Office of Systems Analysis Planning
Road School
March 7, 2007
Driving Indiana’s Economic Growth

DMP (Decision Making Process)

- Receive Project
- Project analysis
- Course of Action (COA) development
- COA Analysis
- COA Comparison
- COA Approval
- Project Revisions

*** Please note: italicized words are used to reference examples or scenarios.

*** Please note: This is derived from the United States Military Decision Making Process.
DMP (Decision Making Process)

- This process is based on Military Decision Making Process
  - It is a tried and true process, it is not a brand new process
  - It uses the data available and helps to organize the thought process

Why is it important

- Decision making process needs to be standardized because:
  - Decisions need to be made very quickly based on limited information
  - Provides a fundamental and common framework that standardizes the decision making process
  - Imagine this:
    - You have been asked to evaluate a proposed project within 3 days for presentation to the Commissioner
    - The only information given is the location of the project
    - The Commissioner want to decide if the project should be done
  - Standardized planning process facilitates rapid decisions.
Basic Problem Solving Model

- Identify the Problem:
  - I need a car
- Develop solutions:
  - Options,
    - New / used
    - Truck, van, sedan, SUV, or motorcycle
- Compare alternatives:
  - cost, gas mileage, reliability, etc.
- Decision:
  - used Huffy 3 speed

Project Analysis

- Why:
  - Must accurately define the problem
  - What am I trying to do, what is the problem I am trying to solve?
  - Sometimes problem identification is very easy, sometimes is it very difficult
  - End state of Project Analysis
    - is a clearly defined project statement which provides organizational focus.
  - Do I really need a car?
  - OR
  - Do I really need transportation to/from work
Project Analysis Process

- Review project proposal and documentation
  - Who proposed the project
  - Type of project
  - General guidance
  - Policies/Standards
  - Existing plans/maps
- Determine: specified / implied / project essential tasks (PET)

Scenario: Conduct a field check (FC)

- Specified:
  - Type of field check (Preliminary, Final, etc.)
  - Set meeting time/location
  - Decide who is essential to project analysis success to invite
- Implied:
  - Travel arrangements
  - Prepare agenda and any project plan sheets
  - Review project notes
- Project Essential Tasks:
  - Contact Invitees
  - Conduct the field check
  - Prepare and distribute meeting notes
Project Analysis Process  Continued…

- Review available assets and constraints
  - Existing plans and maps
  - Condition data such as:
    - Pavement and Bridge condition
    - Accident and Traffic data
  - Standards (i.e. Green Book, INDOT Standard Drawings, Design Manual, etc.)
  - Subject matter experts within INDOT
  - Restrictions that limit the project:
    - Parameters you have to operate within
      - i.e. We must design to a certain standard
    - Often are redundant with specified tasks
      - i.e. field verifying the slope shown on the plans

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Project Analysis Process  Continued…

- Field Check Scenario:
  - Time constraint: The field check must be completed before the project goes to letting.
  - Level of field check
    - If preliminary FC, possible to suggest different options
    - If final FC, limited to just reviewing
Identify relevant facts and assumptions
- Must be relevant to project.
- Assumptions are used to fill-in information voids (must be realistic)
  - Don’t want to adopt a specific course of action based on faulty and unrealistic assumptions.
  - Must be stated up front to ensure all planners are planning based on same approved assumptions

Any requirements/conditions
- Who requested project
- Special time frame for project

Field Check Scenario:
- Facts:
  - Field check must be complete by a certain date
  - Cannot move to next step in design process
- Assumptions:
  - Field check will fill in missing data required for design
Determine project requirements
- What information do I need to complete my project?
- How can I best get that information?
- Who is best suited to get the information?

Field Check Scenario:
- Need location information for field check meeting site
- Project Requirements:
  - Check with local district / sub-district office for information
    - Special items such as: parking needs, special equipment, traffic control
  - Check video log for visual reference
  - Look at map for determining route to site
Project Analysis Process  Continued...

