

Building Engineering & Construction

History of an Important Department at MIT

By Werner H. Gumpertz, P.E., F., ASCE

This is a personal history. It tells a story from my memory; however, many important elements may be missing.

Engineering is as old as the hills, with fascinating examples from merely old or antique, to ancient (see Stonehenge). As an organized compendium of applied science, "civil engineering" was paired with (and sometimes derived from) military engineering. The 19th century saw civil engineering develop as an academic discipline, and was soon followed by mechanical, sanitary, electrical, chemical and aeronautical fields of knowledge. "Civil Engineering", as the senior field, eventually encompassed sanitary, environmental engineering, and surveying/geodetic engineering. The "structural" part of engineering specialized in strength of materials and the knowledge of buildings, bridges, tunnels, and other fields.



Concrete mixing in the laboratory (from 1951 brochure).

With growing sophistication, engineering education specialized more and more on the theory and practice of structures, while the field of architecture developed the art and practice of how to plan buildings. This division between engineering and architecture relied more and more on the practice of building construction – the master builder and the skill of craftsmen. In the middle of the 20th century, some engineering schools developed "Architectural Engineering" as a field of science and practice concentrating on how to put buildings together. The Architectural Engineering curricula encompassed a knowledge of building

Recent articles have demonstrated the growing awareness among structural engineers of the need for greater emphasis on constructability, understanding the properties of materials, and the interaction of structural with architectural and mechanical elements. Therefore, it is useful to look at a course that was designed to meet those needs in the past, and consider what can be learned from that experience.

Richard Hess, SE, SECB
S.B. MIT XVII '57



A student comes to talk over personal affairs with the head of his department (from 1951 brochure; at the desk, Professor Walter C. Voss, Department Head).

materials and envelopes, a course of study that had fallen behind in the academic education. As buildings became more complex, the need for engineering every building component resulted in the academic field to systematize building envelopes, components, and materials, that had formerly the specialization of experienced craftsmen.

Early History

Prominent contractors in the Boston area realized in the late 1920s that their industry needed more effort in developing talent in the building industry than the "father and son" tradition, a popular trend among prominent builders of the time. They found that Civil Engineering offered education in structures

and sanitary science, but was not sufficient in the technology and practice of building construction. Louis J. Horowitz, then President of the prominent firm of Thompson-Starrett Company, along with other top builders, initiated a new MIT department, to provide a professional engineering education specializing in building construction. The department was to provide the same scientific base as that of Civil Engineering, but with less emphasis on non-building subjects and more on materials and management engineering. His ideas were to give an academic education for a new generation of industry leaders comprised of structural engineering, building material research, building technology, and business subjects.

The first head of Course XVII of MIT (*Building Engineering and Construction*) was Ross F. Tucker, a building industry leader. Following him was Walter C. Voss, formerly a structural engineer for the Portland Cement Association, and head of the Architectural Engineering Department of the Wentworth Institute in Boston, MA.

Faculty members of Course XVII were

STAFF MEMBERS IN THE 1950s

In the early years, the professors were:

- Ross F. Tucker – Building Construction
- Walter C. Voss – Building Construction, Materials, Estimating – SM
- Howard R. Staley – Building Construction and Codes – SM
- James A. Murray – Chemistry of Materials, Cementitious Building Components – SB
- Albert G. H. Dietz – Building Materials/Plastics/Wood – ScD
- Dean Peabody Jr. – Structural Engineering – SM

Later additions included:

- Howard Simpson – Structural Engineer – ScD
- Frank J. Heger – Structural Engineer – ScD
- Werner H. Gumpertz – Building Construction – Bldg. E.
- Demetrios A. Polychrone – Structural Engineering – ScD
- Albert J. O'Neill – Laboratory Instructor – SB
- Thomas A. Hood – Instructor of Building Construction – SB
- Frederick J. McGarry – Civil and Polymeric Engineering – SM
- William Maini – Instructor of Building Construction – SM
- Mary O'Donnell – Secretary
- Raymond Boyd – Secretary
- Marion Curley – Secretary

expected to have not only an academic background, but experience in the field of building construction.

Curriculum

Figure 1 shows the standard B.S. curriculum of Course XVII in 1951, with the first year the same for all MIT students. The next three years indicate standard structural engineering, with an emphasis on building material and construction. Building sciences and construction engineering are important subjects not emphasized in conventional Civil Engineering. A thesis was expected as a condition of graduation.

