

## EXECUTIVE SUMMARY

CastleGlenn Consultants Inc. was retained in April, 2010 to undertake a Functional Planning Study that would determine the “ultimate” 8-lane configuration for Highway 22X (13.3 km section from the East Calgary Freeway to Range Road 273) and confirm the location of future interchanges along the highway corridor. Development pressures and continued growth in Calgary and outlying areas have warranted the need to advance planning of Highway 22X to a freeway standard to ensure the highway can meet future transportation demand. This study outlines the property required to ensure development of the “ultimate” Highway 22X corridor and the associated interchanges, including lands required for the realignment of Highway 791 that would be implemented as part of the Highway 22X/791 interchange.

### *Objectives*

The primary objectives of the *Highway 22X and Highway 791 Functional Planning Study* were to:

- determine the infrastructure requirements necessary to accommodate the “ultimate” 8-lane Highway 22X freeway designation;
- determine the optimal location and spacing of future Highway 22X interchanges that will provide for sufficient capacity to accommodate “ultimate” build-out forecast traffic volumes;
- provide rationale for selecting the recommended Highway 22X widening and interchange designs, taking into account the location of the *Calgary East Freeway* systems interchange and the future conceptual *Regional Ring Road* systems interchange envisioned between Highway 791 and Range Road 273 (former Highway 797); and
- identify the configuration and right-of-way requirements for future interchanges located along the Highway 22X corridor, including the realignment of Highway 791 as part of the Highway 22X/791 interchange.

### *Existing Conditions*

The existing 13.3 km section of the Highway 22X corridor (See Exhibit ES-1) within the study limits (east of 88<sup>th</sup> Street to west of Range Road 273) can be characterised as follows:

- *Classification:* Highway 22X is classified as “Level 2” arterial highway that accommodates the movement of people, goods and services intra-provincially.
- *Vehicle Designation:* Highway 22X is not designated as a “*High Load Corridor*”<sup>1</sup>; however, the highway is a “*Long Combination Vehicle Route*”<sup>1</sup>.
- *Design Designation:* Highway 22X is currently designated as a 2-lane undivided rural arterial, with a posted speed of 100 km/hr.

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<sup>1</sup> as per information referenced from AT website’s outlining commercial vehicle requirements in Alberta

- *Cross-Section:* The existing 2-lane undivided Highway 22X cross-section consist of a pavement width that varies from 13.2 to 13.4 m and a highway right-of-way that varies between 64 m and 68 m in width along the corridor.
- *Horizontal and Vertical Geometry:* The alignment of Highway 22X is primarily tangential and level with the exception of a 3.7 km segment that contains three horizontal curves forming the approach roads to the CPR overpass structure (BF77548).
- *Access Management:* Access to Highway 22X is provided via ten at-grade intersections, which are stop-controlled on the minor leg. The spacing between intersections generally varies from 1.6 km to 2.0 km.
- *Collision Information:* A total of 53 collisions (including animal and non-animal collisions) were reported along the corridor, which corresponds to collision rate of 0.49 collisions per million vehicle kilometres. This rate is significantly lower than the 2009 Provincial average of 6.38 collisions per million vehicle kilometres for a similar highway.
- *Shepard Canal Culvert Crossing:* Approximately 1 km west of Range Road 285, Highway 22X crosses over the Shepard Canal (BF 84079) on square via two 51.2 m (long), 3.315 m (span), 4.575 m (rise) SPCSP ellipse culverts. The culvert crossing was constructed in 2007 as part of the City of Calgary's *Shepard Stormwater Diversion Project*, which provides a route for stormwater on the east side of the city to reach the Bow River (The City of Calgary constructed the canal assuming twinning of Hwy 22X was to occur on the north side of the existing lanes. The Mahogany Storm Trunk located just west of the Shepard Canal was constructed in 2010 assuming twinning of Hwy 22X was to occur on the south side of the existing lanes).
- *CP Rail Bridge Structure:* Approximately 900 m east of Highway 791, the Highway 22X corridor crosses over a single CPR track via a three span 70 m long bridge (BF77548) constructed on a 51° 38' RHF skew. The structure was built in 1981 and is considered to be in very good condition.
- *Existing Facilities Adjacent to the Highway Corridor:* Land uses adjacent to the highway corridor are primarily agricultural/farm land with some county residential lots. The Hamlet of Indus is located on the north side of Highway 22X with Highway 791 providing primary access to the community. Just west of Range Road 282 an aerodrome facility fronts the south side of Highway 22X.
- *Additional Factors:* A review of environmental conditions, geotechnical conditions and historical resources indicates that no significant issues or mitigations measures are required to implement the proposed Highway 22X and Highway 791 improvements.