- **Timing of project**
  - When does the project need to be done
  - Plan use of available time
  - VERY IMPORTANT STEP

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**Field Check Scenario**

- Final field check must be completed before project can go to start letting process
- Select date for field check (must be 5 months before let date)
- Notify invitees of date 4 weeks before field check and get commitments
- Check on final design plans 3 weeks before field check and decide on what is needed on field check
- Prepare copies of documentation and plans 1 week before field check
- Establish meeting point for attendees 1 week before field check
- Reserve cars 3 days before field check
- Conduct field check
- Send meeting notes within 1 week of field check
Project Analysis Process  Continued...

- **Project Statement**
  - Develop restated project proposal/intent/scope
    - Your project analysis results in a proposed project statement answering: who, what, when, where, and why.

Project Analysis Process  Continued...

- **Field Check Scenario**
  - **Who:** Project Engineer
  - **What:** Conducts final field check
  - **When:** 5 months before let date
  - **Where:** Project Site
  - **Why:** To finalize design plans
Course of Action

- Upon completion of Project Analysis, you should be able to develop COA's:
  - COA's to be considered
  - COA's not to be considered
    - Knowing what you don't want is just as valuable as knowing what you want.
- To maintain the project's intent each COA considered and developed must be:
  - Suitable - can accomplish project intent
  - Feasible - within capabilities of design resources
  - Acceptable - means justify the ends
  - Distinguishable - each COA must be distinguishable from the others

COA Development

- Analyze possible solutions
- Generate options
- Arrange design possibilities
- Develop methodology of executing project
- Prepare COA statements / sketches
COA Analysis

- **Gather the information**
  - **Tools:**
    - Maps, pictures, terrain analysis products
    - COA sketches
    - Data analysis
    - Video log
    - Matrix comparison

- **List available information concerning project**
  - Location, condition, traffic/accident/inventory data

- **List assumptions**
  - Review assumptions made during project analysis:
    - Are they still valid / relevant?
    - Do we need to make any additional assumptions?
    - Do we have any new information that will validate existing assumptions?

COA Analysis Continued...

- **List known critical events and decision points**
  - **Critical events:** key actions you know or anticipate will occur that warrant detailed analysis.
    - Other project in the area
    - Special events
  - **Decision Points:** key actions you know or anticipate that may require a significant decision.
    - Does a bridge need replacement or rehab
    - What year does the project need to be done
COA Analysis

- Determine evaluation criteria:
  - What criteria will you use to analyze and compare each COA.
  - How will you quantify each criteria?
  - Criteria typically include:
    - Does COA facilitate flexibility?
      - Once we reach a given point, do we have any options remaining?
    - Simplicity?
      - How simple / complex is our plan?
    - Does the COA accomplish the objective?

COA Analysis

- Select scoring methodology
  - Decision Matrix:
    - Lays out the information in a consistent and logical fashion
    - Records and documents why and how a decision was made
    - Results in a planning tool that you need/can use later
    - More time consuming
  - Review data for obvious results
    - All the data directs to one answer
  - Evaluate and assess results
## COA Comparison

<table>
<thead>
<tr>
<th></th>
<th>Pavement</th>
<th>Bridge</th>
<th>Congestion</th>
<th>Safety</th>
<th>Other1</th>
<th>Other2</th>
<th>Cost</th>
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<td>Score</td>
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## Decision Brief

- Once COAs are developed and analyzed, and a recommended COA is decided, a decision brief is given to the decision maker.
- **What is a Decision Brief?**
  - It is a meeting with decision makers to obtain an answer or decision
  - It may be formal or informal depending on the circumstances
  - It provides information on a subject so the decision maker can make an informed decision
  - It provides a recommendation based on the analysis of the decision making process
  - It is included in the final documentation for the decision making process
What is in a decision brief

- Introduction
  - Brief statement of problem/situation
  - Recommended COA - Could End Here
- Body
  - Key facts about the problem
  - Pertinent facts that may affect the decision
  - Objective discussion about the positive and negative facts
  - Necessary assumptions required to fill in gaps in factual information
- Courses of Action (COA)
  - Discussion of COA’s considered that can resolve the problem

