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SEMINAR

XII

Professional Responsibility in Structural Engineering

Les responsabilités professionnelles dans la construction du génie civil

Fragen der Verantwortung im konstruktiven Ingenieurbau

Panelists:

Moderator:	Jacobus H. Wynhoven, Dr. Eng., Toorak, Vic., Australia
Owner:	Roger A. Dorton, Manager, Struct. Office, Min. of Transp. and Communic., Downsview, ON, Canada
Engineer:	Gerald F. Fox, Partner, HNTB, New York, NY, USA
Contractor:	Frans Nije, Ballast Nedam Groep N.V. Amstelveen, Netherlands
Community:	Marita Kersken-Bradley, Dr., Ing. Büro, München, Fed. Rep. of Germany

Taking part in the discussion from the floor:

S. Bonasso, USA
B.P. Wex, UK
W.J.R. Smyth, UK
A. Tedesko, USA
M. Stiller, FR Germany
J.H.R. Haswell, UK
T.N. Subba Rao, India
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MODERATOR
On behalf of my four colleagues I welcome you to our panel discussion entitled "Professional Responsibility in Structural Engineering". You will agree, a broad and ambitious title for a seminar. You will also ask what the title means, why it was chosen and what we hope to achieve.

The Oxford dictionary defines "professional" as a person having great skill or experience in a particular field or activity. While "responsibility" is defined as a duty, an obligation, or a burden or a thing that one is responsible for. I dont think that makes you much wiser, but that's the definition by the Oxford dictionary.

Why we chose this theme: The scientific commitee, in following the conference theme, "Structural Engineering Today and Tomorrow", considered, that the problems facing the engineer today, are not just technical, but many human problems have to be recognised and overcome. These people problems are going to become more dominant tomorrow and we therefore wanted to have some relief from the nitty-gritty technical subjects (with which engineers feel very comfortable), and to tackle some of the people problems, (with which engineers feel least comfortable).

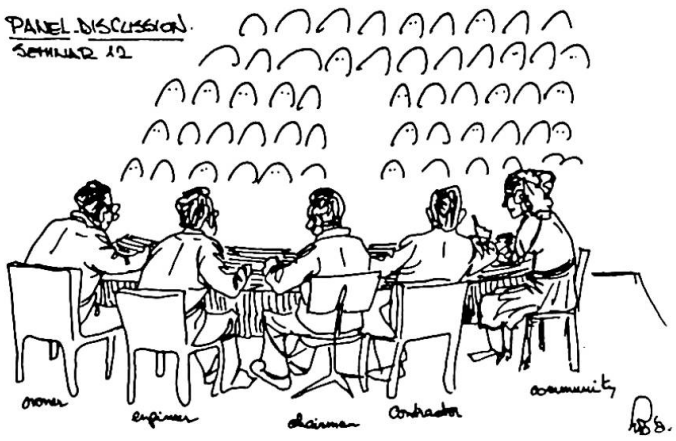
We wanted to take the opportunity of exchanging our concerns and attitudes with our international colleagues, and through this free exchange, open a debate that can be continued if thought worthwile at future symposiums.

The theme: the engineering profession around the world is experiencing increased community, legal and political demands, which is causing confusion, frustration and dissapointment, particularly for the younger engineer, whose education has a very strong technical bias. The engineer grows up, believing he applies the laws of nature and technology to improve the living standards and well-being of the community, which educated and trained him to its standards. He does not understand that the bridge, building, industrial complex or community facility is not wanted, or often strongly opposed by sections of the community. In fact, even when he practices the art of engineering - and I empasize art rather than science - to his best abilities and uses the best available knowledge within reasonable economic constraints, he may still finish up in court defending himself against a claim from the owner.

The degree to which a particular community or country takes the engineer to task for his action will vary considerably, but there is uniformity in the fact, that the demands on the engineer today, will be even greater tomorrow.

We hope today, to explore by audience-participation the way in which this increasing professional responsibility is affecting us personally and professionally, whether it will hinder innovation in order to reduce risk and what - if anything - we should be doing about it as individuals and as a professional body such as IABSE.

The broad and ill-defined nature of the problem, that we are going to discuss, has required us to set up some simple rules within which the panel will act as a frame work. The panel consists of four parties and we consider these to be representatives of the four parties that you would have in any engineering project. They are: The owner, the engineer, the contractor and the community. Each of these parties has a role, a responsibility and an expectation.



These are the roles as we see them:

The contractor:	to contract and execute,
The community:	to be the economic, social, legal and educational environment,
The owner:	decides on the project, arranges for its design and construction, owns and operates the facility,
The engineer:	plans and designs the project, administers the contract, monitors that construction meets the contract.

I will now ask in turn the panel members to define their expectation and responsibility. The first speaker will be Mr. Roger Dorton who is the owner.

OWNER

As the Moderator has indicated, I am going to give the owner's expectations of the three other parties that are represented at this table and in turn I will just brief it out, what I think an owner would expect of 1. the engineer 2. the contractor and 3. the community.

The engineer is expected to provide to the owner the technical and other expert advice for which he was engaged. He expects the engineer to act in the owner's interest in a professional manner, that means he has to have some independence obviously and not compromise his professional position. He expects the engineer to provide a safe, economical structural design. If, in fact, the engineer is to monitor the construction - I think monitor is the word that the Moderator has used, we have been careful not to use the word supervise - if in fact he is doing that, he would be administering the contract, to make sure the contract between the owner and the contractor is properly carried out. So the owner expects the engineer to administrate the contract in a fair manner. And the owner would also not expect the engineer to provide him a service beyond his technical competence.

The owner's expectations of the contractor would be to fulfill the contract on schedule to the required quality, to negotiate fairly any claims that might arise. These next items might be a little less specific, but I think an owner would expect a contractor to draw his attention to any inaccuracies in the documents or any omissions, rather than to hide these and bring them up as rather difficult claimed items on a later date. He would expect the contractor to co-operate with other parties to successfully complete the project. And obviously he would expect him in doing this to abide by all the laws governing the construction-project itself.

And the owner's expectations of the community: to bring legitimate concerns to the owner's attention early, not to obstruct the construction if all legal requirements have been met.

That is about what the owner expects of the other three parties and now I want to spend a few minutes on dealing with what the owner's own responsibility would be. I divided these into a number of categories: 1. the responsibility of the owner to his own organisation. Obviously he has a responsibility to build a structure in accordance with the expectations of the owner that he represents. That might be an incorporated company in which case he might have to meet the exceptations of the shareholders, and meet the commercial objectives of the company that he represents. Dealing with the other type of owner, either a semi-public or public organisation, he would have the responsibility to build according to agreed requirements following some input, both from the government policy point of view and also some input from the community itself.

