COMMISSION RESUMES ON 8 NOVEMBER 2011 AT 9.40 AM

MR MILLS CALLS

BRET LIZUNDIA (VIA VIDEO LINK) (AFFIRMS)

FRED TURNER (VIA VIDEO LINK) (AFFIRMS)

MR LIZUNDIA:

Thank you very much Justice Cooper and thank you very much for the opportunity to be of assistance to you and your Commission. I'd like to first complement the Commission on the overall undertaking of such a comprehensive and thoughtful approach to information gathering. I think it's very unusual, in my experience both in the US and around the world, and I think that the wealth of reports that you've been acquiring on different issues, scientific and earthquake engineering practice will undoubtedly benefit and inform the public policies that are made and the practice of earthquake engineering certainly in New Zealand but, I think, also abroad as well. So it's very interesting and a pleasure to be part of the process. I will organise the comments that I make into kind of four categories based on discussions that I've had with the Commission staff by email. The first will be review of my comments, at least the general and the recommendations that I made on the original August URM report by Professors Ingham and Griffith. The second will be just some very brief comments on areas of agreement or possible some disagreement with Mr Turner's report and then, third, a review of the recently received addendum report on damage to buildings in the February event and then, finally, some very brief comments on the Commission's own October interim report as far as it pertains to the URM section. So without prelude the first part of those comments has to do with summarising key points from my original September 30th 2011 Peer Review Report on the original August report by the professors. The purpose of my review letter in that report was simply to provide some international perspective, to place the report, its findings, its recommendations in the context of what we see and do in California and in the United States, since that's kind of my own personal

background. So, as far as general comments go, I found that the purpose of the report, it's always good to understand what the authors are aiming for, was a broad one. It was intended to provide information that would be of value both to lay persons and to the Commissioners and to other people who are going to make submissions to the Commission and I think that the level of detail and the writing style and the way the information is presented, captures that intended target audience well. There are a number of identified goals in the beginning of that report where the authors set out what they plan to do and I think there is information on each of those goals so I think that's successful. Nonetheless I had many comments as I'm sure you're aware and I'll try and go through those in some detail. The first had to do with defining what it is we are actually talking about. The report uses the term 'URM buildings' and I think it's important, both from an engineering point of view but also from a public policy point of view, to be very clear what one means by that definition because in the US we distinguish building types very specifically into several different categories, one of which is, and perhaps the most significant of which is, buildings where the brick or stone masonry walls are carrying gravity loads in addition to resisting the loads of the earthquake and those are what we call bearing wall buildings. Other types of buildings have in-fill frames meaning that they are steel or concrete frames that are holding up gravity loads and the masonry is resisting the lateral loads. Then there are buildings that have veneer over a wood frame and there are even other ones we call confined masonry that are found in many parts of the world. It turns out that the intent of this report has been confirmed in the addendum as what I expected, which is that they are focused on bearing wall buildings and that resonates well here in California because that has been our focus as well. The vast majority of the research, the guidelines, the codes and legislative action have focused primarily on URM bearing wall buildings and as the years have gone by we have broadened the scope to other building types. So that's the topic at hand that the report intends to cover. It then has sections describing techniques of how those buildings are retrofit, various deficient elements within them tackled and there are examples shown. I think that they're a short list of a larger set of possible techniques that may be used in

New Zealand. They certainly do not list some of the techniques that we see in California and I highlighted a few of those in the peer review report. There is throughout the document, both in the original report and in the addendum, reference to the Percent New Building Standard Metric. This is something that we don't typically have in the US, particularly for URM buildings I would say, but it's my understanding it's quite commonly embedded in practice –

VIDEO LINK LOST

COMMISSION ADJOURNS: 9.54 AM

COMMISSION RESUMES: 10.54 AM

JUSTICE COOPER:

Q. Mr Lizundia you had just told us that the concept of requiring to meet a percentage of new building standards was not used in the United States for unreinforced masonry buildings and you were going on to comment about, I think, what you think of that approach.

A. Yes, yes, I was worried that you were having an earthquake in Christchurch and you were seeing that but I assume that's not the case.

Q. No, that is not the case.

MR LIZUNDIA CONTINUES:

Good I'm pleased. Yes I was just starting to comment on the metric of using percent NBS or percentage of new building standard which I understand is sort of widely used in New Zealand, it's embedded in the 2006 guidelines that the society for Earthquake Engineering developed, it's an easy to understand, it's an easy to communicate value that I think would resonate well with building owners, with users, but like many through single values, it comes with challenges of whether it completely addresses the complexity of what can be, you know a comprehensive and not simple issue, and I think that's part of my concern. In the US we have many years ago, I would say, decades even, when we began to focus and develop standards for existing buildings separately from new buildings, it was – there has been and there continues to

be a large effort on that front funded by the National Government to a large extent and there's almost parallel documents or parallel streams of documents that exist, those for new buildings and those that exist for evaluating and retrofitting existing buildings, and in the existing buildings front we have developed standards that are both prescriptive and performance based so those that are prescriptive pretty much came first, they continue to exist, they have much value and we continue to use them, the international existing building code is one example, and it lays out a list of topics, it has equations, it has criteria and engineers are obligated to satisfy those provisions, and many of which come out of sort of a long history of observing damage that happens in earthquakes and dealing with that, with it that way. And those equations and provisions are very different from the new building standards. A separate set of documents as part of the whole performance based design trend, Asc41 is an example of that, there is currently a 2006 edition being updated to a new one as we speak and it looks at all building types, not just URM buildings and it sets out performance objectives and associates acceptance criteria with hazard levels, so that owners and engineers can choose lower levels or higher levels and they have methodologies for addressing those. So those are the sort of two ways it's dealt with in the US and as I kind of observe and have actually had the opportunity to try out the percent NBS methodology on a project in New Zealand, you know one of the observations I made is one has to be careful about using the 2006 guidelines for determining the percent NBS value, there's both an upfront and an appendix version, and the appendix version is a little more tailored I would say to the issue at hand but upfront it focussed primarily on the incline capacity of the walls and this is really the point that if you haven't connected all the elements of the building the walls to the floors, the walls to the roof, you effectively have a zero NBS value or a very nominal value because the capacity's very small, so I worry a little bit that some of the numbers in the original report may be overstating the capacity. I'll talk in much more detail about how that percent NBS value comes into play when I talk about the addendum report because there, there's a very nice set of correlations between percent NBS and observed damage, but I'd like to kind of talk about it in specific there. The next comment I –

general comment I had on the original report is related to that somewhat. It had to do with the importance for anyone here in the US, in New Zealand, owners, guideline writers, code writers, who established the intended performance objective of what we're trying to achieve with any set of public policy guidelines. We, I think in the lay world sort of probably presume that there is simply one way you do it and what performance based design has taught us is that's definitely not the case. If we are aiming for high levels of performance, say in important facilities that need to remain operational after an earthquake, we would have much different provisions, if we are aiming for a lower level of performance that might be appropriate to other kinds of buildings, it's different and I think that it's important when you are making recommendations for the country as a whole, to acknowledge that issue as, you know are we targeting the right level of performance with the guidelines we have in the US. There's definitely debate about that, I think there's greater and greater concern that certain performance objectives maybe, that we'd been using, maybe too low. They may not be adequately dealing with downtime and continued use of the building with economic damage because they've solely been focussed on life safety, so I believe it's important as we're formulating that and we're writing about the goals of different retrofit techniques and standards, to acknowledge that issue and to really drill down and deal with it, and I also think it's very, very important for the public to appreciate this. This is not a subtle issue that is about engineers arguing about small technical concepts, this is about what will happen to their buildings after an earthquake and whether they're happy with that or not, and so in the US over the years, for better for worse, the retrofit ordinances for URM's have targeted a relatively low standard compared to new buildings and that is what's many people have called a risk reduction level. Fred Turner did a nice job of quoting a number of documents, I quoted in my comments an example from the IEBC and I'd like to read that because if people take away nothing from this, I'd like them to appreciate that. So the purpose of that particular guideline, this is basically the standard of practice in California for retrofitting buildings, that are unreinforced masonry, is to promote public safety and welfare by reducing the risk of death or injury that may result from

the effects of earthquakes on existing unreinforced masonry bearing wall buildings. The provisions are intended as minimum standards for structural seismic resistance and are established primarily to reduce the risk of life loss or injury.

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Compliance with these provisions will not necessarily prevent loss of life or injury nor prevent earthquake damage to rehabilitated buildings so just as you see all the disclaimers and softening adjectives that are used in there and that is very deliberate and I think very realistic given what we have seen in Loma Prieta in 1989 in the Northridge earthquake in 1994 and now in Christchurch as well. This is kind of a not unrealistic target for what is actually achievable and so people have to understand a lot of money is being spent and yet there is no guarantee certainly a perfection but even perhaps of what they might have thought they were getting and we I think as an engineering community in the US have done a poor job of educating the public about this and I hope in New Zealand you can do a better job of that because we need to have people in the public appreciating what it is we're trying to provide them and I mentioned that's definitely lower than a new building standard so if one targets the performance of new buildings which is much, much higher than that this is a very significant cost to go from that close that I mentioned to a much more significant level of the equivalence of new buildings. There is discussion in the original report about the cost of seismic retrofitting and there is a lot of information in there. I think it's information that garners a lot of attention in the press and as it should. As far as I can tell apparently from one particular source and there are a number of issues that I pointed out in my comments that I'll briefly touch on here. This is another one of those things where one has to be careful when you know picking a particular cost number about really understanding what the underlying assumptions because you can get very, very different answers depending on what you include in the cost so one issue which I'll touch on more later it has to do with costs are associated with percent NBS what is exactly included in that particular percent NBS. There's no definition of the scope of those values so it may be difficult to know what is actually being costed. There is no discussion because the original

report authors which was a consulting firm which was you know wasn't doing it for this reason but there's comparison between the four stages as the professor has identified and the cost and so when they recommended stage one or stage two or stage three you have no idea what cost is associated with that. You have no idea what you know losses are associated with that as well but then there is the subtleties of how the cost are compared and I actually have had some experience with this issue in the United States. We have a process called an environmental impact report process that occasionally gets invoked by certain jurisdictions when ordinances are being required by communities so many years ago when San Francisco was considering whether to have and what type of ordinance to have for unreinforced masonry buildings they decided they were going to trigger the environmental impact report process. They didn't want the, that approach to be stopped by people complaining they had not done due diligence with that so as part of that the impact of potential ordinances were evaluated and those impacts included losses but they also included costs and disruptions to owners and to tenants and to neighbours so as part of the cost effort you know we were involved in helping the city with that and then later cities as well and we learned kind of the hard way of the very many issues that people have to think about when we do that and in reading those Griffiths and Ingham report and in reading the original report that it came from I don't think it's fully comprehensive about whether all those issues have been addressed or not. They may have been but it's not clearly indicated so as some examples they include you know what costs have been actually included. Do they have engineering and design fees, testing and inspection costs, plan checking, insurance, administration, construction management, lost revenue during construction if people have to move out. Were they assuming the building would be occupied when the work was done? By wing, by portion or were they assuming people would be moved out which makes it far simpler to do than with occupants in place. The cost can be dramatically different. It's not clear. Both were done so it depends on the project, depends on the owner. Was the retrofit part of an overall process? You know sometimes I think retrofitting is lumped in with capital improvements for all kinds of other systems in the building and so

there is an economy of scale that can come into place in the general conditions costs the contractors will charge will be much different. Were the buildings architecturally sensitive? I think the presumption of this study was that they were but not all buildings are and often there is you know it's less expensive when you have less concerns about the historic fabric of the building. How were people assuming hazardous materials were dealt with? Now this is a big issue in the United States. Lead paint, asbestos, buried tanks these can pick up costs significantly and so one has to define whether those are included or not and there's a long list of other ones that I included in the report so I think the message I want to leave you with is be careful you know when you're looking at costs like that and assuming that you fully captured the breath of the issues that come into place. I did do this quick comparison and I noted in the comments about some values and interestingly you know I got quite a bit different numbers that you might see in the US but again it's difficult to make comparisons across country but it made me wonder if one had to look carefully at these numbers. It was sort of a good rule of some check. The professor's report ends with a series of public policy recommendations nice, concise recommends. The interim report that the Commission wrote draws on those significantly so I thought I would, when I wrote this originally I would actually comment on each individual one because there's, I think there's a whole report but the kind, of where you're going with things depends on those recommendations and whether you agree with them and what you do with those recommendations so briefly the first one is to identify all the URM buildings in New Zealand. In general I would agree with that. That is a very common thing that we do in the United States. Many years ago we passed an ordinance, a law I'm sorry in California called Senate Bill 547 and it's I think quite similar to kind of what's happened in New Zealand. That law is part of a political compromise when it was passed, allowed individual jurisdictions so in our country those would be cities and counties. Those are the ones that govern typical private buildings. They were able to choose what that ordinance was so you had to have an ordinance but each community was left with that and notification and identification was one of the few things that was part of that so once you, you can't really understand

the scope of the probe unless you know how many you have. I mean I think the report does a nice job of attempting to identify those but you know each community can do a more careful job of that so that's not an unreasonable suggestion and it would be very valuable in understanding the magnitude of the issue that you currently face in providing better numbers than you currently have. The report mentions that successful retrofit showed it is possible to make strengthen buildings survive severe ground motion. I worried before we got the addendum report whether that was really true given my experience in our past earthquakes. It is very hard unless we do very significant expensive things to make buildings withstand very large ground motion and in Christchurch they totally had very large ground motion so I think that that may still be somewhat overstated although there are clearly the 100 percent NBS strengthened buildings did quite well and I'll talk about that when we get to the addendum report so I think that the only information that was acquired in the addendum really addressed some of my comments on the original report. The third recommendation they have in the URM report talked about four stages or levels of rehabilitation and the Commission has taken those and essentially you know extracted the definitions of them verbatim in your October report and so it's worth appreciating what those four are. So the first has to do with parapets and ornamentation, you know portions of the building that can fall and providing mitigation methods to address those.

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The second one has what I would call wall to diaphragm ties and possibly out-of-plane wall braces. The third is more vague. It's a little hard from an engineering point of view for me to understand what's intended there but it talks about ensuring adequate connection between all the structural elements of the building so it responds as a cohesive unit. This may include floor and roof strengthening, it might include structurally strengthening the walls and the connections at the corners and then the fourth level, apparently, is exclusively devoted to in-plane strengthening of walls. There is definitely a progression from, you know, smaller to high, from more benefit to cost as you go from each of those levels from one to four that makes a lot of sense. I would probably purse things somewhat differently given our experience in California.

