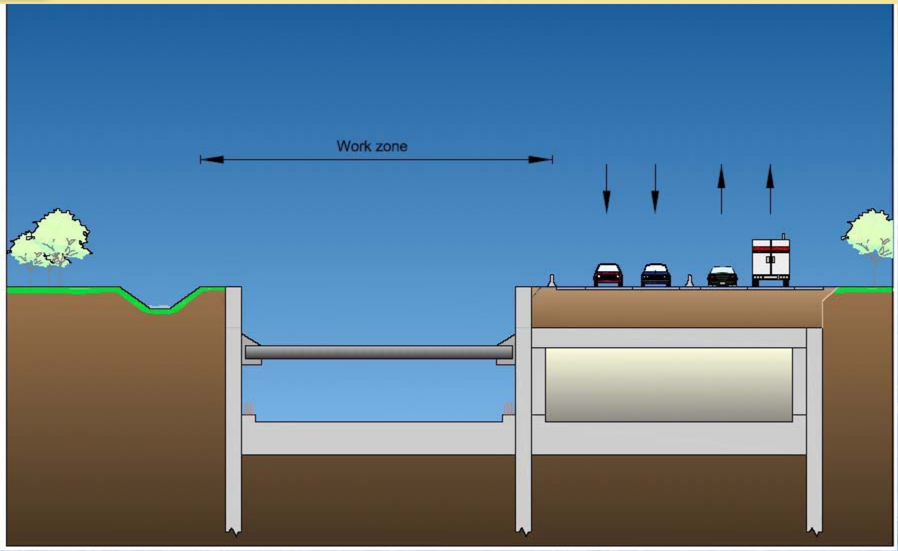
Cut and Cover Construction



2nd Level Struts & Excavate 3rd Level

Cut and Cover Construction

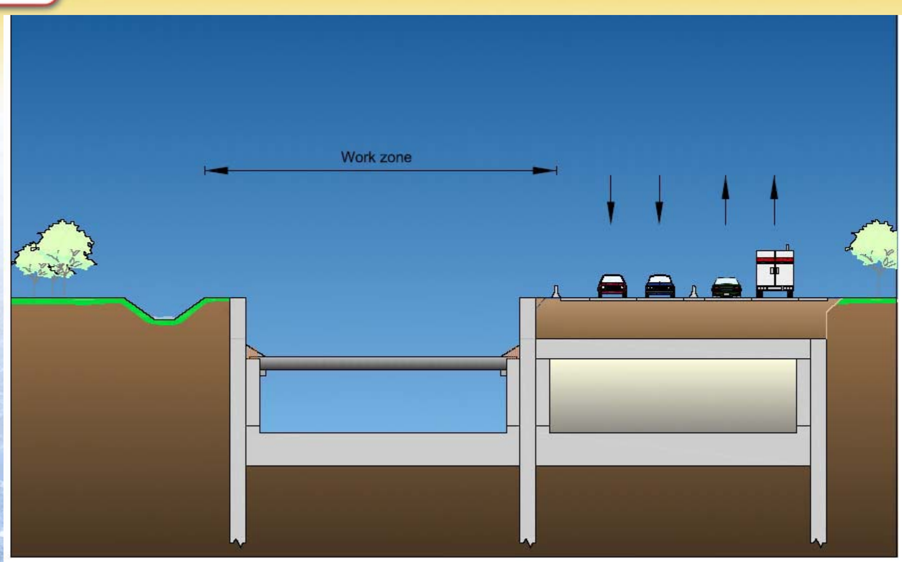
Detritoit River INTERNATIONAL CROSSING STUDY



