HERITAGE PRESERVATION ENGINEERING EDUCATION AT THE NATIONAL LEVEL

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"Heritage preservation engineering" – how does one go about defining that term? I think back to my earliest efforts in this field and I am appalled by how little I knew about the subject. I started my practice in structural engineering on January 1, 1966. It turns out that 1966 was an outstanding year in the annals of historic preservation in the United States. If we look around at heritage preservation on a national level as a general topic prior to 1966 there was not much that had been formalized. Although the Antiquities Act of 1906 (designed to prevent looting of heritage sites) and the Historic Sites Act of 1935 (that stated that it was Federal policy to preserve for public use historic sites and buildings of national significance) had both been legislated, there was no real established machinery to effectuate historic preservation policy on a national basis. Yes, HABS was a depression baby conceived to put unemployed architects to work and it performed an immensely valuable service.

The National Historic Preservation Act was not signed into law by President Johnson until October of 1966 and it took some time for its effects to be felt. The New York City Landmarks Preservation Commission was started eight months before I opened my practice; of course its birth was the reaction to the demolition of Penn Station. But the NYC LPC too started quite slowly and did not have any real teeth or much public advocacy in its early years. Indeed academic programs in historic preservation were in their birth throes at that time. In June of 1966 the first graduates of James Marston Fitch's masters degree program in historic preservation at Columbia made their entrance into the working world.

Thus I feel very comfortable (as well as very old) talking about the history of the national historic preservation effort as it has developed formally since its birth in 1966, the same year that I started in my own practice.

I would like to start with two national priorities that were, perhaps, as responsible as anything else for creating the awareness in both public citizens and legislators of the need for preservation of our cultural heritage in the built environment. These two programs were President Eisenhower's interstate highways and President Kennedy's urban renewal. The former caused the destruction of countless cultural landscapes and the latter the destruction of so much of the fabric of our inner cities that contained not only historic buildings but also long-established social patterns.

This national background is useful in setting the stage for a discussion of educational curricula in the field of historic preservation. Prior to 1964 there was no formal higher education curriculum devoted solely to historic preservation. But in 1964 Jim Fitch authored such a program at Columbia in their Graduate School of Architecture.

Fitch was a most remarkable man and I am honored to be able to call him my mentor. My major regret was that I did not seek him out earlier in my career, but nevertheless, he has had an enormous influence on me as well as on hundreds of others whom he taught and who have read his crystal clear essays. Jim was a restless character who could not be silent in the face of what he considered to be injustice. Although from the deep south, he was an extreme and outspoken liberal. What caught his attention in the late 1950's and early 1960's was the large-scale destruction of significant pieces of architecture and landscape at the hands of the aforementioned federal highways program and the federally funded urban renewal program. Although he did not literally lay down in front of the bulldozers, he used the power of his pen to rail against these destructive acts. He also realized that we needed trained professionals to be able to deal with these historic sites and buildings. Thus the genesis of his program in historic preservation.

However the Columbia program was designed to be open to any college graduate from any field of study. Indeed it attracted many architects but there were just as many sociologists, anthropologists, English and history majors. There was no special appeal to engineering graduates and while I have no hard statistics to back up this statement, I am quite certain from having talked to Jim that very few engineers enrolled. And Fitch's

curriculum became the model for the more than 50 current programs in historic preservation, both undergraduate and graduate, that are now offered by American universities, none of them concentrating on attracting engineering students.

I am going to use examples from structural engineering as that is my field. It is also likely that heritage conservation presents more challenges to structural engineering than it does to either mechanical or electrical engineering. However, these latter disciples must not be ignored and I am sure that they face the same problems as structural engineers.