I would certainly want in future reports the Commission issues, if you go that route, to be much clearer about what Level 3 really is and there's, and I think you can identify terms that are understandable and don't too broadly expand that but I think that will be very helpful moving forward. The report then recommends that at least the first two levels or two stages should be dealt with and if you're doing the third and fourth stages the building strengthening should aim for 100 percent of fall code by as a minimum a 67 percent value should, you know, might be acceptable. We in the US have long ago made a decision, for better for worse, that we usually do not strengthen existing buildings to the level of new buildings, even when we're using a poor space design. We have generally found, and this may be engineers presuming too much, but the engineering community has generally decided we will do less than that. We might use three-quarters of the code or we might use a lower scope or we might do different things, we might accept more damage, the less detailing, but my concern is that if we really, my concern is that if you target 100 percent and you really mean the equivalent of new building code you're talking about something very very different than what we do in the US and I think much, potentially far more expensive in order to provide the same amount of ductility and performance that new buildings have against collapse and against economic damage and I don't think that the report and I don't think the addendum does as clear a job as could be about explaining that issue. It may be that we're simply coming from two fundamentally different views in the two countries. The report mentions that it would be good if the country as a whole had similar policies than leaving it to individual jurisdictions and given the observations that I've seen, and this is just my own opinion of what's happened in California because of that senate bill, we have this patchwork quilt, if you will of San Francisco has one set of rules, Los Angeles has another, the city of Palo Alto has something different. Some are voluntary, some are mandatory, some of the mandatory ones are at a high level, some are at a lower level, some are done in different years so they are out of date at this point given what we know in the engineering community and from an engineers point of view it is simply not a good thing, it's confusing, it's complicated, it's unnecessarily inefficient. So the real issue is, if you agreed

with that as an engineering point of view, whether there's the political will, which there was not in California apparently, but if there is the political will in New Zealand and the legislative ability to be able to do it my own opinion is that that would be better than leaving it to individual communities. That does not mean that each, that there needs to be one standard for every community and the interim report mentions thresholds. So if you adopted, for example, an ordinance like the IEBC, the IEBC has different thresholds of requirements that are key to different levels of ground motion. So if you have a community like Auckland where the seismicity is lower as compared to Wellington where it's much higher, you can have the same ordinance but it means and requires different things because that ordinance, embedded within it, has tied certain provisions to different levels. So at least everybody's operating from the same framework. The way it's getting implemented is different. So my own preference is that that would definitely be a good way to go and I agree with the professors on that. They mention that it would be good if there were more technical capability for seismic assessment and evaluation of this particular building type in the New Zealand community. You know it's known far and wide that the New Zealand earthquake engineering community is one of the best in the world but my own observation in California where we think, you know, we have a roughly good idea is that that would still be true here. You know these buildings pose specific challenges. Some people, you know, without experience would probably not fully appreciate some of the issues as we go farther away from the west coast and go back east where the amount of work on these buildings is limited that's even more true. I mean I've given sessions and seminars to people around the US and these can be very experienced engineers but they're just not experienced in this particular issue. So I think that's a good recommendation and I think it's one of those practical things that one has to appreciate. You can pass a public policy but you have to make sure it's actually effectively implemented and that's one way of doing that. The report also describes field testing should be conducted and you know one might presume professors would make such a recommendation but I actually think it's a very good idea. I'm concerned that you may lose opportunities and that really present themselves now with buildings that are

going to be demolished. Obviously New Zealand, and Christchurch in particular, face huge challenges with money and the burden that this earthquake has put on it but this is the perfect time to do in situ research that will benefit everyone so I'm hoping that the authorities and the funders will appreciate that. I think what would be better is if the report or subsequent (inaudible 11.21.46) kind of get a clear job of explaining which particular topics they would like to research because some would be of more value than others so, hopefully, that can be done. I didn't really see that in the addendum as well. There's a sort of final one that mentions, you know, budgeting constraints will likely limit what can be done. Well good. That's true. We are not blessed with infinite resources here in United States or in New Zealand so there is mention that priority should be given to Stage 1 and 2. The Commission has done that as an interim recommendation. I would agree but I think that one will have to be careful about identifying, in my opinion, seismicity with the requirements so that you've done that already by setting a threshold of .15G on things and I think as you go forward with final recommendations I hope that that continues to be the case. The professors sort of end with closing remarks and one of them is, I'll talk about a couple of them. One is that there is a statement that the current building standards that are used in New Zealand for these buildings are representative of the best practice and this is an area where I believe I have to respectfully disagree. I don't think that's the case. Part of it may be simply I am not a practising engineer in New Zealand and so I'm not fully aware of what all is done but, on the face of what I've been able to glean from limited conversations with people and in the documents that I've read, it really appears to me that the designers, structural engineers in New Zealand, are only able to use new building codes and the 2006 New Zealand Society of Earthquake Engineering Guidelines for these buildings. So neither of these are documents that are specifically tailored for the challenges of retrofitting existing buildings so this whole stream that I described in the United States of documents that are been developed specifically for addressing existing buildings does not seem to be there in New Zealand and I think that that leads to a widespread difference of implementation.

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If I ask one engineering firm what they're doing, if I asked another one it may not be the same thing because they're really not working from a standard document. The 2006 guidelines are really for evaluation, they're not for retrofitting. There are many issues that they do not address, specific measures that would certainly be used in the US and I'm sure in New Zealand as well but they're not talked about. The guidelines in the back dealing with incline shear are very academic and, I think, would almost never be used in practice and people have told me that as well, that they don't use them. So I think that there's a big need to develop that, you know, and that could be an important recommendation of the Commission moving forward and, similarly, in California we have a historic building code and, you know, you used the term 'heritage buildings'. You know a heritage building standard that specifically is addressed to these buildings would be a valuable thing as well to sort of codify and provide the flexibility of addressing the unique issues those buildings pose. Then, I'll skip to the last closing remark they make. They talk about the estimated cost, so remember extracted from that Christchurch City Council commissioned report. They talk about the cost of dealing with all the 3800 URM buildings in New Zealand to a minimum of 60 percent of new building standard being apparently 2.1 billion dollars which exceeds the cost of the building stock. It's a pretty dramatic statement and they point out that at least implementing Stage 1 and 2 improvements will not be excessive and should be within the budget capability of most building owners. Well, you know, that's a pretty debateable statement. I mean what is excessive and what is within the budget capability of building owners certainly depends on their perspective, it depends on their financial situation now and moving forward. This is the kind of thing that economists evaluate in great detail. I presume that happens in New Zealand as well as it does here when we're thinking about something that expensive being passed as a public policy. So I mentioned in San Francisco and in many other communities economists have looked at that carefully and have tried to inform the city

councils that are faced with those choices. Okay so that was a long summary of general comments. I'll be quicker about the recommendation section of my report which those are recommendations that came about before the addendum but they're pretty similar still. So the first one was collect some more damage information and sure enough we now have an addendum report that has done a great job of collecting damage information. One of the things that's missing, and I'm not trying to be gruesome and I appreciate this is a very very sensitive issue to the building, people who have suffered loss of their relatives, but I do think it's of engineering and scientific value to understand what led to injuries and what led to deaths. My understanding from the Commission's own website is that over 40 deaths were associated with this particular building type. It's a big number and obviously there were probably many many injuries as well. I think we have a rough idea from an engineering point of view, having seen things in the past, but this is, I think, something that would be of value. If our goal is to reduce the risk to loss of lives what could we do that's better than really understanding how people have suffered on this issue in the past. So we don't have that information, at least in the report. I had mentioned understanding retrofitted versus unretrofitted performance. Now we have an addendum that does exactly that. It has been discussed about how adhesive anchors, these are the adhesives that connect dowels that go into the masonry and connect the floors and the roof to the walls. A study is in process on that. The addendum talks about that. I am concerned that that has not fully illuminated the issue and I think a lot more needs to be done on that front. I think, as I mentioned earlier, that as you move forward New Zealand needs to think about what performance objectives it wants to have. Does it want a low one, a medium one, a high one, a different one than you currently think you have, a different one than we have in the US. You know, what is the appropriate one? That will have an impact on losses in the future. It will have a big impact on the costs associated with this work and to inform that one thing that can be done is perhaps a more expansive broader study than was done in Christchurch and was quoted in the report and one that tackles many of the issues I mentioned but one that also looks at loss of life. I mean you obviously have a perfect

case study of what happened in Christchurch but extrapolating that throughout the country to other areas with different seismicity I think if you're looking at this on a national level will be important. You know it slows things down but I think an issue of this magnitude that impacts so many people bears thorough investigation. I think, as I mentioned, we need in the US, and we are working on it, and you need in New Zealand improved guidelines for dealing with undamaged URM buildings. So we have these standards but they need to be better and so those are buildings that haven't been damaged by the earthquake and we have a lot of those and so do you. But you also now have a bunch of buildings in Christchurch that were damaged and developing guidelines, I understand people are hard at work on that and already produced drafts and that's very important because they pose additional challenges that the virgin buildings, the one's that haven't been damaged yet, don't have. And that leads to the next sort of document that's important to have, and I understand again there's work on that going on, but how do you repair these buildings, not just how you evaluate them but how do you repair them and when do you have to strengthen them to higher levels than they had before. This is a very important issue. We struggled with this after the 1994 earthquake on many building types and it's been a contentious point but you, I'm sure, are facing that right now with the discussions that are going on between owners and jurisdictions about how far they have to do. So, finally, with all those studies and documents you are going to end up having to determine a course of action and what we have seen in the US is now is the time when it's still fresh in people's minds, when the political will is better than it will be when other challenges are there so this is an opportunity not to be lost and, obviously, with all the work the Commission's doing you're clearly embracing that. So I complement you on that. But one hopes that as you go forward, this is my own personal view, that you're not going to have the status quo, the passive ordinances that have been passed, allowed to occur in many moderate to high seismic areas. Hopefully people will realise that that is, perhaps, not the best public policy and you can come up with something that people can live with. Okay so that was my comments on the original report. I was gonna move on to very briefly some highlights of Fred Turner's report. I'll

obviously leave his report to Fred but I was just going to note the areas where I really agree with his points and wanted to re-emphasise them and then a couple of areas where we might have a slightly different view. He and I did not talk about our reports before we issued them, deliberately. So even though we're both in California we approached this from our own personal point of view and they really are quite independent. So the first thing is, in general, I agree with the vast majority of Fred's comments and I think we talked about similar issues but we also talked about different ones. So he may have mentioned something that I didn't and vice versa so I think, in total, they all kind of nicely complement one, together with the original reports. I think that's great that you are able to have two people, because that's much better than one. Mr Turner pointed out that care needs to be taken about overly optimistic statements of anticipated performance and I completely agree. I mentioned that to some extent in mine. I think Fred did a better job of emphasising that and I think the public really needs to appreciate that, that that is the case and there will be differences of performance, perhaps less than they would like, perhaps less than we as engineers would even be aiming for and that is simply the nature of the dispersion that will occur.

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Fred pointed out that it's very important when we're implementing public policy and we're trying to make sure it actually works that we have adequate staffing and training of the people who are going to be enforcing the role and that we have adequate inspection of the contractors who are building the retrofit designs that I would do as a practicing engineer. I didn't make that point. I should have. I didn't think of it but I totally agree with it and we've certainly observed that in California. In the Northridge earthquake I think very clearly in many different building types that URM buildings included we saw the jurisdictions that had better enforcement and better inspection ended up getting better designs and they had better performance so this is money well spent when we train our staff, when we require rigorous plan check, when we require inspection in the field we get better results obviously at a cost so like all public policy we're trading things off but we have seen that that can be a very good benefit to cost ratio in California so I think that's a great comment.

Fred also pointed out that it's important to correlate the ground motion that these buildings are experiencing with the damage that was observed and I think even though the buildings were primarily concentrated in the central business district area and in the addendum exclusively in that area there still is differences of ground motion that had been observed so in California when we collected building damage data we tried to very carefully associate ground motion with the particular building. Whether we done it as a modified mercalli intensity, whether we done it as a peak ground acceleration, special acceleration any number of other perimeters the reports don't do that and I think they should and that's something that can certainly be done moving forward but I think you know we would probably be able to have a better explanation of the damage if we have that described so in terms of a couple of areas where we might have a slightly different view or a different new one there's a similar issue I think that Fred mentions considering merging stage three and stage four so that it's just, there's a stage one that gets to two and then three and four lump together. I would certainly agree with that idea in the theories of high seismicity but it's possible that in areas of lower seismicity we may want to have what we call the bolt methodology here and some areas of California so wall to diaphragm ties together without a plane briefing so I think that's in New Zealand you may you know end up with a similar approach. Mr Turner also notes that there is a trend in the United States where we have in the existing buildings world where we have been going from four stage techniques and moving towards displacement based techniques as part of performance based design. That is undoubtedly true. We've been working on that for quite a while. It's definitely where things are going. It's where the majority of the research is and I think there's building types where we really benefit from that. Concrete shear walls, concrete moment frames I would totally agree with that and whenever I'm faced with evaluating those buildings that's how I do it. On the other hand interestingly for this particular building type at issue here today URM buildings I actually take a different view. Unfortunately I think that performance based designs methodology we have ASP41 for example does not look at the buildings as a whole. It doesn't inform and have provisions that we've observed to be very valuable from past

earthquakes. These are very pragmatic, practical, simple non sexy things like adding belt and suspenders, ties if you will of added posts underneath trusses or adding extra ties in corners or understanding how this particular element of a diaphragm relates to how the outer plane strengthening of wall is done. The performance based design method used has been developed on a component basis so that they focus kind of on the wall itself and then totally separately might talk about in-plane and out-of-plane and while they might be very sophisticated on that particular issue they don't have holistic view that I think is quite important so if I were faced with a choice between doing today at least doing a traditional say IDBBC kind of approach or a more modern ASP41 I would currently choose and I have generally recommended to people based with this decision to use the more traditional approach. That could change as we move forward but I think Fred and I might disagree a little bit there so I'll leave the rest of Fred's comments, hopefully I haven't stolen too much of his thunder there. Okay so the third topic of my four was commenting on the addendum report that was received. Our reports the peer view reports were of course written on the original report, the addendum didn't exist yet. I got you know the request so there is no written comments that I've issued on this but I can make verbal comments today to talk about this and actually I've quite a few. The first thing is I think that you know this will be quite a valuable document. It's really a wonderful compilation of the tremendous amount of valuable information and the Commission staff and the Commission is to be complimented on requesting it so let me kind of go into the comments despite that. So the first thing is you know it talks about this is about retrofitted buildings. I think the title is misleading. It actually talks about retrofitted and unretrofitted buildings and that's very valuable comparing the two and understanding what benefits and derives from retrofitted buildings is important and so I would have picked a different title. Plainly comment but more descriptive. The other thing I noticed is that the report authors have read our peer reviews because they have been nice enough to include some comments about some of the things and have tried to tackle some of the suggestions that we made so we haven't, at least I haven't communicated with them but the internet apparently works wonders so that's nice to see. So I

have personally collected a lot of URM damage information in past earthquakes in the United States and so this is something I am kind of, a personal interest of mine and one of the things we struggle with when we try and collect damage information is limited resources and time so we usually end up seeing reports that are anecdotal and by that I mean that they talk about an individual building and then try and draw lessons learned but it's done without any statistical complexity or really any statistical validity and so every earthquake we always bemoan this fact and we wish there were funding and time to investigate things more carefully because when we try and make a lot of sense from this, when we try and make public policy we can't base things on anecdotes. You really need to understand the scope of the problem and so the key is to really figure out what is the denominator and what is the numerator and what I mean by that in this particular case for the denominator is we wanted to find the number of, the total number of buildings that are at issue so in this case what the report authors in the addendum have done is they have defined the buildings being those that are unreinforced masonry bearing wall buildings in the central business district of Christchurch in the February event and I think that's you know very important and a very good idea and the good news is they almost capture all of them so they think there's maybe two that they didn't get damage information on and about 10 others that they don't have on the west side that they didn't have so out of the 380 they got 368. That's pretty remarkable so that makes the denominator you know one of the best it's ever going to achieve. The harder one is the numerator so the numerator has to do with you take a particular character, particular building or you take a particular issue with the building and you want to have as many probably all of the buildings that have that particular issue so if you're trying to figure out about how many buildings in the central business district are red tagged you want to have all the red tag buildings. You don't want to have unknown or you don't want to have or you couldn't get the info on that one so they have some characteristics where they have a lot of great information and others where this is less true so for example the construction date, not the most important thing but an interesting thing, they have that for half the buildings.

