Elgin O'Hare - West Bypass: Finalist System Alternatives Preliminary Lane Requirements

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Introduction

The regional travel forecasting model is an important tool in the determination of future system requirements to accommodate projected demand. In the EO-WB study, the model was utilized to evaluate alternative configurations and to determine preliminary sizing requirements of the various roadway improvements considered.

The purpose of memorandum is to document procedures used to establish the preliminary lane configuration and conceptual layout of the "representative" new freeway facilities that make up the EO-WB Finalist Roadway System Alternatives. The following sections describe existing and 2030 Baseline (No-Action) traffic characteristics, preliminary corridor sizing requirements (along with procedures and assumptions used to establish the lane requirements), and next steps in the corridor sizing process.

I. Characteristics of the Existing System

The study area is a major transportation hub in the Chicago metropolitan region. Among the key features of the existing transportation system is an expansive network of access-controlled highways, totaling approximately 407 lane miles (26% of total highway lane miles) in the study area. Freeways and tollways in this area consist of I-294 (Tri-State Tollway), I-90 (Kennedy Expressway and Jane Addams Memorial Tollway), I-190, I-290 (Eisenhower Expressway), I-290/IL 53, I-355 (North-South Tollway), and the Elgin-O'Hare Expressway. Exhibit 1 shows the study area along with major area highways.

More than 18 percent of all travel in the Chicago metropolitan region enters, leaves, travels within, or passes through the study area, and many of these trips occur on the area's access-controlled highways. As detailed in the *Final Transportation System Performance Report (July 2009)*, severe congestion is a key transportation issue on the area's major highway network. Some of the specific reasons for concerns are as follows:

- In 2007, the daily Vehicles Miles of Travel (VMT) on freeways and tollways in the study area totaled 10,939,000, with approximately 1,576,000 VMT or 14 percent occurring in the critical p.m. peak period (4 p.m. to 6 p.m.). During the p.m. peak period, roughly 88 percent of the freeways and tollways operate at congested conditions, defined as level of service (LOS) D, E or F.
- Principal arterials in the study area experience comparable congestion levels to those on the freeway and tollway system. In 2007, roughly 79 percent of these highways operated under congested conditions in the p.m. peak period.

A. Existing Interchanges and Cross Section

The location of the service and system interchanges, interchange type and interchange access for the various interstates and tollways in the study area are shown in Exhibit 2. There are 18 full service interchanges, 9 partial service interchanges and 6 complete system interchanges in the study area. All of the system interchanges include full access. The study area also includes the Des Plaines Oasis along I-90 and the O'Hare Oasis along I-294.

The existing basic number of lanes and auxiliary lane locations for interstates, tollways and expressways in the study area is shown in Exhibit 2. I-90 is a toll facility with 3 basic lanes in each direction and up to 2 auxiliary lanes. I-294 is also a toll facility with 4 basic lanes in each direction and one auxiliary lane in select segments. I-290 consists of 3 to 4 basic lanes in each direction with segments carrying up to 3 auxiliary lanes. I-290 also has a 3-lane southbound CD road and a 4-lane northbound CD road between I-90 and IL 62 (Algonquin Rd). I-190 provides 2 or 3 basic lanes in each direction with one auxiliary lane in each of two segments. The existing Elgin O'Hare Expressway has 3 basic lanes in each direction and one WB auxiliary lane between IL 53/ Rohlwing Rd and Meacham Rd. The expressway provides 2 basic lanes in each direction between Meacham Rd and US 20.

B. Existing Traffic Characteristics

The 2007 p.m. peak period (4:00 p.m. – 6:00 p.m.) traffic volumes generated by the travel demand model are shown in Exhibit 3. Except for the Elgin O'Hare between Gary Avenue and US 20, all other interstate and tollway facilities carry over 15,000 vehicles in the peak direction during the p.m. peak period. Segments of IL 83, Meacham Road and Army Trail Road carry between 10,000 and 15,000 vehicles in the peak direction. Most of the principal arterials carry between 5,000 and 10,000 vehicles in the peak direction. Minor arterials typically carry between 2,500 and 5,000 vehicles in the peak direction during the p.m. peak period.

Based on the travel demand model, various interstate and tollway segments operated at congested conditions in the 2007 p.m. peak period (see Exhibit 4). Traffic service commonly is measured in terms of LOS. For freeways, LOS is related directly to the volume to capacity (v/c) ratio. LOS measures the quality of traffic service and may be determined for each arterial roadway segment on the basis of delay, congested speed, v/c ratio, or vehicle density by functional roadway class. Congested roadways were defined as those facilities indicated to operate at LOS D, E, or F in the p.m. peak period.