### ***Traffic Volumes***

- *Existing Traffic Volumes:* Two-way Average Annual Daily Traffic (AADT) volumes are approximately 8,830 vehicles-per-day (vpd) east of 88th Street and 3,820 vpd west of Range Road 273;
- *20-Year Forecast Traffic Volumes:* Two-way AADT volumes are approximately 25,800 vpd east of 88th Street and 20,100 vpd west of Range Road 273; and

- “Ultimate” Forecast Traffic Volumes (75-year horizon): Two-way AADT volumes are approximately 77,800 vpd east of 88th Street and 62,200 vpd west of Range Road 273.

Development of the forecast traffic volumes included a review of historic traffic information, past modelling efforts and available land use information, including the *City of Calgary’s Regional Transportation Model (RTM), East Regional Context Study, Indus Area Structure Plan* and the *Fulton Industrial Development*.

### ***Highway 22X Twinning***

The options examined for the twinning of Highway 22X involved constructing a new set of lanes either on the north side or south side of the existing 2-lane Highway 22X corridor using a 40 m centerline spacing with a 104 m wide basic right-of-way. A comparative matrix analysis indicated that twinning Highway 22X to the south is the preferred alternative given:

- *Highway Geometrical Design Adherence*: Twinning to the south is consistent with the Highway 22X twinning configuration proposed outside the study limits (as indicated in the Calgary East Freeway/Highway 22X systems interchange plans and Highway 1, Alignment and Area Network Functional Planning Study). A consistent south twinning eliminates the need for horizontal highway curves that would otherwise be required to connect a south to north twinning;
- *Required Highway Right-of-Way*: The property area (excluding interchanges) required to accommodate a north twinning of Highway 22X was estimated at 143 acres and 123 acres for a south twinning option; and
- *Highway 22X/CPR Rail Crossing*: Twinning to the south provides for increased design flexibility by allowing construction of various crossing angles over the CPR corridor for the new eastbound Highway 22X lanes. [A benefit-cost analysis indicates that the preferred skew crossing for the new structure is a 51° 38' RHF skew, which parallels the existing Highway 22X/CPR overpass, however a significant factor that must be considered before construction of the eastbound Highway 22X lanes is the future location of the Regional Ring Road and associated systems interchange currently envisioned approximately 2.2 km east of the existing Highway 22X/CPR crossing. The proposed configuration and exact location of the systems interchange remains to be determined and may impact the decision to construct a tangential Highway 22X alignment (64° skew angle) over the CPR corridor.]

The following structural modifications will be required to accommodate the twinning of Highway 22X:

- *Shepard’s Canal Culvert Crossing* (BF 84079): The two 51.2 m long culverts will have to be extended by approximately 55.1 m (10.4 m on the north and 44.7 m on the south side). A hydraulic analysis indicates that the culvert extensions should not have any significant impacts on flow velocities and flow depths.
- *CP Rail Bridge Structure* (BF77548): With the advent of twinning, the posted speed along the Highway 22X corridor would increase from the existing 100 km/hr speed limit to 110 km/hr. This speed increase requires modifications to the existing structure and bridge approach roads (to be used by westbound traffic), specifically, the existing

vertical curve (114 K value consistent with a 110km/hr design speed) along the structure would be reconstructed to a minimum 140 K value to satisfy stopping sight distance requirements for a 130 km/h design speed. (An alternative option that should be reviewed at the time of detailed design is to maintain the existing K 114 crest curve on the structure and request a "design exception" taking into account the latest condition of the structure, traffic volumes and preferred location of the Regional Ring Road)

### ***Interchange Planning***

- *Highway 22X/Range Road 285 Interchange:* Application of AT's interchange spacing guidelines indicates that the closest position for a local interchange east of the East Calgary Freeway systems interchange is at Range Road 285. This location provides for a satisfactory 3.2 km separation to the systems interchange, integrates with Rocky View County's long range transportation plan and provides for an all movement access to the East Regional Context Study lands. (The East Calgary Freeway systems interchange does not provide for the S-E movement nor the E-S movement at the interchange site. As such, full movement access to lands located south of Highway 22X, including the Calgary Hospital, are restricted.)
- *Highway 22X/Highway 791 Interchange:* A geometrical review of the existing Highway 22X/791 junction indicates that the site is not a preferred location for an interchange given that the close proximity of the CP Rail corridor creates numerous interchange design constraints. A comparative matrix analysis of five candidate locations for a Highway 22X/791 interchange indicates that an interchange located along Range Road 282 (1.2 km west of the existing Highway 791 alignment) is preferred. The site will require constructing a 4.3 km long segment of Highway 791, including a northbound and southbound Highway 791 structure over the CPR corridor.

