The Advanced Topics in the Science and Technology of Concrete
Prof. Surendra. P. Shah
Prof. Ravindra Gettu
Indian Institute of Technology Madras, Chennai
Interview with Prof. Surendra. P. Shah

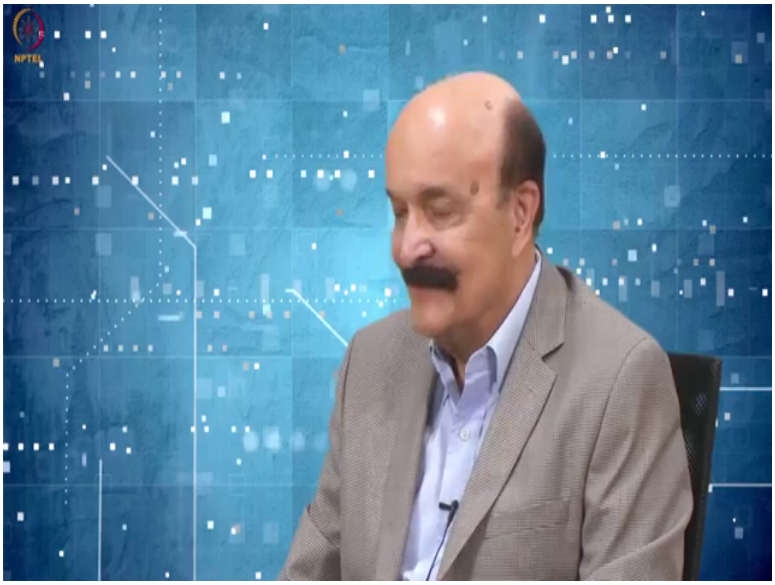
(Refer Slide Time: 0:15)

Prof Ravindra: We have a Prof Surendra P Shah with us, he is an emeritus professor at Northwestern University, he is been at Northwestern University since the early 1980s, we are also fortunate that he is a distinguished professor at IIT Madras, thank you for being here and visiting us often and talking to our students and mentoring us, there is a lot that I can say of Prof Shah, I have known him from when I was a student at Northwestern in the 80s.

He has, he is one of the top people and I think in my opinion the leader in concrete science and technology for many years, in terms of the impact if we just look at the paper is that he is published, reports that he is written and committees that he has added, he has close to or more than 1000 publications, out of that about 500, close to 500 would be journal papers and if you look at citations, I just pulled up some data on Google scholar, he has 52000 citations he is hatch index is much more than 100 and I do know if, I do not think he will look at statistics but I10 index is about more than 1000.

So it is very impressive the impact that he has had on civil engineering, especially the material research, now what I would like to ask so Suru is what do you think are the greatest milestones in your career or what are the biggest thing that you have sort of brought up and shown.

(Refer Slide Time: 2:01)



Prof Surendra: Now the first let me tell you that I really enjoyed coming to IIT and talking with students and the faculty and I am very impressed with the young students you have and very and I think I also appreciate the fact that you have comes in many places large number of female students very bright and hard-working, so and I for me coming here I learn from you a lot and that is what keeps me going, learning new things.

It is hard, you know I started; I have been very fortunate right from the beginning that I got interested and got good support and doing my research, when I started as an assistant professor at University of Illinois, I was in the Department of Materials engineering and actually I thought under graduate courses in materials science, so I got, although my Ph.D. was civilly structured engineering, so I got good flavour of interdisciplinary and one of the thing for me is that I have enjoyed working in new things, fiber reinforce concrete was one of the first one that I did research on then and then we had organised the first high-strength conference, it was NSF funded and the Nick was the coachable and I was the UICN and Bastion, Prof Bastion at that time it was not western and so that time you know high-strength concrete was relatively new and we call high-strength concrete as a 40 to 50 MPa and the development now we are talking about 200 MPa.

So that is I think that the increase in strength, oh look at that way, increase in strength has been quite remarkable that I am part of it, then I think my, when I moved from University of Illinois Chicago to Northwestern was certainly very very important, Northwestern has one of the top notch research-based university, I was very very fortune, excellent students for

example prosegeto, we were just then installing closed-loop system and he was keen so he went to Minneapolis to visit the MTS to design our system.

