Preparing the Next Generation of Transportation Engineers

Randall S. Over, PE, ODOT District 12
Ruth A. Klee, PE, GPD Group
James S. Bowling, PE, City of Kent
AGENDA

- The Current and Future Need for Transportation Engineers from a National and Local Perspective
- Teaching the Technical Skills of Engineering
- Challenges of Preparing the Next Generation of Transportation Engineers
The Current and Future Need for Transportation Engineers from a National and Local Perspective

Randall S. Over, PE, ODOT District 12
### Funding Needs

- **ASCE’s “Failure to Act” reports**
- **Industry Projections**

#### Annual additional investment needed to achieve a “B”

<table>
<thead>
<tr>
<th>Infrastructure System</th>
<th>Total Needs</th>
<th>Estimated Funding</th>
<th>Funding Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Transportation¹</td>
<td>$1,723</td>
<td>$877</td>
<td>$846</td>
</tr>
<tr>
<td>Water/Wastewater Infrastructure¹</td>
<td>$126</td>
<td>$42</td>
<td>$84</td>
</tr>
<tr>
<td>Electricity¹</td>
<td>$736</td>
<td>$629</td>
<td>$107</td>
</tr>
<tr>
<td>Airports¹</td>
<td>$184</td>
<td>$95</td>
<td>$39</td>
</tr>
<tr>
<td>Inland Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dams³</td>
<td>$10</td>
<td>$6</td>
<td>$15</td>
</tr>
<tr>
<td>Hazardous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levees⁵</td>
<td></td>
<td>$8</td>
<td>$72</td>
</tr>
<tr>
<td>Public Parks &amp; Recreation⁶</td>
<td></td>
<td>$134</td>
<td>$104</td>
</tr>
<tr>
<td>Rail⁷</td>
<td>$109</td>
<td>$89</td>
<td>$11</td>
</tr>
<tr>
<td>Schools⁸</td>
<td>$391</td>
<td>$20</td>
<td>$271</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>$3,635</strong></td>
<td><strong>$2,024</strong></td>
<td><strong>$1,611</strong></td>
</tr>
<tr>
<td><strong>YEARLY INVESTMENT NEEDED</strong></td>
<td><strong>$454</strong></td>
<td><strong>$253</strong></td>
<td><strong>$201</strong></td>
</tr>
</tbody>
</table>
American businesses and workers pay a heavy price.

America would lose 877,000 jobs.

Another 234,000 jobs exist only if many more workers agree to paycuts.

Between now and 2020 transportation costs increase $430B.

Families have a lower standard of living.

American families would earn $700 less each year.

And spend $360 more each year.

Total impact on each family’s budget: $1,060 per year.

America loses ground in the global economy.

U.S. exports would drop by $28 billion.

Exports drop in 79 of 93 different tradable commodities.

America’s gross domestic product underperforms by $897B.
Report Card Findings

Roads

2013 GRADE D

Highlights

• Roads improved slightly from a D- to a D; due mostly pavement condition improvements and significant reductions in highway fatalities.

• Forty-two percent of America’s major urban highways remain congested; costing the economy an estimated $101 billion in wasted time and fuel annually.

• Current investment of $91 billion annually is still short of what is needed; resulting in a decline in conditions and long term performance.
Highlights
• The overall number of structurally deficient bridges continuing to trend downward. However, one in nine of the nation’s bridges are rated as structurally deficient; resulting in a grade improved to C+.
• In urban areas, which carry the most traffic, the number of deficient bridges is rising.
• Over two hundred million trips are taken daily across deficient bridges in the nation’s 102 largest metropolitan regions.
Report Card Findings

Highlights
• Transit remained unchanged with a grade of D.
• Americans who do have access, increased their ridership 9.1% in the past decade, and that trend is expected to continue. However, 45% of Americans still lack access to transit.
• Although investment in transit has also increased, deficient and deteriorating transit systems cost the U.S. economy $90 billion in 2010, as many transit agencies are struggling to maintain aging and obsolete fleets and facilities amid an economic downturn that has reduced their funding, forcing service cuts and fare increases.
Report Card Findings