### ***Highway 22X/Range Road 285 Interchange***

- *"Ultimate" Interchange Configuration:* A Parclo "A" Highway 22X/Range Rd 285 interchange configuration (See Exhibit ES-1) was found to provide satisfactory operations at the Long-Range horizon travel demand forecast and is depicted as the preferred design in the study functional plans. (To provide AT with maximum design flexibility, the right-of-way boundaries protect for a possible Parclo "B" configuration. Providing for this design flexibility was particularly prudent at this location given that the traffic forecasts for the E-S movement are significantly high and require double left-turn lanes operating at maximum capacity. Should traffic volumes during the Long-Range horizon year develop differently or increase demand specifically for the E-S movement, a Parclo "B" configuration may be the preferred design.)
- *Bridge Configuration and Ramp Terminals:* The "ultimate" Parclo "A" interchange includes a 7-lane Range Road 285 structure over an 8-lane Highway 22X (excluding loop entrance terminals) with a single-lane loop ramp in the SW interchange quadrant and a dual lane loop ramp in the NE interchange quadrant. Both the south and north ramp terminals were found to provide improved operations under traffic signal control, however the design accommodates roundabouts if required. (The staging strategy for the interchange remains to be determined).

### ***Highway 22X/791 Interchange***

- *"Ultimate" Interchange Configuration:* A Parclo "B" Highway 22X/Highway 791 configuration (See Exhibit ES-1), with roundabout ramp terminals, was found to provide the best traffic operation characteristics and is depicted as the preferred design in the study functional plans. The Parclo "B" configuration also protects for sufficient property to allow construction of a Parclo "A" configuration if warranted in the future. This provides AT with maximum design and staging flexibility to implement an alternative interchange configuration should traffic patterns change within the study area.
- *Bridge Configuration and Ramp Terminals:* The "ultimate" Parclo "B" interchange includes a 6-lane Highway 791 structure over an 8-lane Highway 22X (excluding collector roads for loop entrance terminals) with a single lane loop in the NW and the SE interchange quadrants. Roundabout ramp terminals are proposed at both the north and south ramp terminals. The roundabouts consist of two circulatory lanes with a 78 m inscribed diameter that accommodates the turning movements of a WB-36 heavy vehicle. The roundabouts can be converted to standard intersections if required. (The staging strategy for the interchange remains to be determined)

### ***Highway 791 Realignment***

The 4.3 km long new segment of Highway 791 (beginning at Hwy 22X and tying into the existing Hwy 791 corridor approximately 800 m north of Township Road 231) can be characterised as follows:

- *Horizontal Alignment:* The horizontal highway alignment is primarily tangential with the exception of two horizontal curves located north of the CPR rail corridor. The two curves (R 1200 m) provide for a transition back to the existing Highway 791 alignment and tie into a westerly twinning of the corridor as proposed in the "*Highway 791 Functional Planning Study*" (UMA|AECOM, November 2008).
- *Vertical Alignment:* The vertical alignment consists of a gradual profile varying between 0% and 2% with above minimum vertical curve parameters. The design allows intersections along Highway 791 to be configured as both roundabouts and standard intersections.
- *Access Management:* Three intersections are proposed along the new segment of Highway 791, including at Township Road 231, Township Road 230 and a new intersection located 500 m north of the Highway 22X/791 interchange north ramp terminal. The spacing between the intersections varies between 500 m (within the vicinity of the interchange) to 1.6 km (between Township Road 230 and Township Road 231).
- *Intersection Configuration:* The functional plans depicted roundabouts at all intersectional locations along the highway corridor, including at the Highway 22X/Highway 791 interchange ramp terminals. The roundabouts are located outside of horizontal curves, provide for two circulating lanes (with an inscribed diameter 78 m) and provisions to accommodate the turning movement of a WB-36.