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For buildings that have cavity wall construction, this is not something we typically have on the West Coast but become very important in Christchurch, this is where there is an air gap in between the outer wythe or leaf as you call it in New Zealand, the masonry and the inner leafs and it's generally perceived I would think to make the buildings worse from a seismic point of view. They have that for a bit over a third. So for the other two-thirds its unknown. So when you're trying to statistical conclusions you're only drawing them on one-third of your building stock there and you don't know if that one-third is representative of the total or not. So that limits the statistical validity of the conclusions that can be drawn. For the extremely interesting parameter percent new building standard, it's apparently known for 125 buildings of which 31 of those are known not to have been strengthened. That's great but I mean it's still only a small portion of the total. So I think we have to be careful in drawing conclusions on that. But, nonetheless, compared to the vast majority of earthquakes that people have documented, you know, this is a treasure trove of information for those that are interested. So I think this is going to be an incredibly valuable resource in New Zealand and in the United States as well. I mean I think there's going to be a lot of research that can take, that can use this both here and where you are. So what I'm going to do is comment on each, a couple of points in each chapter because of the way its organised, it's sort of an easier way to flow through this. So you know, on the introduction, the authors have re-quoted Fred's comments about the limitations of retrofits. I think it's very important and I think they, you know they softened some of the original report appropriate because of that but unfortunately at the end of quoting this, the sort of single example they chose is you could do a wonderful job and have no problems in the building and then one brick falls and hurts somebody. That is not the point. The point is that, that would obviously be relatively rare and obviously really sad but the real issue is that there is going to be in any population of strengthened URM buildings a wide distribution of damage. You can try as hard as you want and change the shape of that distribution, you can make it shift to better or worse

ends of the distribution but you're still going to have a form of a bell curve and that is just the nature of the problem and there's too much variability in ground motion, too much variability in buildings, too much variability in the way we do engineering, in what we know and I really want the Commission and the public in New Zealand to appreciate that we, that's kind of the best that we can do, unfortunately. I wish it were better, it will certainly improve as time goes on, as we know more but, you know, we live in an imperfect science and in imperfect engineering. In chapter there's, this chapter is an interesting one. It's sort of intended to demonstrate how earthquake practice in California and in New Zealand are similar and I think in my opinion it really doesn't do that and it provides not as much definition or detail on the structural elements, the material properties the two countries have, how the retrofit techniques are really used in detail, how we analyse buildings in New Zealand and in the US and what design methods we have. I would have hoped for more. It's a very hard challenge I think but I came away relatively unconvinced. So there's a great, you know, typology description in the original report and repeated in the addendum that I think is an excellent idea of trying to categorise how the geometries of New Zealand buildings are but I would prefer to go into more detail. So for example in 30% of the buildings in the Central Business District in Christchurch they have cavity wall construction, apparently outside there is anecdotal evidence that there is even more. That's a very big difference than what we have in California. We don't have that. We have it on the East Coast. It's a cold climate sort of thing but I would expect, all other things being equal, that a population of Christchurch buildings versus a population of, say, San Francisco buildings, the Christchurch buildings would do worse because more of them would have cavity wall construction. So you've got to be careful about drawing, you know, conclusions if you don't have that. More subtle things like, you know, what kind of diaphragms are there really, are they built the same way, have the same models of strength, are wall area ratios similar, you know in, in Chile and in the US there's very big differences between the way concrete buildings are built. It's not obvious to me that the buildings in Christchurch are built all that differently. You know on the face of it my observation is they're pretty similar too but I think from an engineering

point of view to really make that claim one would have to be a lot more detailed and careful. I think the same would be true of the way engineers in their offices are evaluating in actual practice. I think, you know, there's no real discussion of that in the report. That would have to come from, you know, interviews with engineers but that would be important. I suspect that if you did that you would find very interesting and illuminating similarities and differences that might have real meaning in the way things perform for better or for worse. You know they might be doing something wonderful in New Zealand that makes things work really well that we're missing here or vice versa but there's nothing in the report that really explains analytical differences that might be occurring. In chapter 3 there's a nice description of how they did, collected information, what was inspected, what was collected. Apparently though because of safety reasons and I certainly experienced this when I toured the Central Business District many of the evaluations were done from the outside, so from the street because they're worried about going inside the buildings which I completely understand. However the report doesn't identify how many were in which category and whether there's correlations between that. So for example are the buildings that were, you know, they didn't go into the more heavily damaged and thus, you know, information is sort of biased in one direction or other because of that. I think that would be of scientific value. There is a description of using Google maps and Google imagery before and after the earthquake. I think that's a wonderful thing. I mean I think what this is showing us is people are embracing the technological advances in a whole variety of ways and even to just do earthquake reconnaissance remotely by computer is pretty, pretty cool frankly. So I think that's a great point. It obviously has limitations but I think they did, you know were able to acquire a lot of info on things they couldn't see, either on top of the buildings or behind the buildings, that satellite imagery could provide. So, ultimately, you know, they collected a lot of data. I didn't see the survey form that was used. I would recommend that that, you know, be published so people know it's out there. I don't know if the professors are willing to make their data base available to the public or other researchers, you know, when it's sort of finalised but I, you know, I understand

the publishing issues that might be faced there but it, it will be incredibly valuable to many people so hopefully when it's ready they would be willing to do that. They collect information on whether buildings are standing alone or whether they're in a row and if they're in a row whether they're at the end or in the middle. That is a great idea. We have seen and made kind of anecdotal observations that buildings on the end of a row might be doing worse because they're forced with supporting all their neighbours. We certainly saw that with wood buildings in the 1989 Loma Prieta earthquake in the marina district of San Francisco dramatically. Corner buildings were falling down and mid, mid-block buildings were not. Whether that's true in your own buildings, they do a nice job later in the report of describing the differences so my compliments to them. That's really nicely done and there's also a bunch of other information that's been collected. It's kind of cutting edge and thoughtful about concrete ring beams, cavity wall constructions, awnings, information about the kind of damage that was happening on elevations that sometimes has been collected, sometimes not in the past so again it will be incredibly value. They haven't had an opportunity to analyse all this information given the time constraints but I'm sure they will moving forward. Some of the key statistics or metrics that are collected that are used repeatedly in subsequent chapters in, kind of the important ones have to do with the damage scale that was developed as part of the ATC-13 project many years ago and it was sort of a seminal document in the history of earthquake engineering loss estimation and it came up with a scale that had some words but it also had some percentage of replacement cost values.

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So what that means is a slight or insignificant or moderate or heavy damage is associated with a percent that that damage is of the replacement cost of the building and it this has been used repeatedly over the years but it's a very flawed method. We don't have a better substitute but the issues for example include nobody's done a cost estimation of the damage. You're sitting out there as an inspector, as a grad student, as an engineer and just winging it. You're just looking up there and you have a few minutes and you say okay I think it's that one. You didn't have the time, the resources to have a contract

to identify you know how much it would cost to replace that and obviously that would be extraordinary so that's one point. Another one is that you can't replace an unreinforced masonry building even if you wanted to. It's against the law so at least in California and so you can't replace the thing that you're claiming you're replacing and if you tried to you'd have to simulate it. You'd have to replicate the loss and the feel but you'd have to use modern material. This is less true with URM going types but with the URM goings it's you know it's a particular dilemma. So nonetheless you know we have that scale but it's worth bearing the kind of disclaimers on it so the final part of that chapter is they talk about retrofitting and they put things in three categories – heritage strengthened only buildings, what's called type A and what's called type B so type A has to do with diaphragm the wall ties cable and diaphragm strengthening which is an unusual addition at least in my experience and then type B which has only to do with the walls apparently. It has to do with in-plane and out-of-plane strengthening of the walls so this does not directly relate to the stage one, two and three recommendations in the first report so a mapping of those you know would have to be done if you tried to associate the data recommendation. I also you know wouldn't do it that way. At a minimum I would think of splitting up type A and I would probably extract the diaphragm strengthening and make that a separate category. The reason is perhaps a bias from California but historically we have thought that due to the disruption and the cost of strengthening diaphragms because you know that means you have to go inside the building and mess around with the ceilings and floors and impact everyone that's impacted or affected by those areas but that is a very high cost to benefit element so it's usually done near the end in more comprehensive schemes. It's not done in earlier things so I would and I would think you would get more value in splitting that out and focusing only on the diaphragm the wall ties and gables and that would be more in keeping with the stage two and I would perhaps add into that out-of-plane wall bracing which we often include with wall ties but you know there's still great cables in the report that try and extract some of that information. They also explain how they determine the percent NBS and I'm surely not an expert on this but in my reading of the New Zealand standard from which that's taken and in the

calculations that are included in the addendum I think there are several things that may be split and you may not be getting the right answer because of that so I think the calculation of FT and K new need to be revisited. I think there may be some issues there. I think this is all dependent on a period of, a fundamental period of building that changes the value, a period of half a second is assumed. Assigning a period in a URM building is a technically problematic thing. We're used to doing that with other kinds of building of the code, the new code is based on but URM buildings have multiple periods some having to do with the walls, some having to do with the diaphragms and this is made use of period a really problematic issue in the United States and I think it's problematic as well with trying to do this in New Zealand. Chapter four is the great collection of general damage and demolition statistics and they indeed found that mid block row buildings did better than end of block so that's an important confirmation. What's interesting though is that they boasted better than standalone buildings which I would not necessarily have guessed. You know I would have perhaps thought the end of the row might be the worse so that has some kind of new data that may change our opinions on that issue. It's relevant because there's a lot of row buildings in the central business district and other areas of New Zealand as there are in the United States and we have known about this problem for years but because of ownership differences, you know someone on this side of the row and someone on that side of the row or different owners trying to get them to all work together is not simple so we all need to figure out a way to tackle that problem better. There's an interesting finding that the heritage buildings and the non-heritage buildings perform similarly in terms of the damage. Some differences but not dramatic. That's not an obvious finding at all. What's very interesting to me is that the number of heritage buildings that have been demolished at least at the time of writing this report is less than the non heritage buildings, which I think if you are a historic preservation specialist or someone like me who cares about the historic fabric that's great. On the other hand there's a huge number of historic buildings that have been demolished. It's staggering so you know New Zealand and Christchurch have lost a huge portion of what made the central business special and that is a

very sad thing. The performance of earthquake strengthening techniques is in chapter five. There is discussion, very interesting discussion about parapets that had been strengthened or braced or restrained depending on your adjective did better than those that hadn't which we would certainly hope to be the case but a very large number of them were significantly damaged. They either suffered partial or full collapse and you know even though I would expect the distribution of performance like the professors who wrote the report I am concerned about that too. I think I would not have expected the extent of the image and so getting to the bottom of that issue do we have design issues? Do we have an installation issue? Do we have ground motions that were too big? Do we need a different way of thinking? It is a very important problem. Every URM building in California has a parapet just about. I mean with a fire safety protection measure so you know parapets are not a small thing. We need to understand how to fix parapets because that's the first thing to go. That's the thing that endangers people on the street. It's always going to be in a minimum phase of the ordinance. If we don't understand how to fix parapets we have a big problem. Similarly gable there's similar problems. Triangular shape end of a building didn't do as well as we'd like. I think that's similar in, or warrants further investigation. I would like to see a better categorisation of the type A and type B like I mentioned on the chapter four and as it you know extrapolated through chapter five. Chapter six talks about the percent new building standards so there are some you know very concise, very powerful cables 62 and 63 in the report that point out things like 97 percent of the buildings that had not been strengthened were in what's called heavy, major or destroyed, the high end of the damage, the very bad end of damage and yet if things were strengthened to greater than 100 percent of new building standard zero were in that category. Now the numbers that we actually have are very small. There was only 11 buildings in the last category so that is definitely I am sure going to garner attention amongst engineers and amongst the media and it should but as I tried to explain previously and we have to be very, very careful about understanding what we really mean by those values. You know if we don't have the same consensus, clear standard of how to retrofit these buildings then one person

100 percent NBS be other person's something else and you know as an example of that what does it really mean to strengthen wall to diaphragm ties say between 100 percent and 33 percent. Does that mean that the ones that have 33 percent goal were three times farther apart? Does that mean the diameter was smaller? Does that mean the depth was smaller? Does that mean the forces were different? When we go into something like the in-plane wall what does that mean? A 33 percent level does that mean maybe the wall worked as it was but at 100 percent it didn't work and suddenly we're shocked created or supplement it in some way. You know these are very important things and I don't think we really understand what percent NBS actually means at least I don't, in the way it's being implemented.

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So I think we've got to be very, very careful about drawing, you know, comprehensive conclusions using that method. That's not to say we shouldn't but I think more specificity, more investigation, more clarity of what that really means in practice and in what was observed would be, to me, incredibly valuable and would allow us to formulate better public policy and have a better understanding of the practice of earthquake engineering. There is a great section, really unusual and interesting section on the risk to pedestrians and occupants. It's long been known that, that the people on the street are the ones that are at the greatest risk. That's been borne out in every earthquake that I can think of and they wanted information on that. Unfortunately we don't have the actual statistics. So these are their predictions of what might have been the greater risk to neighbours, to the building occupants and to the people on the street but what we really would like to have is what happened. So, you know, who, who suffered in the adjacent buildings, who suffered on the street and who suffered inside the building. That would, you know, be much more powerful I think. I think chapter 7 which is sort of a kind of unique chapter in here talks about some of the research that's been done on identifying mortar compressor strengths, brick compressor strengths. This is not a value that we use a lot in the United States. We use something called the in-place push test where we measure the shear capacity of mortar. There's reference to 15 buildings, or 15 bed joint shear tests were done, if

there were more or if those were documented that would be great. The issue basically is, how does the shear strength of the mortar in Christchurch compare with say other locales, like what we see in California. So is it better, is it worse – I don't know but I think that that matters when you're trying to evaluate in-plane strength a lot. There is documentation of an investigation of adhesive anchors in there but, unfortunately, they mention that they due to safety considerations, probably due to access considerations they were unable to test existing anchors in damaged buildings in situ. So some folks came and given that dilemma they were only able to install new anchors in existing buildings and to me that really misses the point. The issue, there've been rumours, statements, anecdotal mentions and photographs about adhesive anchor problems but there's nothing statistical, there's nothing definitive that I've seen and we can't then answer the question of, is there something wrong with the product, is there something wrong with the way it's being installed, is there something wrong with the design of the (inaudible 12:07:21). Were the forces too big. These are the key questions and we don't have the answers to that. So I think we've got to be very careful about blaming a particular product of technique until we really understand there is a lot of that or not and what was actually happening and I think it's really a shame that that opportunity has been lost. Okay so the last chapter in there has to do with their recommendations and the addendum recommendations as well. So they mentioned the performance of parapet restraints was highly variable and investigation needs to be done. I totally agree as I mentioned before. It is recommended that seismic strengthening of buildings should aim for 100% of the requirement of new buildings or at least 67%. That, as I've mentioned before, is very challenging and I've mentioned all the dilemmas with that before. They mention that if owners chose to do something less than that then they need to be made aware that this may not prevent substantial damage. I completely agree. You know, both Fred and I spent a lot of time talking about that so it's good to see that that's been embraced and pointed out. They mention that you should do measures that eliminate brittle failure. True but it's not clear what they mean by that and what specific recommendations are actually saying so I would hope that that could be

expanded. There is mention that it would be good to tackle row buildings but acknowledge these are owned and occupied by different people and so we're all, if you have a brilliant solution to that problem we would love to know about it too because we have legal and technical challenges with that but it's good to, to point it out and to get people thinking about that. They would like to, they point out the need for thorough investigations into building material properties and construction types and, for example, knowing whether cavity wall constructions are there. They found that some of the records of drawings that they obtained from the city didn't always match the information they observed in the field which is not entirely surprisingly in my experience but it's disappointing, it's sad and I think one of the things we've tried to deal with ordinances in the United States to help that, but we're certainly never going to get rid of the issue, is we require specific information in a very codified way to be included in the, in the retrofit documents. So there's kind of less of what you need to include on there and having people forced to acknowledge whether the building has a cavity, how close it is to an adjacent building and putting that on the drawing is a good way of reminding the engineer and reminding the plan checking personnel to do that. So I think that's, you know, a good suggestion on their part. Throughout their report they mention a number of, you know, they didn't have an opportunity or time to look into something or perhaps somebody in the future, maybe them, should be looking at that and I was left with the same feeling. You know, it's this, oh, there's this wonderful report but there's so much more that we could do moving forward and so I have my own list which supplements theirs and I'd just tick them off. I think understanding wall behaviour types, they have information, we can look at those. That's, you know, it would be a good idea. How effective temporary shoring in the September event was. Moving forward into February, definitely key. How liquefaction impacted damage and didn't, they don't, they collected info apparently but we don't have any correlations of that. What's really the scope of the retrofits as in respect to the %NBS, as I've mentioned repeatedly we need more on that. Due to time they only looked at the Central Business District but apparently you could expand the population of buildings by another 250 by going beyond that and they have this information so, you

know, in the future I think that would help. Correlating ground shaking with, with results is essential. All these places were, the numerator is less than we'd love to have. You know, there's a small number of, of buildings where the data has been collected. I know it's a huge effort to collect this information so it's staggering what they've been able to accomplish but in my wish list of things in the world I would love to have that numerator expanded on some of the more crucial variables as I'm sure would they. They mentioned it would be great to compare what happened in Christchurch with the damage that's been collected in other events, so say in Long Beach 1933, 1989 Loma Prieta, 1994 Northridge. I agree, that would be a great idea because we could figure out whether there really are differences between different approaches and have a better understanding and, you know, maybe be more cautious about comparing New Zealand and California. Pounding parapets, quality of construction, costs of retrofitting. Is there a way to know, you know, what the cost had been of these buildings. That would be, you know, another way of doing this study I had mentioned before so. I'm sure there's many, many others. So I'll wrap up with the last topic here very quickly which has to do with the Commission's own October interim report which I understand, you know, is just the first of a much, you know, larger one that's going to come after all these hearings have occurred. I, I think, I would assume the Commission will be updating the information in there after they've heard from, you know, the whole host of people who made submissions and I think that would be valuable because I think the addendum, for example, contains a vast amount of useful information. Hopefully, you know, Fred Turner's comments and mine have provided a little bit of assistance to the Commission. I'm sure many other people who will talk to you will make suggestions as well. I think the four stages that are currently in there, as I've said before, are confusing and can use specificity and clarity and you may not end up with exactly the same ones in the end. I think you really need to figure out what performance you're trying to achieve. I think having more detailed costs and loss estimates may be of value if you want to have a more kind of rigorous, economic and engineering basis to the decisions that you recommend and as I mentioned previously, we all need better guidelines on

undamaged buildings, evaluating damaged buildings and retrofitting and repair and strengthening damaged buildings.