Construct Base & Remove 2nd Level Struts

Cut and Cover Construction

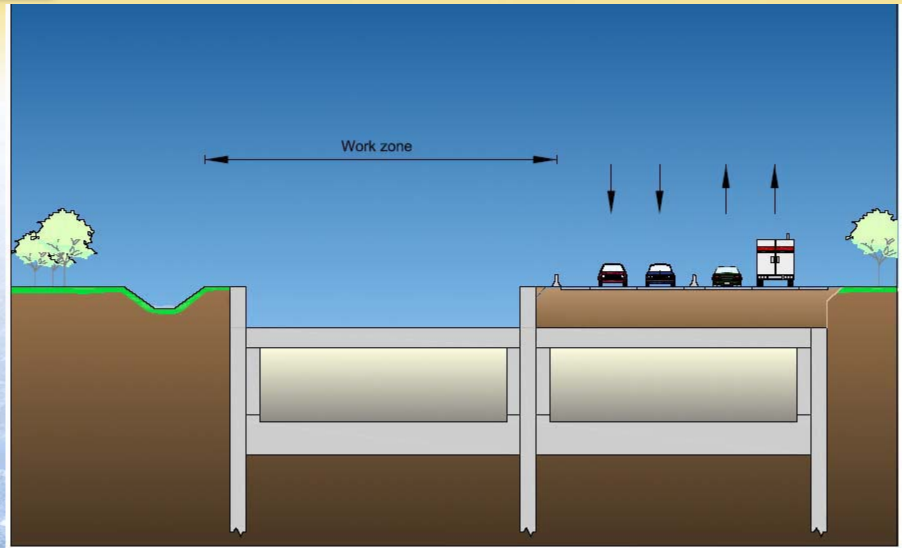
Detroit River INTERNATIONAL CROSSING STUDY



Construct Side Walls

Detroit River INTERNATIONAL CROSSING STUDY

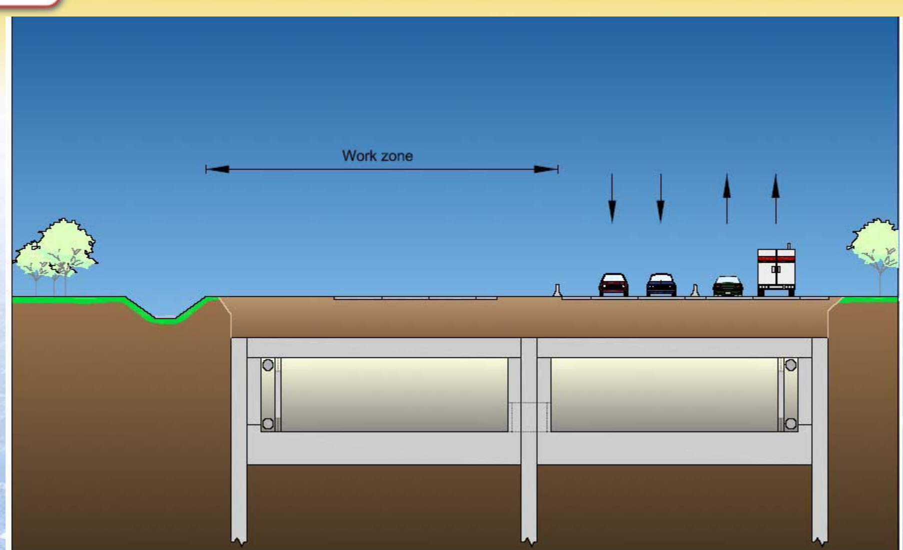
Cut and Cover Construction



Construct Roof & Remove 1st Level Struts

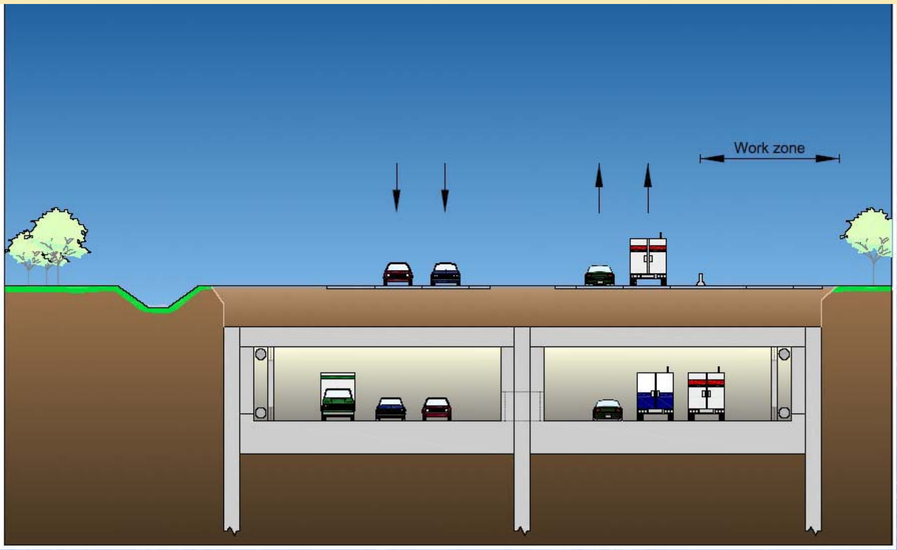
Detroit River INTERNATIONAL CROSSING STUDY