- *Cross-section:* The Highway 791 cross-section (referenced from *AT Highway Geometric Design Guide*, Figure C-6.2a) provides for a 90 m wide basic right-of-way with a 22.6 m median (30 m centerline-to-centerline spacing).

### ***Highway 22X Potential Staging and Associated Costs***

The following potential staging strategy (based on 20-year and 75-year forecast traffic volumes) was developed for the Highway 22X corridor (Given that the factors and assumptions used in the staging strategy are variable and subject to revision, it is recommended that the proposed Highway 22X staging strategy be monitored and substantiated over time as development initiatives become further clarified and traffic assumptions become increasingly formulized):

- *4-lane Highway 22X:* Construction of a 4-lane Highway 22X is anticipated in year 2030 or sooner with an estimated cost of **\$43.1M**, which includes:
  - road works required for a 13.3 km southerly twinning of the existing Highway 22X corridor;
  - a new 2-lane eastbound Highway 22X structure over the CPR;
  - the extension of the Shepard Canal culvert and realignment of a section of the canal;
  - relocation of utilities required for the twinning and also for the “ultimate” 8-lane Highway 22X cross-section; and
  - signals or roundabouts at five Highway 22X intersections.
- *6-lane Highway 22X:* Construction of a 6-lane Highway 22X is anticipated in year 2055 with an estimated cost of **\$30.2M**, which includes:
  - road works required for an additional eastbound and westbound Highway 22X lane;
  - removal of the existing two-lane Highway 22X/CPR structure (BF 77548);
  - construction of a new 3-lane westbound Highway 22X/CPR structure;
  - one lane widening of the 2-lane eastbound Highway 22X/CPR structure constructed in Stage I; and
  - signals or roundabouts at the remaining five Highway 22X intersections.
- *8-lane Highway 22X:* Construction of an 8-lane Highway 22X is anticipated in year 2075 with estimated cost of **\$170.5M**, which includes:
  - road works required for additional eastbound and westbound Highway 22X through lanes;
  - one lane widening of the 3-lane eastbound and westbound Highway 22X/CPR structures;
  - construction of service roads to allow for the closure of at-grade intersections;
  - road works required for the 3.7 km (north of the Highway 22X/791 Interchange) 4-lane Highway 791 cross-section;
  - construction of interchanges at Range Road 285 and the new Hwy 791 corridor; and

- relocation of utilities that conflict with proposed construction works.

### ***Public Consultation Process***

The public consultation process for the study included:

- *Public Open House and Focus Groups # 1*: Provided the opportunity to present the study objectives, Highway 22X existing conditions, potential interchange locations and conceptual Highway 22X twinning options. Approximately 33 individuals attended the first public open house, while 7 individuals attended focus group meetings;
- *Public Open House and Focus Groups # 2*: Addressed the Highway 791 corridor, including: existing conditions, potential locations for a Highway 22X/791 interchange and Highway 791 realignment options. Approximately 75 individuals attended the second public open house, while 24 individuals attended focus group meetings; and
- *Public Open House and Focus Groups # 3*: Presented the consultants recommended Highway 22X twinning, Highway 791 realignment and proposed interchange designs along the Highway 22X corridor. Approximately 27 individuals attended the third public open house, while 22 individuals attended focus group meetings.

### ***Recommendations***

It is recommended that...

1. The infrastructure improvements consistent with the *Highway 22X & Highway 791 Functional Planning Study* be received by Alberta Transportation;
2. Rocky View County and the City of Calgary be informed that the *Highway 22X & Highway 791 Functional Planning Study* represents a planning document and Highway 22X improvements are currently not scheduled;
3. Rocky View County Council and City of Calgary Council be requested to incorporate the *Highway 22X & Highway 791 Functional Planning Study* within their area structure plans and municipal development plans; and
  - a) Subsequent to Alberta Transportation's endorsement of the Highway 22X & Highway 791 functional designs, as recommended in the *Highway 22X & Highway 791 Functional Planning Study*, Alberta Transportation is encouraged to pursue those initiatives necessary to confirm the detailed engineering feasibility of the proposed Highway 22X improvements including develop of detailed construction staging plans.

EXHIBIT ES-1  
HIGHWAY 22X AND HIGHWAY 791  
PROPOSED IMPROVEMENTS

CONSULTANT  
PROJECT NO. PLAN No.

FUNCTIONAL PLAN  
SUBJECT TO REVISION