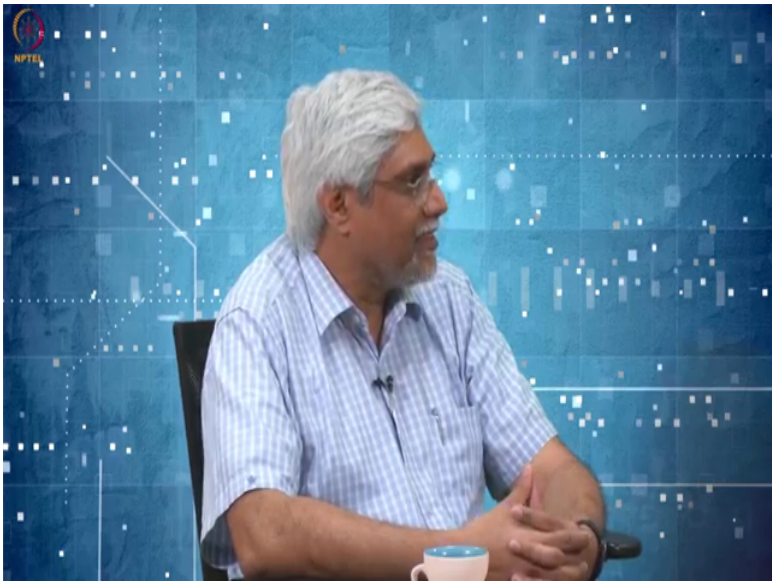
So we had, I think that for teaching, the learning and having the student is the most rewarding thing, they become part of your family, my highlight is having top note students and then it turned out that more or less middle as a air force said they wanted centre in concrete, there is a look without a pavement we could land our super, duper air plane, so they and so that selected 3, 4 and I put at or interdisciplinary team but we did get it.

University of Illinois at Barnard got the centre but then National Science Foundation came up with the big proposal on call science and technology centre and so University of Illinois said look we have the air force centre, so why do not you take a lead and we applied and we were very fortune because is very competitive, so that centre was interdisciplinary, inter-university and for me I learned a lot from people chemical engineering and electrical engineering and certainly material science because our centre was based in science division of and so that was certainly very, for me very important learning experience.

I also learned how to be administrators and director which is also very learning experience and you know very useful and I think that one when you decide to retire, you know in US you do not have to retire you can continue but after a certain time I thought that I would like to day to day managing the centre was too much.

So I did retire and I have been very very fortunate that I keep doing and learning new things, certainly coming here I have similar involvement in Hong Kong and China and that is being nourishing and so you people all are quite a bit younger, you may not realise but it is a challenge how to, what to do when you grow old you can play bridge if you want to but I think that, I find is very rewarding and satisfying working with young people and learning new things.

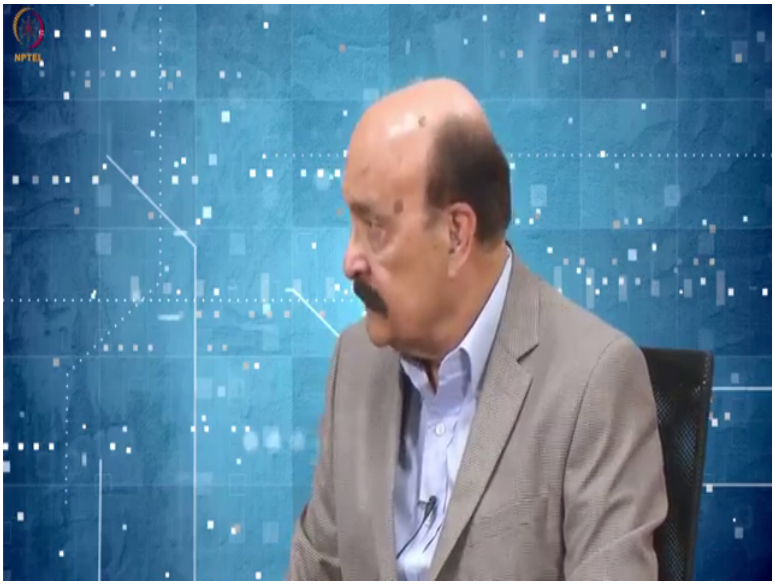
(Refer Slide Time: 7:48)



Prof Ravindra: While coming back to couple of the things that you mentioned, the ACBM Centre was really a landmark and I think in concrete science and engineering research that is a before and after and Prof Manusanthanan and I were fortunate to be students in that centre and we learned a lot and it was centre that involved like you said large groups and certainly managerial skills very important to keep the group together it is not easy to have top researchers from four different institutions to work together.

