Design Memo 16-04

Designer Summary of Required Utility Relocations - Project Design and Utility Summary

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Session Overview
Project Design & Utility Summary

- **Ultimate goal** – successful delivery of our proposed project
  - On time and on budget

- **Utilities can be an intricate part of your project delivery**
  - Open to traffic commitment next year
    - Can your project absorb 12 months of utility relocation work, build the project, & open to traffic
  - How about $1 million relocation
    - Utility have the money
    - Reimbursable - does your project have the money
Why Design Around Utilities

- Current Utility Coordination paradigm (IDM 104)
- Reinforced – INDOT Open Roads Program Guide
- Utilities are a long term business partner within existing public right-of-way and/or along them
- Utility stakeholders – almost all of us; same stakeholders that are funding our road/bridge projects
Designing around Utilities

- Establish **viable** options to deliver the project
  - Utility relocation options
  - Project design around options
  - Develop a decision matrix to be able to make informed decisions
- Focus
  - Integrity of the project - purpose/need & capital investment
  - Safety of the traveling public
Develop design/utility decision matrix

- **Design and Utility Summary Table**
  - Documentation tool
    - *Project_Design_and_Utility_Summary_Table*
      (INDOT Utility Coordination\Standard Documents – General)
  - Roadmap to solutions and final decisions
    - Advantages and Disadvantages for Utility relocation vs. Design around
      - Environmental impact, R/W, Constructability, Project Schedule, and Project Cost
    - Expand to add details – critical points table
## Example Design/Utility matrix

### Project Description

<table>
<thead>
<tr>
<th>Designer's Justification To Impact The Utility</th>
<th>Design Around Alternative Description*</th>
<th>Design Around Estimated Cost*</th>
<th>Utility Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed design meets the current Purpose and Need of the project; To design around the utility, there is substantial project impact of additional R/W and Construction cost.</td>
<td>Leave utility in place by constructing a slightly graded foreslope to provide cover over the utility, then construct the open ditch further away from the roadway; substantial project impact of additional R/W and Construction cost.</td>
<td>$200,000 of additional R/W and Construction costs.</td>
<td>Substantial cost and time to relocate - prefer to stay in place; Relocate to 5 ft inside proposed R/W.</td>
</tr>
<tr>
<td>Utility Relocation Plan</td>
<td>Estimated Utility Relocation Cost</td>
<td>Utility Relocation Reimbursable</td>
<td></td>
</tr>
<tr>
<td>$1,200,000</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Example Design/Utility matrix

#### Project Team Collaboration

<table>
<thead>
<tr>
<th>Environmental Impact</th>
<th>Right-of-Way Impact</th>
<th>Constructability Impact</th>
<th>Project Schedule Impact</th>
<th>Project Cost Impact</th>
<th>Recommended Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Around</td>
<td>Utility Relocation</td>
<td>Design Around</td>
<td>Utility Relocation</td>
<td>Design Around</td>
<td>Utility Relocation</td>
</tr>
<tr>
<td>CE/NEPA document</td>
<td>No additional impact (area already covered in CE/NEPA doc.)</td>
<td>2 parcels impacted for a total of 0.7 additional acres permanent R/W</td>
<td>No additional R/W required</td>
<td>R/W must be clear &amp; staked prior to notice to proceed issued for utility work</td>
<td>Approx. 20 additional days to construct design around option (additional fill and stormwater structures)</td>
</tr>
<tr>
<td>Additional Information required to account for 0.7 acre of additional R/W; No additional impacts expected after environmental coord. (no waterways, wetlands, historic in area)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Design Around Option chosen; Utility enters into agreement to pay $200,000 Design Around Option; Saves the Utility $1,000,000; Saves 10 months during construction</td>
</tr>
</tbody>
</table>
How to implement

- **Early and effective communication**
  - Commitments from Utilities, UC, Designers, PM..... *Don’t forget Construction*
  - Project development timelines & expectations
  - Essential to identify critical points early
  - Realize this will be an iterative process of sharing information back and forth
  - Plan for Design flexibility
Project Kick Off

- Review proposed Design footprint vs existing utilities
  - Critical Design elements – bridges, stormwater trunkline, underdrains, etc.
  - Critical Utility features: not just lines in the survey
    - Vaults, duct banks, overhead electric with clearance restrictions, etc.
Critical Facilities
Critical Facilities
Effective SUE strategy

- Develop a design envelope around utilities
- What additional utility information is needed?
  - 811 locates surveyed... +/- 2 ft horizontal
  - Depths/elevation known by the Utility Company
Effective SUE strategy

- Develop a SUE strategy to gather more accurate location information
  - Narrow down the design envelope

- Communicate SUE specific required information
  - Underground conduit duct bank – need all 4 corners, top left/right with bottom of critical side?
  - QL-B – Electromagnetic wand (EM) & Ground Penetrating Radar (GPR)
    - +/- 6 inches Horizontal and Vertical
    - Limitations
    - Critical location – no margin/wiggle room
      - QL-A/pot hole with details surveyed
### Critical Table: One Example