As indicated on Exhibit 4, most freeways and tollways in the study area currently experience congestion due to heavy traffic demand during the peak period. Whereas capacity and operational analyses were not performed at this time for interchanges along these corridors, field observations suggest poor operational conditions at numerous system and service interchanges. Potential contributing factors include traffic volumes exceeding capacity, absence of some movements, inefficient loop style ramps, and short weaving sections. Another potential issue relates to the lack of convenient interstate access to major arterials, resulting in out-of direction travel and operational inefficiencies.

II. Characteristics of the 2030 Baseline Freeway/ Tollway System

The 2030 No-Action (Baseline) Alternative consists of the existing transportation system plus projects expected to be in place by 2030, excluding the major transportation improvements being considered by this study. The 2030 baseline network, including proposed freeway and tollway improvements, were developed with input from each transportation agency in the study area and a review of regional and agency plan information. Programmed and expected roadway projects within the 2030 baseline roadway network are listed in Table 1 and shown in Exhibit 5.

TABLE 1
Roadway Baseline Projects

Name	Project Type	To	From
Balmoral Avenue	New interchange, extend roadway	Bessie Coleman Drive	East of US Route 12/20/45
IL Rte 53 (Rohlwing Road)	Add lanes, bridge replacement	Elgin O'Hare Expressway	Army Trail Road
I-290	Corridor improvement, HOV, auxiliary lanes	St. Charles Road	IL Route 50 (Cicero Avenue)
I-294 (Tri-State Tollway)	Widening, reconstruction	Balmoral Avenue	Dempster Street
I-90 (Jane Addams Memorial Tollway)	Add lane, reconstruction	I-294 (Tri-State Tollway)	IL Route 53
Thorndale Avenue	Add lane	I-290	York Road
US 12/20/45 (Manheim Rd)	Widen Mannheim to three lanes in each direction	IL Rte 19 (Irving Park Road)	IL Route 72 (Higgins Road)
I-294 (Tri-State Tollway)	Add interchange ramp	Balmoral Road	

The 2030 baseline p.m. peak period modeled traffic demand along the interstates and tollways is shown in Exhibit 6. The 2030 baseline corridor-wide interstate and tollway operational characteristics (model generated p.m. peak period LOS) are shown in Exhibit 7. Whereas limited capacity improvements are planned for the network and travel demand in projected to continue to grow through the 2030 planning horizon, the roadway system will experience greater congestion in the future. As illustrated on Exhibit 7, all existing freeways and tollways in the study area will continue to experience congestion, with many corridors operating at severe congestion levels (LOS F).

Freeway and tollway corridors experience extreme congestion due to very high average daily travel demand. As examples, the bi-directional ADT along I-90 (Elmhurst Road to Devon Avenue) and along I-294 (I-190 and IL 19) are over 285,000 and 332,000, respectively. The bi-directional ADT along I-290 between Thorndale Avenue and IL 62 are over 256,000. Of particular importance, congestion at the system interchanges of I-90/I-190/I-294 just east of O'Hare Airport and the IL53/ I-290/ I-90 are expected to deteriorate even further without diversion of some of the demand to another corridor.

Development of the baseline system is predicated, in part, on the following findings of the travel forecasts:

- By 2030, daily VMT on existing freeways and tollways is projected to increase to 12,711,000 (2030 No-Action Alternative), with approximately 1,693,000 vehicle trips, or 13 percent of the total, occurring in the p.m. peak period. By 2030, roughly 90 percent of these highways will operate at congested conditions during the p.m. peak period. Note that 2030 forecasts reflect planned capacity improvements contained in the 2030 baseline network, including the widening of I-90.
- With the 2030 No-Action Alternative, congestion on principal arterials is projected to increase to include 92 percent of the arterial network in the p.m. peak period. Approximately 79 percent of the principal arterial system was congested in 2007.

Network segments expected to operate at a congested level in the 2030 p.m. peak period for the baseline network and areas of congestion and congestion increases (2007–2030) are described in detail in the *Final Transportation System Performance Report (July 2009).*

The procedures, assumptions, and references related to model generated p.m. peak period volumes and LOS are described in the *Travel Demand Modeling and Forecasting Report (July 2009).*

III. Finalist Roadway System Alternatives – Preliminary Corridor Sizing

This section includes a description of the Finalist Roadway System Alternatives considered, corridor sizing principles, preliminary corridor sizing requirements for the Elgin O'Hare and West Bypass corridors, as well as assumptions regarding lane requirements for other roadway improvement corridors.