Cut and Cover Construction



Backfill, Paving & Complete In-Tunnel Finishes & Systems

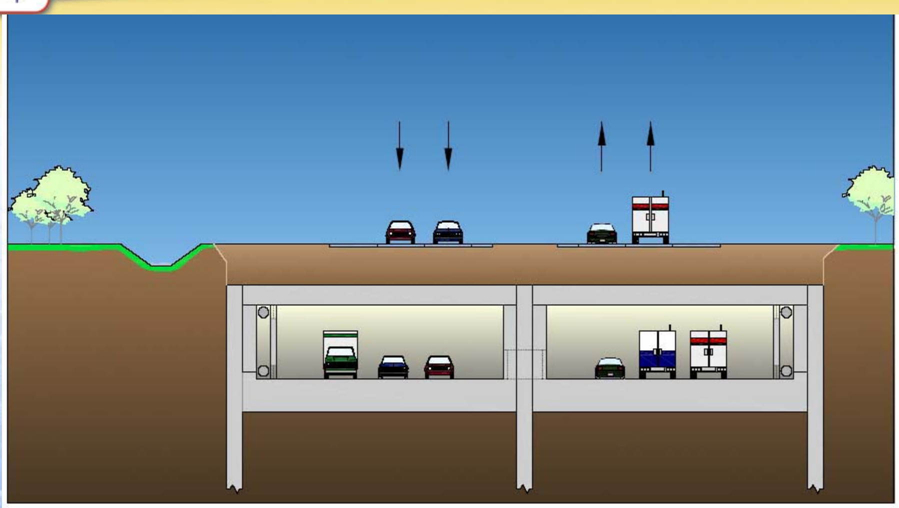
Cut and Cover Construction



Relocate Traffic

Detroit River
INTERNATIONAL CROSSING
STUDY

Cut and Cover Construction



Finish Surface

Note: Design elements such as landscaping and treatments are being developed through public consultation through Fall 2006

Structural Requirements for Tunnel

Design Tunnel per Existing Codes (Bridge Code, Building Code)

Structural Elements Include:

- Bottom Slab;
- Outside Walls;
- Centre Wall including Openings for Emergency Cross-over;
- Roof Slab;
- Waterproofing;
- Ventilation Ducts and Shafts;
- Portals (Including Retaining Walls);
- Exit and Entrance Ramps to Service Roads;
- Emergency Access & Egress to/from Surface; and
- Pumping Station(s) and Ventilation Building(s).

Tunnel Ventilation

Why is Tunnel Ventilation Required?

- A vehicle tunnel can be either **naturally ventilated** or **mechanically ventilated**. Tunnel ventilation is required to control:
  - air quality within a tunnel;
  - air emissions from the tunnel's entrance and exit portals; and,
  - fire and/or emergency conditions within the tunnel.

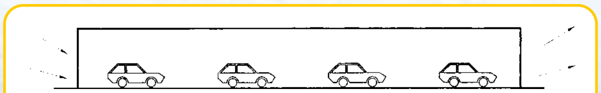
Ventilation Design Options

✖ **Naturally Ventilated Tunnels**

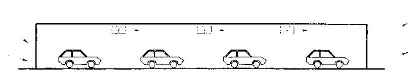
- For tunnels between 150 to 200 meters in length can be ventilated naturally. **Not considered practical for Access Road alternatives.**