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
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<td>854.72</td>
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<td>2405</td>
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<td>849.73</td>
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<td>846.0</td>
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<td>20+16</td>
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<td>5.50</td>
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<td>18</td>
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<td>0.23</td>
<td>844.07</td>
<td>845.53</td>
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<td>18</td>
<td>842.0</td>
</tr>
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<td>8</td>
<td>28+47</td>
<td>848.08</td>
<td>5.08</td>
<td>843.00</td>
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<td>842.80</td>
<td>18</td>
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<td>849.46</td>
<td>5.33</td>
<td>844.13</td>
<td>2503</td>
<td>845.00</td>
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<tr>
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<td>4.33</td>
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<td>2505</td>
<td>846.60</td>
<td>12</td>
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<td>846.37</td>
<td>847.83</td>
<td>0.00</td>
<td>24</td>
<td>844.0</td>
</tr>
</tbody>
</table>

**NOTE:** SEPERATION is the distance between the top of duct and the bottom of storm pipe; negative # means the duct is up into the pipe.

All ducts are too close to remain without being lowered.

Pipe thickness taken from INDOT Design Manual Figure 28-6Q for RCP

**U.S. 31 Hamilton County**

116th St. & Pennsylvania St. - AT&T Indiana duct run test hole data
Review-Revise-Repeat

- Update utility information in models
- Re-plot in plans and cross sections
- Incorporate change capability into design
- Identify potential alternatives
- Develop cost-benefit scenarios
- Review changes with facility owners
- Discuss options/motivations of facility owners
Review - Revise - Repeat
Design Techniques/ Alternatives

- **Designing and Constructing Around Utilities**
  (INDOT Utility Coordination website – References)
- Relocate/revise storm sewer configuration
- Revise inlet/manhole selection
- Incorporate multiple trunklines
- Add flexibility into the design
- Realign/relocate bridge piers/abutments
- Revise signal layout
- Revise retaining wall configuration
- MSE wall – excavation/strap length...support facilities
Conflict Remediation

- Design conflict structure
- Create a utility cradle
- Develop underground bridging slab
- Modify subgrade treatment selection
- Alter MOT Plan
- Hold facilities in-place during construction
- Splay duct banks
811 compared with SUE

- Isn’t 811 the same as QLB?
- The one critical question you have to answer?
LPA & Local Project Application

- **LPA Projects**
  - Still follow IDM & Associated Design Memos
  - Coordinate SUE with the Project Owner at the beginning of the project
  - Mitigates overall risk on cost and time

- **Local Projects**
  - Time is typically driving factor
  - Conflict Analysis & Matrix helps identify risk early on
Design Alternatives

- Concrete capping of shallow facilities
- Using water quality pipe for storm sewers close to water lines
- Bridging facilities through an MSE wall or retaining wall
- Spanning fuel lines
- Using curb turn outs
Project Examples

- Pennsylvania & City Center Drive
  - Carmel Bond Project
  - Locally Funded
  - Design started in March
  - Construction completed by end of 2016
  - Design alternatives were the rule, not the exception
## Utilization of Conflict Matrix