The owner would have a legal responsibility to the community to build in accordance with and to have a knowledge of all governing laws, building codes, safety regulations and environmental restrictions. The owner would expect to have a financial responsibility both to the engineer that he engages and to the contractor with whom he contracts, to be financially viable to undertake the project, to be able to pay the engineer, the contractors and other parties engaged and to be insured adequately to provide financial protection to all the parties engaged and the public in a case of mishap.

I will also add what I call a moral responsibility, somewhat less easy to define in relation to the community, but I think the owner as a member of the community is expected to consider possible adverse effects of his structure on that community, during construction and during

service and is expected to minimise the impacts of that work. He should be prepared to consider the legitimate concerns of the community.

The owner would have a professional responsibility in relation to the engineer with whom he is working, to engage and treat the engineer in keeping with the requirements of whatever the professional engineer's act or similar legal requirements are in the location in which he is carrying out his work. And obviously in conclusion he has a legal responsibility to the contractor to abide by the terms and conditions of the contract, that they have engaged in.

MODERATOR
Thank you, Mr. Owner.
The next party is the engineer Mr. Gerry Fox.

ENGINEER

First adressing the expectations that the engineer might have of the other 3 parties and treating the community first, I believe that the community should be critical of the project in its early stages, from an esthetic, an economical, an environmental and a functional viewpoint. But, once a decision has been made and the project approved, I would hope that the community would not harass and obstruct the project from going ahead.

I would expect that the community would have adequate laws to protect the workers and public during the construction period. I would also expect them to be prompt in approvals and in issuing permits for the construction. I would hope that the community would understand the risks that were connected with the project. And lastly, that they would be patient during the construction period.

Turning to the owner, I would say that the engineer's expectation of the owner is that he would make prompt decisions on the recommendations and the alternatives proposed by the engineer. That he would give support to the engineer who is really truly representing him.
The client should review and pay invoices promptly for professional services and also for the contractor's work. I would hope that he would be sympathetic to the engineers or contractors plea that they are performing extra work that is essential.

The engineer's exceptation of the contractor is that he would make prompt submissions of erection schemes and working-drawings. That he would have a quality control program for the project and that he would cooperate with the engineer during the construction and monitoring period. I would expect the contractor to construct the project according to the plans and specifications. The contractor should be well aware of safety, and have a well thought out safety-plan for the project. He is also expected to complete the job within the time period specified in the contract.

Turning now to the the responsibilities of the structural engineer I would say that he must be loyal to his client or the owner unless there is a clear conflict with his professional ethics. He really serves as an arm of the owner and he should keep the owner completely informed during the life of his assignment.

The engineer develops alternative structural schemes for a project, recognizing the objectives of the owner and the community. In addition the resources available and constraints imposed must be taken into account. He should advise the owner of the costs, advantages and disadvantages of the alternates studied to enable him to make a meaningful choice.

The engineer should establish the functional and design criteria to be used for the final design. He should inform the client as to the risks that are inherent in choosing criteria such as return periods of earthquakes or wind. He should design an economical structure that is safe and will last at least as long as the intended life. He should prepare the plans and specifications for the project as well as the bidding documents.

The engineer should assist the client in evaluation of bids and award of contract. He then during the contract administration period would review the contractors submissions such as erection-schemes and working drawings for compliance with the plans and specifications. He would administrate the contract and also monitor the contractors operations to ensure that the plans and specifications are being followed.

MODERATOR
Thank you Mr. Engineer.
We now ask the contractor, Mr. Frans Nije to state his expectations and responsibilities.

CONTRACTOR
I will reverse the sequence and start indeed with the responsibility of the contractor. As we have chosen a rather traditional set up of the relations between owner, engineer and contractor, this makes it quite easy for me to define the responsibilities of a contractor as for this situation almost everything has been determined already for him. The simple thing he has to do is to execute the contract in time and quality and that is his main responsibility. In addition to that, I guess, it is very important that contractors do not accept contracts which they are not capable of performing.

May I then go to my expectations of owner, engineer and community: I feel that work should never be hampered by lack of budgets or delayed payments. This is one of the main expectations of a contractor. A contractor expects a clear definition of plan from the owner. He should not have later on too many changes to the contract. A third thing is, certainly in our complex-society nowadays, both at home and abroad, that the contractor shall have his permits, necessary to perform the contract in time. Owners sometimes hampered by external influences, may need reverse decisions. Important saying is, that these decisions are to be taken as soon as possible. As for the contractor, unexpected situations can occur, it is important that the owner is fair in his judgement as far as the new conditions and its contractual consequences are concerned. At last but not least in view of the audience, we feel that one of the most important saying is, that the owner selects a professional engineer for the design and contract services he requires.

I now come to the expectations from my side of the engineer: we expect him to deliver a product of a professional standard, technical-wise, administrive-wise and budgeting-wise. Let me highlight the last thing: as an owner very much depends on the budget advised by the engineer, a project can be very adversely be influenced by wrong advises from the engineer on that point upon award of contract and when judging claims. We contractors consider the engineer as the in-between judge for contractor and owner. In order to perform this task, we expect from him impartiality. Very important saying we have to face, certainly on international contracts, the matter of obtaining approvals for work methods, site-conditions, materials etc. These approvals and especially the time aspects related to it are of prime importance, so I expect from the engineer time conscientiousness.

Then we move on to the community: The community shall have to take care of the final approval of the plans, and the necessary budgets. In addition to that, I expect industrial laws, which facilitate the contractor to perform his work. The same applies to social laws and conditions for a contractor to work under. I am mainly referring to labour laws which allow special employment conditions for labour in the construction industry.

MODERATOR
Thank you Mr. Contractor, we now call upon a community representative, Mrs. Kersken-Bradley.

COMMUNITY
Since the three preceeding parties identified themselves as truly ideal and responsible members of the community, at least verbally, I am now in the situation to have to repeat some of the statements previously made. I as well prefer to start off with the responsibility of the community, according to my opinion.

The responsibility of the community is to provide for a legal, economical, educational and social system within which these three parties can operate to meet their roles and thereby meet, or at least not interfere with community needs and desires. In turn the community expects these parties as well as any other party, to be aware of their responsibility as members of the community themselves.

My particular expectation towards the owner asks for the following conduct: He should adequately inform the community of the intended project, he should attempt to establish a sensible relationship between the hazards imposed on the community due to the construction, existence, operation and performance of the structure, and the benefit to be expected from the structure. He should select qualified engineers and contractors only, this also includes for example that he selects tenders, not only with regard to the minimum price. I expect him to establish appropriate contractual arrangements, including e.g. a sensible allocation of tasks to different parties and a clear specification of rights and duties, appropriate to the tasks, as well as fees and payments appropriate to the tasks. This also comprises a comprehensive coverage of all safety-related tasks, the collection and transfer of necessary data to the engineer and the contractor, a timely consultation of engineers and finally an acknowledgment of the responsibilities of all contracting parties.