And a very importantly and this I would like you to elaborate on was that you could bring industry also in, so it was not just based on lab work or theory but you could get industry to participate and I suppose that was a major influence on the sector.

(Refer Slide Time: 8:42)



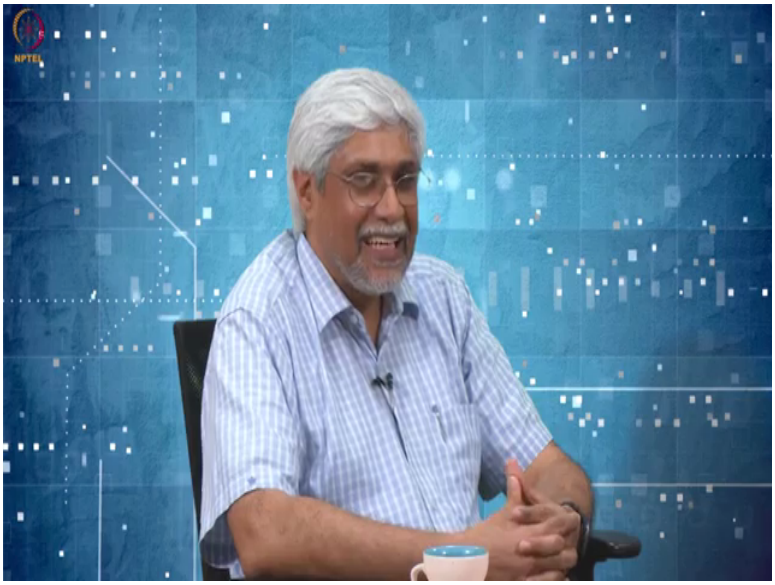
Prof Surendra: That is the certainly good point and I think that industry involvement and as seen your work put into practice through industry, it is certainly very important and I know you have been very fortunate here to have a program with Larson and Turbo, when the centre started, National Science Foundation insisted that you have industrial program and you know in the beginning we were so busy.

So we paid that for it yes yes and we will organise, seminar and invite industry but then as of incident it has to be much more intense and so we decided to hire an industrial liaison person and then we, myself and my co-director he was from University of Illinois Francis M, we went to different industry, presented our work and they like the idea that we have this four top note University plus the government lab NIST, with us and one of the industrial partner says this is like one-stop shopping.

So they learn new things, they very much like interacting with students because students, you know good for them to as far as placement and what, so what we had was that we invite twice a year industrial partners and present what we are doing and one evening with wine and cheese student posters and industry then select which is the best poster and good, like 500 or 1000 that work very well.

So I think it for, certainly for us industrial contacts was important as far as knowing that our research eventually may get into the practice and also important that the research was govern by the basic curiosity and science need an industry like that because it was primary funded by NSF, so they can then learn and if they find something useful then they can, you know have a separate relationship with that faculty and that worked out well.

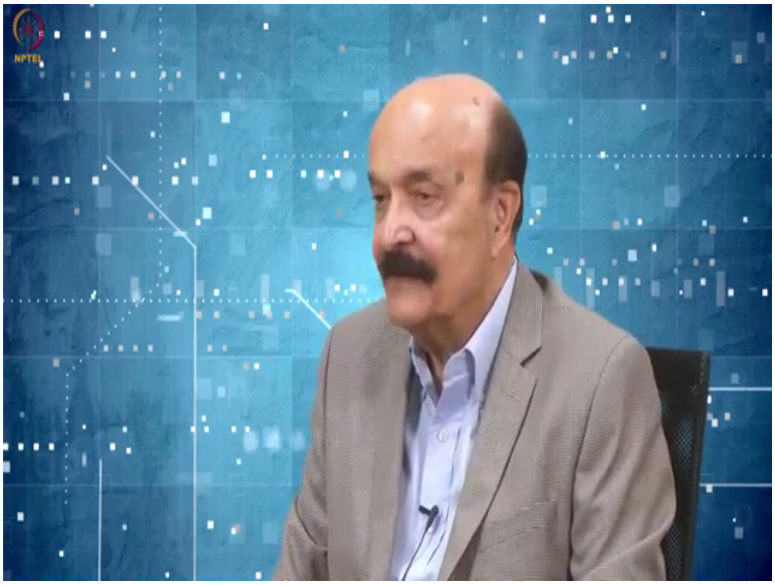
(Refer Slide Time: 11:13)



