**Tier 1 Analysis**

Tier 1 Analysis is a high-level interpretation of Existing and No Build Analysis results. It identifies preliminary alternatives for further investigation that address the purpose and need while considering project constraints.

Alternatives are options that include one or more improvements meant to solve the identified problem. The alternative must address the purpose and need, be technically and economically feasible, be consistent with policy, conform with management plans of the area, and be substantially different in design and effects to another analyzed alternative. Minor adjustments within the main course of action are not a separate alternative. See Figures 1 and 2 for further clarification.

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Unsignalized with Turn Lanes</td>
<td>Adds NB and SB left turn lanes</td>
</tr>
<tr>
<td>2 – All-way Stop Control</td>
<td>All approaches stop controlled</td>
</tr>
<tr>
<td>3 – Roundabout</td>
<td>Single lane roundabout with NB right slip lane</td>
</tr>
<tr>
<td>4 – Signalized with turn lanes</td>
<td>Adds traffic signal with NB and SB left turn lanes</td>
</tr>
<tr>
<td>5 – Unsignalized Continuous Green T</td>
<td>Adds SB left turn lane and NB receiving lane</td>
</tr>
</tbody>
</table>

*Figure 1: Examples of Alternatives*

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Unsignalized with Turn Lanes</td>
<td>Adds NB and SB left turn lanes</td>
</tr>
<tr>
<td>2 – Roundabout</td>
<td>Single lane roundabout with NB and SB right slip lanes</td>
</tr>
<tr>
<td>3 – Roundabout</td>
<td>Multilane roundabout</td>
</tr>
<tr>
<td>4 – All-way Stop</td>
<td>All approaches stop controlled</td>
</tr>
<tr>
<td>5 – Signalized</td>
<td>Adds traffic signal</td>
</tr>
<tr>
<td>6 – Signalized with turn lanes</td>
<td>Adds traffic signal with NB and SB left turn lanes</td>
</tr>
</tbody>
</table>

*Figure 2: Examples of Improvements Labeled as Alternatives*

The minimum alternatives types considered are different for interchanges and non-interchanges, but all alternatives must be compiled in a matrix format for examination. See below for specific requirements for each and criteria for matrices.

A. Alternative Considerations

1. Interchanges

If multiple interchanges are analyzed, then consult Traffic Engineering Management for Tier 1 guidance.

All interchange configurations for the area (rural or urban) and its connection type (freeway to freeway, freeway to arterial/collector, freeway to local road, etc.) shall be included for initial consideration within the matrix. Multiple analysis tools can be used for the selection process, but FHWA’s Capacity Analysis for Planning of Junctions (CAP-X) shall be used.
At a minimum, the following basic interchange types shall be considered in the selection process:

- **T and Y interchanges (three-leg interchanges)**
  - Trumpet
  - Two loop
  - Directional
- **Diamond interchanges**
  - Rural
  - Compressed
  - Tight-Urban
  - Single-Point (SPUI)
  - Split
  - Three-Level
  - Diverging
- **Cloverleaf interchange**
- **Partial cloverleaf interchanges**
  - Parclo-A
  - Parclo-A (2 Quad)
  - Parclo-B
  - Parclo-B (2 Quad)
  - Parclo-AB
  - Parclo-AB (2 Quad)
  - Single Loop Parclo (4 Variations)
- **Directional interchanges**
  - All Directional
  - Directional with loops

**For Interchange Modifications** - each alternative should satisfy all eight (8) traffic movements with the proposed interchange modification.

**For Interchange Justifications** - each alternative that is advanced should not be a variation of the same interchange type. For example, a diamond interchange with signalized ramp terminal intersections and a diamond interchange with roundabout ramp terminal intersections are not considered two different alternatives.

2. **Non-Interchange**

Critical intersections, segments and/or corridors studied may consider more alternative types, but at a minimum, shall examine the following:

- Conventional
- Quad Road
- Full Displaced Left
- Partial Displaced Left
- Michigan U-turn
- R-CUT
- Partial Median U-turn
- Roundabout
If a new access connection with low volumes is considered, then DOTD may waive these requirements and only look at criteria such as, but not limited to, a left turn lane, right turn lane, full access driveway or restricted driveway.

B. Comparison Criteria and Matrix

The alternatives selected for inclusion in the Comparison Matrix will be ranked using high level criteria such as, but not limited to, Operations, Right Of Way (ROW), Cost, and Environmental Impacts. Criteria used should be quantified with thresholds that allow for a scored comparison between all alternatives and will vary depending on the defined problem. Documentation explaining all alternatives for or against consideration for Tier 2 shall be included. Depending on complexity, this could be a Notes column in the Evaluation Matrix or several paragraphs of explanation.

**Operations**

Alternatives may be graded for capacity if it was identified as a problem during previous analysis. If used, the capacity of each alternative may use general rules of thumb based on areas of concern identified in the results of the Existing Network Analysis. Capacity thresholds should be defined and expressed with a range of low to high. Tools such as FHWA’s Capacity Analysis for Planning of Junctions (CAP-X) may be used to assist in this evaluation.