My particular expectation towards the engineer asks for the following conduct: He should provide the owner and the community with a safe and economic structure. This he may achieve by pursueing alternatives with regard to technical aspects and to the allocation of costs to the effort in planning, construction, operation and maintenance, by considering all relevant code requirements and assessing their adequacy (with regard to safety and economy for the particular project). This also implies, that he does not accept commitments in excess of his experience or knowledge, if experienced colleagues are available or that he at least consults experienced colleagues. I expect him not to accept commitments on inappropriate terms of contract that is, when tasks and duties are not clearly specified or where rights and fees are not in appropriate relation to the tasks, or where the owner does not fullfill his own task. I also expect the engineer to represent the safety concerns of the community and I expect him, to provide for economic coverage for possible consequences of his errors, e.g. by insurances. Finally I also expect the engineers as a profession, to inform the community on the possibilities and limits of prediction in engineering.

Finally, my particular expectation with regard to the contractor, asks for a conduct as follows: he should provide the owner with the structure according to his contract by e.g. ensuring working conditions allowing good practice, by persueing a tight cooperation with the engineer and the owner, by subcontracting works which are in excess of his own qualifications to qualified subcontractors. I expect him not to tender below financially reasonable limits and I expect him not to accept terms of contract, e.g. with impracticable structural specifications, with unduly time-contraints and where tasks, rights and duties are not clearly specified. I also expect him to provide for an economic coverage for consequences of errors e.g. by insurance. Finally I also expect him to acknowledge the professional responsibilities of the engineers working within his contracting firm and with those engineers representing other parties.

MODERATOR
Thank you, the community.
And now a call for members of the panel, who have disagreements with those expectations and responsibilities expressed by any of the other parties.

COMMUNITY
The first two parties strongly emphasized the issue that the community should not interfere

in a project anymore after a certain stage of approval has been accomplished. But on the other hand, I would like to point out, that the owner as well as the engineer often do not inform the community in time on the critical issues of a project.

OWNER
As the owner I have stated that in order to carry out a project on an economic basis I have to abide by all the legal requirements. As an owner I think that legal requirements come from the community and one has to operate within known boundaries. It's very difficult for an owner to guess what the community's reaction might be. It might be the beginnings of the feelings that eventually lead to a change in the law. But I think all the owner can be expected to do is to abide by the law as it stands at that time and not be expected to constantly change it during the project by trying to react to the changing perceptions perhaps of the impact of the project upon the community itself.

COMMUNITY
The legal requirements generally refer to very well experienced hazards and risks but we are talking of projects with risks and hazards which (fortunately) are not well experienced and which have to be identified by the owner and the engineer in time, so that the community can decide whether the common legal constraints sufficiently cover these hazards or whether this is a new situation which has to be dealt with individually.

ENGINEER
In general, all codes or other legal requirements are not sufficient to apply to all projects and it is certainly the duty of the structural engineer to modify or to recommend the use of a different code procedure when he feels that the written codes are inadequate. And certainly the risks arising out of his making these changes would have to be thoroughly examined. He should certainly inform the client about the changes and risks and I would hope also the community for major projects.

MODERATOR
Any other question from amongst the panel?

OWNER
The community had indicated, that the owner should not select the contractor based on price but there were other items that should be brought into consideration. As owner I find this is very difficult to do, and that an owner to have the confidence of the contractive industries must feel that any contractor who has been through business of preparing a bid at great expense should expect to get the bid if he has prepared it in compliance with the requirements and his is the lowest price. It is very difficult to return to a contractor and try to identify in which way he is deficient in regard to the community at that bidding time and I think it is essential that the requirements of the contracts be stated at bidding time and in fact, if the bid is prepared fairly and properly it should go to the lowest bidder, provided the owner obviously needs to have guarantee, as to the financial capability of the contractor. But I think there is an expectation on the owner's part that the bidder will fulfill the technical and quality assurance requirements of the contracts satisfactorily.

MODERATOR
I would just like the view of the contractor on that because he is very much affected by that policy of the owner.

CONTRACTOR
This of course is a very popular subject and the situation is very much hated by the contractor. A contracor who is lowest bidder, for sure expects to get that contract. And unless he has made an irresponsible or incomplete bid, he expects the client to give that contract to him. The actual measures and the criteria on which the client and engineer can determine whether it is finally justified to give the contract to No. 2 are very difficult to establish. In these cases, there is in fact only one good solution: open the whole bid completely and discuss it in detail and it is up to the contractor then to prove by facts that he can and will fulfill the contract in accordance with the specifications and for the contracted budget.

ENGINEER
I would like to state that there is one small safety valve for this case in a lot of jurisdictions and that is that contractors are required to be prequalified to work on a project of any size.

MODERATOR
Thank you. I now invite response from the audience on what you have heard so far, or criticisms you have, or agreements?

Sam BONASSO, USA
I have a consulting engineering and architecture office. It seems that there is a dimension missing from the presentation that you have provided us: the time-line. The responsibilities that all of you are involved with prior to the contract award are considerably different from the responsibilities after construction commences. I think your comment, Mr. Engineer, about prequalified contractors is probably one of the things that occur before the project becomes a reality. Once the project becomes a reality it seems that your responsibilities are on a different level. I can not imagine with a group of prequalified contractors why the owner would'nt give it to the lowest bidder. But by the same token I understand the community's concern about having appropriate contractors bidding on the project. It's the same question with the owner as to whether or not he has got a project that the community wants. If the community truly does want it, there's no question about it moving ahead. So my point is that there seems to be an element of time after which the responsibilities of everyone are dramatically different. When the project goes ahead, the engineer's responsibilities to the project are considerably different, than his responsibilities while it was being designed.

OWNER
Regarding this question of pre-qualification I think we have to separate the different types of owner, who might be represented. If it is a private owner, then by all means, you can pre-qualify based on past-experience or quality of work, whichever you so choose. That is rarily open to a public authority which is the owner. However in the interest of public opportunity and equal opportunity, you might say, the only type of qualification that is normally exercised in that case is one of financial capability. I'm leaving the contracts as qualified on their financial capability to do work of a certain value. They then have to establish a competence on the job to do the work, but that is not carried through from job to job. This might be an interesting point Mr. Moderator - we use this kind of pre-qualification - could it operate in different jurisdictions?

Bernard P. WEX, UK
The Client felt he had to use open tender lists to permit full and fair competition for the benefit of the Community. Surely for a public client this is a dangerous policy, especially since minimum price is used as the basis of contract award. For this reason I would expect a public client to be very discriminating in his choice of bidders; that is he should be sure of the qualifications of each bidder to carry out the work, should he submit the lowest-tender. Perhaps the private sector if it wishes might use open tender lists of non prequalified contractors, and face the consequences, but public works, in my opinion, should not be subject to such risk. The private sector may not necessarily work on the basis of selection by minimum bid, although it seems the public sector finds it very difficult not to do so.