Aviation 2013 GRADE D

Highlights

• Despite the recession, commercial flights were about 33 million higher in number in 2011 than in 2000, stretching the system’s ability to meet the needs of the nation’s economy.
• The estimated cost of airport congestion and delays was about $22 billion in 2012 according to the Federal Aviation Administration.
• Major projects like NextGen promise to modernize our airport system, but they require full funding and planning to meet both near and long term needs.
2013 REPORT CARD for america's INFRASTRUCTURE

Ohio's Infrastructure

361 High Hazard Dams

What you should know about Ohio's Infrastructure

15% of major roads are in poor condition

$12.2 billion is needed for drinking water

$14.2 billion is needed for wastewater

2,242 structurally deficient bridges

...costing motorists $4,113/yr
ASCE Members (Ages 36-50 & >65)

Membership Trends

- Ages 36-50
- Over 65
Enrollment & Programs

**US BS Civil Engineering Degrees (ASEE 2014)**
(Civil/Construction/Environmental/Architectural)
9,703 (2005) to 14,833 (2014)

**US ABET Accredited BS Engineering Programs**
240 Civil
67 Environmental
16 Construction
19 Architectural
Survey of Transportation Engineers
35 & Younger

- Baby-Boomers - 1946-1964
- Generation X - Early 1960’s to Early 1980’s - 2015, the largest at ~80M
  ----- 35 years and under -----
- Millennial - Early 1980’s to Early 2000’s

.....Survey about looking forward, not comparisons to previous generations.....
Survey Stats:

- Sent August to Early September 2015
- 19 questions via Survey Monkey; some allowed for more than 1 answer and open ended
- 265 respondents
Survey question:
Please identify your current employer.

60% State of Ohio, City, County, FHWA, or MPO
1% Construction
39% Consulting
Survey question:
What are the main reasons you chose to work at your current place of employment (choose 2)?

- 28% Job stability
- 17% Location
- 14% Salary and benefits
- 12% Flexibility of work hours
- 10% Challenging work
- 8% Opportunity for advancement
- 6% Employer reputation
- 5% Other (work/family balance, first job offer after years of searching, environment, benefits, co-op turns into full time, provide service to society, rewarding, friends and colleagues)
Career Aspirations

Survey question:
Please choose one of the following that best describes your current career aspirations?

46% Significant departmental authority and management of personnel
21% Chief design/construction engineer w/limited personnel management authority
12% Project manager/team leader with no personnel management authority
  9% Design/construction engineer
  8% Ownership/partner/CEO of a company
  4% Other (research, technical expert, business development, college professor)
Leaving the Profession?

Survey question:
In the past year, have you seriously considered leaving the Transportation Engineering profession?

21% Yes
79% No
Survey question:
If yes, what profession have you considered?

- Oil/gas/petroleum industry
- Construction/construction management
- Stay at home parent
- Teacher
- Non-engineering
- Finance
- Entrepreneur
- Law
- Screen writer
- Chef
- Farming
Career Move out of Ohio?

Survey question:
In the past year, have you considered making a career move out of Ohio?

28% Yes
72% No
Teaching the Technical Skills of Engineering

Ruth A. Klee, PE, GPD Group
Need for Technical Training

Why is technical training needed?

To design and construct a state-of-the-art transportation system in the State of Ohio.
Need for Technical Training

Replace retiring or upwardly mobile Transportation Engineers

- Technical Design Experts
- Project Managers
- Construction Managers/Superintendents
- Transportation Planners
Need for Technical Training

Survey question:
How would you best describe the majority of your work assignments?