A. Description of Finalist Roadway System Alternatives

Seven roadway system alternatives and a range of potential connection options for the O'Hare West Bypass and IL 83 Freeway were considered (see Exhibit 8)

Alternative 202 provides a new freeway along Thorndale Avenue between IL 53 and York Road. The north leg of IL 83 and the south leg of York Road, developed as a freeway, would comprise the West Bypass of O'Hare Airport. **Alternative 203** would provide a mainline freeway and frontage road system along Thorndale Avenue, similar to Alternative 202, with a different configuration for system and service interchange access. A system interchange would be provided at the junction of the Elgin O'Hare Extension, the north and south legs of the O'Hare West Bypass, and the proposed O'Hare West Terminal entrance.

Alternatives 401, 402, and 403 each provide a mainline freeway and frontage road system along Thorndale Avenue, similar to Alternatives 202 and 203, but with a different configuration for system and service interchange access and different locations for adjacent arterial capacity improvements. The three alternatives include only the south leg of the O'Hare West Bypass. Under Alternative 401, the IL 83 corridor north of Thorndale Avenue would be widened to provide additional arterial capacity. Under Alternative 403, both the north and south legs of IL 83 would be widened. With Alternative 402, capacity improvements are proposed along the north leg of Elmhurst Road.

A**lternative 404** would provide a mainline freeway and frontage road system along Thorndale Avenue similar to Alternative 203, but with a different configuration for the system interchange and with adjacent arterial capacity improvements. It includes only the

north leg of the O'Hare West Bypass which would be located along Elmhurst Road. It also includes arterial capacity improvements along the south leg of IL 83, York Road and IL 19 (between York Road and I-294).

Unlike the other alternatives, **Alternative 501** would terminate the Elgin O'Hare Extension at IL 83 and widen the Thorndale Road arterial section from east of IL 83 through York Road/Elmhurst Road. East of IL 83, the freeway section would end and transition to an arterial. Thorndale Avenue would be widened to 4 lanes in each direction. Additional arterial widening improvements included within Alternative 501 are IL 83 (north and south legs), and York Road (south leg).

B. Corridor Sizing Principles

When considering the construction of new freeway links within a mature urban freeway system, one must first understand the following:

- The inter-relationship of new and existing freeway corridors, including interface points (system interchanges), and sizing characteristics of existing freeways
- Projected travel demand both along the new and existing facilities within the study influence area, including relative travel demand, the location and amount of projected traffic redistribution (from existing to new freeway corridors), and the relationship between forecast traffic and the number of basic travel lanes to be provided
- The operational inter-relationship between existing and new corridors, including constraints on the existing freeway system.

A basic design characteristic of new access-controlled highways is corridor sizing – in other words the number of basic (through) travel lanes, and the location and type of auxiliary lanes required to accommodate travel demand along the corridor. Key planning principles for urban freeways include:

- Maintain route continuity
- Maintain basic number of lanes
- Provide lane balance and continuity

Corridor sizing requirements are generally driven by two basic inputs – *design year traffic* and *design level of service*; in other words the level of traffic demand and the operational quality for which the facility is designed. While design year traffic and level of service guide the determination of corridor sizing, several important policy and design considerations must also be considered when determining the appropriate sizing for new freeway corridors. These include financial viability, operational acceptability, motorist expectations, and stakeholder acceptability related to potential social and environmental impacts.

The Chicago Metropolitan Agency for Planning (CMAP)'s *2030 RTP* represents the regionally endorsed transportation plan and its underlying land use assumptions, and thus serves as the foundation for project development efforts. As previously discussed, projects identified in the *2030 RTP*, with the exception of the major potential improvements under consideration with this study (the Elgin O'Hare Extension and the West O'Hare Bypass) are committed projects, and as such are included in the 2030 No-Action Alternative. The design year selected for the

Tier 1 EIS is 2030. This design year is compatible with current regional planning horizon; but note that the 2040 RTP process is on-going with scheduled plan finalization in 2010.

LOS is an operational measure of the quality of traffic flow. Procedures for determining a highway's level of service are outlined in TRB Special Report 209, year 2000 edition, Highway Capacity Manual.

LOS is not a 'standard'. A project cannot have an LOS goal that is significantly different from other competing facilities. It is possible and indeed may be desirable to accept different LOS thresholds for different design elements of an interchange like basic freeway, ramp merge and diverge and ramp termini. Design Level of Service is a choice that involves trade-offs. Better LOS means larger 'footprint' and improved safety. Lower LOS means lesser right of way and other physical impacts, and more operation under congestion.