OWNER
Yes I think certainly if you are dealing with exceptional structures, I have no argument at all with what you are saying, but I think that is not a situation that we are faced with 98% of the time. I think most public works that we are dealing with are works that 20 or 30 contractors can capably bid on, and thinking in terms of Mr. Wex own experiences on long-span suspension bridges and orthotropic box-girders, certainly the number of capable contractors there would be extremely limited and I do not think we have in mind these extreme types of structures, I hope we are dealing with more normal structures for which there will be a number of qualified people to bid and, that we would not really have to restrict in that fashion.

William J.R. SMYTH, UK
It seems to me that it is an awful waste of the community's resources, to have 20 or 30 contractors bidding for a project and it is unfair on the contractors themselves.

CONTRACTOR
I shall first respond to the previous speaker. I am talking more about the international situation: based on the amount of paper-work we, as contractors, get on our desks for pre-qualification purposes, I certainly can not support the picture given by Mr. Owner, in which only the financial data of a contractor determines, whether he will be qualified for a certain type of work, or not. Furthermore, internationally, there are agencies which have a system - and I am now referring to the World-Bank - where the two aspects are separated, even separated in a tender stage when you have to present a technical bid and in addition to that, in a separate envelope, your financial proposal. In these cases, there is due attention given to the technical aspects, and they may even be weighed more than the financial ones.

The matter of having 30 or 40 contractors bidding on a project, again, I fully agree with the last speaker, is not fair towards the contractors, and the community, in terms of money spent by contractors on preparing tenders, and community-money spent on evaluating tenders. It is for sure, that a good pre-qualification procedure, which finally ends up in a listing of 5-10 contractors, is the only reasonable approach for bidding projects.

MODERATOR
Mr. Engineer, could you respond how you are affected by these pressures from the owner and the contractor?

ENGINEER
The engineer would want to have a means of having some qualification of contractors beyond price. I think that there are too many times, a contractor secures a job, which he is not qualified for, and the engineer spends quite a bit of time making sure that the owners interests are kept. I agree with the contractor, that having 30 contractors bidding on a job, is wasteful, and I also believe that in the near future we may see 30 engineers bidding for the design which would be equally as wasteful.

COMMUNITY
Would we want the lowest bid criteria for engineers?

Anton TEDESKO, USA
I do not mean to interrupt your discussion, as there may be more people wishing to add to what you have just discussed. But I would like to bring up another subject. I would like to have the panel's thoughts on what Professor Thürlimann brought up during his address at the opening session of this Congress. I would appreciate having your reaction as to what should be done in the face of the interference, overregulations, and delays with which we are confronted on so many jobs. We have to work in that direction. How should we approach the subject?

MODERATOR
Thank you, perhaps that could be one of the case studies we will cover.

Manfred STILLER, FR GERMANY
We should have in mind, that one pre-condition of your discussion is, that the four partners on the panel, are different, separate bodies. You know, that there are combinations very often, that the owner at the same time is the engineer, the contractor is an engineer and the owner is at the same time the community. And, I think, all the expectations, you have pronounced are the same if you have this case of combinations, or do you have other expectations?

MODERATOR
Thank you, that is a very interesting point, of course, we were faced with this problem and we were trying to define a structure, in which we could have this sort of discussion and we had to limit it to a more traditional and - if you like - pure set-up. There is no doubt that when you have the owner also acting as the designer, as often happens - for instance our OWNER here is in fact in that very position, but we have asked him to forget that and just wear the hat of an owner. Likewise, the contractor would often be in a situation where he would also be the designer. We have deliberately adopted the traditional basis in order to simplify the discussion.

J.H. Roderick HASWELL, UK
I am an engineer in a private practice in England. I regret that I disagree strongly with Mr. Fox on his definition of the engineer and his duties. I am convinced that it should be an absolute requirement that the Engineer's first duty should be to his profession. It is only in that way that he, the engineer, may be and be seen to be properly independent. In addition to the obvious advantages for the Works this arrangement would lead to a great improvement in the matter of engineering disputes since there would no longer be any possibility of questionable ethical considerations having affected any of the Engineer's decisions. Where some form of hybrid arrangement exists as for example where the Employer is a Government Department or large Local Authority and his (the Employer's) representative is also acting as the "Engineer" for the Works, the spirit of the Tender System is lost. I believe that in such a case since the person concerned is a direct employee acting merely as some form of technical assistant of the Employer he ceases to have the right to call himself an Engineer. In a recent case when I asked a senior engineer who was a civil servant (i.e. a government employee) where his first duty lay, he replied "To my Minister". I told him that unless he appreciated that his first duty was to the profession he could not properly hold himself out to be an engineer, he was surprised and seemed clearly never to have considered this truly fundamental issue.

Certain of the other definitions we heard from the Owner and the Community seem to be somewhat ingenuous. Further, while I as an Engineer was glad to hear that it was thought that the Community should pay for the Engineer's professional indemnity policy, I find it difficult to imagine how that might be arranged.

I consider the Invitation System of Tendering to be the best arrangement. I also think that it would be in the best general interests if tendering costs were to be included in the capital cost of the Works. This was done I believe in a case in Germany some years ago. Not only would this be fair but also it would make a significant reduction on costs generally.

ENGINEER
I did not think I was defining engineer, I believe I said that in fact the engineer must be loyal to his client, unless there was a clear conflict with his professional ethics. I also said that he serves as an arm of the client.

T.N. SUBBA RAO, India
What should be the stand of the Engineer vis-a-vis the Owner and Contractor, in the event the Owner does not meet timely payments to the Contractor and the work suffers therefor? Should he support foreclosure of the contract, if the contractor is unable to perform in consequence and support him in every way regarding compensation, etc. without sideing with the owner or should he place himself purely as a technical supervisor of the contract and leave the payment aspect to be settled between owner and contractor and remain aloof regarding his claims? Since the 'Engineer' acts for and on behalf of the client on the

contract and also has a professional responsibility regarding equitable handling of the contract, his position becomes somewhat hazy under such a situation.

Is it not the responsibility of the Engineer to issue a completion of 'work' certificate immediately on completion of the job without referring to the owner, although this is not saying completion of the 'contract', which authority lies of course with the owner. Does he always exercise this right, without clearing the same in advance with the owner? If not, why not?

Both the above issues are topical in the Mid-East and North-Africa where the engineer has often remained silent, perhaps with a view to retain his relationship with the client intact.

ENGINEER
First, the construction contract is between the contractor and the owner and not between the engineer and the contractor. So as I understand the first question if the contractor is performing the work, and is not being paid, what can the engineer do? The engineer can only recommend and urge the owner to pay the contractor. Since the contract that the contractor has entered into is between himself and the owner the contractor is going to apply pressure to the owner to receive his money. The engineer has no direct contractual relationship between himself and the contractor. He certifies that the work is complete.