Analysis

- Criteria by which the COA’s are evaluated (screening and evaluation)
- The advantage and disadvantage of each COA

Comparison

- What are the criteria
- How are the COA’s against the screening and evaluation criteria

Conclusion

- Discussion of why the selection COA is best
- Ask for any questions
- Restate recommendation and ask for a decision
Decision Brief

The decision needs to be documented and circulated
- Other personnel may need to implement the decision
- When questions arise concerning why and how a decision is made
- There needs to be written documentation concerning the decision made

- It is up to the decision maker to make the final recommendation

Example

Let's consider the following example
SR 57 Median Project

- Median construction project on SR 57 between the US 50 bypass and old US 50 on the south side of Washington, Daviess County, IN
  - Two 12’ lanes with 4’ shoulders on each side of the road.
  - Drainage: Open ditch that flows along the side of the road
  - No exclusive turn lanes are provided except at the US 50 bypass & Old US 50
- Functional Class: Rural Minor Arterial
- National Highway System (NHS) Route
- Population: approximately 11,380 (Year 2000)
- The I-69 corridor runs parallel with this route.
SR 57 Median Project

Videolog

SR 57 Median Project

- Alternatives Considered
  - Median Construction
  - Do-nothing
  - Spot improvements
SR 57 Median Project

- Evaluation Parameters Used
  - Crash History
  - Congestion/Traffic
  - Pavement Condition
  - Project Cost
  - Right of Way Impacts
  - Social impacts

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### Crash History

Safety can be prime reason to do a median construction.

<table>
<thead>
<tr>
<th>Collision Type</th>
<th>Year</th>
<th>HEAD ON</th>
<th>LEFT TURN</th>
<th>RAN OFF ROAD</th>
<th>REAR END</th>
<th>RIGHT ANGLE</th>
<th>BACKING CRASH</th>
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<td>1</td>
<td>3</td>
<td>1</td>
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<td></td>
<td>3</td>
<td>8</td>
<td></td>
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<td></td>
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<td>2</td>
<td>3</td>
<td></td>
<td>1</td>
<td>1</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>12</td>
<td>1</td>
<td>26</td>
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*Crash data provided by INDOT’s Safety Management Unit using the Vehicle Crash Records System*
SR 57 Median Project

Crash History Analysis

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<tr>
<th>Severity</th>
<th>Year</th>
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<tr>
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<td>2004</td>
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<tr>
<td>INJURY</td>
<td>2</td>
<td>4</td>
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<tr>
<td>PDO</td>
<td>4</td>
<td>9</td>
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<tr>
<td>Grand Total</td>
<td>6</td>
<td>13</td>
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<table>
<thead>
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<th>Project Crash Frequency Rate</th>
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<td>Project Length</td>
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<tr>
<td>Number of Years of Crashes</td>
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<td>Crash Rate/100 Million VMT/Year</td>
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2004 MOTOR VEHICLE CRASH RATES

<table>
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<tr>
<th>System</th>
<th>Fatal Crashes</th>
<th>Fatal Crashes per 100 M VMT</th>
<th>Injury Crashes</th>
<th>Injury Crashes per 100 M VMT</th>
<th>PDO Crashes</th>
<th>PDO Crashes per 100 M VMT</th>
<th>All Crashes</th>
<th>All Crashes per 100 M VMT</th>
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<td>Statewide</td>
<td>857</td>
<td>1.15</td>
<td>43,867</td>
<td>58.85</td>
<td>162,589</td>
<td>218.13</td>
<td>207,313</td>
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<td>SR</td>
<td>201</td>
<td>2.04</td>
<td>6,769</td>
<td>68.79</td>
<td>20,989</td>
<td>213.29</td>
<td>27,959</td>
<td>284.12</td>
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Crash rates from INDOT’s Safety Management Unit

SR 57 Median Project

Crash History

Crash Frequency Rate Index

\[ ICf = \frac{(A - a \cdot Y)}{\sqrt{A + a^2 \cdot Y^2 \cdot D}} \]

Where:

- \( A \) = Number of crashes during years
- \( Y \) = Number of years in the analyzed period in years
- \( D \) = Over-dispersion parameter
- \( Q \) = AADT along the road segment, in thousand vehicles per day
- \( L \) = Length of Section in Miles

\( a = 0.733 \cdot L \cdot Q^{0.577} \)

<table>
<thead>
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<th></th>
<th>( L )</th>
<th>( a )</th>
<th>( D )</th>
<th>( Q )</th>
<th>( ICf )</th>
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<td></td>
<td>1.555</td>
<td>11</td>
<td>1.459</td>
<td>11.951</td>
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\( ICf = 9 \)

Expected Average Number of Crashes = 11
Actual Average Number of Crashes = 9
There is not a serious crash problem along this section
Several crashes occurred at Highland Ave – May be reasonable to do an intersection improvement at this location
SR 57 Median Project

- **Congestion/Traffic**
  - **Average Annual Daily Traffic (AADT)**
    - 2006 AADT = 12,000 vpd
    - 2026 AADT = 13,000 vpd
    - 2036 AADT = 14,000 vpd
      - Based on a 0.5% growth rate and construction year of 2016
  - **Commercial/Truck Traffic**
    - 22% south of US 50 (estimate 15% thru Washington)
    - I-69 will divert thru traffic

- **Current design is adequate**

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SR 57 Median Project

- **Pavement Condition**

<table>
<thead>
<tr>
<th>Year</th>
<th>PQI_I</th>
<th>PQI_D</th>
<th>IRI_Avg_I</th>
<th>IRI_Avg_D</th>
<th>PCR_I</th>
<th>PCR_D</th>
<th>Rut_I(in)</th>
<th>Rut_D(in)</th>
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<td>66</td>
<td>63</td>
<td>146</td>
<td>153</td>
<td>88</td>
<td>88</td>
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<td>157</td>
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<td>2003</td>
<td>73</td>
<td>74</td>
<td>138</td>
<td>141</td>
<td>94</td>
<td>94</td>
<td>0.24</td>
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<td>2005</td>
<td>73</td>
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<td>83</td>
<td>83</td>
<td>0.10</td>
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"I" indicates pavement condition in the northbound direction and "D" indicates pavement condition in the southbound direction Data from INDOT’s pavement management system

- Pavement can be maintain with resurfacing and preventive maintenance
Cost & Right of Way (ROW) Impacts
- Median Project would cost approximately $4 million plus ROW Costs
  - Need additional 15’+ ROW all along the section (both sides)
  - Would require total takes & relocations ($$$)
- Spot Improvement such as an intersection improvement would cost approximately $800,000+/-$ plus ROW costs
  - Would required 4 corner cuts
  - Cost would depend on turn lane lengths
  - May resolve a possible crash problem
- Do-Nothing would be normal maintenance costs

Social Impacts
- Washington is a city of approximately 12,000 people which is a small city.
- The project area is a suburban type area with several homes, businesses, and open areas.
- The area in general is in good condition.
- Median Project (TWLT) lane
  - It could be rather significant in terms residential and business relocations required
  - Could be seen as dividing the south end of the city.
  - Could increase the speed of traffic in the project area which could cause problems with cross traffic and pedestrians.
  - Context sensitive design
- If a spot improvement is done, such as an intersection improvement at Highland, there would be much less coordination required and the impacts would be much less.
SR 57 Median Project

- In Conclusion,
  - For a Median Project
    - There doesn't appear to be a significant safety or traffic problem in the area.
    - Pavement condition can be maintained for the long term by resurfacing.
    - Right of way and social impacts could be significant.
    - The costs of the project are high in both monetary and social terms with little benefit in terms of accident reduction and improved traffic flow.
  - For a Spot Improvement
    - It may make sense to improve the intersection at SR 57 and Highland.
    - The area had the most crashes along the project section and has no reserved left turn lanes.

SR 57 Median Project

- The final recommendation for this project would be to consider an intersection improvement with a resurface of the project area.
"If we're going to prioritize, we're going to need some priorities."