THE ENGINEERING AND CONSTRUCTION INDUSTRY

Charles H. Helliwell, Jr.
Lecturer
AGENDA

• Monday, October 22 @ 8:45AM
  – E&C Industry Overview
  – Assignment: Profile a Company
• Wednesday, October 24 @ 8:45AM
  – Strategic Management Issues
• Wednesday, October 31 @ 8:30AM
  – Student Presentations
  – Summary
SKILLS OF AN EFFECTIVE ENGINEER

• Skills
  – Technical
  – Human
  – Conceptual

• Levels
  – Industry
  – Company
  – Project
  – Task/Assignment
ROLE OF THE E&C INDUSTRY

Through planning, design, construction, operation, and maintenance activities, the E&C industry transforms resources of labor, capital (money, materials, & equipment), and knowledge into the physical facilities required to meet a broad range of social and economic needs.
PRODUCTS OF THE E&C INDUSTRY

- Buildings
- Industrial Plants
- Infrastructure Systems
- Environmental Restoration & Remediation Projects
FACILITY PROJECT LIFE CYCLE*

MARKET DEMANDS OR PERCEIVED NEEDS → CONCEPTUAL PLANNING & FEASIBILITY STUDIES → DESIGN & ENGINEERING → PROCUREMENT & CONSTRUCTION

STARTUP FOR OCCUPANCY → OPERATION & MAINTENANCE → RENOVATION CONVERSION OR DEMOLITION

* Adapted from: “Project Management for Construction”; Chris Hendrickson & Tung Au Prentice Hall; 1989
GLOBAL PERSPECTIVE
Year 2000

- WORLD TOTAL $3.41 Trillion
  - ASIA $1,113 Billion
  - EUROPE $1,017 Billion
  - NORTH AMERICA $885 Billion
  - LATIN AMERICA $241 Billion
  - MIDDLE EAST $101 Billion
  - AFRICA $56 Billion
<table>
<thead>
<tr>
<th>Country</th>
<th>GDP</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNITED STATES (1)</td>
<td>$819B</td>
<td>8.2%</td>
</tr>
<tr>
<td>JAPAN (2)</td>
<td>$618B</td>
<td>13.9%</td>
</tr>
<tr>
<td>GERMANY (3)</td>
<td>$253B</td>
<td>11.4%</td>
</tr>
<tr>
<td>CHINA (4)</td>
<td>$181B</td>
<td>17.0%</td>
</tr>
<tr>
<td>UNITED KINGDOM (5)</td>
<td>$109B</td>
<td>7.7%</td>
</tr>
<tr>
<td>BRAZIL (6)</td>
<td>$109B</td>
<td>13.8%</td>
</tr>
<tr>
<td>FRANCE (7)</td>
<td>$107B</td>
<td>7.0%</td>
</tr>
</tbody>
</table>
TOP COUNTRIES (Cont’d)

• ITALY(8)   $96 B   8.1%
• SPAIN(9)    $86 B   14.8%
• KOREA,Rep(10) $68 B   15.4%
• CANADA(11) $65 B   10.2%
• INDIA(12)  $60 B   12.3%
• MEXICO(13) $45 B   9.0%
• RUSSIAN FED(14) $43 B   10.8%
TOTAL CONSTRUCTION
2000-2006

- 2006  $1,167,261 million
- 2005  1,194,492
- 2004  1,075,307
- 2003  972,958
- 2002  895,422
- 2001  873,279
- 2000  840,333
BLS INDUSTRY SUPERSECTORS

- Construction
- Education & Health Services
- Financial Activities
- Government
- Information
- Leisure & Hospitality
BLS INDUSTRY SUPERSECTORS (Cont’d)

- Manufacturing
- Natural Resources & Mining
- Other Services
- Professional & Business Services
- Transportation & Utilities
- Wholesale & Retail Trade
ECONOMIC CONTRIBUTIONS IN THE USA IN 2006

- US GNP $13,615 Billion
- Construction $1,167 Billion
- GFCF: 45-50%
- Employment: 7.3 million (5.4% of workforce)
- Backward & Forward Linkages
- Establishments: 9.8%
- Entrepreneurial Opportunities
NATURE OF USA DEMAND
2005