<table>
<thead>
<tr>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
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</thead>
<tbody>
<tr>
<td>1627-16</td>
<td>7</td>
<td>F/O</td>
<td>UG</td>
<td>Conduit</td>
<td>2 x 1&quot;</td>
<td>Storm</td>
<td>14+87</td>
<td>43'</td>
</tr>
<tr>
<td>CATV</td>
<td>1627-15</td>
<td>7</td>
<td>Cable</td>
<td>UG</td>
<td>Jacketed</td>
<td>1&quot;</td>
<td>Storm</td>
<td>14+87</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>1627-14</td>
<td>7</td>
<td>Cable</td>
<td>UG</td>
<td>Jacketed</td>
<td>1&quot;</td>
<td>Storm</td>
<td>14+84</td>
</tr>
<tr>
<td>Windstream</td>
<td>1627-13</td>
<td>7</td>
<td>F/O (Duct Bank)</td>
<td>UG</td>
<td>Conduit</td>
<td>1&quot;</td>
<td>Storm</td>
<td>14+80</td>
</tr>
<tr>
<td>MCI</td>
<td>1627-12</td>
<td>7</td>
<td>F/O</td>
<td>UG</td>
<td>Conduit</td>
<td>3 x 1&quot;</td>
<td>Storm</td>
<td>14+78</td>
</tr>
<tr>
<td>Brighthouse</td>
<td>1627-11</td>
<td>7</td>
<td>Cable</td>
<td>UG</td>
<td>Conduit</td>
<td>2&quot;</td>
<td>Storm</td>
<td>14+78</td>
</tr>
<tr>
<td>CATV</td>
<td>1627-10</td>
<td>7</td>
<td>Cable</td>
<td>UG</td>
<td>Conduit</td>
<td>1&quot;</td>
<td>Storm</td>
<td>14+75</td>
</tr>
<tr>
<td>City of Carmel</td>
<td>1627-42</td>
<td>Water (Unknown)</td>
<td>UG</td>
<td>Plastic</td>
<td>2&quot;</td>
<td>Storm</td>
<td>14+77</td>
<td>27'</td>
</tr>
<tr>
<td>Vectren</td>
<td>1627-9</td>
<td>7</td>
<td>Gas</td>
<td>UG</td>
<td>Plastic</td>
<td>2&quot;</td>
<td>Storm</td>
<td>14+70</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>1627-43</td>
<td>F/O (Unknown)</td>
<td>UG</td>
<td>Conduit</td>
<td>1&quot;</td>
<td>Underdrain</td>
<td>14+57</td>
<td>51'</td>
</tr>
<tr>
<td>Vectren</td>
<td>1627-23</td>
<td>7</td>
<td>Gas</td>
<td>UG</td>
<td>Plastic</td>
<td>2&quot;</td>
<td>Underdrain</td>
<td>14+50</td>
</tr>
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<td>CATV</td>
<td>1627-24</td>
<td>7</td>
<td>Cable</td>
<td>UG</td>
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<td>2&quot;</td>
<td>Underdrain</td>
<td>14+45</td>
</tr>
<tr>
<td>1627-25</td>
<td>7</td>
<td>D.O.T. F/O</td>
<td>UG</td>
<td>Conduit</td>
<td>2 x 4&quot;</td>
<td>Underdrain</td>
<td>14+30</td>
<td>95'</td>
</tr>
</tbody>
</table>
## Utilization of Conflict Matrix

<table>
<thead>
<tr>
<th>R/L/X</th>
<th>LINE</th>
<th>QL A OR B</th>
<th>SURVEY ID NUMBER</th>
<th>DEPTH</th>
<th>SURFACE SURVEY ELEVATION</th>
<th>UTILITY ELEVATION</th>
<th>IMPACT REQUIRED (Y/N) &amp; EXPLAIN</th>
<th>ALTERNATIVES EXPLORED</th>
<th>RE-DESIGN ESTIMATED COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;A&quot;</td>
<td>12059</td>
<td>2.72</td>
<td>851.57</td>
<td>848.85</td>
<td>N - behind prop. storm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>12060</td>
<td>2.6</td>
<td>852.34</td>
<td>849.74</td>
<td>N - above prop. storm (1')</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>12061</td>
<td>2</td>
<td>852.55</td>
<td>850.55</td>
<td>Y - in Pavement</td>
<td></td>
<td></td>
<td>Lower line w/o impact (at bottom of pavement, w/ current design)</td>
<td></td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>12062</td>
<td>2.5</td>
<td>852.90</td>
<td>850.40</td>
<td>Y - in Pavement</td>
<td></td>
<td></td>
<td>Lower line w/o impact (at bottom of pavement, w/ current design)</td>
<td></td>
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<td>12063</td>
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<td>852.89</td>
<td>847.81</td>
<td>N - Storm Revised to avoid</td>
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<td>852.91</td>
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<td>852.83</td>
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<td>N - above prop. storm (1')</td>
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<td>no underdrain</td>
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<td>Y - too shallow for UD</td>
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<td>no underdrain</td>
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</tbody>
</table>
Results & Lessons Learned

- Removed all Underdrain
- Utilized existing storm sewers & structures
- Minimal utility relocations
- Caution – potholing yields a “snapshot” at a particular location
Design Around

- **SR 1**
  - Four Interstate gas transmission lines in their own easement
    - Relocation would have been about $2 Million and the project construction cost was only $2.9 Million
    - Depths were established and the storm sewer was designed around those gas facilities
Design Changes

- Small Structure SR 18
  - Wing wall Geometry
  - By changing the angles on the wing walls we were able to pull back away from a 8” natural gas main
Design Changes
Unique Special Provisions

- **Electric Transmission**
  - Relocation can sometimes be cost prohibitive
  - When this occurs we discuss the possibility of outages
  - Upside- Economic feasibility
  - Downside- May cause off hours construction work and may be weather dependent
When You Shouldn’t Design Around Utilities

- **Aging Facilities**
  - How old is that sewer main?
  - Will I not get my return on this investment?

- **Constructability**
  - Can I use a vibratory roller over that gas main?
Summary

- **Original goal?**
  - Successful delivery of our proposed project
    - On Time
    - On budget
  - Designing around utilities
    - Establish **viable** options to deliver the project
  - Keys to success
    - Early communication
    - Design flexibility
    - Develop a decision matrix to be able to make informed decisions
Question and Discussion
Thank you