Careers of Graduates

A 1951 pamphlet, published by the MIT Admissions Office, shows the distribution of graduates of Course XVII:

- 42% work for general contractors
- 17% work for building material suppliers and manufacturers
- 11% work as consulting engineers
- 13% work in plant maintenance and real estate management
- 8% work in public construction agencies
- 9% work in teaching, architecture, and unrelated activities

More than half of the graduates were in senior positions in engineering or construction.

End of the Department

The Department was abolished at the time of Professor Voss's retirement, concurrent with the general conversion of MIT to a computer-based institute of applied science. The building industry, one of the major industries in the United States, was left without an academic basis, except for a few remaining Architectural Engineering courses. Building Technology and Building Science, presently important components of education for Engineering and Construction, was preserved by some faculty members and graduates of Course XVII, such as LeMessurier, Simpson Gumpertz & Heger, and Symmes, Maini & McKee, all in Greater Boston. Graduates fulfilled the expectations of the founders of the Department, assuming leadership roles in Building Engineering and Construction in many prominent positions.

Publications

As is customary, faculty members publish a number of papers; some graduates in industry do the same. In addition, Course XVII needed textbooks for the department, and Professor Voss developed a list of subjects appropriate for use as textbooks, all to be published by

Curriculum for Building Engineering and Construction

FIRST YEAR	
First Term	Second Term
<ul style="list-style-type: none"> • General Chemistry • Physics • Calculus o English Composition ■ Engineering Drawing Military Science Athletic Program 	<ul style="list-style-type: none"> • General Chemistry • Physics • Calculus o English Composition ■ Engineering Drawing Military Science Athletic Program
SECOND YEAR	
<ul style="list-style-type: none"> • Physics • Calculus o History Δ Statics and Dynamics ■ Building Construction Military Science 	<ul style="list-style-type: none"> • Physics • Differential Equations o History Δ Strength of Materials ■ Building Construction Military Science
SUMMER CAMP ■ Surveying and Construction Survey Fieldwork	
THIRD YEAR	
<ul style="list-style-type: none"> o Economic Principles Δ Fluid Mechanics Δ Heat Engineering ■ Soil Mechanics & Foundation Engineering ■ Building Construction ■ Materials – Metals 	<ul style="list-style-type: none"> o Humanities ■ Structures ■ Job Management ■ Steel Design ■ Materials – Masonry ■ Materials – Wood
FOURTH YEAR	
<ul style="list-style-type: none"> o Humanities IV o Humanities Elective Δ Electrical Engineering Fundamentals ■ Structures ■ Wood Design ■ Professional Electives ■ Thesis 	<ul style="list-style-type: none"> o Humanities IV o Humanities Elective ■ Structures ■ Concrete Design ■ Professional Electives ■ Thesis
• Elementary Science Δ Applied Science o Humanities ■ Professional	

Figure 1

the D. Van Nostrand Company Inc. in New York/Toronto/London.

I am familiar with the following list, having used the content during my teaching:

1946 & 1954 *Dwelling House Construction*, by Albert G. H. Dietz

1948 *Fireproof Construction*, by Walter C. Voss

1949 *Semi-Fireproof Construction*, By Howard R. Staley

1936 & 1946 *The Design of Reinforced Concrete Structures*, by Dean Peabody, Jr.

Papers By Walter C. Voss:

1938 *Why Masonry Walls Leak*, National Lime Association, Washington, DC

1947 *Engineering Laminates: Fundamentals*

Underlying the Problems of their Inhomogeneity, ASTM Edgar Marburg Memorial Lecture

1946 Investigation of Copper Shapes and Gutter Shapes for the Revere Copper and Brass Co., Inc., (with Albert J. O'Neill) (A seminal work in the technology of metal roofing and flashing)

1950 Tentative Statute Law for Building Code Administration, drafted by the Committee on Building Codes of the American Institute of Architects, revised (Walter C. Voss, Chairman) for the AIA

1954 *Tornado in New England*, Technology Review, MIT, Cambridge, MA

1954 Survey on and Suggested Procedure for Selection of Materials, New Home Office Building, Connecticut General Life Insurance Co.

