
# Guiding Principles for the Future of Civil Engineering

Aris Chatzidakis ECCE president

## Brave new world

Engineers have faced rapidly changing, complex and increasingly demanding solutions in an environmentally sensitive world.

- Our world faces the challenge of climate change and an unstoppable process of urbanization and population growth.
- Territorial justice
- Climate change is one of the biggest challenges of our time and its adverse effects undermine the potential of all countries to achieve sustainable development.
- Social and economic development relies upon the sustainable management of the world's natural resources.

# Brave new world

- The pace of technological innovation will continue to be rapid and will be deployed in a globally interconnected world.
- New materials, updated data analysis and expert systems together with new construction processes will demand new skills to its workforce and will change our work environment substantially.
- the 4th industrial revolution, artificial intelligence and digital technology create a completely new professional environment and business opportunities

# Brave new world

- New software facilities make routine calculations easier for engineers giving time for engineering synthesis. In the same time these facilities introduce the risk of creating the illusion that anyone can master them. Designer-analyst.
- Design will pass from two to three dimensions. This great innovation will change the way engineers have structured their way of thinking and their problem solving abilities.
- Globalization of the construction market will bring new pressure on working conditions on the engineers of developed countries face to their colleagues of developing ones. New ethical issues will arise.

# Our professional environment will be more and more digital

- Traditional building design was largely reliant upon two-dimensional technical drawings (plans, elevations, sections, etc.). Building information modeling extends this beyond 3D, augmenting the three primary spatial dimensions (width, height and depth) with time as the fourth dimension (4D) and cost as the fifth (5D). BIM therefore covers more than just geometry. It also covers spatial relationships, light analysis, geographic information, and quantities and properties of building components (for example, manufacturers' details).

## BIM is here, holistic information environment.

- For the professionals involved in a project, BIM enables a virtual information model to be handed from the design team (architects, landscape architects, surveyors, civil, structural and building services engineers, etc.) to the main contractor and subcontractors and then on to the owner/operator;
- each professional adds discipline-specific data to the single shared model.
- This reduces information losses that traditionally occurred when a new team takes 'ownership' of the project, and provides more extensive information to owners of complex structures.

## existing structures?

- The vast majority of the existing European building stock has been built without modern provisions for earthquake resistance and energy efficiency, resulting in seismic vulnerable and low energy performance buildings.
- Europe's basic road infrastructure was built mainly between the years 1950-1980. It counts already 40-60 years of life. When designed and constructed, technical knowledge was quite different as far as it concerns durability maters, earthquake risk and seismic loads, analysis methods and modeling facilities, pollution impact on ageing process of structures and most of all poor quality of concrete and completely different, less heavy, traffic loads.

## Recent progress on our structural ideas has been made mainly by our involvement with existing structures

- Interventions on existing structures, repair and strengthening , have become a very important professional object of civil engineers.
- The new generation of our Codes has a special part, Eurocode 8 part 3. Assessment and retrofitting of real structures have made us think the limits of our analytical methods.
- We have to calculate not an ideal structure that could adopt to our mathematical assumptions but a real structure with more or less badly known response. New ideas like level of knowledge, and performance level had to be adopted. We have to choose analytical methods that correspond to our level of knowledge .

## Sustainable Structural Upgrade

- These assets of European countries need urgent maintenance and retrofitting to keep their value and meet today's functional and safety standards.
- They need to be upgraded if Europe wants to maintain its productive and human respect standards.
- This represents a huge renovation and maintenance volume that Europe has to deal with during the next years.
- This has to be done with a sustainable and innovative way.
- The application of advanced asset and risk management methodologies based on research is needed to further increase the efficiency of interventions.

# Team work

- The global and complex reality will demand a multidisciplinary approach of engineering problems. A deep knowledge of principles of mechanics, many years of experience and a whole team with designers and analysts will be needed to keep engineering excellence on our professional status. Continuing education has always been a necessity to our profession.
- In any case, in this demanding environment, engineering design will be a team work but a team needs also a leader that is the engineering talent. BIM facilitates team work.

# Engineering excellence

- Engineering excellence requires the ability to draw upon a broad and comprehensive body of knowledge to make focused judgments about optimal solutions to unique, complex problems, in the interest of enhancing public health, safety, and welfare.
- A holistic approach which will require, through both education and training, a broad background of humanities, social sciences, and economics to understand and manage the impact of engineering solutions in a global, economic, environmental, and societal (i.e., sustainable) context while remaining well grounded in the basics of mathematics and science is necessary.