Prof Ravindra: And certainly you have a very large network and I think that is something that we appreciate those were at ACBM and were at Northwestern was that you brought together a lot of people and that network continues, I suppose you have, you know people in any part of the world, I am sure that you will end up anywhere and certainly there will be ten people who know you and what I would also like to highlight is Prof Shah is a fellow of three academies, the American, Indian and Chinese and I believe he is the only engineer who is a fellow of three national only civil engineer who is the member of three national academies.

And as I said the network has been very useful in keeping people together, having a dialogue and having information exchange and this has also been continued in lot of committees, a lot of international organisations, he is a fellow of Rilem and the ACI and this is also been reflection of the impact that he has had on industry and another thing that I would like to highlight is that he has a lot of students and students have really enjoyed working with him and then I also see that you continue to enjoy working to students and discussing with students and this I suppose is very important.

(Refer Slide Time: 12:43)



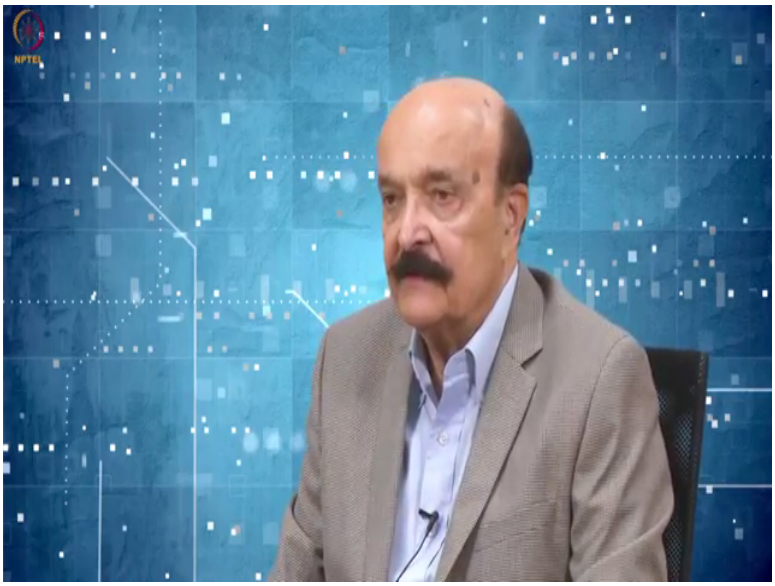
Prof Surendra: Yes and I like to point out what you mention about the international aspects, thing is very important that science and engineering are doing the issues are the same as we are in India or China or England and so these and I am glad that your students are involved in the international aspects, they go to international conferences and you have organised just last September, the Rilem conference and when student said that was very good because they meet people from around the world.

Similarly when we had visitors at the centre and I am sure you have visitors, so I asked student and student are keen to volunteer to show them around the lab because then they get to interact with that industrial or faculty members, so it is very very useful to have this international connections and because my former students are at many places, so that all so as is very rewarding for me to visit them.

(Refer Slide Time: 13:53)

Prof Ravindra: You know also I think part of the trading that you give your students, you would encourage them to go to conferences while they were students and make presentations because sometimes we see that faculty members want to sort of take up the task of presenting all the work themselves but you very early on and with a large group of students you made them present and this I think also help them get faculty positions and go on.

(Refer Slide Time: 14:14)



Prof Surendra: Oh absolutely, in fact my first job I had gone to present paper which has to do with, my work at, I was at Cornell in Florida and this was in January, so it cause very cold so after my talk I decided to take advantage of swimming pool and who else was swimming was

Adam Neville, so he said you know I heard you talk, very interesting and are you planning to go to industrial teaching as a planning to go in teaching.