If we think about the students enrolled in a structural engineering major in the various departments of civil engineering throughout the country in the 1960's, 70's and 80's, we will find that they were seduced by the grandeur of tall or long span structures. Innovative wind engineering systems had opened a new chapter in skyscraper technology. The concrete shell builders of Europe and Latin America were idolized by students. Cable structures became much more refined. No longer was the dead weight of the deck used to stabilize suspension bridges; now they were aerodynamically designed using light orthotropic plate decks. Cable stayed bridges first appeared. And long span cable roof structures, starting with the elegant Raleigh Arena in 1954 became popular. These challenges were much more romantic to a young engineer than examining in minute detail the remains of an archaic structure. Furthermore the engineering faculties were not trained in the analysis of historic buildings and they therefore were not capable nor were they interested in teaching this subject. The newly found powers of computers

made possible the exact analysis of what was previously only approximate analysis or even impossible analysis. In addition, serviceability questions such as deflections could be accurately predicted with the new electronic digital capability. Even the analysis of ordinary structures benefited from computers because of the accuracy of the results and the elimination of much drudgery. Who wanted to mess around with the old when there was all of this new opening up?

All of this new knowledge challenged the traditional undergraduate engineering curriculum of this period. Many schools went to a five-year undergraduate program in order to fit in all of the required course work. Those that clung to the four-year degree, had to eliminate many desirable ancillary humanities courses, turning out trade school graduates. There was simply no time for anything extra. In fact, many professors and deans felt that there was insufficient time to teach the bare minimum course work. Complaints were fed back to the universities from industry that the graduates knew nothing practical and that the initial on-the-job training required was out of proportion to what should be expected for a newly graduated engineer.

One would have thought then that the graduate programs in structural engineering might have been able to address education of engineers in the analysis of traditional and historic buildings and in techniques for renovating, repairing and upgrading them. But instead the newfound computer technology opened many new and interesting challenges, including some very sophisticated research into the understanding of both material and structural behavior. These topics were much sexier than old buildings and bridges.

If what I have just described was the attitude of the educators in the early years of the formal movement of historic preservation in the United States, has much changed since then? I would have to say categorically, "No." If anything, department heads feel more intimidated by the amount of information that needs to be crammed into their students' heads in the short period of time that they have available. There has been an explosion in the amount of solid information floating about; educators are having a great deal of trouble prioritizing what they must teach and finding sufficient time to fit it all in. Furthermore students themselves are now treated as consumers at many universities and they are demanding to be trained such that they will be the most valuable commodities upon their graduation. They feel that cutting edge knowledge of the latest techniques and technologies is far more worthwhile than the study of old structures.

I can remember a conversation that I had in the late 1990's with a dean of a prominent engineering school. I was teaching a course in the philosophy of technology at the same university in the school of architecture. The course dealt with the ethical use of our power as technologists in creating the built environment. It was not specific to architecture, but to all facets of the built environment. I asked if the course could be cross-listed in the school of engineering so that students there could choose to take it as an elective. There would be no cost to the school of engineering as everything to do with this course was paid for by the other school. The dean was astounded at my naïveté, telling me that students barely had time to eat lunch. There was simply no room at all for any other courses, particularly electives that might draw them away from the more technical specialty courses. I know that had I come to this dean with a similar request to

teach a course in preservation engineering, I would have been met with the same stone wall. And I am certain that this university was not unique. I will talk about that a little later in this discussion.

So if there is no desire to teach heritage engineering as it were from the top down, is there any demand for it at all? Apparently so, or this colloquium would not have been convened. Obviously the need arises from practice, from the immediate requirements to solve problems encountered. Architects, landscape architects, conservators and the entire body of heritage conservation professionals do not have the expertise to solve structural problems. As all of us who are familiar with heritage conservation know, structural issues can be quite daunting and without available solutions, many projects would come to a screeching halt. In addition to simply solving a problem at hand, most practitioners in allied fields would hope that the solutions arrived at were sympathetic to preservation needs and goals of the project and of whatever standards are applicable. Thus a knowledge of preservation principles in general is very helpful in the structural engineer. It is these pressing needs that either have been or must be communicated to those who develop and administer engineering curricula.