# Engineering excellence

- This holistic decision-making approach demands collaboration with non-engineers and will require better communication, management, leadership, and other professional practice skills on the part of engineers, in order to keep and show the critical contribution of engineering to society.
- Leadership in the ethical practice of engineering will be needed to hold paramount public health, safety, and welfare wherever engineering is practiced, independent of its origin and destination.

# Engineering excellence

- Professional practice requires compliance to each country's applicable laws, regulations, standards, and codes specific to each engineering discipline and area of practice. Efficient public procurement processes are key to deliver proper engineering and core to project success.
- Last but not least, the rapid and accelerating pace of technological innovation will require all stakeholders to enhance continuing professional development and lifelong learning schemes for engineering professionals

# Tradition and innovation

- The professions of engineers have a complex history, evolution and characteristics linked to country specifics. They constitute a substantial element of the European civilization, shaping the modern world and its traditions which have become part of our heritage. Innovation must be built in this sound tradition. A sound knowledge of the history of construction and engineering science as well as the history of our profession is essential for future engineers.

# European heritage

- The liberal intellectual professions, including of course this of engineers, are an essential element of European culture: they shaped our modern world and the traditions they created are now part of our heritage. Therefore the attempt of breaking down this framework of knowledge, collective conscience and ethical principles shared by the members of our profession is not based on correct assumptions.

## Engineering Profession ?

Essential attributes of a profession:

- Possession of a body of knowledge or art.
- An educational process.
- A standard of professional qualifications.
- A standard of conduct .
- Formal recognition of status by colleagues or the state.
- An organization devoted to common advancement and social duty rather than the maintenance of economic monopoly.

- Professional status is an implied contract: to serve society over and beyond all specific duty to client or employer in consideration of the privileges and protection of society extends to the profession.

# Professionalism ?

- Professionalism may be regarded essentially as the institutionalization of asocial distinction – a distinction between the leaders and the led which a particular expertise, acquired through approved methods of training and practiced under the discipline of an accepted code of conduct, is put at the disposal of society and rewarded in terms of status and with remuneration which benefits that status.
- “Ingegnere” used to be, and maybe still is,  a title of social distinction and respect.

# Madrid Declaration

- Civil Engineers, as members of the global community must base their practice in compliance with the ethical, human and social values of our time.
- Civil engineering should commit its expertise and practice to fulfill social and technical demands linked to the territory.
- Consequently, civil engineering, as a professional activity, should be able to identify feasible goals consistent with stakeholders' interests and concerns through effective management and efficient use of the tools and resources available.
- The existence of an Engineering-Society Nexus implies the mutual commitment on which engineers take the responsibility to faithfully serve society, whereas society is to provide the means to honor such undertaking.

# American Society of Civil Engineers' Vision 2025

Civil engineers serve as ethical, competent and collaborative experts:

- **Planners, designers, builders and managers of** economic and social engine of society, which is called **the built environment**;
- **Custodians of the natural environment and the proper and efficient use of its resources;**
- **Innovators and integrators of ideas and technologies** in the public, private and academic sectors;
- **Risk Managers** of any uncertainties caused by natural events, accidents and other threats; and;
- **Leader in debates and decisions** that shape both environmental and infrastructure public policies.

# Professional organizations

- Engineering associations incorporate and transmit the best professional practices built by the years of their experience.

- A global scenario in which the civil engineering profession contributes decisively to improve the quality of life of mankind, is necessary to establish sound partnerships between those who share common interests, for the benefit of our professional Engineers and society as a whole.
- Due to this, we advocate the need for the existence and irreplaceable role of Engineering Professional Associations to:

# Professional organizations

1. Regulate engineering practice for the sake of society, enforcing ethical and deontological codes of practice ensuring: honoring public interest; security and protection against unlicensed practice; efficient use of natural resources; environment protection; vulnerability reduction to natural disasters and climate change.
2. Provide continuing professional education to its members to keep professional practice updated with new materials, procedures and techniques.
3. Safeguard and promote adequate broad-based training of at least 5 years to be expanded throughout the professional life through continuous professional development.

# Mobility of Engineers

- Mobility of engineers is a historic reality. From the time of cathedrals, the architects of the time, the companies with their personnel have been moving freely over the years and the provision of dependent services by employment of engineers encounters no barriers.
- Meanwhile, the provision of independent services on an individual basis constitutes an extremely limited practice and there are also no severe impediments to the provision of counseling services on a corporation basis.
- Regarding the case where the author of a study differentiates from the person who, through its signature, assumes the technical liability, it is a current practice not restricted to the cases of cross-borders mobility.

