Methodology

With the completion of Step 4 of the ODOT's PDP for Major Projects, several freeway mainline and interchange alternatives were recommended and approved for further study in Step 5.

Depending on whether the alternative was a mainline alignment or interchange, the method of concept development varied. Step 5 procedures, as included in the current version of the ODOT *Location and Design Manual* (LDM) Section 1400, were employed at a minimum and in many ways that level of effort was exceeded. More in-depth means of evaluation were used in areas where more uncertainty could result in higher risk of increased cost or questionable feasibility.

The LDM stipulates rather general assessment criteria such as conceptual typical sections and 2-D alignment layout. However, the physical space within the project limits is highly constrained by buildings, parallel arterial streets, Mill Creek and railroad tracks within close proximity to the existing project roadways. As a consequence and with the approval of the Department, the mainline alignment alternatives have been engineered using Geopak both horizontally and vertically. Roadway profiles and cross sections were generated and assessed for ways to reduce collateral impacts using a single design iteration. As such, the alignment solutions should not be considered optimized, however, a relatively high degree of confidence in the alignments can be assumed.

Design criteria applied in the development of alternatives is shown below. The design approach is consistent with the LDM and AASHTO *A Policy on Geometric Design of Highways and Streets* 2004 (hereafter referred to as the "Green Book") for given roadway classifications and design speeds. Cross section generation was accomplished using an unmodified ODOT Geopak criteria file and visual inspection for retaining wall limits. Geometric layouts were developed using design-level aerial mapping supplied by ODOT Office of Aerial Engineering as well as the model TIN (terrain model) used to generate profiles and cross sections. Mainline alternative earthwork and retaining wall quantities were calculated from the Geopak generated cross sections.

For efficient use of time, only Microstation was utilized without applying Geopak for interchange alternative layout. As such, no vertical information (profiles or cross sections) was created for ramps or arterial streets and, consequently, accuracy of interchange concepts is lower than that of the mainline. The exception is the proposed I-74 directional ramps where profiles were designed to determine their feasibility.

Interchange intersections were analyzed using Synchro v6 (for signals) and RODEL v1 (for modern roundabouts) using 2030 design year turning movement volumes. Ultimately, signalized

intersection analyses will be performed with the Highway Capacity Software (HCS) as required in PDP Step 6. Synchro was used to provide a reasonably high degree of confidence of expected intersection operation. Intersections were designed for a LOS D which is acceptable as per the Green Book. In the course of evaluating the PDP Step 4 alternatives, several alternatives were found to be potentially deficient. Additional alternatives recommended for further evaluation have been identified and are listed below.

The following table lists the alternatives recommended for further evaluation in Step 5:

Step 4 Recommended Alternatives			
Alternative	**Description**	**Alternative**	**Description**
I75-NB	No Build Plus Minor Improvements	**MIT-NB**	No Build Plus Minor Improvements
I75-A	4-Lane Continuity with Auxiliary Lanes	**MIT-A**	Tight Urban Diamond Interchange
I75-B	5-Lane Continuity		
I75-C	4-Lane Continuity with Elevated Express Lanes	**NOR-NB**	No Build Plus Minor Improvements
		NOR-A	Modified Interchange with Additional Ramp Lanes
HOP-NB	No Build Plus Minor Improvements		
HOP-A	Tight Urban Diamond Interchange	**TOW-NB**	No Build Plus Minor Improvements
HOP-B	Offset Roundabout Diamond Interchange	**TOW-A**	Close Ramps
I74-NB	No Build Plus Minor Improvements	**PAD-NB**	No Build Plus Minor Improvements
I74-A	Fully Directional Interchange with Local Access	**PAD-A**	Low Impact Improvement
I74-B	Fully Directional Interchange with No Local Access	**PAD-B**	Double Roundabout Diamond Interchange
COL-NB	No Build Plus Minor Improvements		
COL-A	Low Impact Improvement with Full Movements		
COL-B	Double Roundabout Diamond Interchange		

The following table lists four alternatives that were added after Step 5 began:

Additional Step 5 Alternatives			
Alternative	**Description**	**Alternative**	**Description**
I75-D	5/4-Lane	**COL-A1**	Low Impact Improvement with Full Movements (WB Ramp Loop)
HOP-B1	Offset Diamond Interchange (No Roundabout)	**COL-B1**	Double Roundabout Diamond Interchange (WB Ramp Loop)

In general, the freeway alternatives have been evaluated independently from the interchange alternatives since each are planned to be self-contained construction projects in the future. In so far as practical, a qualitative evaluation of system-level operation has been made and is discussed later in this report.