The need for heritage conservation to embrace the principles of modern technology was recognized by the United States Congress in 1986 when it requested the federal Office of Technology Assessment to investigate this topic. The OTA convened several panels of experts and reported back to Congress which in turn created the National Center for Preservation Training and Technology in 1992. Section 401 of Public Law 102-575

states, “The Congress finds and declares that, given the complexity of technical problems encountered in preserving historic properties and the lack of adequate distribution of technical information to preserve such properties, a national initiative to coordinate and promote research, distribute information, and provide training about preservation skills and technologies would be beneficial.” The next sections of the law create NCPTT, locate it in Natchitoches, LA and briefly outline its purposes.

Clearly one of the purposes of NCPTT is to offer training, particularly in areas where other agencies or organizations have failed. Quite early on, NCPTT recognized that training of engineers in historic preservation was sorely lacking in our university system. With the assistance of engineers on the PTT Board and using the Association for Preservation Technology (APT) as a staunch ally, NCPTT advanced an effort to get university faculties in engineering to recognize the need for including heritage conservation studies in their curricula. In short, this initial attempt was a dismal failure. Perhaps a dozen or so universities were visited by engineers interested in heritage engineering. All of these engineers had been briefed during the NCPTT/APT initiative. They met with what seemed like a universally negative response, one that I have stated above. There was simply no time or place in the curriculum to add yet more courses.

NCPTT and APT investigated the notion of establishing distance learning courses. That is, developing web based education much like many universities were beginning to do. That too had its problems. They soon learned that the only successful way to run a distance learning program was to invest a huge amount of money up front for

development of each course and then continue with the investment by maintaining the course with a professor available to the on-line students on a regular basis as they went through the course. There was simply no funding available for this sort of venture.

NCPTT has conducted small scale seminars, mostly of a one or two week duration during the summer. These mini courses are targeted at specific techniques for engineers in historic preservation. APT has run mini courses in conjunction with their annual conferences, again generally aimed at a narrow topic that can be covered in two or three days. But these certainly are no substitute for a full engineering curriculum.

But is there a possible alternative to a complete curriculum in heritage engineering? In our own office we currently have five engineers with undergraduate degrees in structural engineering and masters degrees in historic preservation. Thus they have learned to basics of the regular structural engineering curriculum and then added skills in architectural history, building pathology, historic building materials and methods, conservation techniques and standards and guidelines. It is true that they have not addressed some of the specifics of preservation engineering such as allowable stresses and factors of safety for older materials, the use of modern materials as repair media for historic fabric, application of computer analysis to historic buildings, etc. But we have successfully taught these engineers those skills pretty quickly and combined with their preservation studies, we think they probably have received the equivalent of a complete engineering curriculum, perhaps even more since they have studied topics outside the mainstream of structures. But upon reflection our office is not the typical structural

engineering office; we have probably done more engineering on historic buildings than almost any other firm in the United States and we have a cadre of experienced engineers who have learned their skills over many years by means of on the job training. In an office where that level of experience does not exist, perhaps the outcome would not be so successful.

Because of the significant role that sustainability has assumed in our current society, the preservation and renovation of the existing building stock has become a popular cause. Preservationists have thus taken up the mantle as natural leaders in the sustainability movement. NCPTT in collaboration with the National Trust for Historic Preservation has just within the last few months convened a symposium to examine the natural ties between the two disciplines. When published, the results of this symposium will gain national attention for the heritage conservation movement.

So where are we now in mid-2009, 41 years after passage of the Historic Preservation Act, 23 years after the OTA recognized the technological complexity of preserving our built environment, and 17 years after Congress established NCPTT to deal with the shortcomings we have cited above? Clearly the need has been established. The OTA cited the need for more development of technology in preservation in 1986, Congress created NCPTT in 1992 and for the past 40 years an increasing demand has been produced by the preservation community for more skilled heritage engineers. I think that it is this last item that we must focus on. The best impetus for universities to change their ways and to implement preservation engineering topics, modules or courses in the

curriculum is demand from the market. So how can we create more visibility and more demand?

