

CE-220: Fundamentals of Civil Engineering

Jacob Sigman

Lecture 1 - 1/25/22

- Course Description
 - Planning, execution, and interpretation of drawings and specifications for Civil Engineering projects.
 - Sample drawings and specifications.
 - Contractual requirements and sample contracts.
 - Permitting, scheduling, and cost estimation.
 - Basic operations of design and construction firms.
 - Interface with other disciplines on Civil Engineering projects.
- Midterm
 - Likely March 8, before Spring Break.
 - Multiple choice questions (might have multiple right answers)
- Final group project/presentation
- Grading
 - Class participation: 20%
 - Quizzes: 15%
 - HW: 20%
 - Midterm: 15%
 - Final Project: 30%
- Office Hours: 4:30 - 5:00, 8:00 - 8:30, by appointment
- 10 points deducted for each week that an assignment is late.
- Recommended readings: ENR, ASCE, any professional journals of interest
- Abbreviated notes will be posted in teams. Take notes like they won't be.
- Civil Engineering Sub-Disciplines
 - Airport Engineering
 - Architectural Engineering
 - Coastal Engineering
 - Construction Engineering
 - Earthquake Engineering
 - Environmental Engineering
 - Forensic Engineering
 - Geotechnical Engineering

- Highway Engineering
- Ports and Marine Engineering
- Materials Engineering
- Municipal/Urban Engineering
- Railway Engineering
- Site Engineering
- Structural Engineering
- Transportation Engineering
- Wastewater/Water Resources Engineering
- Civil Engineers fulfill society’s needs, a service profession.
- Introduction
 - **The Process** - from Request for Qualifications and Proposal for initial Planning to Opening Day for the Project.
 - * Where it begins
 - * A “Need” is identified
 - Owner needs to develop property purchased to lease for income (return on investment)
 - Inspectors note that deck deterioration is advanced and needs repair/replacement.
 - Traffic demands have grown to regularly “jam” the route and no viable alternates are available.
 - * Scope developed - usually by owner or owner’s representative (program manager for major projects)
 - * Request for Qualifications (RFQ) or Request for Proposal (RFP) for Design issued by Owners
 - Lists *qualifications* needed - (Sometimes 2-step process: RFQ first and shortlisted teams get the RFP second).
 - Objectives and Scope of Work are detailed
 - Schedule is defined
 - Criteria
 - **The Players** - Relationships among Owners, Designers, Builders (and sometimes Financers)
 - * Owner/Owner’s Representative
 - * Designer/Engineer - Develops construction (or contract) Documents (CDs). Supports construction (reviews of Contractor’s alternatives, RFIs, Means and Methods, relays design intent).
 - * Contractor - Bids on work defined in CDs. Lowest qualified bidder (usually) gets awarded the contract.
 - * Resident/Construction Inspector - Assures work is performed in accordance with CDs. Processes pay requisitions. Coordinates submissions to/from designer.
 - * Quality Control/Quality Assurance/Testing
 - * **Design-Bid-Build** Contractual relationships between owner and engineer and owner and contractor. Cooperative support between engineer and contractor.
 - * Roles civil engineers play: Designer, Resident/Owner’s Representative, Contractor, Owner, Maintenance Engineer, QA/QC.
 - **New Construction** - Case Study - Tacoma Narrows Bridge
 - * Timeline for Tacoma Narrows Bridge
 - 1994 - WSDOT Public - Private Initiative Announced
 - 1996 - Major Investment Study

- 1996/98 - Environmental Impact Studies
- 1999 - Project Standards and Criteria Development
- 2000 - Basic Configuration and Initial Design
- 2001 - Determination of Fixed Price
- 2002 - Legislation enacted and bonds shortlisted
- 2002 - Notice to proceed - 9/25/2002
- 2007 - Opening day - 7/17/2007
- * Financial mechanisms for procuring and paying for projects.
 - Buildings v. Bridges
 - Procurement Methods
 - Conventional Design-Bid-Build (DBB)
 - Design/Build (DB) and Progressive Design/Build (PDB)
 - Public-Private Partnerships (P3) and Design-Build-Bid-Operate-Maintain (DBOM)
 - Construction Manager/General Contractor (CM/GC)
 - Last three are called alternate delivery (AltD)
 - Conventional Design-Bid-Build: Owner → Design → contract bid then built
Engineering Oriented: Owner controlled, low risk, low opportunity.
 - Design-Build and P3: Owner → 30-40% Design and RFP → Design/Build teams advance design, bid then final designed/built staged. Also adds finance/operate/maintain in P3.
Construction Oriented: Contractor controlled, managed risk, better opportunity.
 - Progressive Design-Build: Owner → 5-10% Design and RFP → PDB teams selected on qualifications, advance design with owner and owner's representative.
Investor Oriented: Investor controlled, high risk, high opportunity.
 - CMGC - Owner "brokers" the marriage
 - Private public Partnerships, Design/Build/Operate/Maintain and other concepts
 - Bonding/Tolling and its place in financing
 - Federally funded projects - interstate system
 - Real estate and tax implications
- * Contracts for Design
 - General Terms and Conditions: Standard of care, Insurance, Payment terms, other "legalese"
 - Scope of Work
 - Compensation - types of Contracts
 - Schedule for project
 - Special provisions
- * Construction Inspection and Construction Management
- * Contracts for Contractors - General terms and conditions (Division 1). The rest is the construction documents (plans and specifications, usually done by the design engineer)
- **Rehabilitation** - Case Study - Verrazzano Narrows Upper Level Deck Replacement
 - * First phase - Study and design brief
 - Notice to proceed - 12/2003
 - Two viable operations: steel orthotropic and concrete filled steel grid.
 - Traffic studies to determine workable staging
 - Utility survey to evaluate relocation
 - Analyses to "global" impact of each alternative
 - Final recommendations
 - Two conceptual (10%) designs

- Budgetary cost estimates
- * Second Phase - Designer
 - Two main construction contracts (Part A: Utility Relocation and Part B: Deck Replacement)
 - Two prototypes (Trinidad Lake asphalt pavement at throggs neck bridge and orthotropic deck for fabrication “proof of concept” and fatigue tests)
 - Additional Wind Tunnel Testing
 - Value Engineering
 - Constructability review
 - Final Design - VN-90A - December 2008
 - Survey - How Dissimilar might the panels be?
- **Recent Trends**
 - * Sustainability - Going “Green” needs to be part of process early if it will be followed through to completion.
 - * Integrated Project Delivery/BIM
- Homework 0
 - Do one random act of kindness
 - You cannot personally benefit from this
 - You must not tell anyone what it is
 - If the person you did it for finds out, it doesn’t count