Introduction

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• Project Director, HR Green, Inc.,
• APWA Past President
• Served on the ISI Board of Directors
Overview of Today’s Topic

You will have a better understanding of:

- Basics of modern civil infrastructure asset management
- Benefits of asset management
- Clive’s pavement management study – why and how
- Clive’s innovative approaches to pavement management and outcomes
What is Asset Management?
Common Myths about AM

Asset management is NOT:

• A specific project or one time plan
• A software program
• Just doing condition assessments
• A series of checklists
• Something that is done “for” you
But, Asset Management is.....

Asset management is:

- An everyday activity
- A defendable way of prioritizing projects and resources
- Planning for what will be needed and how to pay for it
There is No One Size Fits All System
But, You Need a System
Asset Management 101

- Inventory/Condition Assessment
- Set Condition Thresholds
- Develop Maintenance, Rehabilitation, and Replacement Strategies
- Set Trigger Points for Strategies & Resets
- Develop Capital Improvement Plan
- Measure and Track Performance
Clive, Iowa - Background

- Incorporated on October 9, 1956
- Population: 17,506 (2015 Special Census)
  - 1960 752
  - 1970 3,005
  - 1980 6,064
  - 1990 7,515
  - 2000 12,809
  - 2005 13,985
  - 2010 15,447
- Landlocked
- Projected Population: 27,000 – 28,000
Why change how Clive streets are managed?

- Unique situation
- No really old infrastructure
- Time to begin considering replacement/No large backlog
- What is the cost of ownership for SUSTAINABLE infrastructure
Why Change?

There’s a Looming Problem!
City Responsibility

- Developer constructs infrastructure
- City accepts improvements with obligation to maintain in PERPETUITY
- City provides all maintenance
- City is responsible for reconstruction when necessary
  - May use assessments, may be big impact on home owners (25% of value of home)
  - Future reconstruction costs include removal of existing in addition to reconstruction costs.
Dellwood Drive – 3 years old
Airline Drive – 4 years old
Tanglewood Drive – 10 years old
Hammontree Court – 15 years old
Sheridan Avenue (20 years old)
Woodcrest Drive – 25 years old
“Over half of all streets in Clive are in Good or Better condition…

unfortunately, these favorable ratings will not last forever and are due to the relative new-ness of streets in Clive…

without changes to funding in Clive, over half of all of its streets will decline to Poor or Worse condition in only 20 years”
Study Goals

- Review City Standards
  - Street Design/Construction
  - Street Maintenance
- Develop inventory of streets in Clive
- Determine rehabilitation and reconstruction alternatives and trigger thresholds for improvements
- Develop 2 pavement replacement schedules for existing and future streets (existing and proposed standard)
- Develop sustainable maintenance replacement schedules for the following scenarios
  - Maintaining different levels of PCI
  - Using various funding levels
Pavement Standards Study

Analysis of the following components

- PCC Pavement foundation – why and how
- PCC Pavement – proper design principles
- Current Clive design standards for pavements
- Recommended Clive design standards
- Cost/Benefit Comparisons
Appendix A: References


Proper design, construction, and maintenance of the various components of the pavement system are critical to the performance of long-life pavements.
Performance of pavements depends on the quality of its subgrade and subbase layers

Quality Pavement Foundation Guidelines

- Subgrade soils
  - Iowa soils generally provide poor support
  - Stabilized subgrades
    - Chemical
    - Reinforced, geosynthetics

- Subbases
  - Necessary for subsurface drainage in Iowa’s cold, wet climate
  - Longitudinal subdrains necessary
  - Drainage helps to prevent early pavement joint deterioration
PCC Pavement Guidelines

- Pavement thickness
  - Thickness design tables
  - Default thickness
  - Iowa experience
- Pavement jointing
  - Proper transverse and longitudinal spacing
  - Plain and reinforced, JPCP and JRCP
- Pavement mix
  - Provide durability and resistance to degradation (primarily due to de-icing)
  - C-SUD Mix
Current Residential Standard