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So, finally, to me I think there's probably many things you could conclude from this but one of the things that I take away is a key question really comes down to how much improved performance are we willing to pay for. In the United States one of my political observations in recent times that I find very sad is that we increasingly want what we're unwilling to pay for. We want lower taxes but we don't want less service. You know how can you have that. We want buildings that will perform wonderfully but are we able to afford that? Can we pay for that? Are we willing to pay for that? Are we willing to take from the other incredibly valuable and useful things we need to do with our limited resources and put them with that. You know these are tough questions that every community, every country, ever owner faces and I have no doubt in New Zealand you have similar challenges, hopefully you do it better than we do but so in the end I think, you know, understanding and clearly identifying the performance that we want to achieve, standardising associated retrofitting requirements with good guidelines with clear consensus based work so that we're all working from the same thing, and determining the related costs of that, the related benefits of that, is the best way that we can make informed public policy decisions. So I know this was super long so I apologise for that but you can see I'm kind of passionate about this and, unfortunately, this is something that I'm really interested in so thank you for allowing me to speak for so long.

JUSTICE COOPER:

Q. Well thank you very much for that Mr Lizundia and for a very valuable contribution to our work. I'll just check, I think we'd better move on to Mr Turner. I understand that you're now willing to wait for us to hear from Mr Turner and then participate in a discussion which will involved Associate Professor Ingham as well. Does that still apply, notwithstanding the time we lost because of the technical problems.

A. Yeah and contributed to the problem as well so, of course, I will stay.

JUSTICE COOPER TO MR FRED TURNER:

Q. Okay well thank you very much. Well now if we can move on to you Mr Turner. We need to alter the, yes Mr Turner are you still there.

A. I am still there, thank you Chairman Cooper, Commissioner Carter and Commissioner Fenwick. I appreciate this opportunity and first my thoughts and prayers are really focused on the victims of the February earthquake, their families and relatives so please convey my condolences if you can. For the sake of timing I perhaps would like to ask your staff how much time I do have and if you'd like me to adjust on the fly I'd perhaps …..

Q. I understood from what Mr Mills told us at the beginning of the day that you planned to talk to us for about half an hour at this stage, is that, was that your plan.

A. That's correct. I'm shooting for that.

Q. Well I think you should stick to your plan. Thank you very much.

A. Okay I will attempt to do that. I have some slides so if I could garner the help from your staff to put those slides up and I will attempt to orally flip through those, so you're actually going to be looking at a hard copy, is that how it's working?

Q. Yes we're looking at a slide called 'Background on the California Seismic Safety Commission' – that's displayed at the moment.

A. All right and they are displayed and so for the benefit of the internet they will see some of that as well.

Q. Yes they will, yes there'll be a –

A. Okay, I would suggest you show those instead of my head, I think the slides might actually be more important.

Q. I think that will happen.

FRED TURNER:

Great, the Royal Commission staff has asked me to supply some background on the California Seismic Safety Commission and these slides are just an introduction into that. The second slide describes the Commission as a multi-disciplinary entity with 20 commissioners. They're volunteers and they have

five paid support staff and that Commission provides public policy advice and independent reviews as well as conducts research learning from earthquakes both within the States and internationally. We also sponsor earthquake legislation as well and our website is seismic.ca.gov if anybody would like more information. If you could flip to the third slide. The disciplines on the Seismic Safety Commission are listed. There are four representatives from local government. Our current chairperson is a City Council member from the city of Riverside, so we have very heavy representation of local government on our Commission. We have one senator, one assembly member, one California government building official, which is essentially analogous to your building consent authority in New Zealand. We have one representative from the California Emergency Management Agency, a representative from the Building Standards Commission, which is really our state-wide regulator that establishes building codes and standards. We have the State architect and then there are three sets of disciplines that are represented by a group of commissioners. The first set is comprised of four commissioners and they represent, at various times, architecture, planning, fire protection, utilities, electrical and mechanical engineering. The second set represents, of four commissioners, represents structural engineering, geotechnical engineering, geology and seismology and then we have two commissioners that represent, at various times, insurance, social services and emergency services. So the combined effect is you actually have a lot of different perspectives coming together and trying to understand what the values and priorities are of other disciplines to arrive at a consensus to advise state and local governments on policy measures. Let me suggest you flip to the fourth slide and that's a list of our current agenda for a meeting we're having on Thursday and it gives you a flavour of the kinds of work that the Commission is currently involved in and it really is very widespread. We currently are funding a shake-table research test and also conducting fires in an earthquake damaged building on the shake-table to examine the effects of shake related damage and how it might adversely impact the propagation of fires after earthquakes. We're also reviewing, conducting an independent review of a water system improvement programme, it's one of the largest programmes in California. We are

reviewing nuclear power plant hazards. We're involved with an effort to plan to speed up the restoration of California's commerce after future earthquakes and much of that is involved in minimising the loss of market share after future (inaudible 12.22.44) disasters in California. Two weeks ago we had a state-wide drill that engaged the public in dropping, covering and holding on under sturdy furniture and we will be having a summary of the developments and lessons learned from that state-wide drill. It involved about 8 million people in California. We have an ongoing effort to attempt to retrofit existing public schools and we've been enhancing the Emergency Management Agency's safety assessment programme and improving barricading and stabilisation practices. This is an effort that actually was initiated as a result of lessons learned from the Christchurch sequence of events. Similarly, we initiated a research effort to survey hospital personnel, particularly those involved with post-earthquake evacuations of hospitals and we've actually sent a team to Christchurch to conduct some interviews there and we're also conducting interviews in Southern California and Mexico in the aftermath of the Baja earthquake of April 4, 2010.

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That gives you the flavour of the wide variety of different topics that the Commission is currently involved in, and it perhaps gives you a sense that we realise back in 1975 when our Commission was created that it's very difficult for an ad hoc Commission such as yours to undertake recommendations sort of in a snapshot and then leave it as if it's going to handle itself for years to come and I think the tact that California has taken is that they acknowledge that this is a long-term problem, it's going to take a very long term commitment to (inaudible 12:24:41) that problem and that's (inaudible 12:24:44). If you could turn to the fifth slide that's titled "Major CSSC Accomplishments". Your staff asked me to emphasise the positive but also to highlight some of the negative, but I will attempt to do that in this slide as well. The first is that we have been able to introduce a lot of risk management programmes throughout California over the years and I'll highlight the unreinforced masonry programme later in this talk, but we have programmes for hospital (inaudible 12:25:17) public schools, bridges, dams, and if you

want more information about this we can certainly make that available to you. We have engaged in public awareness campaigns such as our drop, cover and hold on campaign and we've sponsored some actual incentives in California over the years, some of which worked, some of which haven't. I'll highlight one that is somewhat successful, although it has some limitations as well. We sponsored a constitutional amendment to provide a tax exclusion for property taxes for owners of unreinforced masonry buildings that retrofit their buildings. Unfortunately when that was enacted we had to cut back and scale back and so the law actually lacks any matrix, and we had no ability to judge how many unreinforced masonry building owners had actually participated in this property tax exclusion, particularly since we're not collecting the data, and so those are lessons that we've learned in the past that in some cases you have to compromise in order to get legislation enacted and in this case unfortunately we left out a matrix to actually determine how effective that kind of incentive is. The Commission has also sponsored financing for major capital outlays, loans and grants for example, providing retrofitting, at the date available and I could give you an example of how that can go awry as well and your staff asked, "Well how did you engage other advocates?" Well in the process of sponsoring loans and grants for retrofitting we engaged the rural community and the low income advocates for housing and others, and as a result of that engagement of course, we had to compromise and so we agreed to set aside a fraction of the loans and grants for low income, multi-units, residential unreinforced masonry buildings in rural communities, but of course come to find out there are none of those built that exist in California and so while it was well intentioned, we probably got out of hand a bit in our compromising and those funds were eventually re-assigned but there are actually a lot of lessons that we could learn about trying to engage other advocates and make compromises and still be effective, and so there are actually many lessons that we've learnt over time, those are just a few of the downsides of attempting to engage others in public housing needs. The Commission has developed an independent review policy and I'm glad to see that you are actually undertaking independent reviews, I think it's an excellent way of improving the quality and providing some outside perspective on your

efforts (inaudible 12:28:09). I'd be happy to share our policy with you. In many respects you're following it, there are some distinct differences and I'd be happy to discuss those with you in more detail, and as I mentioned earlier we do have an active research and development programme. If I could turn to the sixth slide, it's titled, 'Similarities between California and New Zealand.' I just want to highlight that one of the reasons it's produced, I spent a lot of time with our colleagues in New Zealand, I think we have many, many things in common, probably more things in common than nearly other country than perhaps except Canada, and the reason for it is that New Zealand and California in a lot of ways rule at comparable rates, much of our population started in the mid 1800's, New Zealand, it was somewhat smaller in land area and population than California, but still our population growth followed similar patterns and we have a very similar building stock dominated by wood construction and commercial unreinforced masonry buildings that are all over downtown. We have active earthquake engineering practices, we're known for our enforcement (inaudible 12:29:23) and we have a lot of cross-pollination between academics and practitioners, where I've actually taken courses using books by Park and Paulay and many other of our colleagues have been trained in New Zealand and have come back to California and vice versa. So we actually have many, many things in common and we can use that to our advantage. We also share a high and moderate seismicity region throughout both countries and the State of California as well. If I could suggest you turn to slide 7, I'll now highlight the State of California's unreinforced masonry building loss. Brett Lizundia mentioned a few of these aspects and I'll try to be somewhat more specific and complementary to what Brett stated. Our law was enacted much later than New Zealand's 1968 law, ours was enacted in 1986 after many, many years of trying to get other laws enacted, this was after years and years of failure, 11 years of attempts by the Seismic Safety Commission, so it was an easy law to enact and it only addresses unreinforced masonry buildings in the high seismic regions, there were 26,000 roughly unreinforced masonry buildings inventoried in 283 (inaudible 12:30:39) jurisdiction, or as you call them, Territorial Authorities. Of those as of 2006 70% have either been retrofitted or demolished and we have about

7800 buildings remaining that have yet to be retrofitted and I'll get into some of the reasons why this programme will remain incomplete in a way, because we allowed that to happen from a policy stand point. The law, if you turn to slide 8, the law is available online, its inspection 88 75 of our government code and there's a web address if you'd like to get it, and read the law specifically for comparison sake and it essentially requires our local government or Territorial Authorities to do three things, inventory URM buildings, establish loss reduction programmes that can be tailored to local government discretion and then report progress to the Seismic Safety Commission and we provide metrics and summarise mitigation progress periodically, so that the policy makers can monitor and follow along. If you turn to slide 9, that describes four types of URM programmes that have evolved or emerged (inaudible 12:32:02). The first and most popular type encompasses about three force of the buildings. They're called mandatory retro-active strengthening programmes, the type of programme our commission strongly recommend and those have the highest retrofit and demolition rate of about 87% of the buildings in those programmes have either been retrofitted or demolished. But we also have voluntary strengthening programmes where local governments have encouraged but not required strengthening and we have local governments that have simply notified the owners that they own buildings that might be prone to collapse but don't actually establish standards or recommendations or advice on what to do about it and as you can see the retrofitted demolition rates for notification on the programmes are very low, so in essence those are relatively ineffective. There are other types of programmes, often variance of the previous three types, some of them are quite creative and actually quite effective because the local governments have tried to figure out what works best for them, for their particular circumstances and in that sense there's some wisdom that the state has allowed some creativity (inaudible 12:33:21) and I do think our local governments do appreciate the trust that the State government has given them (inaudible 12:33:32). There is a fifth group of buildings, they're in no programmes at all, so we still have 2% of our buildings that are in jurisdictions that don't comply with this law, and you can see their retrofitted demolition

rate actually exceeds that of some of our less effective programmes, so there may be some lessons to learn here as well, that perhaps doing nothing at all in some jurisdictions may eventually result in some retrofit and demolition activity nevertheless.

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If you turn to the tenth slide it's a map of California and it depicts that there's wide ranges of mitigation progress or percentages of retrofits and demolitions throughout California ranging from the counties that are furthest along there in blue and green all the way to the counties that are done relatively little retrofitting and demolition. Those are the red and yellow counties and you can see very dramatic differences over short distances throughout California reflecting local priorities essentially and the State's law is a relatively flexible one in that it allows that local discretion to take place. On the plus side I think we are pleasantly surprised to see how much retrofitting demolition has actually occurred given the fact that this law was relatively (inaudible 12:34:56) to begin with. Another lesson that perhaps we can draw from this – it's one of the mistakes that California made early on, 1986. In their haste to enact this law California did not have a retrofit standard in 1986 and so here they were in 1986 telling local governments to enact some kind of a programme and yet there was not clear guidance on what a minimum, minimally acceptable retrofit should be. It took us six years. We did eventually enact a minimum retrofit standard in 1992 but prior to that there was approximately 20 years of activity throughout California where there were a variety of different retrofits took place and now we recognise those buildings, there's approximately 3500 buildings that have been retrofitted to standards that probably don't correlate well, that are currently recognised as minimum standards. And that is very much a similar dilemma that confronts New Zealand at this point. So in hindsight had we had to do it all over again I'm sure that our Commission would certainly recommend to establish retrofit standards first and then talk about how to tailor litigation programmes to best address those minimum, minimally acceptable retrofit standards. Now before I get into other aspects I'd like to ask the Commission if I could engage in a

little dialogue beforehand. Maybe three overarching questions, if that's okay with the Chairman?

JUSTICE COOPER:

Yes.

MR TURNER TO JUSTICE COOPER:

Q. Thank you very much. The first question I have is, can the Royal Commission consider integrating some of the recommendations and the responses and make responses to some of the comments that you received from other people such as David Hopkins, the Department of Building and Housing, SESOC and, and others, many of which I find are quite relevant to what we're talking about and, in many respects, quite persuasive?

A. Yes well we certainly can. I'm not quite sure what you're asking me there. Inputs that we've had from everybody will be considered and will contribute to a greater or lesser extent to the opinions we form and reflect in our final report but if you're asking, is it possible now to refer to material that you're aware we've received for the purposes of this discussion, well, yes you can if you wish you. So I'm sure if I've picked up what you're asking me?

Q. Yes. I do have some advice and what I can do is perhaps send you some written information that attempts to respond to some of the issues that have been raised which I think are in many respects quite relevant.

A. Yes well you're welcome to do that.

Q. I'm getting a lot of feedback. Okay. The second question I have is in reading the interim report that was generated on October 11th by the Royal Commission there are specific recommendations for changes to design and construction practice for modern buildings and new –

A. Yes.

Q. And yet at this point there are no similar recommendations for changes to regulatory practices, design and construction or inspection practices for retrofitting unreinforced masonry buildings. So what I'm seeing,

there is essentially a potential for inconsistency and I'm wondering if your staff or yourself have already identified this and you anticipate filling that gap with comparable recommendations for changes to regulatory practises and standards for design and construction for retrofitting URMs?

A. Well that's something which is exercising us and I think the answer is that we will if we can but our thinking is, is still being developed and hopefully it will be informed by this process that we're going through. We're certainly very interested in having inputs about the standards that should be aimed at and the means by which they could be achieved and we were very interested in the discussion earlier today about, from Mr Lizundia about the whole utility with respect to URM buildings of the percentage of new building standard approach. It seems to be an approach which currently is based in our nationally applicable Building Act and we are considering ourselves the utility of that, of that approach to standard setting.

Q. Good. I'm glad to hear that. I would suggest you make an appeal to the Department of Building and Housing, to SESOC, to NZSEE, to David Hopkins. I think they'd provide you several very good approaches to addressing some of those needs.

A. Yes.

Q. They raise many relevant issues.

A. Yes.

Q. And perhaps in the interim between now and April they may be able to come forward with a set of recommendations to essentially balance what are already recommendations for new construction in your interim report but with the focus on retrofitting unreinforced masonry buildings and perhaps repairing the damaged unreinforced masonry buildings.

A. Yes, if I could just explain what may appear to you to be –

Q. Sure.

A. – an imbalance. Part of the reason for that was that our interim report was directed to the rebuild of Christchurch and we felt the need to make sure that we said something about the standards that should be

achieved by new buildings about to be constructed. So it's, that posture of the report very much reflected the time at which it had to be produced.