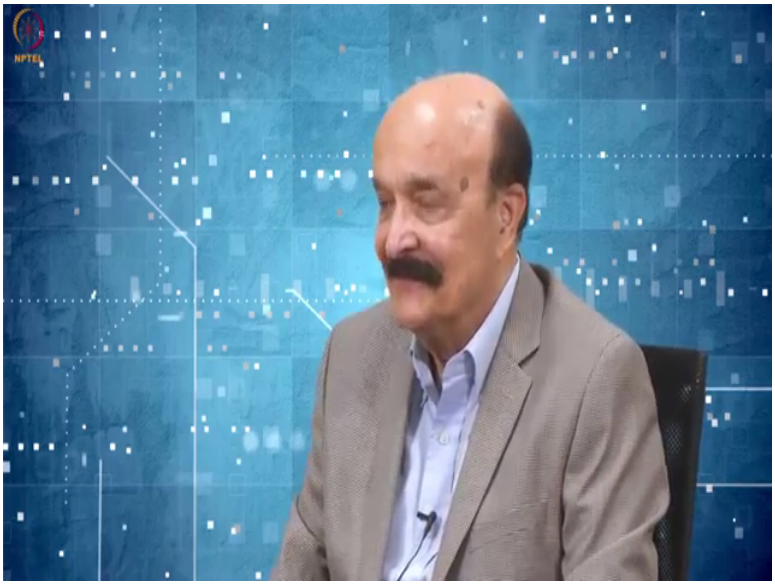
So Adam went, he was then that Calgary, so he went to Calgary and send me an offer and you know a graduate student without any interview first offer, so I was quite excited but Calgary seem so far, so I wrote to him that, you know thank you but I like to visit, so I visited in February and that was bad, that was very very cold and I, Calgary that time was not, now it much much improvement, that time and it was very conservative place, in the bar men sit on one side and woman on other and I know Dorothy will not be very happy.

But so it is certainly presentation for students at international and national conference is very important and how you presented and you know you can learn from, for example your professor how to present your ideas very important.

(Refer Slide Time: 15:52)

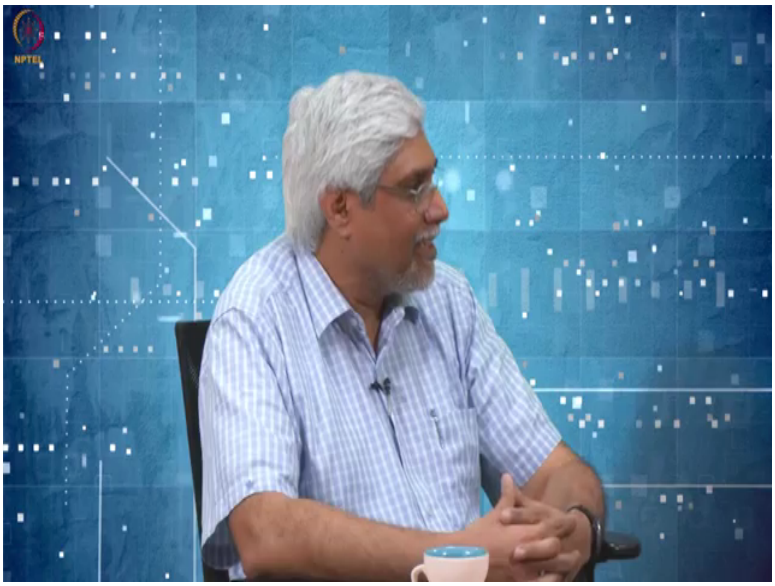
Prof Ravindra: While talking about presentations one thing that people appreciate when you talk as you make things, sound very simple, very easy to understand but I am sure there have been struggles to put forward ideas, I remembered that when you started working on high-strength concrete at Cornell and even when this topic of strain softening, I remember being in discussions where the majority of people would say that concrete, strain softening its artificial, it is just a machine giving and it is not a real phenomenal and now in thirty years, I think you cannot even think that the discussion like that would happen.

