Appendix 3.5.3 An example of data collected for secondary analysis

Theme- Interplay overview

To fulfil the PhD Objectives, 3 interfaces of decision making interplay have been identified: Policy, planning and design. The LTRs have explored what this might mean in different scale of context, with the LTR 7-9 specifically on three cities to prepare the case study.

This theme of interplay is concerned with why conflicts and synergies exist between resilience and sustainable development concepts, and this notion is explored through the differences between the 'paperwork' and the operational reality, what knowledge is being operationalised?

The next three themes will be individually explored through the analysis of interview data collected on references to policy, planning and design codes of practice and its context to be compared with the "working reality". The analysis will group data in power:knowledge groups to consider 1) the identified issue 2) the cause and effect. Gaps in knowledge will be identified. The thematic discussions will then consider how the conflicts and synergies are being generated in practice. This output will then inform what issues need to be considered specifically in a model and inform the detailed case studies.

Theme: Interplay- working design

Previously the LTRs have been discussing frameworks in operation and identified a gap (phd gap 3). Data has been collected on causal responses of decisions because the issues identified will indicate why there are conflicts and synergies in practice of sustainability and resilience.

In order to interpret how synergies and conflicts are created in decision making, the "cause" and "effects (impact of the decision)" need to be identified. This may relate to institutionalised theory and also to the power:knowledge of who makes the decision, but a simplistic view has been adopted and limited by personal interpretation.

The coded data has been interpreted by considering the context of what has been said, and de-coupling the causal response by considering what could be the cause or effect components of each statement provided. Shown in

table x below, are the decoupled responses listed by power:knowledge group, can dominant themes in the ‘cause and effect’ be identified?

This is a retrospective analysis on planning and associated decision making processes to identify, if there is a particular cause or known reference that is referred to in decision making, the effect is also interpreted from the working knowledge.

Working design practice

This analysis is on an interpretation of working design to consider the reality of decision making. Are there gaps of knowledge? Is there a general interpretation of policy in each city that translates into the design process? The data has been grouped together by city to consider how the policies affect decision making in the urban city context. This will create the basis of the case study and causal modelling. (The case study will then combine the LTR 6-9, with themes: policy and working policy, and working planning practice).

Group Boston	Who/what is identified?	Interpreted Cause	Interpreted Effect or impact or action required
BOS 01	1. Basically the first floor of office buildings and buildings are meant to be flooded. so that's an accommodation. If you will. 2. This no such thing as a sustainable building. The only thing that we can actually work on this going to have positive effect on the planet is the people and the the people in the building, yet is not is not to say that the building is important. You don't you don't want to keep dumping carbon into the air. You don't want to have resource excessively resource materials, you we want to do all that stuff but it's insufficient in itself. You have to be working on people's role. What is our role in life and how to we reengage yourself with the way life wants to work in that particular place.	1. Boston is regularly flooding 2.Operational energy has the greatest impact of carbon emissions of buildings. 3. sustainable design approaches are not included in the building codes and are out of touch	1. Buildings need to have a capacity to be flooded. 2. People (the building user) need to be engaged in the design process 3. Mnemonic approach to design focused on safety (but ironically not up to date hazard scenario planning).

	3. because most of those most of those codes and statutes are way out of date and not applicable or borrowed from other people are barred from national code agencies certainly don't want help, but with structural safety and fire safety. Of course, but zoning laws are typically a joke in terms of how life wants to work, they're basically an application or compromise between political and economic interests so very look very rarely do they take life into account.		
Bos 02	1. So there's sort of a three-step process that we use. The first step is to really understand the context of a project or a place to where we're working. And that is sort of an outreaching process of understanding context. The second step is to engage as many stakeholders as possible in whatever this is. If it's municipality then the Mayor plus the council people plus the city staff plus some of the key stakeholders that kind of thing. If it's a project then you get an owner and a developer and all that kinda stuff as well as project team people and probably some town regulator people and things like that. And engage them in a process of really identifying - sort of looking at the context and identifying goals to that context, so goals and principles so that we know what stuff we care about. And in many cases those principles when you let people sort of set their own principles and goals, those principles and goals are at a very high level, people want to do amazing stuff. And then we take that and	1. Activist approach to managing sustainability and resilience, using LEED-RELi, BRDC and other tools 2. considering hazard planning 3. management of energy and water use to comply with design approach 4. Interpretation of resilience 5. zoning compliance 6. interpretation of resilience= robustness 7. frustrations with building codes 8. stringent energy and water use targets	1. Three step process 1) context of place 2) people engagement 3) establish project goals and targets. 2. Use of tools to model emergency responses- hazard management starts to create a trend in solutions i.e. fire and heat waves- structural treatment, approach to building access 3. resilience and sustainability merge on energy and water use wrt passiv-survivability, if you take a passiv-haus stance design must consider sustainable buildings in hazard scenarios- vulnerability, risk and impacts. [if you start considering risk and impacts- civil structural engineers are best placed to generate "safety"] 4. Effective resilience needs to work with municipalities and people to create communities (this is starting to sound like sustainability but with hazard warning systems).