Q. In many respects you have as great a demand for advice for retrofitting and repairing unreinforced masonry buildings.

A. Yes, well –

Q. Do you know?

A. Well that's definitely something, as I say, that we have our eye on for the purposes of the final report.

Q. Excellent. I'm glad to hear that. My third question to you is can the Royal Commission consider issuing this addendum report by Professors Griffith and Ingham as well as well as their original report in a revised format, perhaps combined, after the authors have had an opportunity to dialogue with independent reviewers, hopefully this is a start today, and we reach a mutual understanding on the changes that might be warranted to those reports?

A. Well the answer to that's probably no because we, we have, we regard both reports as reports that we've requested, advice that we have sought and further procedures in relation to those reports are not envisaged other than how we treat them and distil that advice or accept or reject it along with what we're told by others when we write our final report. So they're really there as records of advice that we have received and if there is to be further publication or refinement of the views expressed there it will, it won't be under the auspices of the Royal Commission it will be as a consequence of normal academic publication and, and peer review and dialogue dialogue and so on so does that answer your question.

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Q. It does. I'm a disappointed but I can understand your time constraint as well.

A. The question of procedures it is not just a question of time constraints but we have to, in the end we are a body that has to make recommendations and we base those recommendations on advice that

we receive and our judgements and understanding so we are not engaged in an academic exercise here but one would has to have a practical outcome in terms of recommendations to the legislature.

Q. I understand thank you very much.

FRED TURNER CONTINUES:

I suppose I should attempt as much as I can to compliment what Bret Lizundia has already told you. I actually agreed to a very large extent with many of Bret's comments. I don't need to reiterate most of them. There are a couple of areas where we perhaps on paper differed in terms of our tone or in terms of the extent of what we said but in the end the dialogue we've already had between Bret and myself we realise we were actually much closer in our view points than further along. There are a couple of things I want to mention. Firstly I really feel that New Zealand has done an excellent job engaging the public in educating the public as compared to the United States and California specifically and I actually have less problems in the use of the percent new building standards metric. I think the public demands and wants to understand how the metric can be interpreted so that they can make its own decision and at this point I think in a lot of ways the New Zealand resources that are available and the fact that the public is actively engaged in the dialogue is really a plus in its working to your standards so I would recommend you continue that. The engineers on the other hand are going to continually make a judgement to what the building standard is and they can make that behind the scenes and still allow the public to be engaged. That's really not been the case in California where there is actually a lot more confusion. Less of the public is engaged and as a result less understanding about making important decisions than is currently occurring in New Zealand. In that sense that's probably my biggest different of opinion myself. I also think that you've been doing a better job of informing the public such as this Royal Commission providing very helpful and public information that is clearly going to make it easier for policy makers to make informed decisions and by comparison perhaps that because California is substantially prodigious in

nature we're less willing to do that and it's actually quite refreshing to see the openness that it has provided in ensuring many technical documents and having this exchange with the public. I think it's far better, that is actually a far better policy than in many respects we have in the United States so I applaud you for that. The third I think I'd like to mention regarding one of the comments that Bret Lizundia stated. It's in respect to the use of displacement based methods or performance based earthquake engineering and I actually wrote that with an eye to the future. We've been working, collaborating quite actively with Professor Ingham and many of his colleagues Stuart Oliver from Holmes Group, (inaudible 12:48:36), Derek Shaw, Alistair Russell, Phil Tremain, there's a group of New Zealanders who'd been actively involved in updating the American Society of Civil Engineers standard for the seismic retrofit of existing buildings and that will be coming out in final form in 2013 but the rough draft for masonry buildings is already available. I would be happy to share that with your staff and others and it's largely much of the work is coming from a collaboration between Canadians, US and New Zealanders and we are hopeful that future applications of performance based earthquake engineering will in fact benefit all three countries and other countries around this world so it's my hope that we can eventually move towards performance based earthquake engineering when it comes to register unreinforced masonry buildings. We're not quite there yet and then it's absolutely right looking back on our current standards there are many flaws with respect to performance based earthquake engineering and it applies to retrofitting unreinforced masonry buildings and we're currently still leaning heavily towards using prescriptive requirements in the international existing building code. I might also mention that we are proposing to move the requirements of the international existing building code into ASP41 as the defined alternative so in essence future standards at least in the United States will have both choices and they'll be somewhat more aligned with each other and calibrated to some extent better than we have in the past so I think if you think of future there is actually a lot of positive that are going on in recent months and much to the credit of many of the active New Zealanders in that effort. I'd like to now view my comments to the first report by Professors Ingham and Griffith

and make a few statements essentially to mention some things that Bret Lizundia perhaps didn't have an opportunity to mention and that I could amplify. The first is in respect to section in the August 2011 report by Ingham and Griffith regarding costs. I did have a comment that if you accounted for the likelihood of demolition that will undoubtedly occur for a significant fraction of unreinforced masonry buildings in the future particular the non-historic buildings. I'm a preservation advocate so I'm not advocating for demolition of historic buildings but for non-historic buildings we should really be looking from a holistic stand point about replacing those buildings that have exceeded their economic life and that in the end in the long run replacing those buildings with more modern perhaps larger and more (inaudible 12:51:45) buildings would be the long term best choice over retrofitting so I think at this point which you have the rather simplistic assumption that we have two choices we either retrofit or we don't when in fact we have many interpretations of policy alternatives as well demolition and replacement being a very clear alternative that can be costed out and included in the overall policy frame point. My next comment deals with variability. Bret touched on this and I think that there are ways of addressing both the original report as well as the addendum and I have suggested that some discussion about the fact that performance in one earthquake by a set of unreinforced masonry buildings is not necessarily indicative of their future performance in other earthquakes and creates unfortunately a lot uncertainty about how they're going to perform again for example particularly damaged unreinforced masonry buildings. The simplistic way of looking at it is perhaps these buildings once shaken are only good for that first shake and they really need to be aggressive about barricading and stabilising those damaged buildings after that first big shake because we essentially lost a lot of integrity of the buildings after that first experience but the very ability of damage can be explained because the ground motion will vary widely with those relatively short distances.

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We have a lot of evidence of that occurring in California, particularly the Parkfield earthquake in 2004 demonstrates that you can have tremendous variability of ground motion in just a matter of a few blocks. So (inaudible

12.54.16) with the foreground motion in the central business district area but I suspect that the variation is even more than that had we had more instruments we would be even more surprised at how (inaudible 12.54.34). But there are other effects, wave propagation effects, building orientation, dramatic differences in assumed quality and the integrity of the building materials or connections and just serendipity, there's a lot of things that seem to happen in earthquakes that we often still can't explain and that, unfortunately, has to be considered when we're making judgements about the suitability of a particular policy objective in light of the uncertain (inaudible 12.55.03) that we're all faced with. And regarding the first report I would suggest, and this has to do with the addendum as well, now that you have information about which of the buildings were retrofitted it would behove us to have a follow up research, and Professor Ingham I'm sure would like to do this, to document how many, how the retrofitted URM buildings performed in the Darfield earthquake compared to nearby unretrofitted, because that gives you a snapshot of how they're performing in a smaller less intense ground shaking and that's yet another data point that can be readily documented now that you have the information. Just as an aside, I spent a lot of time in September going around taking pictures of lightly damaged unreinforced masonry buildings and people were asking why and I was actually focused on trying to capture that incipient level of damage and, hopefully, that kind of study back in September will now pay off because, unfortunately, we have new information from February and we may be able to correlate the progression of damage over time (inaudible 12.56.33) with this stock of retrofitted buildings. Now I'd like to turn my comments to the addendum. I think because Bret focused the predominant amount of his comments on the original report maybe I have the flexibility of focusing on comments on the new report, the addendum report, and I found it to provide a remarkably thorough and well documented, well articulated, amount of information. However, it is presenting a generalised qualitative comparison of the performance of unstrengthened buildings versus strengthened buildings. So, in that sense, it's one way of attacking and attempting to document performance. Can you still hear me?

JUSTICE COOPER:

Q. Yes, yes, no we're hearing you well thank you?

A. Okay, you've, all the background noise from my end has been cut out, so thank you very much, I just wanted to make sure that you could still hear me.

Q. Yes we sent somebody out to do that.

A. Okay, thank you.

FRED TURNER CONTINUES:

The data showed remarkably consistent increases in damage or corresponding decreases in retrofit levels and that's consistent with our observations in past earthquakes as well. The results are also consistent with our preliminary performance surveys that were conducted by the Earthquake Engineering Research Institute from the US. They sent a reconnaissance team which I participated on back in March and we produced this small report that actually has a consistent spread of performance of retrofitted unreinforced masonry buildings. So there is some consistency there and I'm not surprised to see some adjustments in the statistics because we used a smaller number of known retrofitted buildings at the time compared to your larger number and we also included retrofitted buildings in Lyttelton and Lincoln. The report's primary conclusion that retrofitted buildings with low strength or incomplete load paths don't seem to perform significantly better than buildings with no retrofits at all is actually quite consistent with a study that was done after the Loma Prieta earthquake and it's documented in a report, ATC31, and Bret Lizundia participated in similar documentations as well. So I think there is evidence that what you're getting from the basic result is consistent with our observations from past earthquakes in California. So I wanted to provide you some assurance in that regard. The next steps, however, I think are critical and that's why I asked my three over-arching questions to you and I would hope you actually take them to heart that really the more important (inaudible 12.59.38) is to develop specific recommended changes for design and structure and testing and inspection and code enforcement, regulatory

oversight and that is something that would best be done by detailing the specific mechanisms of what caused collapse. So what types of retrofit techniques worked and where didn't they work and why and I think you could get more specific by asking CESOC members or NZSEE members to really provide their perspectives, even building contract owners to provide building specific perspectives that can fill out and flesh out the minutia, the minor points, that can paint a much more rich detail that you currently don't really have with generalised summary of performance by (inaudible 13.00.36). So I think there is other ways of attacking it. You could do that within the time frame of now and April and perhaps round out your recommendation with that information as well and you've heard similar recommendations like this from David Hopkins and CESOC and the Department of Building and Housing. So I think it's a matter of just responding proactively to those recommendations and take the bull by the horns so you can really just make an effort to put that information together. So what I'm asking you seriously consider is to gather the perspectives and lessons learned from professional engineers who designed the retrofits, from contractors that built them, from owners and from the regulators, the Building Consent Authority, that were essentially beyond the scope of the Ingham and Griffith report. Those are essential missing links for you to be providing a full set of guidance to policy (inaudible 13.01.38). I think I'm out of time am I not Chairman Cooper?

JUSTICE COOPER:

Yes, well no, if there's something else you wish to say we'd be pleased to hear it.

FRED TURNER CONTINUES:

Well let me try to pick from a couple of suggestions I have here. Yes let me suggest that I'll put my multi-disciplinary hat on. As you may know I'm a structural engineer but I think that the structural engineering aspects you have are perhaps the least of your problems and the least of your challenges. The bigger issues are the social economic aspects. David Hopkins was very articulate about this suggesting that there's a lack of drivers for market driven

solutions to this and there is a need for evaluation techniques so that you could rate buildings regarding their safety so that its easier to reflect that safety in rental rates and in property values and so forth so that you develop a market driven approach and I'd say that that is really a very long overdue effort in both countries – here in California and New Zealand. But to support that what you really should be investing at this stage is thinking about what do we advocate for future research. I would suggest its social economic research to be conducted so that you can document the downtime costs and the amount of disruption of the damage, the repair costs, the re-evaluation costs of the previous retrofits and so on and so forth so that you have that basic information to assist in the policy makers making informed decisions so that you're filling out not just the structural engineering aspects but the social economic aspects of the policy issues. And I think I should end at that point. I realise that we have an opportunity to have further dialogue and I'd be happy to perhaps interject some other (inaudible 13.03.54) when the time is appropriate. Thank you.

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JUSTICE COOPER ADDRESSES MR MILLS

MR MILLS ADDRESSES MESSRS LIZUNDIA AND TURNER

COMMISSION ADJOURNS: 1.06 PM

COMMISSION RESUMES: 1.34 PM

MR MILLS ADDRESSES THE COURT

BRETT LIZUNDIA (VIA VIDEO LINK UNITED STATES)
FRED TURNER (VIA VIDEO LINK UNITED STATES)
ASSOCIATE PROFESSOR JASON INGHAM

JUSTICE COOPER ADDRESSES PANEL

JUSTICE COOPER TO ASSOCIATE PROFESSOR INGHAM:

Q. Well I thought that we might start by asking you, Dr Ingham, to respond to any particular matters which you think are of particular relevance arising out of the discussion we've had from Messrs Lizundia and Turner this morning.

A. Yes. Thank you. There are a few comments that I would like to make. First of all I just want to acknowledge that I greatly value and welcome the feedback that I've received. It has been noted I've made an attempt to incorporate many of those good thoughts and ideas into the addendum report and certainly in my own mind the combined contribution is far more valuable than any of it on its own. Just as a point of clarification really I wanted to confirm at least from my perspective a sense that each report was by necessity a certain compromise in order to be able to produce it in a timely manner with the first one produced before the interim report and the second one before the hearings and that I think all parties can be quite confident that if I had had the opportunity, along with my co-authors, we would have preferred to have done a more exhaustive analysis on the data set and to be able to report a lot of the detail that Mr Lizundia in particular mentioned. We are very aware of the gaps in our data set but perhaps it is less clear that at the current time my research team has received no funding to make much of that possible except for the funds provided by the Royal Commission itself and so it's sort of somewhat interesting that the work on the adhesive anchors is funded by the United States National Science Foundation and my request for companion funding was declined and, similarly, a lot of the work has been funded from the University of Adelaide so we're very thankful for these funds from other countries. The Commissioners themselves will hopefully recall that before crafting the first report Professor Griffith and I made it clear that we have very little expertise around the cost of retrofits. We received a request to at least begin the debate and hence put in that very crude calculation and in that regard I think it has been successful because the

media have very quickly tuned into that issue and all we really hoped was to begin the debate and the debate has now begun. So I think Professor Griffith and I both look forward to people with better data and more expertise doing more sophisticated work on that topic. I think that very much, certainly in my mind, perhaps, as the lead author of both documents, I was writing for, I think the advice I received is for an informed member of the public and that it is no great surprise to me that some of the comments feel a little as if they lack technical detail because they were not intended to be of that particularly technique nature. Also I think in order to make such technical comments it would have required me to have a greater deal of consultation with others and a longer time period and so what has been presented was to some extent a necessity. To be frank, I suppose, I had not anticipated the degree of scrutiny that some of the comments have received so that's probably a comment on just my own lack of having done such an exercise previously. Nevertheless it's all very valuable. A number of comments were made around the value of such activities as further field testing, further collection of data that would enrich the data set and I believe we've received the answer to that question already from yourself, Justice Cooper, that it would probably not be the, the role of the Royal Commission to request for further data to be collected but, nevertheless, I do want to go on record saying that my research team would be very enthusiastic to expand the data set further if funds were available to do so.

Q. Can I just say, because it may be relevant, having regard to what Mr Turner said as well. We, the Royal Commission does not assert any ownership or property in these two reports that, that have been provided to us or indeed the peer reviews so there is, whilst we have certain time constraints which we must be very conscious of there could be no suggestion that these reports could not be further developed in other forums or for other, or for other purposes.

A. Yes I appreciate your comment. I want to make it very clear that we would be delighted to share the data base with anyone who so chose to

request it so there's no notions of protecting that and we do intend to publish the data we have currently as broadly as is appropriate. The difficulty is that none of the research team are Christchurch based and so the reason why I'm not able currently to provide further information on the adhesive programme is because the principal investigator of that programme is in Minnesota and wishes to get it complete before shared so I actually have no further information on that currently other than what you've seen. Similarly, my Australia colleagues have exhausted their funding and are returning back to Australia and meanwhile, similarly, I from Auckland can't do much more without putting my, my team in the field. So that simply explains why the data set we have is as it is but we will continue to publish that data and share that data as appropriate.

Q. Well the other thing that perhaps I can interpolate, although it will be some months that elapse before we make our final report, is that where we identify whether in this field or others that we think further work should be done we will make recommendations about that. We operate on a limited budget but it may very well be the case that Government agencies would consider seriously recommendations that the Royal Commission might make for further work to be carried out in whatever relevant field so to that extent we may be able to be of assistance.

A. Mr Lizundia mentioned one particular comment in our first report and once I received Mr Lizundia's peer review I went back to that comment and decided that he was completely correct, that it had been written in a way that was unfortunate. It refers to the notion of current standards being appropriate, or some similar wording and it may have come to people's attention. We didn't reproduce that comment in the second report but, furthermore, just to explain the intent I think for a more accurate interpretation from our perspective was that there was nothing in our original report or even in our second report that associated with the collection of data around unreinforced masonry led to an identification of deficiencies in current standards, material design standards produced by Standards of New Zealand which to some extent

is rather obvious because we have no current standard for unreinforced masonry so I was intending for that to imply that there's nothing out of our findings that suggested that the current concrete standard or concrete steel standard would need modification.

