Forrester Cook
PM 686B
Capstone Project
April 19, 2022
BACKGROUND INFORMATION

SIMPLIFIED TIMELINE FOR PUBLIC WORKS PROJECT

PLANNING → DESIGN → CONSTRUCTION → MAINTENANCE & OPERATIONS
BACKGROUND INFORMATION

EXISTING CIVIL ENGINEERING LITERATURE

**DESIGN**
- MANUALS
- STANDARDS
- CODES

**CONSTRUCTION**
- MANUALS
- STANDARD SPECIFICATIONS
- STANDARD DRAWINGS & DETAILS
- CONTRACTS
WHY IS THE INFO GAP IMPORTANT?

ALL INFRASTRUCTURE ULTIMATELY FAILS

Transverse Roadway Cracking  Longitudinal Roadway Cracking
INFRASTRUCTURE FAILURE

30 YEARS OF POOR SOILS & SHALLOW GROUNDWATER

Localized ponding

Curb & gutter and sidewalk with differential heaving
• Localized ponding
• Poor surface conveyance
• Severely broken sidewalk
PROJECT OBJECTIVE

CRAFT A CIVIL ENGINEERING MANUAL OUTLINE

Civil Engineering Manual
MANUAL OUTLINE
COMPREHENSIVE MANUAL

PUBLIC WORKS & CIVIL TRANSPORTATION PROJECTS

DESIGN ENGINEERING

CONSTRUCTION ADMINISTRATION

CONSTRUCTION INSPECTION

MATERIALS TESTING & SPECIAL INSPECTION

PROJECT MANAGEMENT
RESEARCH METHODS & ANALYSIS

PROJECT RESEARCH PHASES

- Alaska Engineering Resource Literature Review (PHASE 1)
- Alaska DOT&PF Procurement & Contracting (PHASE 2)
- Construction & Design Engineer or Project Manager Interview Analysis (PHASE 3)
- State DOT Literature Review (PHASE 4)
- Interview Results & Analysis (PHASE 5)
# RESEARCH – PHASE I
## ALASKA ENGINEERING RESOURCE LITERATURE REVIEW

<table>
<thead>
<tr>
<th>Resource No.</th>
<th>Document Title</th>
<th>Agency Author or Publisher</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>A Policy on Geometric Design of Highway and Streets, AKA “the Green Book”</em></td>
<td>AASHTO</td>
<td>Highway design</td>
</tr>
<tr>
<td>2</td>
<td><em>Guidelines for the Geometric Design of Very Low-Volume Local Roads</em></td>
<td>AASHTO</td>
<td>Rural roadway design</td>
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<tr>
<td>3</td>
<td><em>Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Supports</em></td>
<td>AASHTO</td>
<td>Structural design</td>
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<tr>
<td>4</td>
<td><em>Alaska Highway Preconstruction Manual</em></td>
<td>DOT&amp;PF</td>
<td>Roadway design</td>
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<tr>
<td>5</td>
<td><em>Construction Manual</em></td>
<td>DOT&amp;PF</td>
<td>Construction administration</td>
</tr>
<tr>
<td>6</td>
<td><em>Manual on Uniform Traffic Control Devices (MUTCD)</em></td>
<td>AASHTO</td>
<td>Traffic safety</td>
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<tr>
<td>7</td>
<td><em>Design Criteria Manual</em></td>
<td>MOA</td>
<td>Street design</td>
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<tr>
<td>8</td>
<td><em>Design and Construction Practices Manual</em></td>
<td>MOA</td>
<td>Water and waste water design</td>
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</tbody>
</table>

Civil Engineering Design Standards and Resources Commonly Used by Designers and Resident Engineers
# Research – Phase I

Alaska Engineering Resource Literature Review

<table>
<thead>
<tr>
<th>Subtopic No.</th>
<th>Subtopic Description</th>
<th>Engineering Domain</th>
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<tbody>
<tr>
<td>1</td>
<td>Reinforced concrete design</td>
<td>Structural</td>
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<tr>
<td>2</td>
<td>Steel design</td>
<td>Structural</td>
</tr>
<tr>
<td>3</td>
<td>Timber design</td>
<td>Structural</td>
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<tr>
<td>4</td>
<td>Water quality and water treatment</td>
<td>Environmental</td>
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<tr>
<td>5</td>
<td>Wastewater treatment</td>
<td>Environmental</td>
</tr>
<tr>
<td>6</td>
<td>NEPA permitting</td>
<td>Environmental</td>
</tr>
</tbody>
</table>