- **Pavement Foundation**
  - 12” subgrade prep below pavement

- **Pavement**
  - Concrete – Varies
  - Jointing - Varies
    - 7” Jointed Plain Concrete Pavement (JPCP) w/ CD baskets, or
    - 6” Jointed Reinforced Concrete Pavement (JRCP)
  - Gutterline Jointing
PCC Pavement Foundation Recommendations:

- Conduct geotechnical study
  - Typical Iowa soils have CBR of 1 to 3
- Improve pavement foundation
  - Ensure prepared subgrade has CBR of 10 – hope for 5
  - Construct a drainable, stable granular subbase
- Install longitudinal subdrains
PCC Pavement Recommendations - Residential

- **Pavement thickness**
  - 7” Jointed Plain Concrete Pavement (JPCP)
  - 6” Jointed Reinforced Concrete Pavement (JRCP)

- **Pavement jointing**
  - Transverse, ‘C’
    - 14’ for 7” JPCP
    - 12’ for 6” JRCP
  - Longitudinal
    - Quarter point for both 26’ and 31’-wide pavements

- **Pavement mix**
  - Class C-SUD
    - 6% to 8% air content in placed concrete
    - W/C of 0.40 to 0.45
  - Replace cement with SCMs to decrease permeability
  - Assure air content is 6% to 8%, after placement
Cost/Benefit Analysis

- Typical residential street segments analyzed
- Average cost of pavement system increase approx. 24.3% due to higher standards
  - $56.11/SY to $71.63/SY
- Life expectancy of pavement increased by 42.8%
  - 35 years to 50 years
- B/C of 1.8:1
- Average cost to each lot about $2500 for improved standards, initially
  - Over a 100-year cycle, this additional investment reduces future reconstruction costs by $9,745, in present day dollars
Cost/Benefit Analysis

- **Projected Pavement Construction and Reconstruction Timelines – 100-year Cycle**
  - **Cost Per Lot for Pavement**
    - CURRENT STANDARD
      - 0 years: $8,927
      - 35 years: $9,268
      - 70 years: $9,268
      - TOTAL COST PER LOT: $27,463
    - RECOMMENDED STANDARD
      - 0 years: $11,397
      - 35 years: $8,791
      - TOTAL COST PER LOT: $20,188

- **Total Cost for the Segment (approximately a 900’, 18 lots)**
  - CURRENT STANDARD
    - 0 years: $160,699
    - 35 years: $166,828
    - 70 years: $166,828
    - TOTAL COST: $494,355
  - RECOMMENDED STANDARD
    - 0 years: $205,148
    - 35 years: $158,236
    - TOTAL COST: $363,384

- A savings of $130,971 for the 900’ segment
- This equals a savings of $768,363 per mile of pavement
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Maintenance Practices

Currently, Clive spends approximately $400,000/yr on Crack Filling/Sealing, Full depth Patches, and Pavement Stabilization.

Recommendations:
- Continue using these treatments, as they are the most cost effective.
- Consider other techniques such as partial depth patches (to get more coverage) and those more suited to HMA/Composite pavements (because overlays will become more common).
- Increase expenditures to approximately $500,000/yr to keep a 3 year maintenance rotation on existing and proposed roads.
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Inventory/Data Collection

Collects:
- texture
- pavement distress
- rutting
- roughness

Automated roadway data collection system

- Data provided by IPMP
- Analyzed with dTIMS software, purchased from IPMP by Clive
Data Analysis – Condition Ratings

**Very Good Condition Roads**
These roads had some of the highest overall ratings for both Roughness and PCI. Both 86th St (Arterial) and Hawthorn Dr (Local) have PCI ratings greater than 90.

**Fair Condition Roads**
NW 151st st (Local) & Sunset Terrace (Local) with PCI’s around 50.

**Poor Condition Roads**
Example of Poor road condition. Lake Pointe Dr (Local) with PCI less than 30.

**Very Poor Condition**
One of the worst locations in the City, Summit Dr (Local) with PCI Less Than 10.
Data Analysis – Network Performance

Findings:
- 11% Arterial, 6% Collector, 83% Local Residential
- Almost entirely PCC
- Overall Average PCI of 50, better than most cities in Iowa
- Exceptional Arterial & Collector Roads
Age - East
Age - West
Age/Condition Comparison - East
Age/Condition Comparison - West
Rate of Deterioration - West
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## Treatment Alternatives