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However when I went back and revisited a comment I acknowledged it was very vague. I also didn't mean to imply in any way, shape or form that our findings show that current guidelines or practices associated with how we retrofit unreinforced masonry buildings should be interpreted the same way and in fact I think both through my own evidence and comments and questions yesterday, plus what we've heard this morning it's quite clear that actually that's not true at all. I've also had an opportunity to reflect overnight on yesterday's sort of discussions and I think it's very clear that there is a great lack or comparative lack of detail between how we undertake to design new structures versus existing structures and want to acknowledge that and what Mr Lizundia said in that regard.

Q. Do you agree with Mr Lizundia's comments which, if I'm reflecting them accurately, really are that we have the Building Act and we had the NZSEE guidelines, but they are really in the nature of assessment guidelines rather than, so identifying problems rather than how you would go about seismically strengthening a URM building?

A. Yes, I agree with that comment, I guess I feel that there's several related matters and as was discussed this morning after the questioning I received from Professor Fenwick yesterday I reflected on the origin of the percentage of new building strength.

Q. Yes.

A. Because that's been a key feature I think of the discussions that we've been having over the last two days and no doubt will continue to be so, I could well be wrong because I had no role to play in any of that work but it seems to me when you amalgamate the legislation itself as we discussed in the opening comments yesterday and how it refers to this one-third in the legislation, and then combining that with the 2006 NZSE

document, together those two documents, and I'm not sure which sort of began first and informed the other, really in my understanding is that's the genesis of what we currently have, is the metric. Similarly I think there's widespread agreement and Mr Lizundia made a comment in that regard that the 2006 guidelines amongst users are often found to be difficult to use, that they are incomplete, they do not (inaudible 13:47:10) worked examples. They have in fact, those issues have been recognised and my own research team and research activities have been responsible for developing a draft of a newer version for unreinforced masonry, and those results to some extent are now actually informing the work that Mr Turner's leading in the United States and we're in the process of having those results critically peer reviewed internationally and would in time I hope put a more complete document in place. However over the last two days I've obviously had the opportunity to reflect, even then they would still only be guidelines unless we had a more formal process in place of something akin to a standard for the assessment and retrofit of existing buildings.

JUSTICE COOPER TO MR LIZUNDIA:

Q. Can I just ask Mr Lizundia, because you've had experience as I – I think I heard you say you had experience in New Zealand of trying to use this percentage of new building approach under our codes, could you just tell us a little bit about that and expand on what your experience was.

A. Yeah, you're a careful listener, I probably should have been more cautious about that. But it's true, unfortunately the size of the data set is a whopping one, so I have helped one of the companies in New Zealand evaluate an existing building using the 2006 guidelines. It was a concrete moment frame building so totally different buildings.

Q. Yes.

A. But in using it and learning about it and talking with the authors of it, and talking with other engineers about how it was implemented, you know I learned a lot about the process of – that's applied in trying to do the more detailed evaluation, so this was a building it was – had an initial,

an IEP and then had the later more detailed assessment. However it was a pretty thorough assessment that we did so we were doing a response back here and an analysis over building (inaudible 13:49:36). Had a lot of complexity, more than we thought when we started.

Q. You would have had though, in the case of a building like that, far more substantive rules to cross-refer to wouldn't you than you would in the case of a URM building which lacks any sort of rule.

A. Yes. That's where I was going, you're leading me well and it was through that, in that case there was, New Zealand has a wonderful concrete building standard, and it's one of the best of the world and so there's that and then there's a whole bunch, you know you have sort of an inter-connected web of standards that one has to learn and appreciate, but there really was a lot of information, but it was interesting, but even that building, the concrete building was that many, many times when we faced, when I would pose a question or ask how is this typically handled, that the answer was in so many words, use the new building standard to deal with that, so how is irregularity dealt with. Well, use the new building standard. How is drift dealt with, well, use the new building standard. Now this, you know, it’s more complicated than that but I came away with that, I found it interesting because it's really not the way we do it in the US, as I've mentioned, you know probably too many times that you want to hear it, we really have these parallel streams of new building documents and practice, and then there's other stream of existing building documents and they, they existing building documents are fairly self-contained so you don't typically have to rely, and this is deliberate, you don't have to typically rely on the new building standard to do too much when you're evaluating an existing building and that's, you know, a very deliberate choice because the reason we developed existing building retrofit and evaluation documents is we recognised that they have different worse, ductilities, detailing they have archaic materials, they're put together and raised, you would, if we, given what all we've learned, but we didn't want to discount the fact that given all those disadvantages they still

have measurable capacity, they still have value and we don't want to throw that away, so many, many, many years ago we used to throw it away and we knew it was conservative but we didn't have the tools to take advantage of it. Now the years went by and we tried to really try and understand what was there and embrace it and take as much advantage of it as it was, you know justified, but you know to apply a detailing standard for you know new concrete to an existing material, I mean it doesn't work because they're not the same thing so you know we have dealt with categories of detailing standards that reflect the existing practice and we've associated acceptance criteria with them, so with this concrete building, you know I had a lot of questionings and finally came to understand what the answers were, but we had a lot go to on, whereas the URM buildings as you point out, were much less to go on and I pointed those out in some of my peer review comments but a couple bear repeating, one is what Dr Ingham mentioned is that some of them are challenging, you know the in-plane masonry evaluation guidelines are difficult to use, I mean they're very academic and very unusual, frankly that you would model anything in a design office that way, I mean you really wouldn't do it that way, it would take too much time and doesn't capture some of the more practical issues, but even more fundamentally there's a whole host of deficiencies that don't have explicit associated techniques for addressing them and that's one of the advantages for better or for worse of a document like that, IEBC is, it kind of goes through the litany of things that we've observed to lead to damage in the past, and tries to deal with and provide a solution for that. It may not be the best solution we can come up with but at least it's there.

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And so I think Doctor Ingham's approach of this set of guidelines that he and his research team have been developing and are sharing with the international community and he and others are working with Fred and the ASP41 update team is wonderful. I mean and I actually had the opportunity once I discovered that to sort of stand for what he's done

and it's a huge improvement on what you have now so I'm sure as that process unfolds that it will be you know something that you'll be able to be well served from so I hope that that you know what he wants is what I would like too that that process comes to bear and what's interesting is that's a pretty big document from what I seen and that's just one building type so you know the 2006 standard is all of the building types or at least a pretty healthy collection of them and you know here's a particular one that he has you know expanded in great detail so it kind of illuminates a bit of the issues once you start thinking carefully about retrofitting these buildings there is a lot to it.

Q. Now just to understand the standard that you are referring to there is the 2006 standard what precisely are you wanting to refer to? I thought that we were talking -

A. This is the 2006 NBSE guidelines and the other one that I was referring to is the 2009 International Existing Building Code that's a US international code council produce documents.

Q. Is that the international code for building conservation ICC 2010?

A. Yes.

JUSTICE COOPER TO MR TURNER:

Q. Mr Turner, do you care to comment on what Mr Lizundia has just spoken of? You are less concerned I think about the percentage new building standard approach that we have in New Zealand.

A. I can make a couple of suggestions. The first is I think we both the state of California and New Zealand share a common chronic underfunding of earthquake engineering research and shockingly how little there is in terms of available testing and that's really what we both share and so we have been of late attempting to share resources as best as we can as well as the other countries. There are other countries conducting research Iran, Canada notably and so I think we can perhaps best marshall our resources to solve common problems by improving, the sharing of information and filling the gaps that might actually benefit multiple countries and I think we've seen that effort of late. I am actually

not a designer anymore. I used to design buildings over two decades ago but I'm in essence a regulator in a lot of ways and so I have been viewing you know the NZSEE guidelines since 2006 and then Jason Ingham's, the University of Auckland's draft on reinforced masonry guidelines were issued in February and we have picked some of the best available research, whether it comes from New Zealand or Canada or Georgia Tech or Iran have been incorporating those recommendations and I can say specifically that it was the case of dealing we benefited from hyper-thickness research, tall slender walls, a vigilant flighting criteria, diagonal tension, flange studies that were conducted at the University of Auckland and studies on spandrels (inaudible 13:58:35) and so I think we're going to mutually benefit from that but the overlying constraint that many researchers face is there's really a paltry of investment level of research considering you're thinking about investing several billion dollars of future construction in New Zealand on a possible policy applied to Government authorities based upon a very small amount of research. Think it's really out of balance and I do think that they're out of balance in all countries around the world considering what we say and the potential for life loss and economic impact so additional investment is warranted and so I would urge you to consider recommendations along those lines because I think really what we're dealing with a chronic lack of investment and we're doing what engineers care to do and that is based upon what we have available at this point what should be using to evaluate and retrofit existing buildings and that is essentially what engineers are challenged to do and we're actually making progress and I think we'll see some changes in the near future in standards in both countries but that's unfortunately whether we have faced a common constraint and that is the lack of funding in research.

JUSTICE COOPER TO ASSOCIATE PROFESSOR INGHAM:

Q. Perhaps if I could ask Doctor Ingham these drafts URM guidelines they are publicly available?

A. Yes sir.

Q. And they were published in February this year were they?

A. Yes indeed. I mean the quite humour of it is I was delivering these guidelines in Christchurch the day of the earthquake.

Q. Were you at that conference? What I would like to know is are they guidelines that are at all dependent on the percentage new building standards approach or do they, what is their posture?

A. If I could combine that question with the comment I was wanting to also make.

Q. Certainly.

A. Performance based design has been mentioned this morning particularly by Mr Lizundia and just by way of explanation in collaboration with the University of Canterbury I received a research grant in 2004 and through till 2010 which has created the background and the research results have gone into this guide that my colleagues have authored and in the preparation of that guide I spent some time reflecting on performance based design because it's my interpretation that many people, many structural engineers perceive this to be the next generation of design philosophy. If you're not familiar the background is that you start designing your structure more on how it performs in terms of displacement and strains rather than forces and stresses and I reached the conclusion that at least in New Zealand currently we did not have a consistent or uniform understanding of how we might go about performance based design for structures generally. I was told in my conversations with several leading exponents of structural engineering in New Zealand that there was not a sort of consistent thought on how we would undertake such an exercise even for new structures. I was also informed that such an exercise wouldn't have any legal status currently in terms of the way our Building Act is constructed at the current time and what's more as I tried to convey yesterday in my questioning with Professor Fenwick I had a sense that performance based framework would be much harder to implement for earthquake strengthening of unreinforced masonry buildings than it would for new

structures and final comment is that in my discussions with what you might call the sort of more regular or day structural engineer in the field a lot of them would feel very uncomfortable with the technique in the level of sophistication that some would imply so I developed our guide on a more conventional basis using the loading standard as we discussed yesterday where we would establish a demand on the structure and to answer finally your question we have sections on how to establish the loads on a building and Mr Lizundia referred already to how in fact unreinforced masonry buildings are quite complicated because they have multiple modes, different periods but we also then provided sections on how you would assess the strength of the building.

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So whilst we provided data on how you could then do the ratio and have a more accurate way of calculating percentage new building strength any decision around what level of percentage new building strength you might select is not an inherent part of the design process or an inherent part of the documentation and the way it's written.

JUSTICE COOPER TO ASSOCIATE PROFESSOR INGHAM:

Q. Yes, well I just, when I look at your second report, page 34, you're addressing in paragraph 3, 11.4, that retrofit level as a percentage of new building standard and you appear to me to, the comparison you draw is to the horizontal design action co-efficient and is that right, is that the sort of hinge on which everything turns?

A. I'm sorry I don't have in front of me the particular paragraph. Which page sorry?

Q. Page 34.

A. The, yes on page 34 are the calculations that my research student in Christchurch conveyed to me as the benchmark against which they interpreted their data and so yesterday evening we had some discussion around the validity of the .22 for Z factor.

Q. Yes.

A. That was the Z factor in place prior to the September earthquake. Professor Pennick articulated that it's since been changed to .03 and I think he indicated perhaps there was a thought to make it .35. Mr Lizundia also suggested there was a certain degree of uncertainty around the KU factor and the SP factor.

Q. Yes.

A. That is true. It hinges on this symbol here of Mu – ductility – and how it has been chosen to be interpreted. My research team have taken advice or listened with interest to what has become the standard for the interpretation in Wellington city where they have led the country in doing the initial evaluation procedures and a presentation was made at an earthquake engineering conference, I think two years ago, around how they chose to populate the numbers in those equations and so we have, as a general rule I think, tried to be consistent with that. I don't wish to imply that we have it perfect. Any critical review of the data on this page would obviously require a recalibration of the percentage new building strength plots that are contained in the report but would just be a linear scaling up or down of that axis accordingly and –

Q. Yes, yes, I understand all that but what I'm getting at really is trying to develop my understanding of how this percentage new building standard actually works and that is, is it, this horizontal design action co-efficient, which is set out there, I take it is a co-efficient that would be applied to the structural members, all of the structural members of a new building or is it, or does it look at the performance of the structure as a whole? Is that a sensible question?

A. Yes it is and if I'm allowed to say such a thing I was taught how to use these equations by the person -

Q. On my left.

A. - sitting next to you.

Q. Well you'd prefer him to answer the question?

A. But nevertheless I'll attempt to be a good student. The answer is, in fact, it can be done in both ways. You'd only ever do it in the second of your two scenarios if you were wanting to analyse parts and portions of

a building but, ordinarily, this calculation is applied to the entire structure. You determine the period of the entire structure, the mass of the entire structure and you apply this co-efficient, normally referred to as a base shear, where the loads then are distributed on the structure in an appropriate way according to its structural dynamic characteristics and then you analyse how those loads are transmitted through the structure and then the demands on each and every part.

Q. So if you were going to seismically retrofit a URM building to meet 34 percent of new building standard you would be comparing the performance of the structure as a whole with a new building? You would say well if we do A B and C to seismically strengthen this building we will have achieved, we will have brought that retrofitted URM building up to seismic resistance level which is 34 percent say of what a new building would achieve, looking at the structures as a whole. Is that the way it works?

A. Yes, well I would just like to say that on reflection of the questioning yesterday I think you will receive much better quality of answers when you start having before you practising structural engineers because I, too, would be very interested in knowing how they actually do undertake this professionally in their office. Similarly we don't have formal courses at the universities on how this should be done. So there is a degree of interpretation. However, my interpretation would be that either you make a decision before you begin about what level of percentage new building strength you wish to impose on your structure and then analyse it for that level of loads. In which case if it's deficient, as I mentioned yesterday, you would identify the first deficiency, the weakest deficiency, strengthen that, analyse it again, until finally the building appears to be sufficient for the level of loading you've imposed on it. Or, alternatively, you would do the calculation in reverse. You would analyse the structure and identify it's limiting capacity and calculate that against the load you would put on a new building and work out what it's actual capacity is.

JUSTICE COOPERTO MR LIZUNDIA:

Q. Mr Lizundia can you usefully comment on what we've just been told and, if so, will you?

A. I'll leave it to you to decide whether it's useful or not but I'll comment anyway. I would agree with Professor Ingham that I think the best source of information on how this is actually interpreted and implemented in practising design offices is to speak to practising design engineers and you know if we had more clear prescriptive, definitive, standards that would be less relevant. It still would be important but I think it's particularly relevant here and, you know, as he was talking I agree with his description about certainly it would be one way to do it but I think that's only the beginning of the story because you know I gave you a couple of examples during my comments but I was thinking of a better one as he was speaking which is what we would call supplementary vertical supports. So let's say that you have a truss, it's supported by the brick wall – a very common thing in older buildings, in a church for example – and so it's a heavy concentrated load that's depending on that brick wall to work. So the supplementary support is nothing more than putting another post in front of the wall underneath the truss. Could be a tube, could be a wood post, could be buried inside the wall in concrete, you know it could be done in a lot of ways. But there's no number associated with it. There's no percent new building standard. You are simply prescriptively providing an incredibly valuable thing and so if one says we're gonna target 34 percent MBS how would I have any idea of knowing whether they put in a supplementary vertical support or not. It's not a calculable thing. So that's why I'm concerned about the definition of what's actually happening when we use these percent MBS terms. As an engineer it would be much more useful to me if I knew what the scope of the work entailed and if I knew what they actually analysed and if I knew what the thinking process was. I wish it were simpler but I have to agree with the Professor that the best way to figure this out with the current state would be to ask people and I've tried. I've asked some people and I have gotten kind of the answer that

Professor Ingham said but more the notion that it varies depending on the design office and how it varies and the level of detail and the specificity of that I haven't gotten to the bottom of, nor really tried but I have a feeling you might actually have differences of opinion amongst the profession, reasonable, credible ones, people thinking, you know, this is a good way to do it and other people thinking it's not and neither of them knowing that the other person is doing it that way.