• TOTAL   $1,194,492 Million

• PRIVATE   $940,237 (79%)
  – Residential Building       $665,615   (56%)
  – Nonresidential                   274,622      (23%)

• PUBLIC     $254,255   (21%)
  – Residential Building              8,481        (1%)
  – Nonresidential                   245,774      (20%)
PRIVATE NONRESIDENTIAL KEY SECTORS (Billion)

- Building $177,514
- Manufacturing 34,863
- Power 32,188
- Communications 12,465
- Transportation 8,243
- Amusement & Recreation 8,003
PUBLIC NONRESIDENTIAL KEY SECTORS (Billion)

- Building $93,329
- Highway & Street 67,739
- Transportation 19,970
- Sewage & Waste Disposal 18,557
- Amusement & Recreation 11,695
- Water Supply 11,244
- Public Safety 9,951
- Power 7,396
- Conservation & Development 5,286
PARTICIPANTS

- Clients/Owners
- Designers (Architects, Engineers)
- Contractors & Subcontractors
- Labor Organizations
- Suppliers (Materials, Equipment)
- Finance, Legal, Insurance, etc. Firms
- Regulators
ENR TOP XYZ LISTS

• 500 Design Firms (April)
• 400 Contractors (May)
• 100 Design-Build, CM for Fee, CM at Risk (June)
• 200 International Design Firms (July)
• 200 Environmental Firms (July)
• 225 International/Global Contractors (Aug)
• 600 Specialty Contractors (October)
• Top Owners (November)
TOP 500 DESIGN FIRMS

2006

• Billings: $69.6 Billion
  – Domestic: $ 54.7 Billion
  – Internat’l: $ 11.9 Billion

• Profitability:
  – Domestic: 11%, 455 Profit, 9 Loss
  – Internat’l: 11%, 135 Profit, 23 Loss

• Professional Staff:
  – 466 Increase, 145 Same, 35 Decrease
MARKET STRUCTURE

- Building $16.46 Billion 23.7%
- Transportation $13.39 “ 19.2%
- Petroleum $10.82 “ 15.5%
- Hazardous Waste $7.32 “ 10.5%
- Power $4.95 “ 7.1%
<table>
<thead>
<tr>
<th>Market Structure</th>
<th>Revenue</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewer/Wastewater</td>
<td>$ 4.91B</td>
<td>7.1%</td>
</tr>
<tr>
<td>Water</td>
<td>$ 4.19</td>
<td>6.0%</td>
</tr>
<tr>
<td>Industrial</td>
<td>$ 3.47</td>
<td>5.0%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>$ 1.40</td>
<td>2.0%</td>
</tr>
<tr>
<td>Telecom</td>
<td>$ 0.79</td>
<td>1.1%</td>
</tr>
<tr>
<td>Other</td>
<td>$ 1.90</td>
<td>2.7%</td>
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</tbody>
</table>
TYPES OF FIRMS

• E  = Engineer 183
• EA = Engineer-Architect 101
• EC = Engineer-Contractor 55
• AE = Architect-Engineer 72
• A  = Architect 51
• ENV = Environmental 11
• GE = Soils or Geotech Eng 12
• P  = Planner 0
TYPES OF FIRMS

- AP 3
- AEC 3
- AEP 6
- CEP 1
- EAP 1
- ECA 1
FIRM INFORMATION

• Rank (2005 & 2006)
• Headquarters Location
• Type of Firm
• Billings (Total:$2.9 B-$16 M, & Int’l )
• Market Distribution of Billings
• Top Designers in Market Sectors
• Subsidiaries
• International Operations
TOP 400 CONTRACTORS

• Revenues: $ 194 Billion
  – Domestic: $ 167 Billion
  – Internat’l: $ 27 Billion

• Profitability:
  – Domestic: 2.3%, 325 Profit, 32 Loss
  – Internat’l: 2.7% 50 Profit, 17 Loss

• Professional Staff:
  – 147 Increase, 159 Same, 60 Decrease
MARKET STRUCTURE

• Building $98.7 Billion 51.0%
• Transportation $29.4 " 15.2%
• Petroleum $14.5 " 7.5%
• Power $12.3 " 6.4%
• Industrial $11.2 " 5.8%
• Manufacturing $5.0 " 2.6%
MARKET STRUCTURE