Per guidance from FHWA and IDOT, LOS C was selected for use as the "desirable" mainline LOS for new freeway/tollway corridors, with the objective of identifying conservative footprint requirements at this early stage of project development. The "desirable" LOS was selected for use at this time with the understanding that detailed design criteria (including LOS) will be established with future Tier Two studies and will be the basis for preliminary design development. In urban areas, it is now commonplace to accept LOS E (which is essentially operation at capacity) due to severe 'context' constraints.

C. Preliminary Corridor Sizing – Elgin O'Hare Extension and West Bypass

As noted, an important design element for access-controlled highways is the proposed corridor sizing – in other words, the proposed number of basic (through) lanes and auxiliary lanes. For purposes of developing a representative conceptual layout and estimated construction footprint requirements, the preliminary corridor sizing for the Elgin O'Hare and West Bypass corridors was established. Whereas the limits of new access-controlled highways and associated traffic demand vary between alternatives, a "representative" alternative was selected to develop preliminary corridor sizing requirements.

Alternative 203 was chosen to be used as the "representative" alternative for establishing design year traffic and corridor sizing. Alternative 203 was selected because it provides full build out of the Elgin O'Hare Expressway and O'Hare West Bypass. Thus, the freeway traffic demand along with associated lane requirements would generally be greatest of the alternatives remaining under consideration.

The first step in determining corridor sizing requirements was to establish forecast peak period traffic demand. The traffic forecasts for alternative 203 used for preliminary corridor sizing requirements were based on network coding assumptions that are reflected in the CMAP 2030 RTP model. This included basic 3-lane section in each direction along with representative interchange locations for the Elgin O'Hare and the West Bypass corridors. Additionally, the traffic forecasts reflected transit improvements that were assumed as part of the 2030 RTP and did not account for any additional improvements that would be considered as part of the project. The representative interchange and ramp configurations did not fully reflect the actual interchange layout, and the model generated traffic volumes were re-assigned and manually adjusted based on the locations of the planned interchanges, frontage roads, CD roads and ramps. The adjusted peak period traffic forecasts were then converted to a peak hour volume. Given the saturated condition of traffic during the peak periods, a factor

or 0.52 was used to convert the p.m. peak period volume (2-hour volume) to a peak hour volume.

It is important to note that the preliminary sized corridor and interchange configurations will be used as an input and coded as part of the finalist alternative network assumptions during the finalist alternative modeling process. In addition to roadway network configurations, proposed transit improvements and finalist alternatives specific socio-economic estimates will be included, and finalist alternatives travel demand estimates will be generated with the help of CMAP. Therefore, the final proposed corridor size and interchange configuration may require modifications and refinements to the preliminary corridor sizing estimates to reflect changes in finalist alternative traffic demand and forecast.

The 2030 Finalist System Alternative traffic demand and travel forecast process/estimates are documented separately in the *Travel Demand Modeling and Travel Forecasting Technical Report* (July 2009).

The traffic volumes in the peak direction (a.m. or p.m.) of travel were then used in analyzing the LOS for the corridor. The interchange ramps and corridor mainline were "sized" (designed) for the direction with the higher volume. For the Elgin O'Hare Expressway, the a.m. and p.m. peak period traffic volumes were analyzed for the eastbound and westbound direction, respectively. For the O'Hare West Bypass, the a.m. and p.m. peak period traffic volumes were used for analyzing the northbound and the southbound direction, respectively. The peak hour volumes were reassigned to the interchanges and balanced. Usable design year traffic forecasts were developed that focused on reasonable estimates of turning volumes (rounded to nearest 10 vph).

Where practical, the corridor sizing was developed to accommodate the desirable LOS C as described in the preceding section. Preliminary corridor sizing requirements with associated preliminary traffic forecasts for the Elgin O'Hare and West Bypass corridors are shown in Exhibits 9, 10 and 11 and described below.

Elgin O'Hare Expressway

Mainline

The basic number of lanes between Gary Avenue and O'Hare West Bypass would be 3 lanes in each direction. West of Gary Avenue, the existing configuration of 2 lanes in each direction would be adequate to provide an acceptable LOS C for all mainline operations. There would be two lanes to and from the EOE and the O'Hare Terminal.