✓ **Mechanically Ventilated Tunnels**

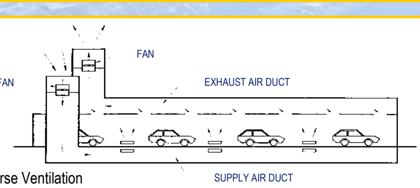
- Practical methods for the tunneled access road alternatives; could accommodate the 6 km tunnel length proposed for the alternatives.
- **Option 1 Longitudinal Ventilation** – 6 km tunnel would require approximately 300 jets; Suitable for low traffic volumes; Design issues include effectiveness of limiting portal emissions and fan noise; Examples include Cassar Tunnel, Vancouver.
- **Full Transverse Ventilation** – 6 km tunnel tunnel would require one large building or three smaller buildings; Design issues include noise, large land requirements but provides pollutant dispersal. Examples include Detroit-Windsor Tunnel.



Natural Ventilation




Longitudinal Ventilation with Jet Fans



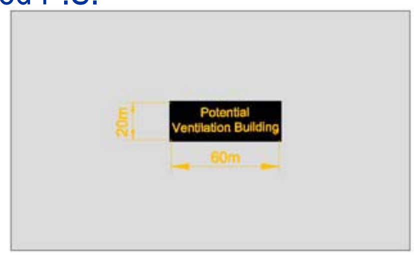
Full Transverse Ventilation

Detroit River
INTERNATIONAL CROSSING
STUDY

Examples of Ventilation Buildings

Scales of Ventilation Buildings

Size Comparison with Oakwood P.S.



Detroit River
INTERNATIONAL CROSSING
STUDY

Potential Sites for Ventilation Buildings

■ **Potential Sites for Ventilation Building**

Detroit River INTERNATIONAL CROSSING STUDY

Mitigation Measures: Pedestrian Plazas – I-696, MI

Context
- 3 pedestrian plazas in an area of mixed residential, community, and commercial properties.

Purpose and Description
- Pedestrian plazas maintain connectivity within neighborhoods
- 3 pedestrian plazas (bridge decks), each approximately 700 feet wide, within a mile length.

Context Sensitive Solutions Approach
- Width of each plaza was determined by adjacent residential developments, established pedestrian paths
- No artificial ventilation would be required
- The bridge carrying Greenfield Road over the freeway was given extra wide pedestrian sidewalks
- A few isolated homes were purchased to increase park areas adjacent to the plazas.

Outcome
- The plaza surfaces are maintained by the cities of Oak Park and Southfield
- MDOT retains maintenance responsibility for the plaza structures.

Detroit River INTERNATIONAL CROSSING STUDY

Air Quality / Noise / Vibration

Ventilation buildings will be designed to ensure compliance with the following regulations:

Air Quality

Federal - National Ambient Air Quality Objectives – Guidelines

Provincial – Ambient Air Quality Criteria – Regulation 337 Ontario Environmental Protection Act

Noise

Provincial – Stationary Sources Guidelines

Vibration

No provincial or federal standards

(will apply Health & Safety Standards 0.14mm/sec)

Public and Highway Safety

Several safety features will have to be incorporated into the design of the tunnel. These include:

- Illumination;
- CCTV;
- ITS;
- Emergency Access Between Tunnels;
- Emergency Access and Egress to/from Tunnel to Surface;
- Ice Prevention at Portals and Ramps;
- Emergency Telephone System;
- Containment of Spills;
- Flood Prevention System;
- Smoke Detector, Carbon Monoxide and Dioxide Monitoring System;
- Fire Sprinkler System;
- Emergency Power Supply;
- Storage for Emergency Supplies; and
- Additional Training for EMS Staff and education for motorists.

What's Next - Tunneling

Additional Work Required	Details
Foundations	Additional Boreholes along Corridor
Structural	Refine Tunnel Design and Construction Methods
Systems Requirements	Develop Concepts for Ventilation Buildings, EMS, etc.
Utilities	Relocation Strategies
Cost	Cost Estimate, including Operating Systems
Safety and Risk Analysis	Safety Review
Equipment & Material Availability	Assess
Schedule	Assess
Air Quality and Ventilation	Complete Air Quality Modeling and Analysis
Noise and Vibration	Modeling to Confirm Mitigation Requirements