<table>
<thead>
<tr>
<th>Category</th>
<th>Treatment</th>
<th>Description</th>
<th>Cost</th>
<th>Trigger</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction</td>
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<td>The complete reconstruction of a roadway and all associated improvements. This assumes new PCC pavement, but full-depth asphalt may be considered based on relevant design criteria.</td>
<td>$165/sy</td>
<td>PCI = Poor OR Very Poor</td>
<td>Full reset</td>
</tr>
<tr>
<td>Major Rehabilitation</td>
<td>Crack and Seat Overlay</td>
<td>&gt;=3 In. Asphalt Overlay with preparation including breaking up existing pavement and setting it up as a good structural base for the new asphalt surface. Effectively creates a new pavement.</td>
<td>$65/sy</td>
<td>PCI = Poor, Surface = PCC, Low D Crack</td>
<td>Reset IRI, deduct 20 years from performance age, set PCI to 80</td>
</tr>
<tr>
<td></td>
<td>Mill and Overlay</td>
<td>1.5 to 3 inches of asphalt pavement is milled off and then replaced with 3 inches of asphalt. Repairs surface issues and improves structural character.</td>
<td>$60/sy</td>
<td>PCI = Poor, Surface = ACC, IRI &gt; 250, Moderate Alligator Cracking</td>
<td>Reset IRI, deduct 15 years from performance age, set PCI to 80</td>
</tr>
<tr>
<td></td>
<td>Thick Overlay</td>
<td>Sometimes called a &quot;Structural Overlay.&quot; 3 inches of Asphalt that adds enough thickness to increase the durability of the roadway, and provides a new wearing surface. Can be done with asphalt or PCC (black-topping/white topping) May require replacing curb and gutter.</td>
<td>$42/sy</td>
<td>PCI = Poor, Low D Crack, Low Spalling, Moderate Alligator Cracking</td>
<td>Reset IRI, deduct 15 Years from performance age, set PCI to 80</td>
</tr>
<tr>
<td>Minor Rehabilitation</td>
<td>Thin Overlay</td>
<td>A “non-structural overlay.” Laid on top of existing pavement; typically 1-2 inches of asphalt. Improves smoothness and extends the life of roads in good to fair condition.</td>
<td>$30/sy</td>
<td>PCI = Poor or Fair, Low D Crack</td>
<td>Reset IRI, deduct 8 Years from performance age, set PCI to 80</td>
</tr>
<tr>
<td></td>
<td>PCC Restoration</td>
<td>Portions of the street in bad repair are torn out and replaced. This may include patching, full panel replacement, and full depth repairs at joints. Slightly improves overall condition and helps extend life by addressing problem areas before they spread</td>
<td>$19/sy</td>
<td>PCI = Fair or Good, Surface=PCC</td>
<td>40% Reduction in Cracking, IRI, &amp; PCI deductions. Deduct 8 Years from Performance age.</td>
</tr>
<tr>
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<td>Microsurfacing</td>
<td>Thin asphalt polymer that seals the pavement from weather effects and corrects for minor irregularities. Typically used as a preventative measure, rather than a corrective one.</td>
<td>$9/sy</td>
<td>PCI = Fair or Good, Low D Crack, Low Alligator Cracking, Moderate Rutting</td>
<td>40% reduction in IRI, deduct 8 Years from performance age, set PCI to 70</td>
</tr>
<tr>
<td></td>
<td>Diamond Grinding</td>
<td>Top ¼ inch to a ½ inch of PCC pavement is ground off and textured. This is only done on rough pavements with good structure to improve ride smoothness and increase vehicle traction for safety purposes.</td>
<td>$5/sy</td>
<td>PCI= Good, IRI&gt;250, Low D Crack, Low Alligator Cracking, Low Rutting</td>
<td>30% reduction in IRI and PCI deductions</td>
</tr>
<tr>
<td>Restoration/Preservation</td>
<td>Crack Sealing</td>
<td>Sealant on cracks and joints is used to prevent spreading and moisture from getting into the pavement structure. Deteriorated cracks may be routed or sawed out to provide better seal and bond.</td>
<td>$10,500/Mile/Lane</td>
<td>Applied every time Last Work Done counter reaches a multiple of 4 years</td>
<td>Maintains</td>
</tr>
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<td></td>
<td>Pavement Patching</td>
<td>Asphalt placed at spot locations. Used only on good pavements with minor failures, or as a stop-gap on poor pavements until a better, more permanent, solution is applied.</td>
<td>$3/sy</td>
<td>No trigger assigned</td>
<td>Maintains</td>
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Projections