Auxiliary Lanes

Auxiliary lanes would be provided to accommodate appropriate transition areas for entering and existing freeway traffic, and to adhere to basic lane balance principles. One auxiliary lane would be provided between the following segments:

- EB and WB ramps to/ from Wright Blvd and Roselle Road
- EB and WB ramps to/ from Prospect Avenue
- EB exit ramps to Wood Dale Road and IL 83 and WB entrance ramps from IL 83 and Wood Dale Rd
- EB entrance ramp from Wood Dale Road and exit ramp to O'Hare Bypass (OBP) NB and WB entrance ramp from OBP and exit ramp to Wood Dale Road

Due to high traffic volumes, 2 auxiliary lanes would be provided in segments between the following roadways:

- Ramps to/ from Roselle Road and I-290
- Ramps to/ from I-290 and Prospect Avenue
- Ramps to/ from Prospect Avenue and Wood Dale Road

The LOS for all the mainline segments along the Elgin O'Hare Expressway would be LOS C or better. The one exception would be in the westbound section between I-290 and Arlington Heights Road, where the conceptual layout would operate at LOS D.

Ramps
The LOS for the WB diverge (exit) to Meacham Road, WB merge (entrance) from Arlington Heights Road and the EB exit to OBP SB would operate at LOS D. All other merge and diverge along the corridor would operate at LOS C or better.

West Bypass

Mainline
The basic number of lanes along this corridor would be 3 lanes in each direction. Auxiliary lanes would be provided to accommodate appropriate transition areas for entering and existing freeway traffic, and to adhere to basic lane balance principles. One auxiliary NB lane (and SB lane in the reserve direction) would be provided between the following roadway segments:

- Exit ramp to Franklin Avenue and NB entrance ramp from IL 19
- Exit to EO-WB and exit to O'Hare Terminal (NB direction only)
- Entrance ramp from EO EB to entrance ramp from Devon Avenue
- Exit to IL 72 and entrance ramp to EB I-90

Due to high traffic volumes 2 auxiliary lanes would be provided in segments between the following roadways (and SB lanes in the reverse direction):

- NB entrance ramps from IL 19 and exit ramp to EOE-WB
- NB entrance ramp from Devon Avenue and exit ramp to IL 72

One auxiliary lane would be provided in each direction along I-90 between the following roadway segments:

- Bypass and IL 72/ Lee Street
- Bypass and Elmhurst Road

The LOS for all the mainline segments along the Bypass would be LOS C or better.

Ramps
All ramp movements between the Bypass and I-90 are two lanes. New one-lane ramps would be provided to/ from Elmhurst Road to west of I-90. The NB diverge (exit) to the Elgin O'Hare WB would operate at LOS D. All other merge and diverge along the Bypass would operate at LOS C or better.

D. Preliminary Lane Requirements – Other Roadway Improvement Corridors

Various existing roadways and new frontage roads were identified for improvement as part of the Finalist Roadway System Alternatives. This includes required improvements adjacent to new system or service interchanges, as well as capacity improvements along existing arterials. The objective at this stage was to identify approximate improvement limits based on operational and geometric design principles, with the understanding that detailed design requirements will be established with future Tier Two studies.

A consistent approach was used to develop preliminary lane requirements for existing roadways as follows:

- For new frontage roads along new freeway segments, all frontage roads were assumed to be two lanes in each direction,
- For arterials where widening improvements were proposed, one additional through lane was added in each direction as compared to the 2030 Baseline condition,
- For existing freeways and tollways adjacent to new system interchanges, lane requirements and preliminary improvement limits were established on the basis of system ramp lane requirements, lane balance principles, and ramp terminal design standards.

IV. Next Steps

The corridor sizing used to develop representative conceptual layouts for the Finalist Roadway System Alternatives was established on the basis of limited traffic analyses for one representative alternative (Alternative 203) using the 2030 CMAP roadway, transit and 2030 Baseline socio-economic assumptions. The preliminary traffic forecast data was derived from Alternative 203 the travel demand model run. The model generated traffic demand was developed assuming three basic lanes in each direction along the Elgin O'Hare and West Bypass corridors along with 2030 CMAP RTP transit improvements and 2030 Baseline socio-economic forecasts.

Following identification of the Build Alternatives to be considered in detail in the *Tier One Draft EIS*, the travel demand model will be updated to reflect alternative-specific transportation improvement features (roadway and transit) and socio-economic characteristics. Whereas additional lanes are proposed along the Elgin O'Hare and West Bypass corridors (as compared to the 3 basic lanes originally reflected in the model), it is anticipated that Build Alternative traffic forecasts may exceed those identified with the current analysis.

Detailed analyses of corridor-specific traffic forecasts along with the development of design hourly volumes for proposed roadway improvements will be performed with future Tier Two studies. This will include selection of design year and LOS to be used through design development process. The proposed corridor sizing for new freeways/ tollway corridors and for associated existing roadway improvements will be finalized with these future studies.