Conceptual Design Designations

The following table summarizes the project design designations:

Design Designations				
Route	**Freeway**	**Directional Ramp**	**Service Ramp**	**Local Street**
Design Functional Classification	Urban Interstate	Urban Interstate	Urban Ramp	Urban Arterial
Terrain[1]	Level	Level	Level	Level
Access Permit	State	State	State	Local
Design Speed	60 MPH	60 MPH Upper 45 MPH Middle	50 MPH Upper 40 MPH Middle 30 MPH Lower	40 MPH[2]
Opening Year	2010	2010	2010	2010
Design Year	2030	2030	2030	2030
Design Vehicle	WB-67	WB-67	WB-67	WB-50[3]
Desirable Design LOS[4]	D	D	D	D
Minimum Design LOS	Existing	Existing	Existing	D
Projected Traffic Volumes	Refer to Traffic Volume Exhibits			

Notes:

1. The terrain designation is proposed to be "level" as per LDM Section 103.2 which describes level terrain as "Any combination of grades and horizontal and vertical alignment permitting heavy vehicles to maintain approximately the same speed as passenger cars. This generally includes grades of no more than 2 percent for a distance of no more than ½ mile." Although there are isolated instances of grades greater than 2% within the project limits, these are short length, do not exceed 4% and are used to avoid costly impacts (such as railroad tracks).

2. With most local streets having a legal speed of 35 MPH or less, this study assumes 40 MPH for local street design speeds. Actual design speeds for local streets will be determined in subsequent PDP Steps when appropriate.

3. Except at Mitchell Avenue where the Department has specifically requested a WB-67 truck be used as the design vehicle.

4. Minimum LOS C is preferred in an urban environment; however, ODOT has determined that a lower LOS is acceptable with MPO and FHWA approval where increased cost and impacts are considered too great.

Design Criteria

A basis for design must be assumed even though ODOT may not have approved design criteria for the project at the initial steps of the PDP. In order to design to specific standards of the LDM, values for curvature, grades, transitions, lane and shoulder widths, etc. were determined based upon known or assumed design designations.

The following table summarizes the LDM criteria used for project conceptual design:

Design Element	Value	L&D Ref	Value	L&D Ref	Value	L&D Ref	Value	L&D Ref
Route	**Freeway**		**Directional Ramp[1]**		**Service Ramp[2]**		**Local Street**	
Horizontal Alignment								
Max Centerline Deflection w/o Horizontal Curve	1° 00'	Fig 202-1E	1° 00' 1° 45'	Fig 202-1E	1° 15' 2° 15' 3° 45'	Fig 202-1E	2° 15'	Fig 202-1E
Maximum Deg of Curve	4° 15'	Fig 202-2E	4° 15' 8° 45'	Fig 202-2E Fig 202-10E	6° 45' 11° 15' 21° 00'	Fig 202-2E Fig 202-10E Fig 202-10E	11° 45'	Fig 202-9E
Max Curve without Super	0° 33'	Fig 202-3E	0° 33' 0° 57'	Fig 202-3E	0° 47' 1° 10' 1° 57'	Fig 202-3E	4° 40'	Fig 202-3E
Maximum Superelevation	6.00%	Fig 202-8E	6.00%	Fig 202-8E Fig 202-10E	6.00%	Fig 202-8E Fig 202-10E	4.00%	Fig 202-9E
Vertical Alignment								
Maximum Grade[3]	3%	Fig 203-1E	3%	Fig 203-1E	4%	Fig 203-1E	7%	203-1
Max Vertical Deflection without a Vertical Curve	0.30%	Fig 203-2E	0.30% 0.55%	Fig 203-2E	0.45% 0.75% 1.30%	Fig 203-2E	0.75%	Fig 203-2E
K-Values								
Crest Vertical Curve	151	Fig 203-3E	151 61	Fig 203-3E	84 44 19	Fig 203-3E	44	Fig 203-3E
Sag Vertical Curve[4]	136	Fig 203-6E	136 79	Fig 203-6E	96 64 37	Fig 203-6E	64	Fig 203-6E
Sight Distance								
Stopping Sight Distance	570'	Fig 201-1E	570' 360'	Fig 201-1E	425' 305' 200'	Fig 201-1E	305'	Fig 201-1E
Min. Passing Sight Distance	---	---	---	---	---	---	1470'	Fig 201-3E
Intersection Sight Distance	---	---	---	---	---	---	445' Left 385' Right	Fig 201-5E
Decision Sight Distance	1150' (B) 1280' (E)	Fig 201-6E	1150' (B) 1280' (E) 800' (B) 930' (E	Fig 201-6E	910' (B) 1030' (E) 690' (B) 825' (E) 490' (B) 620' (E)	Fig 201-6E	690' (B) 825' (E)	Fig 201-6E
Clearances (New & Reconstructed)								
Lateral On Bridge (>=200'long)	14' Rt. 14' Med.	Fig 302-1E	14' Rt. 6' Lt.	Fig 302-1E	8' Rt. 6' Lt.	Fig 302-1E	1'-2'	Fig 301-4E
Lateral On Bridge (<200'long)	14' Rt. 14' Med.	Fig 302-1E	14' Rt. 6' Lt.	Fig 302-1E	8' Rt. 6' Lt.	Fig 302-1E	1'-2'	Fig 301-4E
Vertical	17.0' Pref. 15.5' Min.	Fig 302-1E	17.0' Pref. 15.5' Min.	Fig 302-1E	17.0' Pref. 15.5' Min.	Fig 302-1E	17.0' Pref. 15.5' Min.	Fig 302-1E