1955 Report on Characteristics of Certain Sands, for Committee C-12 Sub IV ASTM (on Standard C144-52T)

1957 Comparative Durability, Functional Appropriateness and Maintenance Appearance of Aluminum, Architectural Bronze and Stainless Steel for the Exterior Wall, of the Bank and Office Building for Harris Trust and Savings Bank, Chicago, IL, prepared for Skidmore, Owings and Merrill, Architects-Engineers

1957 Gaskets and Sealants, Boston Society of Civil Engineers, Boston, MA

1957 Report of Inspection and Recommended Repairs, Woonsocket Hospital, Woonsocket, RI

1957 Report for Inspection and Recommendation for Repairs, Gateway Center Buildings, Golden Triangle, Pittsburgh, PA

? Bond in Masonry, Boston Society of Civil Engineers, Boston, MA

? Providing for Movement in Building

? Qualifications of Contractor (a specification and details)

? Moisture Penetration of Brick Walls, Report No. 1

Careers of Faculty

Since this is a personal recollection, and my search has not produced a reliable recognition of the faculty of Course XVII, the following information is random.

- Professor Walter C. Voss: After his retirement, Prof. Voss continued his consulting in the field of chemistry and building technology in the U.S. and Canada. Professor Albert G. H. Dietz taught Building Engineering in the Department of Architecture at MIT, concentrating on polymeric materials.

- Professor Dean Peabody, Jr. moved to the School of Science, Harvard University.

- Thomas Hood became Chief Engineer of the Vermont Marble Company.

- Professor Frederick McGarry continued teaching in the Department of Civil Engineering, MIT.

- Professors Simpson, Gumpertz, and Heger founded a national engineering firm specializing in Structural Engineering, Building Technology and Science, and Advanced Structural Mechanics. In many ways, Simpson Gumpertz & Heger Inc. carried forward the spirit of Professor Voss and Course XVII of MIT.

- Professor Demetrios N. (James) Polychrone taught structural engineering at Georgia



A question of construction details is raised (From 1951 brochure; Prof. Werner H. Gumpertz at the desk).

Tech. and founded the firm of Demetrios N. Polychrone & Associates in Atlanta, Georgia.

- Professor William LeMessurier founded a firm of structural engineers, designing many prominent buildings throughout the U.S.

- William Maini became co-founder of the Architect-Engineer firm of Symmes Maini & McKee in Cambridge, MA.

On the Lighter Side

The following are random quotes of "Famous Sayings" by Faculty Members from my personal recollections:

- Parody of Longfellow's "Psalm of Life" by Walter C. Voss:

*Tell me not in mournful murmurs
that your walls do leak and creak
for your plans were hardly expert
when you turned them loose last week.*

*Nature's real, nature's earnest
and her forces still prevail.
Better heed her, do her bidding
least your fancy details fail.*

- Advice not to count on sealants for construction, by Werner H. Gumpertz: *Sealants are hole fillers, not waterproofers.*

- On writing, by Werner H. Gumpertz: *If you have to say "in my professional judgment," don't say it (avoid pomposness).*

- On paying professors for their advice, by Werner H. Gumpertz:

*Scire volunt omnes; mercedem solvere nemo
(Everybody wants to know; nobody wants to pay the price).*

- On decision making, by A. Leonard Brown:

Let's be on the side of the angels.

Conclusions

The academic history of MIT Course XVII in Building Engineering and Construction shows its usefulness in developing leadership of the Building Construction Industry. Some inheritors of this tradition have carried on the idea, such as the Architectural Engineering Department of the Pennsylvania State

University under the leadership of Gifford H. Albright, MIT 1955. In addition, prominent consulting engineers such as Walter P. Moore, Simpson Gumpertz & Heger, and Wiss, Janney & Elstner have contributed engineering practices in building technology needed as a foundation for the practice of building construction. I hope that this field of academic pursuit will grow in acceptance and availability, fulfilling a need for science and engineering education beyond that presently available. ■



Concrete Laboratory (From 1951 brochure).

Werner Gumpertz received his S.B. in Civil Engineering, S.M. in Building Engineering and Construction, and an Advanced Professional Degree of Building Engineer, all from Massachusetts Institute of Technology. He served on the faculty of MIT from 1950 to 1957. In 1956, Werner co-founded Simpson Gumpertz and Heger Inc. Mr. Gumpertz is a member of a number of engineering organizations, including ASTM, ASCE and BSCES, which have benefited from his service as a committee member.

Werner has been recognized numerous times for his accomplishments in engineering. He won the 1987 ASTM Walter C. Voss Award for his Outstanding Contribution to the Advancement of Building Technology, the 1968 Honor Award for Design in Urban Transportation from the U.S. Department of Housing & Urban Development, and the 1986 Award of Merit from the American Society for Testing and Materials, among others. In 2003, BSCES bestowed on Werner Gumpertz the title of Honorary Member, a person who has attained acknowledged eminence in his field of endeavor.