Design-related Civil Engineering Subtopic Areas
RESEARCH – PHASE 2

PROJECT DELIVERY MODELS

1. DOT&PF In-House Design with DOT&PF In-House CA
2. DOT&PF In-House Design with Consultant CA
3. Consultant Design with DOT&PF In-House CA
4. Consultant Design with Consultant CA
RESEARCH – PHASE 2

PROJECT DELIVERY TIMELINE

DOT&PF In-House Design with DOT&PF In-House CA

1. STIP
2. Design Engineering
3. Tentative Advertising Schedule
4. Complete Design Engineering
5. Bid Calendar
6. Executed Construction Contract
## RESEARCH – PHASE 2

### DESIGN & CONSTRUCTION

#### PLAN SET DEVELOPMENT

<table>
<thead>
<tr>
<th>Design Level</th>
<th>Plan Set Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>30-50%</td>
<td>Local Review</td>
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<tr>
<td>60-75%</td>
<td>Plans-in-hand</td>
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<tr>
<td>95%</td>
<td>PS&amp;E Review</td>
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<tr>
<td>100%</td>
<td>Certification Set</td>
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<tr>
<td>100%</td>
<td>As Advertised</td>
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</tr>
<tr>
<td>100% +</td>
<td>As Awarded /</td>
<td>Conformed Copy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% +</td>
<td>As-built Set /</td>
<td>Red Line As-Builts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>100% +</td>
<td>Record Drawings</td>
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## RESEARCH – PHASE 3

### SUBJECT MATTER EXPERT INTERVIEW ANALYSIS

<table>
<thead>
<tr>
<th>Research Data Table</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Agencies/State DOTs Contacted</td>
<td>23</td>
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<tr>
<td>State DOT Engineers Contacted</td>
<td>45</td>
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<tr>
<td>State DOT Engineers Surveyed</td>
<td>6</td>
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<tr>
<td>Outreach Success Rate</td>
<td>13%</td>
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</table>

Research Data Table
RESEARCH – PHASE 3
SUBJECT MATTER EXPERT INTERVIEW ANALYSIS
State DOTs Contacted & Surveyed

- Georgia
- Florida
- New Jersey
- North Carolina
- Alabama
- Oklahoma
RESEARCH – PHASE 4
STATE SPECIFIC DOT LITERATURE REVIEW

- Florida Department of Transportation (FDOT)
- Georgia Department of Transportation (GDOT)
- New Jersey Department of Transportation (FDOT)
- AK Department of Transportation & Public Facilities (DOT&PF)
RESEARCH – PHASE 4
CIVIL ENGINEERING
SUBTOPIC AREAS

- Roadway Design Criteria
- Constructability Reviews and Constructability Evaluations
- Distressed Pavement
RESEARCH – PHASE 4
CIVIL ENGINEERING SUBTOPIC AREAS

- Asphaltic Concrete (AC) Pavement Treatments
- Schedule Delays
- Construction Contract Change Order Contingencies
RESEARCH – PHASE 5
SME INTERVIEW ANALYSIS

- Engineering Design Manual Update Frequency
- Variance Between State DOT and Local Muni Design Manuals
- Processes Used by State DOTs to Develop Construction Manuals
RESEARCH – PHASE 5
SME INTERVIEW ANALYSIS

- Internal Engineering and PM Training Available to DOT Personnel
- Construction Inspection as a Prerequisite To Becoming a Resident Engineer
- Transportation Engineering Literature Void Assessment
CONCLUSIONS

- Research Supported Manual Outline Development
- Provided Transparency to Big-Picture Timeline for DOT&PF Projects
- Voids Exist Within Available Civil Engineering Literature
RECOMMENDATIONS – FUTURE RESEARCH

- Report Content Areas
- 72 Civil Engineering Subtopic Areas
- 42 Modules From Manual Outline
DELIVERABLES

THE ALASKA PROJECT MANAGEMENT, DESIGN & CONSTRUCTION MANUAL

Volume 1 – Design Engineering

Volume 2 – Procurement Phase
DELIVERABLES

THE ALASKA PROJECT MANAGEMENT, DESIGN & CONSTRUCTION MANUAL

Volume 3 – Construction Engineering

Volume 4 – Project Management
LESSONS LEARNED

SCOPE MANAGEMENT

- Clearly Defined Scope Elements
- Strategic Scope Execution
LESSONS LEARNED

SCHEDULE MANAGEMENT

- An Extended Capstone Project Duration Provided Several Unplanned Benefits
- Keep it Simple Scholar
LESSONS LEARNED

QUALITY MANAGEMENT

- Progressive Elaboration Requires Patience

PHASED STABILIZATION
QUESTIONS?