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Q. I'm certainly not a practising structural engineer but people might say that when you in, in the language of regulation talk about achieving a percentage of new building standard you are referring to something which on the face of it is readily able to be objectively ascertained and I wonder whether that might be a misleading implication of such a standard?

A. I, I think it is and I may be, you know at one end of the spectrum on this. I understand Fred Turner's point that, that we in California and in the US have done a poor job of communicating. Part of the reason is we don't have a good simple metric or language that people can understand in everyday terms and so there's this incredible appeal to using a number like that or – you say it's 50% NBS, you have this intuitive feeling well that must be about half as good as a new building. You know it kind of intuitively makes some sense but what I'm trying to bring up and maybe not doing a wonderful job of it is that it's a lot more subtle than that and what, and because of that we, we sort of strayed away from doing it that way here a long time ago and have developed approaches that depend on other things which are unfortunately harder to communicate but in my mind are more compelling from an engineering …

JUSTICE COOPER TO MR TURNER:

Q. Mr Turner is there any comment you'd like to make on that?

A. Yes I can try. We have used some techniques in the US to specifically address this potential for variations of interpretation and one of the best techniques is to encourage organisations such as NZSEE or SESOC in

your case to develop workshops and to generate curricula for those workshops that represent the consensus of the earthquake engineering community and then those are presented as a training device to young and old, experienced and inexperienced earthquake engineers who take these courses and are encouraged to provide continuing education for their own benefit as well as the benefit of their clients and in that way the consistency is communicated not only to practising engineers but their regulators as well and so everybody more or less is on a somewhat more even playing field and they know what the rules are and they know how to interpret the rules and so through concerted training and continuing education of the earthquake engineering profession, whether it be on the Government side or in the private sector side is a technique to eliminate or dramatically reduce the uncertainties and the variability's of interpretation of regulations.

JUSTICE COOPER TO ASSOCIATE PROFESSOR INGHAM:

Q. All right. Now Dr Ingham I think you were, you may have had some other things that you wished to say following on from this morning's comments.

A. I do have some further comments but they're reasonably trivial. I just thought perhaps it might be useful to record them. They were comments Mr Lizundia made and my response to them might just help to clear things up. One of them was the title of the addendum report referring exclusively to earthquake strengthened building, that was because I was asked several weeks in advance of beginning to write the report what we could call the report and then thought we better stick with the title we've already communicated.

Q. I think you might be blaming us.

A. I share Mr Lizundia's concerns about the lack of specificity around the type A and type B classing of the retrofits. I had a view to try to re-craft that information but, again, unfortunately, within the timeframe that we'd promised to commit to a report, present the report to you by we were unable to do so. My research students arrived at that idea initially

actually from some conversations they'd received in California with people from San Luis Obispo around that grouping. So that's really just an explanation of why we did that but I completely agree that it's a little, it's a little too aggregated to be particularly helpful. I think other than that really the other comments aren't important.

JUSTICE COOPER:

Now Commissioner Fenwick are there any issues that you would like to raise at this point?

COMMISSIONER FENWICK TO PANEL:

There was one issue I'd like to rise which Professor Ingham is well aware of but I'd like the comments from the others as well and that is how do we interpret the, the excellent material he's produced in terms of the damage, the prevention or limitation you get with increasing percents of new building standards, whatever that means. How do we interpret that for other areas in New Zealand. So let me just fill you in a little bit about my particular concern there. In Christchurch on the 22nd of February we had a very violent short period earthquake. The violent shaking lasted between five and seven seconds, depending on where you were. It was a buried fault with a length of something less than 20 kilometres and that defines the length of shaking, the time of shaking. It was very shallow and so the energy went into, very close to the surface. So we got very intense motions. Where I was it was about 2.2 vertical acceleration and 1.8 horizontal and in the CBD it was about .8 vertically and horizontally approximately. So it was very intense shaking over that period. With this type of earthquake it is unlikely the intensity of shaking would last more than seven or eight seconds because the attenuation was very rapid, you went 10 kilometres away and the motion was quite a lot smaller and taking a 20 kilometre long fault then when you got to the end of that fault you're more than 10 kilometres away from the, your target area and so attenuation would be occurring at quite a major rate. So we had this very intense shaking. It gave us, as I say, very high forces. It's not the normal sort of earthquake that we expect. Certainly we haven't observed this type of

earthquake in New Zealand before. So the problem is now how do we translate that finding into what may be a more normal situation in other centres where you might get a longer period of shaking but nothing like the intensity of the ground accelerations. The major feature here, of course as Dr Ingham, Professor Ingham has referred to, is the, it was based, the new building standards assessment was based on a seismic hazard coefficient of .22. Well now it's at .3 and GNS are recommending a figure of .3/4 or thereabouts. You know we range from Auckland where you have a seismic hazard coefficient of .13 down to Wellington where they have a seismic coefficient of .4. So the problem is how do we, how do we translate that to other centres. Have you got any, any comments please?

JUSTICE COOPER:

Mr Turner we'll hear from you first.

MR TURNER:

Thank you. Commissioner Fenwick, I agree with you. Earthquakes don't happen often enough for us to only draw from information from one country and so I think the way to best answer your question is to figure out ways of learning from performance of similar buildings in other earthquakes around the world and then piecing together an overall performance profile for a range of building types and I concur with you wholeheartedly that's what in fact why we're so interested in Christchurch sequence.

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It's why I have recommended that you conduct the same sorts of documentation of performance for Darfield, because that gives you another performance point with the same set of buildings and that's a very critical parameter as well, but then we can also go back in history and look at the Baja earthquake last year, Eureka last January, the San Simeon earthquake, San Francisco and Paso Robles, Pasquale earthquake in Washington and so on and so forth, and begin to piece together a profile to owners of buildings, with some inferences obviously one of the biggest one raised is the (inaudible 14:24:57) long duration, major metropolitan earthquake except perhaps for the

Darfield event which I think is of great interest, even though it may have been on the edge of the most intensive ground shaking, but the performance of retrofitted buildings in Lincoln for example is very critical and that's why I recommended that you include those because we can learn a great deal since Lincoln actually did suffer long duration and much higher intensity shaking of retrofitted unreinforced masonry buildings.

JUSTICE COOPER TO MR LIZUNDIA:

Q. Mr Lizundia.

A. I win - I get – it's an excellent question, and I agree with Fred's comments about trying to make the best use of all the information that we collectively have as an international community, even if the difficulty is going to be comparing apples to apples so to speak and both on the ground motion side which I don't think is that hard but more on the, on what the building is. Are the buildings similar, are the retrofit techniques similar, you know I'd like to know more about exactly what was done in Christchurch to feel more confident about that. The other thing that Fred was alluding to is something that I think we as a community in general know a very small amount about, which is duration and its impact on degradation and damage, so I mean one of the shocking things, you've got a very short earthquake and you had significant damage so I mean it doesn't bode well for longer events. We worry about that in the US because of the sub-duction earthquakes that are going to happen at some point in the future up in the north-west, where we're going to have very long, you know durations of shaking like they had in Japan, but we've done no research on that, you know effectively and we use standard protocols and we use quasi or you know relatively slow motions, sometimes we do shake table testing but we don't testings for really periods of time and one of my worries would be that take a brick building that has what we call a rocking mechanism of behaviour in the piers, so for the layout and stats as simple as if this is the piers and there is a window here and a window there, the pier is rocking back and forth as the earthquake pushes it this way and pushes

it that way. This is a pretty benign mechanism, it's a mechanism that's considered relatively ductile, doesn't observe a lot of energy, but it's able to go back and forth without too much danger. Well eventually what happens based on the research is that the bottom of these piers begins to degrade and there's only so much that unreinforced masonry can take so you know as those tests have gone on, eventually what looked pretty good, did, and so I think as you're trying and extrapolate results from short testing and short duration research to long periods you know, we should be worried. I think the other thing that Fred mentioned well, and that I you know reiterated is that we want to do as good a job as you possibly can about correlating measures of ground motion with the observed damage, so, you know and Fred pointed out nicely that even within the central business district if you had a better distribution of ground motion sensors we would probably find you know interesting and significant dispersion of shaking and certainly as you go further out amongst the surrounding communities and other cities, that's going to be the case and so that would inform the richness and expansion of this data set and I think that would help address the commissioner's comment to some degree.

JUSTICE COOPER TO ASSOCIATE PROFESSOR INGHAM:

Q. Dr Ingham, do you wish to add to that?

A. I don't think there's much more I can add thank you. Well can I just say then, I think I'm probably repeating myself yesterday but Mr Turner in particular knows, because I've actually sought information from him already but the issue of duration is perhaps the singular most worrying parameter in terms of the performance of the unreinforced masonry building to myself personally, and I don't think we can yet begin to predict what might have happened if we'd received shaking for 60 seconds or 90 seconds as is quiet possible, but I think we all agree there would be a – the damage is not likely to be linear so there will be quite a significant quantum of increased damage and activities, it's just

that we're not able to accurately predict quite what that measure might be.

COMMISSIONER FENWICK TO MR LIZUNDIA:

Q. Think you very much. Just a quick comment to your rocking motion illustrated, is fine for forces in-plane, but if you have simultaneously actions in both directions that can be limiting too couldn't it, under a lot of rocking just for the tipping of the (overtalking 14:30:35).

A. Yes, I, absolutely, and I think that we have, you know learning more about that, we're doing more testing and it's been done you know, Professor Ingham and Professor Elwood and others are studying that, the inter-relationship of in-plane and out-of-plane motion, whether if you have damage from one initially and then you have you know subsequent motion in the other direction, perhaps it's in an aftershock, perhaps it's in the same earthquake later, you know it – we would presume that one harms the other and that they're not independent at all, I think that the rocking analogy of in-plane motion and what we would call the tow degrading and the pier beginning to walk forwards just straight or back into the building and thus, and putting at risk the things that it holds up, which has certainly been observed in small scale tests, is also true for out-of-plane behaviour, you know you're essentially taking that rocking and you're stacking two walks on top of one another and you're doing this, back and forth, I mean initially as those elements begin to degrade over time, you suffer the consequences of that and we, this is something that needs more research and more standardisation. My suspicion is that we're unconservative at the moment.

Q. Thank you.

COMMISSIONER CARTER TO MR TURNER:

Q. Just Mr Turner, you've mentioned that something over 20,000 buildings have been strengthened and you've touched on the development of expertise, we're contemplating thoughts of peer review work and levels of expertise in consenting authorities, do you have anything to offer in

how those sort of skills are developing and are proving to be practical in terms of approval of projects etc.

A. Well Commissioner Carter, I did think that there could be a tremendous amount of gain by investing more in improving the capability of building consents authorities to regulate the retrofit of unreinforced masonry buildings, and we have seen a lot of that, in fact one of the trends we see, and Bret Lizundia was instrumental in identifying this after the Northridge earthquake but one of the most prevailing themes that have emerged from past earthquakes in California is that poor quality in design and construction have actually contributed an inordinate amount of earthquake damage to systems in the past, including unreinforced masonry buildings and so, I know one of the things that came out of the Northridge earthquake and Bret was instrumental in developing the basis for this, was that investing in training, our plan reviewers, with the building consent authorities and our construction inspectors is perhaps one of the best investments we could make.

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While we can trust designers and contractors to a large degree we should have also in place methods to verify that the work they're doing is in fact compliant with the regulations so we have some training so that never had occurred because much of our retrofit activity has tapered off. The 1986 programme is pretty much spent. There are some areas of California if you look on the map of California those circled counties are the areas where we still see a significant amount of retrofit activity but for the most part the other counties have pretty much played themselves out so we still have a few regions in California where this is an ongoing issue but to a large extent where we're actually now progressing into other building systems that also should be retrofitted.

JUSTICE COOPER:

Well now I think that will conclude the discussions and it remains only for me to thank both you Mr Turner and you Mr Lizundia for your valuable contributions to the work of the Commission. It has been very pleasing and

gratifying to us that eminent people such as yourselves have taken time out from your busy schedules to assist us in what is very important work for this country and we are very grateful to you so thank you very much and thank you too Professor Ingham for your very comprehensive report which has been of great value to us thank you.

COMMISSION ADJOURNS: 2.35 PM

COMMISSION RESUMES: 2.42 PM

MR MILLS ADDRESSES THE COURT RE NEXT WITNESSES

The person who is, as I understand it, going to be the principal speaker, at least initially, although the others will be available for question and comment to the Commissioners, is Jeremy Salmond who I think is probably well known to all of you. I will say a little bit about him. He is a principal of Salmond Reed Architects, which I know well because it's in my home town of Devonport. It's the largest conservation architecture office in New Zealand. Jeremy's own specialisation is the conservation of historic buildings and, perhaps of particular significance in the part of New Zealand we're now in, he is a grandson of the well known Dunedin architect, Louis Salmond, and was brought up in Gore, which immediately assists his credentials. Jeremy's had, I've looked at his CV and I think it's now on our website, and as with all of the people we're hearing from what I'm going to say about them doesn't fully do justice to the very extensive and impressive CVs they've all got but I'll just touch on a few points about his work. He's had direct project experience with major projects to rehabilitate and adapt a number of important heritage buildings. Your Honour will probably be familiar with the Auckland Jewish Synagogue and, of course, with the Auckland Civic Theatre. He's also been involved in St Matthews in the city in Auckland, Sacred Heart Cathedral in Wellington and the former Chief Post Office in Auckland, now the Britomart Centre. He's the former Chairman of ICOMOS and a member of the New Zealand Historic Places Trust and other similar organisations. He was elected as a fellow of the New Zealand Institute of Architects for his outstanding contribution to the conservation of historic buildings and in 2007 he was awarded the Queen's Service Order for his contribution to preservation of New Zealand's heritage of significant buildings. The second of the people we're going to hear from is Ian Bowman, who is a principal in his own firm. He is an historian, architect and architectural conservator who specialises in all aspects of build heritage conservation. He has a Bachelor of Architecture degree from the University of Auckland and a Master of Arts and Conservation

Studies from the University of York. He was made a Fellow of the New Zealand Institute of Architects for his services to conservation and to the Institute. He has 30 years of combined experience in architectural and conservation work in England and New Zealand. Again, some of his building projects include the St James Theatre in Wellington, the Regent Theatre in Palmerston North, the Maritime Museum in Wellington, Government Buildings, the Dominion Museum, the Dunedin Law Courts and the Auckland and Wellington Town Halls. He is currently involved in the conservation of Government House, Premier House and Parliament Buildings. He has specialised in the conservation of stone buildings, a point that is of particular relevance in this city. The stone conservation projects he's completed include the former national museum, Dunedin courthouse, Timaru Basilica, the Auckland Town Hall and the restoration of Olveston. He has been involved in conservation projects in addition in structures in marble, granite, briar light and greywacke, including the National War Memorial and he's given advice on a number of other stone conservation projects, including the Dunedin Railway Station and the Christchurch Basilica. He's also given conservation advice to the Christchurch City Council and the former Banks Peninsula District Council including a conservation plan for the Canterbury Provincial Chambers which is a matter, no doubt, of some particular resonance. The third of the speakers, or the third of the panellists is Bruce Petry. He is also a director of Salmond Reed Architects. He began his professional career working with the New Zealand Historic Places Trust and joined Salmond Reed in 1998. In 2007/2008 he worked as a Senior Project Architect in one of Britain's leading firms of conservation architects. He, too, has participated in a number of significant conservation projects in Auckland including the planning and initiation of the Britomart Urban Renewal Project, the expansion and re-development of the Auckland City Art Gallery and, most recently I think, the adapted re-use of the Rob Roy Hotel and the Campbell Free Kindergarten. He is a board member of ICOMOS, the New Zealand Historic Places Trust and the New Zealand Conservators of Cultural Materials. Finally, David Reynolds is a Director of Reynolds and Associates, a consultancy which provides cultural heritage management services to territorial authorities,

heritage agencies, museums and individual owners of heritage assets. He worked for 13 years at the Auckland Museum as the Museum Educator and then for 17 years the New Zealand Historic Places Trust where he became it's Northern Regional Property Manager. He is the founding Chairman of ICOMOS New Zealand and is currently a member of its executive board. So with that background I would like the four of the, if they would please, to come forward and sit over in those seats at the side. Now again I'm not sure if this is submission or evidence but perhaps it doesn't matter.