**Right of Way (ROW)**

Site specific conditions, such as existing structures and constraints identified in the Existing Network Analysis, should be taken into consideration when evaluating alternatives. ROW thresholds should be defined and expressed within a range of low to high.

**Cost**

Construction costs for each alternative may be evaluated using a rough estimate of the required area of construction and a dollar amount per square foot. Cost thresholds should be defined and expressed within a range of low to high.

**Environmental/Social Impacts**

Environmental and social impacts, such as changes in existing access, affected residential or commercial buildings, wetland impacts, and/or noise mitigation should be considered when evaluating alternatives. Impacts identified as a criterion within the matrix should have their thresholds defined and expressed within a range of low to high.

**Other Impacts**

Other specific constraints such as railroads, frontage roads, control of access, etc. may be added as criterion if they have an impact or to help differentiate between alternatives.
All alternatives will be compiled in a table format with a description and/or figure of each alternative and its associated ranking within the defined criteria. Selected alternatives should be based on a comparative evaluation using the total ranking.

Figures 3, 4 and 5 below are three examples of a matrix at different levels of complexity:

![Traffic Engineering Analysis Report Requirements](image)

**Figure 3: Example of a Screening Matrix for Driveway Access**
This correspondence and the information contained herein is prepared solely for the purpose of identifying, evaluating and planning safety improvements on public roads which may be implemented utilizing federal aid highway funds; and is therefore exempt from discovery or admission into evidence pursuant to 23 U.S.C. 409.

### Traffic Engineering Analysis Report Requirements

#### Intersection Delay: 2-lane Roadway 2-way Stop

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Utilities</th>
<th>R.O.W. (DOTD)</th>
<th>Safety</th>
<th>Operations</th>
<th>Tier 2</th>
<th>Notes on elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Full Access Signal with Turn Lanes</td>
<td>Relocate low cost&lt;br&gt; utilities</td>
<td>Right-way needed with no adverse affect</td>
<td>Minimal increase in conflict points</td>
<td>Increase in Capacity</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>2. Restricting to Right-in, right out</td>
<td>Increase in Capacity</td>
<td>Right-way needed with no adverse affect</td>
<td>No change or reduction in conflict points</td>
<td>Increase in Capacity</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>3. Roundabout</td>
<td>Relocate high&lt;br&gt; Cost/Transmission&lt;br&gt; lines</td>
<td>Right-way needed with no adverse affect</td>
<td>No change or reduction in conflict points</td>
<td>Increase in Capacity</td>
<td>No</td>
<td>Utility Cost outside of budget</td>
</tr>
<tr>
<td>4. 2-Way Stop with Adding Turn Lanes</td>
<td>Relocate low cost&lt;br&gt; utilities</td>
<td>Right-way needed with no adverse affect</td>
<td>Minimal increase in conflict points</td>
<td>No change in Capacity</td>
<td>Yes</td>
<td></td>
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<tr>
<td>5. All-Way Stop</td>
<td>No Utilities Relocated</td>
<td>Construct within right-of-way</td>
<td>No change or reduction in conflict points</td>
<td>Decrease in Capacity</td>
<td>No</td>
<td>Doesn’t support Purpose and Need</td>
</tr>
</tbody>
</table>

#### Scale

- **High**
  - Relocate high cost/Transmission lines
  - Taking/relocating Residential and Commercial Buildings
  - Increasing conflict Points
  - Decrease in Capacity

- **Medium**
  - Relocate low cost utilities
  - Right-way needed with no adverse affect
  - Minimal increase in conflict points
  - No change in Capacity

- **Low**
  - No Utilities Relocated
  - Construct within right-of-way
  - No change or reduction in conflict points
  - Increase in Capacity

#### Objectives Screening Evaluation Matrix of Preliminary Alternatives

<table>
<thead>
<tr>
<th>Objective</th>
<th>(1) Minimum R.O.W. Impacts</th>
<th>(2) Avoid/Minimize Impacts to Existing Infrastructure</th>
<th>(3) Minimum Roadway Descriptions During Construction</th>
<th>(4) Optimum Cost</th>
<th>(5) Minimum Construction Risk to EDC Contaminated Areas</th>
<th>(6) Supports/Consistent with Economic Development and Transportation Plans</th>
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<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
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<tr>
<td>No-Build</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>$0</td>
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<tr>
<td>PMA 1-A</td>
<td>PMA 1-B</td>
<td>PMA 1-C</td>
<td>PMA 1-D</td>
<td>PMA 1-E</td>
<td>PMA 1-F</td>
<td>PMA 1-G</td>
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<td>PMA 2-A</td>
<td>PMA 2-B</td>
<td>PMA 2-C</td>
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#### Figures

- **Figure 4:** Example of a Screening Matrix for Intersection Delay at a Two Way Stop on a Two Lane Road
- **Figure 5:** Example of a Complex Screening Matrix for an Interchange

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Tier 1 Analysis Deliverables

- Summary of Screening Criteria
- Critical Intersection Type Matrix and Results
- Any additional tools & outputs used in decision making process (e.g., CAP-X)
- Documentation explaining why alternatives were, or were not, considered in Tier 2.