(Refer Slide Time: 16:30)



Prof Surendra: Yes that is a good point, we had you know with very very high-strength concrete, if you tested in a quality control machine, you were brittle as people say, so then we develop to test with the circumferential control and you get strain softening and people say well as prosegeto that is artificial, I mean that is not really in fact the Arthur Nielsen from Cornell, they say no he does not believe in strain softening, so that is a fun.

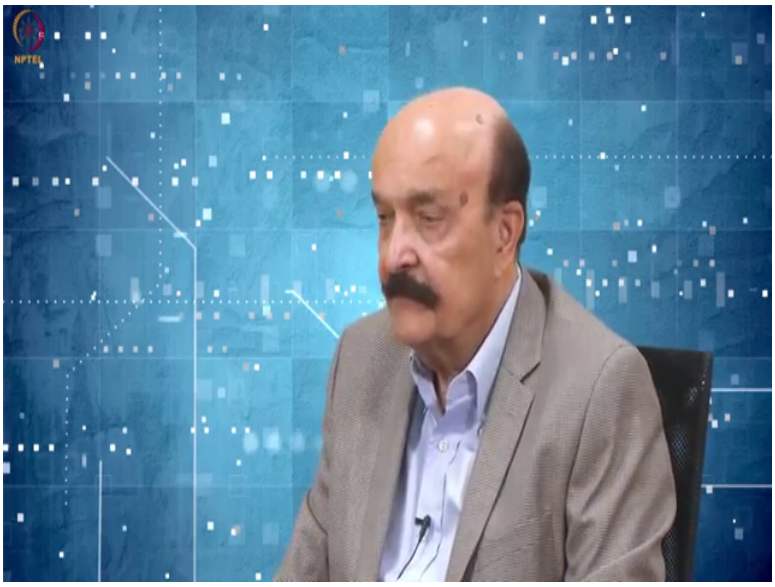
(Refer Slide Time: 17:02)



Prof Ravindra: And there were 80s even books are written about plasticity of concrete, now that brings me to this important thing of experimental research, you have always been in the forefront of experimental research to explain and to understand the fundamental behaviour and what leads to structures but we find more and more and probably could happen to you

also is that people tend to work more on modelling, analytical research because experiments are difficult, need a lot of patience, you need a lot of resources but what has kept you going all these years you focused on new techniques and the experimental work.

(Refer Slide Time: 17:41)



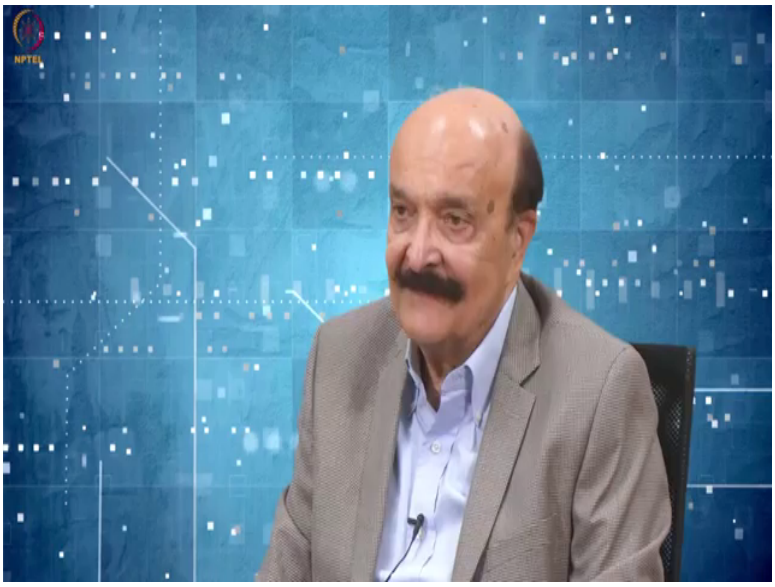
Prof Surendra: No it is certainly true, this is also true in physics as well right, if you see a one people in physics with a neuron or something, there will be 25 authors because experiments are very difficult to do and I think sometimes, some very civil engineering mind set is to do classical testing and it order to get more information to characterise material at the fundamental level, you often have to develop innovative techniques as prosegeto said that we have not only closed- loop testing, where he was involved and then with the laser holographic.

