Use of LCA in different infrastructure delivery methods, some thoughts

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Exhibit 1 Alternative Contractual Arrangements for Delivering Highway Infrastructure

Overview of infrastructure delivery methods

• Design/bid/build (DBB, low bid)
  – Design completed by owner or owner’s consultant
  – Design approach may be selected based on life cycle cost
  – Contractor bids on construction of completed design, selected based on lowest total initial cost

• Design/build (DB)
  – Design requirements prepared by owner, pavement type may also be selected by owner
  – DB proposer submits partial design, may include life cycle cost analysis regarding design approach selected
  – DB contractor selected based on lowest initial cost or combination of partial design, qualifications, total initial cost (best value)
  – May include warranty (typically 1-7 years in US)

• Design/build/maintain (DBM)
  – Design and maintenance performance requirements prepared by owner
  – DBM proposer submits partial design and may also need to submit financial information regarding maintenance funding
  – DB contractor selected based on life cycle cost or combination of partial design, qualifications, life cycle cost (best value)
How can LCA fit into each of these?

**Design/Build/Maintain**

- **Contractor prepares LCA and LCCA for proposed design and maintenance strategy for full life cycle**
- **Contractor selected based on LCCA, LCA and technical and financial qualifications**
  - Contractor financially responsible for cost
  - Actual life cycle materials, construction and use phase impacts can be calculated from documentation of work and road condition
- **DBM used for highest level routes in many national highway networks, including Province of Ontario, Canada**
- **DBM almost never used for public highways in US, although commonly used for water treatment plants and other civil infrastructure**
How can LCA fit into each of these?

**Design/Build**

- **Contractor prepares LCA and LCCA for proposed design and expected maintenance strategy for full life cycle**
- **Contractor selected based on LCCA or initial cost, LCA and technical and financial qualifications**
  - Only responsible for initial cost and can track initial materials, construction and road condition
  - Not responsible for maintenance or road condition over life cycle
- **DB used on high level routes in some national road networks**
- **DB used by many public highway departments in US to varying extents**
Exhibit 2  SEP-14 Design-Build Projects by State
(total and those completed by December 31, 2002 by STAs, toll agencies, or local public agencies)

![Map of the United States showing design-build projects by state, with states colored in blue for those with 4 or fewer projects and yellow for those with 5 or more projects. The map includes numbers of projects completed by December 31, 2002, under SEP-14.

Number of D-B Projects Completed by Dec. 31, 2002/All Completed, Underway, or Proposed SEP-14 Projects

- States with 5 or more projects
- States with 4 or fewer projects

Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003}
How can LCA fit into each of these?

Design/Bid/Build

- **Owner performs LCA and LCCA to determine pavement design approach**
  - Similar to current approach in California for pavement design approach based on LCCA
- **Contractor selected based on lowest initial cost**
- Rest of the process is the same as if only considering LCCA
- Based on prior analyses can include more sustainable practices in specifications
- No incentive to contractor to optimize environmental impact
Questions applicable to all methods

• How much weight to put on LCA?
  – In pavement design selection and optimization
  – In contractor selection (DB and DBM)

• When are we ready to proceed?
  – Databases, Software, Understanding

• Prioritization of impact categories (goal definition)?

• Cost versus benefit of doing LCA?
  – Level of assumptions, time, effort

• Alternative use of indices, like LEEDS for buildings?

• Alternative use of specifications for materials, or even structures tied to pre-determined LCA results such as EcoLabel
Questions in each approach

• Design/Bid/Build
  – Can implementation of LCCA in US be a model for use of LCA?
  – How much incentive for reducing environmental impact through innovation?
  – Scope of LCA? Materials and construction and end of life? Use phase?

• Design/Build and Design/Build/Maintain
  – Confidence in proposer supplied LCA? Same software? Auditing?
  – Extent to which assumptions of LCA can be verified in actual delivery?
  – Scope of LCA?