- 6% More CADD drafting tasks than engineering tasks
- 16% Basic engineering tasks that are not very challenging
- 40% Engineering tasks that are moderately challenging
- 38% Engineering/management tasks that are advanced and I love the challenge
Training and Mentoring

Teach basic engineering terminology and acronyms

- ESAL’s
- Superelevation
- Item Master
- RFI
- SWPPP
- Signal Preemption
- FEMA FIRM
- MPO
- HEC-RAS
- Semi-Integral
- Combination Pole
- PCMS
Provide a wide variety of design tasks
Take along on site visits
Serve on a survey crew
Training and Mentoring

- Big picture design
- Engineering judgment
Training and Mentoring

Avoid using the term “loophole”

Definition: An ambiguity or inadequacy in the law or a set of rules.

Synonyms: means of evasion, means of avoidance
Training and Mentoring

Pace of change in our industry – can you keep up with technology?

Somewhere, something went terribly wrong
Training and Mentoring

Encourage staff to use current technology and computational tools.
Training and Mentoring

Over-reliance of computational tools

What should the result be ... approximately?
Training and Mentoring

Promote a culture of healthy criticism

- Millennials are accustomed to unbridled praise.
- Criticism should **not** be mean-spirited or sarcastic.
- Fact-based **constructive criticism** is motivated by a **sincere** desire to achieve results.
Training and Mentoring

“Why do we do it that way?”

“Because I said so. I don’t have time to explain.”

“Because that’s the way we’ve always done it.”

“Let’s sit down and discuss this.”
Great ideas come from multiple inputs from a team with varied backgrounds and life experiences.
Training and Mentoring

Survey question:
 Which best describes the working relationship with your mentor or supervisor?

👍 75% He/she is available most of the time.

17% He/she is available some of the time.

👎 8% He/she is typically unavailable, unapproachable, or I am expected to learn on my own.
Challenges of Preparing the Next Generation of Transportation Engineers

James S. Bowling, PE, City of Kent
American Management Association Survey (4 C’s)

- Communication Skills (80.4%)
- Critical Thinking (72.4%)
- Collaboration (71.2%)
- Creativity (57.3%)
Soft Skills - Communication

This was a productive four-hour leadership meeting.

I'd like one of you to type up your notes and send an e-mail to the entire company.

No one took notes? I didn't have a pen.

Okay, no problem. Does anyone remember what we decided?

We agreed to increase... something.

Never mind. Let's try it again on Thursday at 8 A.M.

When is the next leadership meeting? I should have written that down.
Great Lawn!
Survey question:
What are the most important “tools” that you think you need to be successful at your next level of leadership?

26% General communication skills
4% Public presentation experience
10% Construction experience
13% Design experience
17% Assertive with those I supervise and how to motivate staff
22% Relationships with clients, other agencies, and other consultants
8% Other
Survey question:
Please select all of the following social media outlets that you currently use.

39% Facebook
15% Twitter
24% LinkedIn
13% Instagram
8% None
1% Other (Snapchat, Pinterest, Yelp, Yammer, Reddit)
Survey question:
What role do you think social media should play in the Transportation Engineering profession?

10% None
65% Public information dissemination
0% Office communications
25% Networking
Respect/Professionalism

Survey question:
What are the most important “tools” that you think you need to be successful at your next level of leadership?

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8% Other
Teaching the Soft Skills

• Mentoring
  – Most effective method (AMA’s Study)
  – Keep an open mind
  – Make time
  – Supportive
  – Model it...
Teaching the Soft Skills

• Practice Good Communication
  – Right method?
    • Text - E-mail - Phone call - In-person
  – Meetings
    • Agenda (formal/informal)
    • Summarize the key points
    • Clear/Concise
  – Training
    • In-House Training
    • ASCE/ASHE
    • Technical writing
    • Others
Teaching the Soft Skills

- Build Relationships with clients, agencies and consultants
  - Professional society meetings
  - Pre-construction meetings
  - Project meetings
  - Conferences
Teaching the Soft Skills

- Practice... Practice ... Practice
  - Integrate it into their job now...
  - Communicate with clients, agencies & others
  - Attend....participate....run meetings (or parts)
  - Assist in preparing and giving presentations
    - In-house/ASCE/ASHE
    - Clients
  - Letter writing (e-mails?)....portions of reports....draft reports
QUESTIONS?

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