We were starting the fracture process zone and then eventually we were now characterising material at the nano scale and people are realising more and more that the lot of excitement in materials science type of research in civil engineering and that is of course it involve quite a bit of innovative experimentation, careful experimentation and the many classical civil engineering, you know they do not have that the kind of material science approach and facilities that we had at ACBM centre and now you have, so it is very important to have that and certainly we have to validate our model with our experimental finding and connected with modelling.

So that will make us better understand and generalise the phenomena, so you need certainly both but because of the importance of advances were made in computation aspect in IT

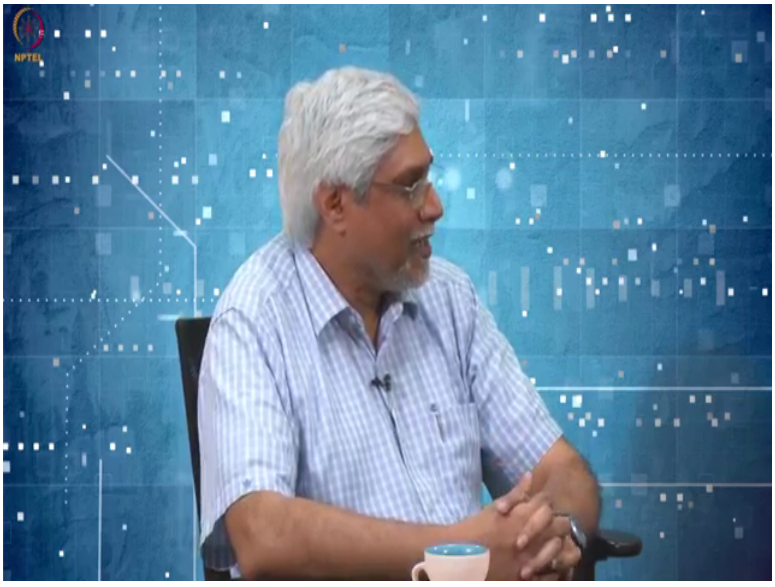
people tend to do more sometimes tend towards numerical modelling rather than experiment but for fundamental breakthrough you need certainly solid innovative experimental researcher, different skills and then modelling.

(Refer Slide Time: 20:05)



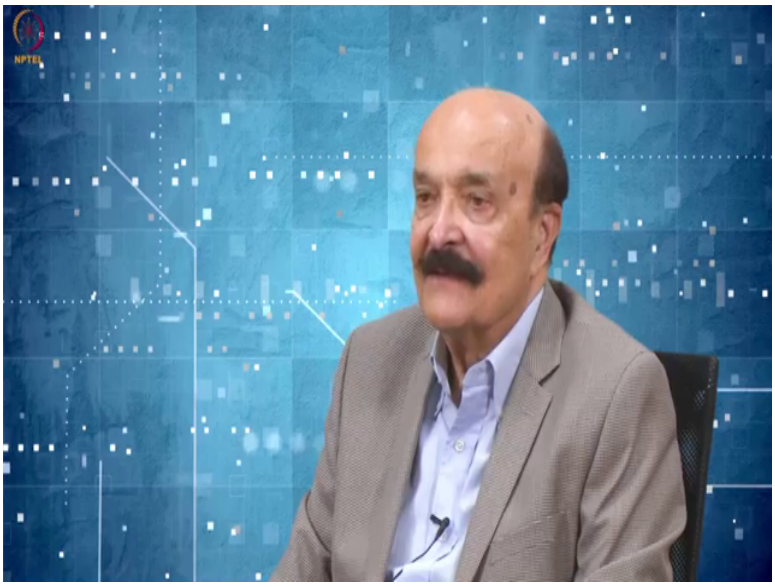
Prof Ravindra: well, I suppose you have seen these waves where modelling is sort of takes over, people think that modelling is enough, at least when you are students at Northwestern there was a rumour, I do not know if it is true that it was the Northwestern civil engineering and applied mechanics was so strong in analysis that they said that we will not need large testing machine at that threw away or try to dismantle the 1,000,000 pound machine and only after you can and then the group was there that testing victim.