- What is the impact of the approved new design standards?
- What's the cost to do optimal maintenance, rehabilitation, and reconstruction, without budget constraints?
- How does the system perform if funding stays the same?
- What happens if the franchise fee is not renewed in 2020?
- What happens if funding increases?
- How much would it cost to:
  - Maintain a Minimum PCI of 70?
  - Maintain a Minimum PCI of 60?
  - Maintain a Minimum PCI of 50?
  - Maintain a Minimum PCI of 40?
  - Maintain a Minimum PCI of 30?
  - Maintain an Average PCI of 70?
  - Maintain an Average PCI of 60?
  - Maintain an Average PCI of 50?
Design Standards Comparison – Future New Streets, ~ 8.4 miles

**Cost Per 5-Year Period**

- **OLD**
- **NEW**

**Total Projected Cost (100yr)**

- **NEW** Ave. $0.35M/Year
- **OLD** Ave. $0.42M/Year
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Ideal Replacement Schedule (Fiscally Unconstrained)

Average Annual Cost = $7.2 Million / Year

Treatment Type Distribution

- Crack Sealing & Patching: 59%
- PCC Restoration: 24%
- Rehabilitation: 7%
- Reconstruction: 10%

Cost Per 5-Year Period

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Funding Scenario Results

Scenario 1: Current Budget ($1.5M)

Scenario 2: Reduced ($0.4M)

Scenario 3: Increased Budget ($3.0M)

Scenario 4: Increased Budget ($6M)
Average PCI by Budget

Scenario 6: Average Condition by Budget

Network Average Pavement Condition Index

Year

$7.0M
$6.5M
$6.0M
$5.5M
$5.0M
$4.5M
$4.0M
$3.5M
$3.0M
$2.5M
$2.0M
$1.5M
$1.0M
$0.5M
$0.0M
Projections

- What is the impact of the approved new design standards?
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  - Maintain an Average PCI of 60?
  - Maintain an Average PCI of 50?
Minimum PCI

-Some upfront expenditures needed to get back on track
-Large funding need between 2037 and 2047
-More expensive if streets are allowed to decline into Poor condition (Target 30)
Average PCI (Minimum Costs)
Clive Council Implementation

- **ADOPT NEW CONSTRUCTION STANDARDS**
  Council adopted this standard per interim report in early 2017.

- **COMMIT TO REGULAR MAINTENANCE ACTIVITIES**
  Increased annual funding for PW Department’s preservation treatments from $400K to $500K.

- **SET ACHIEVABLE GOALS AND PERFORMANCE METRICS**
  Approved a policy establishing a minimum allowable PCI of 40/100, as well as maintaining an average Arterial condition of 65/100, an average Collector condition of 60/100, and an average Local/residential street condition of 50/100.

- **INCREASE TOTAL FUNDING FOR STREET IMPROVEMENTS**
  Established a goal to budget $3.1M per year.
START AN EXTENSIVE PAVEMENT TREATMENT PROGRAM
included Rehabilitation activities such as PCC Restoration and Overlays, as well as full Reconstruction, for future projects.

EXPECT A LARGE PORTION OF ROADS TO REACH FAILURE
The City is fully aware of the looming liability of many roadways nearing the end of their useful life.

CONTINUE TRACKING CONDITION PERFORMANCE IN CLIVE and develop a proactive, data-driven Capital Improvement Plan.
10-year CIP has been developed with multiple treatment strategies utilizing the newly established annual funding goal to do the right projects at the right time.

Staff will be trained to properly operate the dTIMS software to manage their future CIPs and monitor the roadway system conditions.
Contact Information

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Questions?