CONTRACTOR
I may combine the last speaker's remarks with the Engineer's, where the matter of being professional was raised. The problem that is layed down, in fact, handling contractual matters rather than pure technical matters, has very much to do nowadays with the profession of the engineer, and whether the engineer is educated for it? Much shall depend on whether he has been educated in the field of contracts, law and related matters. I think a lot can be improved educationalwise to that respect. Another thing is whether, and to what extend an engineer, has a duty in a conflict as presented, on the matter of the payments. Very much will depend on, what the actual brief is, in other words what does the contract between the engineer and the owner state as far as the duties of the engineers are concerned. We at least internationally, and especially in the Middle East, have examples and I mentioned that yesterday in my paper, where the function of the engineer, in very many cases is eroded and limited to being a technical supervisor only. In such a case it will be clear, that the contractor is dealing directly with the owner, to get his payments effected.

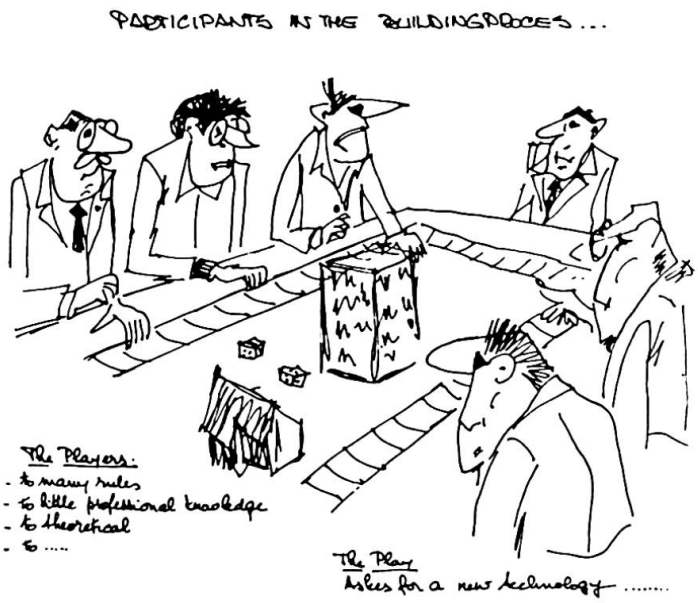
OWNER
There are different ways of writing contracts and different duties for the engineer. I had indicated, as the owner, that my expectation of the engineer was to administer the contract with the contractor fairly. That may sound like a strange statement coming from the owner, when I think the engineer in fact said that he would act as the arm of the owner; so obviously we are talking about two different types of relationship here. The one I am most familiar with, is where the engineer is in fact a separate body, and not part of the owner-organisation. In that his function changes when he is initially engaged by the owners, for carrying out planning and design and preparation of contract-documents, he is obviously working directly and solely in the owner's interest. Once a contract is signed with a contractor, and he has some field duties, I see his function primarily being one of overseeing the correct application and fulfillment of the contract and as such he should be acting in a far more impartial fashion, than he was when he was acting solely as the agent of the owner, doing the contract-document preparation. That is how I see things happening in Canada. It may well differ in other jurisdictions.

Jiti KHANNA, Canada
I am a consulting engineer. The practice here in the USA and Canada is for the design-drawings and contractual documents to be prepared by the engineer, and then for the contractor at the stage of execution to prepare certain drawings such as fabrication drawings and so on, that at some state get reviewed by the engineer. There have been a number of instances where difficulties have occured with the project, some failures have occurred which have related to some deficiency in detailing by the contractor. However

because the engineer has either carefully or superficially reviewed the drawings of the contractor, therefore there has been a certain transferrance of responsibility for this deficiency or error from the contractor to the engineer. And the question which I would like to pose to the panel, is, how do they see this particular problem, what is the expectation, when the engineer reviews a drawing, which according to the practice here is a review for concept and not for detail, and in such instances of course the contractor advances the proposition that since the engineer looked at it, he basically took upon himself the contractors' responsibility.

MODERATOR
I will have the owner's firstly respond to that, but before he does, we will make this the last question for this general response from the audience, and then I would like to get on to at least a couple of the case studies. I am delighted to see the response that we are getting from the audience and obviously you are creating many case-studies out there yourself, but I would like to run through a couple that we have and all of you will certainly get a chance to raise any concern you may have.

OWNER
As an owner obviously I do not want to have a conflict of direct responsibility and if I was an enlightened owner or a wise owner I would make sure, that the contractor is responsible for the preparation and the outline of exactly what the contractor is responsible for. This is, I agree, is a major problem but I think most public jurisdictions anyway make the contractor responsible for the preparation of shop drawings, and then the owner, if he has either his own engineering department or a separate engineer carrying out a review of these, is careful not to have that engineer also stamp or "approve" those drawings, but use the term "review" or give "permission" to constructor or whatever strange wording one choses to concoct, to somehow minimise this conflict between the person who has the responsibility in law, and the person who is acting to try and make sure that the public is adequately safeguarded by having a second party have a look at it. It is certainly a difficult area, and I agree that once something goes wrong, however well you define it in the documents, anybody who has looked at it, and made any comment on it, is, I think, in some fashion implicated and is unable then to extricate himself completely from some responsibility I do not think that is an easy answer, but I want to try and make it as clear as possible, who is the responsible party in law.



MODERATOR
We will now start on the first case-study which I have projected up on the screen for you as a newspaper-headline:

CODE WRITING BY VOLUNTEER ENGINEERS.

We would like the panels response and the audience's reaction to the situation, where engineering codes are generally written by volunteer engineers, whether they are academics or practicing engineers or representatives of various government authorities. They are volunteer engineers, they do that work generally in their perceived responsibility to the community and to the profession because they consider that it will raise the standards and quality of engineering. But what is developing in some countries, is that the volunteer engineer may find himself beeing sued because of clauses and conditions that are written into those codes. I believe that to be the case in North America and certainly there are signs

of that also happening in Australia, so I would like the reaction, and I think I would like to start with the community, - who benefits from this - on their thoughts on where that engineers responsibilities lie and also whether or not he has been fairly treated?

COMMUNITY
First one could argue that the situation might be worse if codes were not written by engineers but were written by lawyers and architects. Then one could also argue that, when you write a code, you actually know that it many become mandatory and that you may put technical features which you consider as not suitable to be mandatory into design-guides or recommandations, you have the option to do that. Then you should also consider that codes are not necessarily only constraints on professional freedom, but also provide some legal protection.

William R. VARLEY, UK
What do you mean by the word "mandatory"?

COMMUNITY
This question should actually go back to the Moderator, he said "In some countries, codes are written by volunteer engineers, and then are adopted as building regulations, laws, or implemented into a legal system".

MODERATOR
Correct, that is as I understand it in North America and also in Australia, I think it is generally the case in most English-speaking countries.