## Independent practice

- The services of the engineer are provided within a relationship of trust and honesty with the clients and no other process could replace this personal relationship which is typical of liberal professions.
- Even if, nowadays the profession is practiced in larger units that integrate the knowledge and the experience of several decades, the profession of engineer remains to a great degree personal and the same holds with the liability and responsibility.

# Community Legislation

- The importance of the engineering profession, and civil engineering in particular, has been wrongly assessed by the European authorities in the later years.
- The attempt to deregulate our profession, lacking of any reasonable basis, could only be explained as obsession to liberal hard-liner ideologies.
- It is a pity that natural disasters, such as the late seismic episodes in Italy, or infrastructure failures, such as New Orleans levees' failure during Hurricane Katrina or Fukushima, the collapse of Genoa bridge, are required to bring awareness of the importance of the profession and the need of new regulations to protect final consumers of such services.

## Mobility Directives

- The professional mobility framework regulated by the EU under 2005/36 EC Directive on Recognition of Professional qualifications defined two mobility modes for civil engineers within: temporary cross-border services and a general system for professional recognition and free establishment in a host country. Such framework has been perfected by different European Court of Justice's case law rulings. The principles behind those rulings have been incorporated into the new directive 2013/55 EC which basically amends 2005/36 EC Directive on the recognition of professional qualifications.

# The revision of mobility Directive, now ….

- On the occasion of the revision of the Directive 2005/36 an assessment of its effectiveness should have been carried out, i.e. It should be examined whether it achieved to its goal.
- Nevertheless, in fact, it is admitted that no increase of the mobility within the European Union has occurred owing to this mechanism.
- Our criticism that, within the framework of the Directive, a horizontal approach of all the professions is followed and different levels of professionals are regarded as equals, at the expense of the most qualified professionals has proven valid.
- Furthermore, equally justified has been proven our criticism that the competent professional organizations and the chambers are faced with a hostile manner.

## What the Directive has achieved

- However, what the Directive did achieve, along with its subsequent interpretations was the establishment of a grey zone of second-class tertiary studies.
- Thus, instead of the mobility of professionals, it facilitated the accumulation, without the occurrence of any mobility, of titles academically inferior and not equal, albeit professionally equivalent.
- Therefore, by this indirect way, the Directive intervened in the educational process, followed in each country, although the Treaty is not purported to provide for such interventions. The professional chambers, as it is expected, opposed against this industry which has acquired over-time and the case-law of the European courts.

## Do we miss the target ? No the target is the social status of engineers

- It is difficult to see why, while the targets of 2020 talk about a knowledge based society and smart development and, besides , the problems become more and more complex, Community legislation promotes lower standards, permits minor effort and opens grey zones of qualifications accumulation through second class processes.

## Engineering studies

- There is a lot of concern about the reasons explaining why the studies of engineering are not any more attractive to young people. Apart from the social reclassifications which have downgraded several middle classes, the downgrading of the educational level of engineers and mainly its reduction to vocational training through the strategy of Bologna has significantly contributed to make the engineering studies less popular.

## Overriding reasons of public interest

- The regulatory framework of the engineering profession is necessary to safeguard the General Public Interest, safety and quality of construction works, protection and improvement of the quality of life of European citizens, sustainability, spatial planning and sustainable development of the built environment.
- These fall within the concept of "overriding reasons of public interest" as developed by the Court in its case law in relation to Articles 43 and 49 of the Treaty. This framework is a critical factor in anticipating natural disasters for the safety and protection of citizens in modern societies.

# ECCE position on mobility

- **New EU regulation will lack applicability without the committed involvement of professional chambers, concurring views with the European Council of Engineering Chambers - ECEC,** and other stakeholders in its discussion, implementation and operation.
- Any **new EU regulation on professional issues is to be discussed and agreed after a thorough assessment**, taking into account both intra-regional and inter-regional mobility.
- **EU regulations should provide a balanced framework as primary requisite to implement extra-EU professional mobility** under the coverage of EU's current and future Free Trade Agreements - FTAs.
- All **professional recognition regulations regarding civil engineering should bear in mind the specifics of this public service oriented and highly-qualified professional sector** with a duty of care towards all users of any public infrastructure or service.

# THANK YOU

***Aris Chatzidakis***
***President***
***European Council of Civil Engineers***