JUSTICE COOPER:

Well I think we'll treat it as submission.

JUSTICE COOPER ADDRESSES THE PANEL RE THEIR EVIDENCE BEING SUBMISSIONS ONLY

JEREMY SALMOND
IAN BOWMAN
BRUCE PETRY
DAVID REYNOLDS

JEREMY SALMOND:

So we're speaking to our submission, sir. I believe you understand what the acronym ICOMOS stands for and perhaps some idea of the background. You may be familiar also with the ICOMOS Charter.

JUSTICE COOPER TO JEREMY SALMOND:

Q. Well I am, I'm not sure if my colleagues are.

A. Very well, it underpins our submission. I'm not sure whether a paper copy was lodged?

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Q. It's available to us on the –

A. Yes, that's correct.

Q. – internet in any event.

A. Yeah. So if I may then proceed sir?

Q. Yes.

JEREMY SALMOND:

This is not a technical submission in the sense that the previous discussions have been although it's fair to say that many of the professional membership of ICOMOS have strong technical interests in these matters and are practitioners in one way or another. ICOMOS includes architects, archaeologists, engineers, conservators, historians. So a wide branching, wide-ranging group of people interested in conservation of cultural heritage property. Our interest I suppose is concerned with widely held community values and related to cultural heritage of New Zealand. These include acknowledged historic buildings but also the generality of what we might call character buildings, shall we say "old" buildings. These values generally once lost are not renewable, they're irreplaceable. A presumption of our submission is that matters of life safety are, of course, paramount. ICOMOS New Zealand seeks that the methods and processes applied to the repair or strengthening of, in this case, unreinforced masonry building stock will recognise these wider social values. ICOMOS seeks that territorial authorities in particular will have regard to such values in framing policy for management of buildings at risk. ICOMOS recommends the national adoption of the policies and principles which are set out in the ICOMOS charter as a means of giving effect to section 6(f) of the Resource Management Act which we note is effectively suspended in Christchurch by the creation of the Statutory Reconstruction Authority. I think I'm correct in saying that. ICOMOS urges the Commission to recommend that cultural heritage values are given protection in any future state of emergency in a manner that reflects the social significance as contemplated by the Act. I think it's fair to say that our interests would include interventions into buildings to prevent damage,

interventions to repair or restore after damage and, in particular, the effects of those interventions on the values for which a structure is valued and we might say, it may be a oxymoron, but it seems fruitless to destroy a structure in order to save it. So in the end we are interested in technique and method. The group, the four of us, we can address any matter related to refurbishment of existing buildings. We, none of us is an engineer. We're interested in the effects on heritage values and we can speak to some recorded cost data that we have collectively and perhaps we can refer to exemplars of what we regard as acceptable practice. So we would welcome questions from the Commission.

JUSTICE COOPER TO JEREMY SALMOND:

Q. We as part of the planning for this hearing approached a number of people, I forget how many people, asking for submissions but we didn't get much – and I'm pleased to see you here Mr Salmond but I think you may have got one of our emails asking for a, an expression of interest or asking for submissions for this hearing and perhaps that's why you're here?

A. Yes that's correct. Our organisation received such.

Q. I suppose it was a bit, it was a bit disappointing that we didn't get many people responding to that invitation but there may be many reasons for that. It may be helpful if, I understand from what you've said that you're all architects. Is that, is that correct?

A. All but one.

Q. Who's the exception?

A. Mr Reynolds.

JUSTICE COOPER TO MR REYNOLDS:

Q. And what's your area of expertise?

A. Archaeology.

Q. Archaeology?

A. My training, yes.

Q. Right.

JUSTICE COOPER:

With specific reference to, to buildings. I'd be interested in anything you could share with us about the level of expertise and it's availability in the field of conservation engineering if I may put it that way as opposed to conservation architecture. Where do you go to. Who do you go to when you're presented with a particular problem concerning the structural implications of work which you might like to carry out.

MR SALMOND:

Well perhaps I'll ask my colleague Mr Bowman, Ian Bowman to speak to that.

JUSTICE COOPER TO MR BOWMAN:

Q. Yes.

A. There are several engineers who do a great deal of work on heritage buildings and I think you'll be hearing from Adam Thornton –

Q. Yes.

A. – possibly tomorrow and he's listed quite a number of projects that I've worked with him on.

Q. Yes.

A. There is an issue and I think other people have brought up the issue of special expertise within the engineering area and I do know that in Australia there's a separate registration for heritage engineers and as far as I'm aware there's only one who has that registrar, Bill Jordan in Newcastle.

Q. Yes.

A. And he has been to Christchurch and has inspected the damage here and has given advice I think to the Historic Places Trust.

Q. Have you ever, my impression as a lay person is that there are not many people who would call themselves conservation engineers. Is this a problem for you as architects?

A. I think there probably is because most engineers don't have the experience in archaic building materials or archaic structural systems.

Issues such as the strength level of lathe and plaster for instance, can the strength of that contribute to overall bracing. Research I know has been done in the States by a number of engineers and I think also the Getty into archaic building materials but I am not sure whether that has filtered down through to New Zealand engineers whereas people like Bill Jordan who have a particular interest in engineering of heritage structures has a tremendous knowledge on materials such as lime and mortar. So lime/mortar will, is used a great deal in historic brick and stone structures and its behaviour he understands well whereas perhaps engineers who are trained more on modern buildings don't have that understanding.

JUSTICE COOPER TO MR SALMOND:

A. If I may add to that sir?

Q. Yes Mr Salmond.

A. Acknowledging as Mr Bowman says that there is not a group of engineers who characterise themselves as historic engineers in New Zealand we would all agree I think that we have found refuge in a number of practitioners who we would agree are sympathetic to those issues, have an understanding, are prepared to perhaps re-examine some of the engineering precepts all within the over-riding circumstance of structural safety of course. No engineer is ever asked to do anything other than make buildings safe but, certainly, in my own practice we have had recourse frequently to engineers whom we recognise as having a particular sympathy to those issues.

Q. Have you, I suppose that the work that, on which you will typically be consulted will in the, in terms of historical restoration of buildings will commonly, or most commonly involve the expenditure of public money. Is that a, is that a fair statement?

1502

A. Well I'll offer my opinion sir probably most commonly I suppose if you added up the numbers the most money is spent by the public. I think both Government and local authority are aware of their obligations in

relation to their own cultural property and the Government has set standards for its own culture property but whereby no means reflected to the expenditure of public money. I think we will all agree that.

Q. I mean to what extent are there private developers or building owners who engage conservation architect in restoring buildings?

A. Absolutely. Mr Petry has a thought to offer on that.

MR PETRY:

I was going to say Britain art is a case in point where you've two different companies in Auckland involved in probably one of the largest downtown redevelopments of existing heritage buildings in the country.

MR BOWMAN:

And if I might also add in Wellington there's a similar firm that does strengthening and refurbishment of heritage buildings. It's owned by the McGuiness family in Wellington.

JUSTICE COOPER:

Yes. I think it is fair to say that the stock of unreinforced masonry buildings in New Zealand is the subject of considerable attention both by us and the public generally as a result of these earthquakes and if as a result of our recommendations pressure comes on to seismically strengthen those buildings is the expertise available, readily available if the choice is made to proceed down that track?

MR SALMOND:

I will speak on that if I may. I believe that expertise is here in reasonable quantities. We're not represented here by a growing profession in New Zealand or in force in the UK but that's the what I call their chartered surveyors, chartered building surveyors these are neither the national surveyors or quantity surveyors they are specialists in building conditions and there's quite a large number of them in New Zealand now and they supplement the work of the conservation architect or the heritage architect.

Of course it's an equation or a function of the validity with which that process might take place and we know that this has been an accident waiting to happen for many, many years because local authorities have not issued the requirements to building owners to upgrade their buildings which they might have under the formal Local Government Act or even under the current Building Act have been very long timeframes for within which owners of buildings are given time to do what is necessary and I don't know that any letters have been issued say in Auckland under either of those Acts to oblige owners to upgrade so in some ways I think we would say we would be happy if that process was accelerated but we might well be overwhelmed I'm not sure.

JUSTICE COOPER:

Again as a layperson in such matters I imagine that tensions can sometimes arise between what you would prefer to see happen in the treatment of the building as a conservation architect and what an engineer might be telling his or her client to the most cost effective way of going about a work is that something you encounter?

MR BOWMAN:

Your Honour if I could answer that. Usually heritage building projects has a team of a number of specialists and an engineer and a conservation architect are normally key members of that. They usually have the conservation plan prepared for heritage building before conservation projects so that outlines for everybody the importance of the building and it also gives policies as to how to go about things like strengthening so once a plan like that has been written then that is the blueprint for the approach for other consultants such as the engineer and mechanical and electrical consultants so where we have we do certainly and I agree with Jeremy that we do have excellent engineers here they are advised by conservation architects and there may well be compromises made but on the whole provided the conservation plan is followed then there ought to be a good outcome and just as an example of that currently the Wellington City Council have decided to rethink from a

building that we strengthened in 1992 and I was a part of the process for both the 1992 strengthening and the current projected strengthening of the building so having that length of experience and also the knowledge of the building and also having prepared the conservation plan that to a certain extent makes the process a little easier because people are aware of what the key heritage places are, what the key heritage fabric is so the engineers they're the ones that are concentrating on they have a great deal of knowledge as to appropriate locations for appropriate strengthening.

JUSTICE COOPER:

The, correct me if I am wrong because I am relying on my memory really but a conservation, the language of a conservation plan or that terminology will generally be at an applicable where the building has been recognised as one of particular value whether by the Historic Places Trust or by the council in its district plan is that right?

MR SALMOND:

Well can I speak to that sir. It's true that registration under the Historic Places Act or scheduling in the district plan recognises heritage value but it doesn't confer it. That's a pre-existing condition. There are many buildings which I think we collectively could probably name that would merit registration or scheduling which are not yet in that happy stage.

JUSTICE COOPER TO MR SALMOND:

Q. But requirements to provide conservation plans would generally be contingent on some kind of formal recognisation wouldn't it?

A. Yes that's true.

Q. And it's not every unreinforced masonry building for example that would require a conservation planning approach.

A. I'm not wishing to hold the action but I would say that I think again we would agree that we would intuitively deal appropriately with a building that did not have a conservation plan but we would wish to do sufficient

study to understand the building so that we approach it in the correct manner.

Q. If you were consulted?

A. Yes always assuming we were consulted yes.

COMMISSIONER CARTER TO MR SALMOND:

Q. Mr Salmond, does ICOMOS ever contemplate advising on replacing such as to capture the same function and visual content or just the general atmosphere of what pre-existed. We are concerned here in this city with buildings that have been unable to be saved and as you mentioned at the beginning of your address life safety is a primary consideration and that's to be taken into account. A lot of what, to me it seems and here is an engineer talking a lot of what people value is what goes on in the building and the atmosphere and the purpose that it serves. In cases where we are forced to acknowledge that the building for one reason or another is not going to continue to live on it seemed to me to be a great pity to lose some of the atmosphere that those buildings created and I might say just to give you an idea as the way my mind is turning say a village type street in which there's been a lot of small businesses occupying those spaces et cetera and the public enjoy the atmosphere that's created in them. There could be then an architectural challenge if you like to recreate that same sort of atmosphere and I know we're dealing with matters that are beyond saving the fabric of the structure when I'm talking like this but I would hate to think there was a gap left where when something is removed the other qualities that went beyond the structure itself which people were enjoying were also lost and I wonder whether that is an unnecessary loss that could be, could be counter-acted by better re-designation of the type of activity that would be permitted in the future on that site.

1512

It's no longer just a piece of bare land but it's land which has a particular function to provide for the public what they had been enjoying in the past but I may be straying way outside of, of your province and, but I

value hearing what your thoughts might be on such things. I've encountered a couple of those cases in my engineering background in which it was impossible to save a large area of buildings according to the owners and the authorities and so forth but the redevelopment required the replication of what had been there before and I think today the, although the buildings are new they look similar to what was there beforehand and they're still serving a purpose of providing that sort of atmosphere that pre-existed. The case I'm talking of is in Singapore.

A. Your question begs a great many others sir, if I may say so. A building once destroyed or demolished is gone.

Q. Yes.

A. And I think the interests of a conservation architect in that building go with the building and I'm happy to stand to be corrected by my colleagues but I would go onto say that the cultural artefact here we might say is the centre of Christchurch, the city and you might then say, your question goes to the quality of the city environment I think which from a heritage or conservation perspective is still perhaps capable of being preserved in some manner. The issue you raise about the quality of what comes next is a matter I think of design and I, and I speak for myself here. I would much prefer to see good contemporary design replace what has been lost. There's a general acceptance amongst professionals who subscribe to the ICOMOS charter that replication or reproduction has less, has limited value simply because it's not authentic as to, it purports to be something that it's not and I think an exciting city can be created equally well with new buildings. That's the next opportunity. The question perhaps remains if, if it was agreed that shall we say the centre of Christchurch is an artefact in its own right then how much can still be saved of the inherited fabric as a component of that new city. It may not be a satisfactory answer. Perhaps my colleagues would want to add –

MR PETRY:

I might be able to add to that. I've had the opportunity to look at Berlin, particularly the reconstruction of Berlin after the, the wall was, was removed and they've undertaken quite a substantial amount of research. Of course the Germans are very thorough in the way they document these, these things and they have combined a range of reproduction as well as building new to re-establish the entire, the entire city in a suppose authentic or a regenerative way and I think that Christchurch could potentially have that same process, that cities are constantly changing and what Sir Ron has talked about is the intangible heritage of a place is very much a part of the history of the place and it's certainly an area of concern that ICOMOS has and I think the loss of that, the intangible feelings of the city is a serious concern and I think to just be focussed on the built environment is problematic, that we need to look at the environment as a whole and to look at the city as a dynamic entity that's changing all the time.

MR REYNOLDS:

If I might add to that. In Christchurch the issue is looming of the retention of facades with buildings no longer behind them. That's probably the most extreme situation you can get in conservation but the ICOMOS Charter, the New Zealand Charter, deals with that situation. It deals with the interventions of conservation processes ranging from the very minimum such as cleaning or just leaving the building well alone through to the absolute maximum intervention that you can undertake. It also discusses such things as replication and all the time it hones in on, on the significance of original fabric and where there is none left that's where we drop off, that's where we think that people ought not to be indulging in, in the reconstruction of something where there is virtually no evidence left to, to replicate it. So the conservation processes that we're dealing with rely very much on knowledge and on evidence.

MR BOWMAN:

And if I may also add my tuppence worth. On a slightly smaller scale where we have heritage areas usually local authorities have designed guidelines written for them so where buildings are removed or demolished then the replacement building has to comply with the design guidelines. In terms of the replication of heritage buildings once they gone, ICOMOS has two very good charters that the Commission may wish to refer to. One is the Dresden Declaration of 1982 and the other is the Riga Charter of 2000 –

Mr Bowman repeats as requested – Riga Charter 2000.

MR BOWMAN CONTINUES:

The Riga Charter and those declarations as well as the Nara Charter that is mentioned in our submission they discuss the possibility of replication of buildings of probably national or international significance only. So the concept of replication is extremely rare and usually revolves around buildings that have a sense of crucial national identity and perhaps one example of that would be the Maori Anglican Church at Otaki where it was burnt to the ground and the local community elected to build an exact replica for, I think, the reasons Sir Ron you were mentioning – the atmosphere, the spiritual connections with the building that had gone. So it has happened in New Zealand.

COMMISSIONER CARTER:

Thank you. I was certainly not advocating replica as such. In fact the case that was really impressed upon me some years ago was in the centre of Frankfurt. I happened to comment that it was amazing that the city had survived the way it had considering the Second World War and they told me that it didn't, it was flattened but they brought out all the old drawings and they rebuilt the centre of Frankfurt exactly how it appeared before. So, I mean, that was a peculiar circumstances and I'm offering no comment on justifying it or whatever. I'm just noting that sometimes these sorts of dramatic events like we've just experienced here might produce unique answers to some of the

matters that you're contemplating and if you're not I wonder who else might and that's –

MR SALMOND:

I suppose it's fair to say sir that there is a social and administrative and jurisdictional context in which those things happen and I'm not persuaded that that context exists in New Zealand at the moment.

JUSTICE COOPER ADDRESSES MR SALMOND

JUSTICE COOPER ADDRESSES MR MILLS

COMMISSION ADJOURNS: 3.22 PM