William R. VARLEY, UK
I would like to explain, why I asked about the meaning of the word "mandatory". It is because in many instances I find it confused with the word "compulsory". The two words are not identical in meaning. A code described as "mandatory" gives a mandate, an authority to work to the limits of the code. If the person mandated considers the code incorrect, or inappropriate, a change to the mandate can be sought. If the code is applied as a "compulsory" document then an engineer is not needed. Anyone can implement it. It becomes a strict code and the operator is held to it; you would be working by vote using a do-it-yourself kit provided by the code.

ENGINEER
I think it could be a very serious problem; i.e. the use of volunteer engineers to actually draw up a code. A famous case involved the American Society of Mechanical Engineers who had a code-writing body composed of volunteer engineers who might have been biased toward some provision of the code, due to perhaps where they work etc., and or least that was implied. Because of the provisions of the code, there was a company, I believe, that went out of business and then sued the American Society of Mechanical Engineers citing the bias and won a very large settlement. There have also been suits against the American Society of Testing Materials, who develops standards. It apears that in the future, it might be almost essential, that codes be developed under government auspices. If a government sponsored the code, then more or less the volunteer engineer who works to develop the code would be immune from liability as an individual. The government might be sued, but not the engineer as an individual. I feel that in the future it will get worse than it is now and that probably something will have to be done along the lines we just discussed.

Leon GRILL, Australia
I am very sorry that I will probably disappoint many of you here, but the code problem is a very "sticky" one, and just trying to define some clauses from a legal point of view, only makes things worse. It has been said, and quite correctly, that we can design strictly according to the code and the end-result is a structure which will still collapse. Such a thing as a perfect code does not exist. There is not a single code which does not contain mistakes and the fact that in most countries codes are revised every two or three years, not due to new discoveries, is proof of this. I compared about 14 codes from different countries, and concluded that there is one code that is a little better than others for a very simple reason: it is the smallest, it is the simplest, and gives only basic, general information and makes two statements: 1. It is assumed, that its users possess the necessary technical insight, and 2. if safety is assessed by both calculation and testing, the results of the tests should govern. This is the Danish code, which does not pretend to provide solutions to every problem.

There are no perfect codes. In every code there are areas and some rules which have been proved to be giving misleading information by reports and lessons drawn from the literature on failures. It seems to me that at the present the greatest beneficiaries of our codes are the lawyers. The codes should not be mandatory. The lawyer should draft a footnote, "Nobody should sue an engineer who followed the code or sue a professional who drafted the code", because in this case, in the future, nobody will help to write a code, so we will not have codes. And I am afraid I will not agree with Mr. Engineer that responsibility for drafting codes should be shifted to the government. I do not believe that, necessarily, engineers who are working for the government are very much better than engineers who are working in a private practice. So perhaps codes should contain just general information for guidance only.

The more complicated, the bigger is the code; and this is only misleading young engineers who consequently believe the code is a bible and are following the code strictly and later on, often the results are giving problems: all sorts of failures from minor ones which are affecting only esthetics to those which are affecting serviceability and to the extreme ones, which are just failures of partial or total collapse. And there are plenty of them. The community is unaware of this for a very simple reason. Even not all engineers know how many failures there are. Obviously it is something which is not published sufficiently. Perhaps we should learn very much more from studies and lessons from failures than from the codes.

Ken WITTHAUS, Rep South Africa
I imagine the situation may vary from country to country, but certainly in South Africa codes of practice as such do not have any force in law. They are guides to the engineer in his design and unless legislation were passed, requiring an engineer to design to a specified code of practice, they would not have any legal force. But in our country, and I believe we are not unique, (I happen to know that similar things are happening in other parts of the world) there is a move towards exactly what the Engineer has indicated might be coming. We started off in South Africa with building by laws in various different municipalities. These mainly affect architects and typical building construction, but they have the force of law. More recently we now have in draft, in fact it is going through a national Act and Regulations. We have a "Bureau of Standards", which is a national body and it has prepared an Act of Parliament which is a set of uniform building regulations, and these actually incorporate much of what is normally included in codes of practice. There is quite a tussle going on in the professional bodies, e.g. we in the South African Institution of Civil Engineers are very concerned about some of the provisions that are being made in this legislation. We are contesting such things as in certain cases the principle is being established that one is guilty, until otherwise proven. In other words, if something falls down, the onus will be upon the professional, that is upon the engineer, to prove that he complied with that code.

Some of the city engineers maintain that because there are some sharp practitioners outside the profession, such provisions are in fact not only desirable, but possibly necessary. But all that is just by way of illustration. The point I am trying to illustrate is, that as I understand it, a code of practice is not either "mandatory" or "compulsory" unless some piece of

legislation says, that it is to be so. I endorse what Mr. Engineer has said and what others have also indicated, that there is a growing tendency for regimentation in our profession, and coming back to what Professor Bruno Thürlimann said in his Opening Adress, I think we should be strongly resisting this regimentation. It is forcing us into rigid obedience to codes which, even if they are written by engineers, may be far from perfect - nobody in this world is perfect. We should be left as responsible designers with some discretion. What we have achieved in South Africa is to date, that for many of the "mandatory" things or, sorry compulsory, in the new legislation, we have now got a concession, that certain codes of practice if one abides by them, are " deemed to satisfy". That is a very important phrase, which we found coming more and more into use.

B. OVERMARS, Netherlands
I read that the case study is "are codes to be written by unpaid professional engineers (volunteers) or by paid professionals"? My feeling is that it has to be done by volunteers because we hope that codes will be diminished and if they are written by professionals, they certainly will be enlarged and that is not what we want.

Ivan M. VIEST, USA
The situation in the USA is very similar as Mr. Witthaus described. The codes for concrete, reinforced concrete and structural steel are written by volunteer engineers, as guidelines.

As the next step, large cities and other jurisdictions adopt these guidelines and than the guidelines become a part of the law. But they are all written as minimum requirements, not as something that must be followed step by step. So they leave quite a bit of leeway.

MODERATOR
That is the case in Australia also, by the way, we also have by-laws and we have a standards-association for which a lot of volunteer engineers write codes and those by-laws once upon a time were 50 mm thick now they reduce them in thickness that simply says, you shall adhere to the concrete-code, the steel code, etc. and then they are law.

Manfred STILLER, FR Germany
I think the question is not quite clear. If you say "volunteer" - would that mean unpaid or paid people? Are the volunteers non-governmental, practical engineers, or are they civil servants? For my understanding the code-writing committees should represent a good mixture of all parties, engineers from the administration and contractors as well as consulting engineers and researchers. I underline the question just raised by my US-colleague: what happens with the paper? Does it remain a rule for engineers, with a deam-to-satisfy-character? Or will it be taken by the administration as a bye-law?

MODERATOR
The meaning of the word "volunteer" there, is a part-time, unpaid engineer, he could be from private practice, he could be from the government, but the fact is, that he would not be paid for his activities and he is doing it in a free capacity, to help the profession and the community. Certainly, I agree, that must be representative, but nevertheless those engineers who are volunteering for that work will find themselves exposed to those risks, and as a result one may not be able to attract the better engineers for fear of being sued at later date.