One way is through publicity. Does the education community realize that given the realities of our economic situation coupled with the emphasis on sustainability, that focus is shifting dramatically from new construction to rehabilitation of the existing building stock? According to some numbers, there is more than 300 billion square feet of existing buildings in the United States today. While only a small fraction may be considered to have historical significance, nonetheless, educators must realize that engineers need to be trained to understand how these buildings are constructed and how they are most effectively renovated. If historic preservation takes the lead in demonstrating the need for special engineering training in these areas, we can argue that the technology is transferable to non-historic buildings as well. If the future of construction is going to emphasize existing buildings over new, then we need to make the educators realize this. More needs to be written in magazines and journals; renovation and historic preservation work needs to be featured in the main line publications.

Everyone will want to emulate success once it has been realized. Perhaps we should concentrate on developing a single, exceptional high quality program in preservation engineering. Something like what Fitch did when he started the Columbia program in 1964. Will it take a person with the charisma, charm, wit, brilliance, perseverance and skill of a Fitch to make this a reality? Does such a person exist? Could it be a team of people? Where would we find the institution willing to sponsor the program? Could

outside funding be found? Even if it is successful, how long would it take for the word to get around? And most of all, how big is the market and would there be a saturation limit to the number of institutions that could attract engineers into a heritage program?

Would it be better to try to expose all engineering students to the principles of heritage engineering and have them all develop the necessary skills? This would entail creating modules to add onto existing courses. My fear here is the one expressed several times above – there is no time in the present curriculum to fit in such a module unless they are willing to sacrifice teaching other components of the topic that they presently feel are necessary. This is likely to become an accreditation issue if universities begin to drop certain topics from their curriculum. Thus, perhaps it is the accreditation organizations that need to be approached first. Perhaps they should demand that heritage engineering skills be taught, much as the AIA has now included preservation requirements for architectural education.

Another way to provide an incentive for universities to offer heritage engineering courses might be to establish a national "certificate" proclaiming professional competence in heritage engineering. The Secretary of the Interior already has professional qualification standards for certain professions such as architecture, historic architecture, history and archeology. Why not have another step in this process that grants formal recognition of completion of a certain course of study? This would certainly create a market for educators to develop the necessary curriculum to satisfy the certification requirements.

Heritage engineering certification has been discussed at APT and it would be worthwhile to revisit those exchanges.

Has anyone determined just how many students would be interested in taking such courses? One would think that in determining the market, the actual number would be a critical piece of information. At the outset it may be quite a small number. If this is so, perhaps another approach could be attempted: Go to a university or several universities that already offer successful historic preservation programs and ask them to develop a module that specializes in preservation engineering. Then, any engineer who was interested in obtaining this training could enroll and come away with either a certificate or a masters degree that would show a clear specialty in engineering. Granted that this approach does not universalize heritage engineering training. Also to be noted is the requirement for an additional year or two of schooling, with the concomitant costs borne by the student. Many could not afford such additional training. However it is an approach that ought to be investigated.

Actually we have already accomplished some steps towards establishment of an engineering curriculum. John Matteo, who will participate later in the Colloquium, has developed a solid theoretical engineering curriculum using a grant from the James Marston Fitch Charitable Foundation to fund his research. This should be discussed in detail at the breakout session.

There is much that can be done at a national level to achieve the goals of establishing formal training for heritage engineering. But given the current economic conditions, it is most likely that any program will be market driven. The only way around this would be to obtain government financing through a new program, but that too seems far-fetched given the budget deficits. We must therefore determine ways to publicize our needs, to get them into the forefront and most importantly, to get educators to understand that there is a market out there for the product. If they offer it, we will come.