- Hazardous Waste $ 6.1 Billion 3.2%
- Sewer/Wastewater $ 3.6 “ 1.8%
- Water $ 2.9 “ 1.5%
- Telecom $ 2.4 “ 1.2%
- Other $ 7.3 “ 3.8%
COMPANY INFORMATION

- Rank (2005 & 2006)
- Headquarters Location
- Total Revenues ($9.7 Billion-$98 Million)
- International Revenues
- New Contract Awards
- Market Distribution (% of Revenues)
- Construction Management Revenues
COMPANY INFO (Cont’d)

• Subsidiaries
• Locations of Overseas Operations
• Top 20 in Major Market Sectors
• Narrative & Strategic Issues
  – General Building
  – Heavy Construction
  – International Market
General economic environment

- Industry 10 years without recession
- Economic predictions universally optimistic
- Continued growth in 2001 but at slower pace
  - Annual growth rate down from 10% to 3%
  - Tighter labor & materials markets
  - Increasing pressure on inflation
- Large increases in Federal construction
VIEW FROM October 2000 (Cont’d)

- Strong office building construction
- Continued strong demand from bio-tech, dot-coms, semiconductor manufacturers

• Need for innovation to meet demand
  - design-build
  - innovative financing
  - streamlining regulations
  - Application of IT to project delivery method
VIEW FROM October 2000 (Cont’d)

• Nature of Projects
  – High-profile high-rise
  – Signature-architect buildings
  – telecom hotels and towers
  – Innovative water resources facilities
    • ground water replenishment systems
    • microfiltration
    • reverse osmosis
    • ultraviolet disinfection
VIEW FROM October 2000 (Cont’d)

• Information-rich project tools
  – Information Age to the Knowledge Age
  – Turning data into knowledge
  – Knowledge based on experience
    • Realistic assessment of past performance & capabilities of individuals on a team
    • Assessment of organizational structure that is formed to accomplish a complex task
  – Mining searchable data
VIEW FROM OCTOBER 2007

• General Economic Environment
  – Few signs of market slowing any time soon
  – Sound Bites
    • Things look good for high-end contractors for next ten years
    • But, can we handle the boom with current resources?
VIEW FROM OCTOBER 2007

• Overall Industry Trends
  – Continuing mergers & acquisitions
    • For additional capacity
    • Geographic
    • Market specialties (healthcare, security, research facilities)
    • Value Adding Services
    • Regional to National Capabilities
VIEW FROM OCTOBER 2007

• Construction Industry Trends
  – Insurance/Bonding Requirements
    • Increased emphasis on management
    • Active management of costs & risk
  – Increasing self-performance vs use of subs
  – Information Technology less of a novelty and selling point, more of a requirement
  – Increasing Emphasis on safety
VIEW FROM OCTOBER 2007

• Design Industry Trends
  – Accelerating Mergers/Acquisitions
    • Technical Expertise
    • Geographical Coverage
    • New Services
    • International Assets/Local Presence
  – Increasing Public Ownership
    • Emphasis on Growth & Shareholder Demands
VIEW FROM OCTOBER 2007

• Design Industry Trends (cont’d)
  – Staffing Issues
    • Shortage of Professionals
    • Increasing Competition for Students
    • Company Involvement in Teaching & Research
    • Recruiting Through Internships
  – Increasing Client Expectation of Perfection in Design
VIEW FROM OCTOBER 2007

• Design Industry Trends (cont’d)
  – Building Information Modeling (BIM)
    • Streamlining Design Process
    • Engineering Driven/Informed Design
    • Consideration of Constructability Issues During Design
    • Changing Relationships Among Contractors, Subs, Design Professionals, Suppliers
    • Increasing Upfront Effort & Cost
• Design Industry Trends (cont’d)
  – Green Building/Sustainability
    • Increasing Public Awareness
    • Increasing Corporate Interest & Action
    • LEED (Leadership in Energy & Environmental Design)
    • Durability of Materials
    • Energy Savings
    • Carbon Footprint Minimization