Sam BONASSO, USA
I just want to support what this gentleman just said. The question might be, what is the alternative to code-writing by volunteer engineers? In many cases the alternative is, a highly authoritarian type of system, where the peoples who are writing codes are perhaps not the best people in that particular field. So it is a question of what the alternative might be also.

Bernard P. WEX, UK
On the matter of volunteer code-wirters, I believe better codes would be produced if all participants were paid for. There are usually four groups represented in a code committee:

officials, academics, contractors and consultants. Use of university resources and the time costs of officials and academics are borne by the state, but the time costs of contractors and consultants are borne by their firms. The people involed are usually of high quality having experience at the "sharp-end" and are needed to earn their firms' livings. Yet they are the very people whose time and experience should be matched against the academic input which is usually thorough, copious and often complex. Unfortunately industry when unpaid, cannot offend to have its key people tied up in code committees to refine thoroughly and simplify for practical purposes the academic input. Thus "sharp-end" input, in my view, is inadequate. If the time of these key "volunteers" from industry was paid for, I believe simpler and more practical codes would result. I think also it would not be unreasonable to hold the Committee jointly and severally responsible for its decisions, if all its members were paid for, in effect by the Community. After all this is the position of any professional engineer in private practice when he is paid to give professional advice. (In some countries he is liable for damages, even if he is not paid - that in my view is another piece of legal nonsense - but it is also another question).

MODERATOR
The owner would like to respond to the various comments that we have had from the floor.

OWNER
Now this owner has disagreed with Mr. Wex one or two items earlier, but I am glad to say that he agrees with Mr. Wex on this item. If I am speaking with my real hat as a representative of the Ontario Ministry of Transportation and Communications, we in fact have followed this very practice in a preparation of our Ontario Highway Bridge Design Code. We have kept our committee small. Those of us who work for the government do not get paid, and we work long hours. For the services of contractors, members of the consulting fraternity and of universities, we pay consulting fees. That way, I know there is a lot of adverse feeling about the government writing codes, but in fact this is the situation that we had in Ontario, they did not write them, but they initiated the code-writing activity, formulated the philosophy, engaged what we think, are the top people to do the job for us, paid them professional fees. But rather than making them responsible, perhaps in the case of a court-claim, for what they have written, the government, in fact, is taking collective responsibility for that code. They are then in the position to implement it as a compulsory code if so chosen; in fact we are only implementing it by subsidiary arrangement. We are stating that the code must be used if you want to get your bridge subsidized by the government, which has the money. So it is not legal from that point of view but it is, or it will be, and it will be used by everybody, and I suspect it is not really a question of is it the law or not? The question is: is it the accepted practice in use? And if somebody deviated very far from is, I think there is still going to be open perhaps to court-action, if they have deviated far from what has become the norm in the practice. I think this question whether it is legal or not, is less important than whether somebody has deviated from normal practice.

MODERATOR
We will make this the last question and then we will move on to another case-study.

Daniel VANDEPITTE, Belgium
I think it is appalling to hear that people who have done code-writing work, are being sued in certain cases. Since a code is never written by one single person but generally by a committee, sometimes a very large one, I wonder whether all members of the committe are being sued, each taken individually, or just one single member; if so, why that particular member and not another one?

ENGINEER
I believe, I cited the case of the legal suit against the American Society of Mechanical Engineers. They were the organization that set up the committee to write the code, so they were the ones who were sued. In addition, I believe I cited another suit against the American Society of Testing Materials not the individual engineer. I do not know of any legal case involving the individual engineer.

Jiti KHANNA, Canada
One of the issues which is obvious from the discussion, is whether codes should be mandatory or whether they should only be guides. I do not think that the panel has addressed that question, obviously the professional engineers would not like codes to be mandatory, they would like them to be guides. So that they have enough freedom to pursue certain avenues of solutions, which are outside of the codes. On the other hand, we have government departments, such as the Ministry of Transportation in Ontario, who believe as enlightened owners that for this specific application, they would like to develop their knowledge which is very precise and very defined. And I think that while for an enlightened owner or somebody who has got a lot of knowledge, Oil Companies e.g. who accumulate a lot of information, research information, they are able to give it to their engineers for applications. In those instances, certainly having some codes which such owners would like their engineers to follow, is appropriate, but I think in general, we have to work toward the objective of having codes which are not mandatory. And in that way, I think that that would also reduce the liability which obviously in certain instances the volunteer engineers have been exposed to.

MODERATOR
We are going to give our community a chance to speak. What we would like to address is the aspect of risk, which the community will accept either voluntarily, like driving a car or smoking cigarettes and involuntarily, such as an engineer designing a building or a bridge and the engineer is left with actually having to quantify the risk the public really does or cannot relate to it, except when perhaps they buy a ticket in a lottery and know that their chances are one in ten million of winning a million dollars. I would like the subject

RISK VERSUS COST AND BENEFIT

covered for a brief time, if I could have the Community's comment.

COMMUNITY
I am afraid I cannot say something terribly new on this subject, but I think we have to acknowledge the situation that the community still needs information and education by the profession on this issue. People still have to be convinced, that there is no possibility to realise a technical project with a zero-risk. This also includes an understanding, that e.g. a failure probability of one in a million does not render an excuse for an engineer, that he just happened to be the one in a million incident, but that this number is only a guidance for decision-making. And if we have educated the public or the community to this extent, we also have to bring to them the understanding of the role of costs in this game. The dispute on tolerable risks would be reduced to a dispute on how much is the community willing to pay, either for alternative solutions, or for minimizing the risks associated with a certain problem.

MODERATOR
The contractor of course also takes risks during construction and I do not know to what extent that he would quantify those but he would certainly relate them directly to potential savings in time and money so I would like the contractor just to comment on risk and as he perceives it.

CONTRACTOR
The risk, being run by a contractor, is mostly determined by extreme influences beyond his control and which cannot be reasonably well covered by insurances. His problem is to assess at forehand in how far, this risk could be detrimental for him to continue to exist as a contractor. The risk inherent to his working method etc. are assessible risks, and a responsible contractor will not take any risks which ultimately will end up in a disaster for himself and for the community, he will always allow in his price, sufficient coverage for this type of risk.

Algernon C. LIEBENBERG, Rep South Africa
I think in this consideration of risk we must clarify one issue very clearly. When we talk about risk with a probability of 10^{-6} which is of the order that codes try to quantify, then

we are talking about things that very rarely occur. The events that cause disasters or failures in engineering are mostly caused by bad judgement, by gross errors or events beyond our control. So as far as code-writing is concerned, I do not think that cost-benefit is really a consideration. It is not easy in any case to quantify these risks clearly. Those who have made a study of reliability theory will realize that safety is not cost sensitive. The actual real risks are those in the three categories I have mentioned and therein we have a very real problem.