(Refer Slide Time: 20:34)



Prof Surendra: That is true, that is the Northwestern had 1,000,000 pound compression or maybe a universal testing machine but as prosegeto said there was, you know strong group in mechanics, so that nobody was doing it, so they got, they did get rid of it, so when I started there was absolutely no testing, no experimental facility, so we started with somehow I found and install machine and we started with that and then we build on and then of course people realise how important it is to do the experiments and connected with modelling.

(Refer Slide Time: 21:19)



Prof Ravindra: So you continued to believe that experiments are certainly necessary and along with the required modelling, well I also know that other then you focus on research and technology transfer, you also believe that life should be lived well, so you travel a lot, you spend a lot of time in fitness and food.

(Refer Slide Time: 21:42)

Prof Surendra: Yes I like that, that is my obsession food, that is sometimes we can, when we go to the conferences my former students know that if you go out to eat with Prof Shah I have a heavy wallet because you know I like to eat and food and certainly this happen in bunch of that in Chenian other parts of the world, so I like food, I like also to cook good food and travel.

Yes, we have been trying for successfully to do travel together for a few days in India and we went to Bhutan.

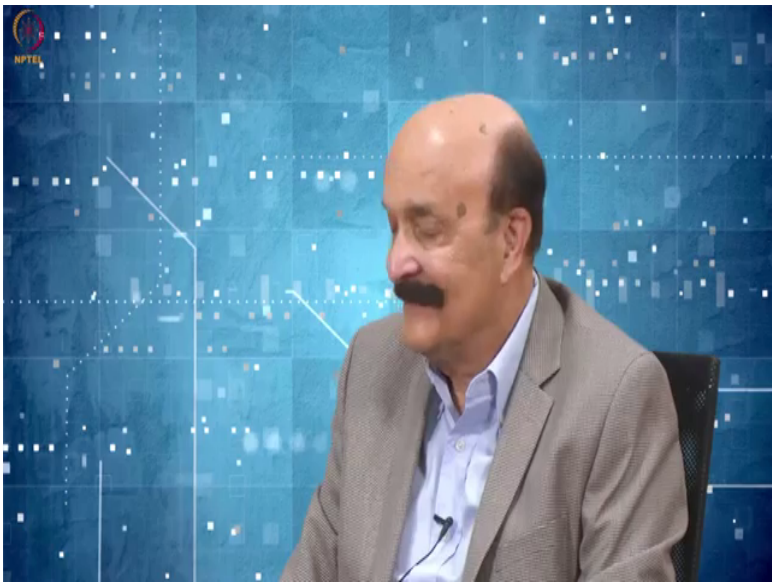
(Refer Slide Time: 22:26)

Prof Ravindra: But sometime as researchers we find that you should focus only on work and it is not good to do other thing but I suppose you do not believe you think that one will also help because you.

(Refer Slide Time: 22:35)

Prof Surendra: Certainly, yes I mean people are different hobbies, some people are music, you know one of my student Nathan trigger is did Ph.D. but he had joint minor in music and here he really like music and it really helps, you know later on, whatever hobby you have a this is very important to have, that a new, you are learning music in and photography for you.

(Refer Slide Time: 23:13)



Prof Ravindra: To finish, what do you think is the future of concrete? Will they be concrete in the next 50 years or do you, so you work so much in materials, new materials is there something that will replace concrete in the near future, what you think is?

(Refer Slide Time: 23:28)

Prof Surendra: Yes will, you know people, certainly there are issues and we can improve the sustainability of concrete, I mean you can see that actually people, we are using more concrete not less, all super tall buildings are now made with concrete rather than steel but in highways, bridges and other thing concrete would be there and many many applications, so I do not see, and especially in Asia and also increase in Africa, we need more infrastructure, more urban housing because you know UN says that, there is a strong shift from width and this urban housing to be energy efficient has to be high-rise building and then the concrete will play a major role.

But it does not mean that, it needs improvement innovation, it needs alteration and that is you know certainly already happening and when you look at it, when I started 30 MPa was the normal and the now we are talking about ready mix that can deliver 150, so that is a big big improve, the same thing in many many other aspects, so you know progress has been remarkable and I would think that it continues to be remarkable, we need that.

(Refer Slide Time: 25:04)

Prof Ravindra: Well, thank you very much, it is always a pleasure talking to you and have you visitors. Thank you.

Prof Surendra: Great, okay.