Stephen WEARNE, UK
I am not quite sure what is the problem. If you mean how do we evaluate costs and benefits, in deciding to build a project or to what quality or reliability to build it, we have to be careful not to be too rational. If we start with a perfect world and applied cost benefit-theory to every decision, most of us would be unemployed and most of the famous structures of the world such as the Sydney Opera House, Chartres-Cathedral and many public highways would not have been built. What I think you are saying is that engineers have to learn how to evaluate the social value of projects, state the probable costs, state their confidence limits and be prepared to discuss probable benefits and give risky figures. You indicated a sort of static world in which the community is predictable. It is not. More and more those who know technically how things can be done have to learn the language of cost-benefits, and learn how to discuss with society how things should be done and whether they should be done.

MODERATOR
Actually I totally agree with your statement and I think that is an excellent summing-up.

Henry J. COWAN, Australia
I think this question of structural risk, is being grossly exaggerated. I did some calculations about 15 years ago and reached the conclusion, that a structural designer was 700 times as likely to get killed in a motorcar-accident, than suffer a minor collapse in a building that he had designed, which suggests to me that we are overdoing it. It is of course very difficult to alter the rigidity of present regulations because these regulations are made by people who are elected on a platform and I think a person who stood on a platform and said he was in favor of increasing the possibility of structural collapse, was unlikely to get reelected. But in actual fact, I think the real dangers such as we have in the building industry, are twofold: One is accidents during construction due to inadequate enforcement of regulations, and the other one, which is an extremely difficult one, is the fact, that once the building is up, it is extremely difficult to insist on its proper maintenance. And the real damage to property and casualities that occur, are in out-dated buildings that do not conform to fire-regulations.

Anton TEDESKO, USA
As a conclusion of this case history I would like to quote my friend, the late Arthur Casagrande, who spoke on the subject of "calculated risks"; he defined a calculated risk as a risk which nobody can calculate.

COMMUNITY
Of course I agree with Messrs Tedesko and Cowan. But to Mr. Wearne: did I understand you correctly when you said, the more we say as a profession, the more people you have standing up and opposing?

Stephen WEARNE, UK
I am saying that engineering as a whole has to learn to deal with the fact that the community is not only not predictable, but contains elements within it who have an interest, political and other, in using information of an ill-judged nature for their purposes. Democracy seems to exist in such a form. We have to learn to deal with it. I was being slightly critical of your opening statements that indicate that you think that you could predict what the community would like and they would then work to it. They will not, not all of them.

COMMUNITY
Yes, as concerns the unpredictability of the community I agree, not as the community of course but personally. But do you not think that the difficulties only increase if you, as a profession, do not adequately inform the community in time, because then you have the situation arising that the community receives false information from unreliable sources, delayed and incomplete information and then contributes to the time delays, adequately and all the trouble we are having today. That is because the public is not informed in time.

MODERATOR
The next and final case-study is

"BAN ON" ENGINEER

and what we are trying to discuss here is in one particular country a consulting engineer accepted an appointment to design a "cruise missile-base". He was then excluded by the local municipality from doing work for it as they opposed the cruise-missile project. That is just an illustration I think there could be many of those situations developing. I would like to firstly hear comment from the panel and then from the floor on that.

CONTRACTOR
The case mentioned is related to an engineering office, but it could just as well apply to a contractor, who his performing work, probably even governmental-approved. From that point of view there should be nothing wrong by doing so. But private clients or lower- and semi-governmental bodies, with a large influence of progressive management within the organisation, could decide on banning that specific contractor from their standard list of qualified contractors. I do not think that governmental or semi-governmental bodies could justify this attitude and in this particular case indeed, the decision was reversed after a few days. The danger for a contractor depends on the typre and number of private clients he normally has. That he will be excluded , by some of these clients, from a number of contracts is of course very realistic.

COMMUNITY
I would say, that it actually opposes the normal rules of the game democracy, because, if a federal government has agreed on employing a certain defence-system or a certain military-system then the municipality of a town within a democracy, has to submit to the decision of the majority. They cannot pursue their own politics.

B. OVERMARS, Netherlands
I think, we can discuss this matter, but we cannot solve it. We as engineers from the Netherlands may either work in Israel or work in the Arab countries. Not in both, that is just the same problem.

Thomas F. MAHONEY, USA
I am really pleased to see the programs of this seminar take two directions: 1. the technical advancement of engineering, and 2. the advancement of social awareness within engineering. I think this is an essential point in rounding out ourselves as professionals.

MODERATOR
What I would like to do now is sum up. Some of my comments were before the seminar but I think that several of these came out in the discussion and the comments that I have listed here really are a reflection of what I have heard discussed by engineers and I have read in articles in international magazines in preparation for this panel discussion. But I think they are worth relating to you. As far as the professional responsibility in conduct that we all should aim for. The points that I have here: Firstly professional conduct as such is more than simply adhering to the law and exercising financial prudence it is not good enough to say, well, I am going to do this so that I don't finish up in jail, or I am going to do this because it is financially more advantageous to the owner. It is really a commitment to exellence in engineering.

Secondly, we should continue to advance technology, even though we know this exposes us to known or greater risks which is one of the things we have discussed. In fact one cannot stop progress, we should not stop the progress, we should encourage it.

Thirdly, we should assess and convey to our employers, clients and the community, the benefits, costs, possible consequences, and the risks associated with our proposals or designs. And that is to involve them in the decisions that engineers make.

Further we should set a high standard of professional conduct and insure that expert evidence and advice which may be writing codes, is given impartially. And finally we should initiate, and support changes in the systems of administra-tion, regulations and codes, and the law, where our particular expertise is if properly applied and communicated, we will benefit the communities long-term needs, not just the the short term political swings or desires, that we may have.

I would like to give the panel the opportunity of adding any final commence that they have.

COMMUNITY
I would like to remind the engineering profession, to take up the demand on the engineers imposed on them today, because otherwise, other parties or other people in our society which were quoted before already, will take up these positions and will reduce the engineers to calculating technicians.

MODERATOR
Finally I would like you to join me in thanking the panel. They were volunteers not as we talked about before, but in the sense of a volunteer, where you get asked in such a way that you cannot say no, and they have had to prepare for this seminar with relatively short notice and without having the opportunity of meeting together. I think they have been given a very tough task, I think that they have discharged it in an exellent way and I certainly, as the Moderator, have been very fortunate with their tolerance and sense of humor, in having to front this audience and raise a subject so difficult to discuss and also in thanking the speakers on the panel, I would also like you to at the same time applaud yourself. I think that you have been absolutely fantastic in responding, in coming forward, in fact I had prepared with the panel some eight case-studies. We managed to get througth three, but I think if you really looked at the discussion, we have about twenty that came up from the floor.

So thank you for your attention and please join me in thanking the panel and yourself.

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