	develop an action plan that gets us there essentially. So that action plan may be a series of certifications and some engineering work that has to be done and various other – some guidelines written and things like that. 2. So we use those tools to understand what matters, how much, and you characterise the set of hazards, that is in terms of how devastating versus how frequent versus how likely they are, what the risk profile is for a particular kind of hazard. With the understanding that in many cases the outcome of a hazard happening, that across hazards those outcomes have a lot a similarities and that planning for flooding has a lot a similarities to planning for earthquakes. Even though some of the adaptation mechanisms are gonna be different. But some of the planning parts of it, they're gonna be very similar. And in fact, we've done some work recently where the client sort of said to us – we're working with a particularly housing authority client and the emergency management organisation for that city. And they both agree it's like look, we actually kind of characterise emergency response as one thing. It doesn't really matter what kind of hazard you're responding to. If you're responding to a giant fire you're gonna structure your emergency response the same as if you're responding to a heat wave. It's just that a heat wave happens in a slower time-frame and so you have more time to do it. 3. *Have you found from your experience that there's opportunities in the*		5. zoning compliance needs to consider social ramifications not just how to prepare a building for flooding 6. robustness and public safety in buildings is dominant (because it is more familiar) rather than seeing buildings as transformative and adaptable. 7. designers are adopting practice that suits their needs. It needs more localisation and more information on future scenario planning 8. focus on energy and water use reduction, not "resilience". This has given rise to RELi and emerging use in practice with LEED-RELi.

	projects that you're doing to manage sustainability and resilience together? Yes. *Could you expand slightly?* From my perspective the issues are that about half the issues overlap completely. he big ones are energy issues – energy and water use are big issues. There's a whole thought in the resilience world which I helped to perpetrate, about what's called passive survivability. And passive survivability essentially describes a situation which a building gets unplugged from all of its inputs and still manages to be liveable. And what that means is that (pause) the building has to be able to maintain liveable temperatures without energy inputs and to manage enough water without water inputs to be liveable. So, what that means you have to have a pretty solid envelope, building envelope that is highly developed, you're talking about essentially a passive house standard envelope to be able to do this. And you have to have natural ventilation to be able to do it, because buildings that aren't ventilated are quite problematic when there's no electrical inputs. And, you have to be able to have rainwater capture and a few other systems that'll allow you to have available water within the system. Those are definitely sustainability goals. And so what it does is it adds a little extra power to those sustainability goals. Just a moment. Reference 4 - 1.55% Coverage		

	In the resilience world, in the adaptation world the city is lost in this - you know, we're gonna armour the city blah blah blah. But, if you look at the really forward looking places, what they're doing, they're doing some of that – a little bit here and there. What they're really doing is building stronger communities and that work is a little bit harder, it's a little harder to find. You can't hire an engineering firm and say, "oh build me a stronger community," we're just - and it has to in many way it comes from the community. It's not something an outside consultant can do. So a lot of our work ends up being kind of working with municipalities, getting them to understand this and then setting up processes where the communities themselves can generate what they need to be resilient. Reference 5 - 1.42% Coverage One of the other things can happen in Boston is that they're low-lying areas of relatively poor neighbourhoods that will in fact get flooded soon enough. And so our contention is that the city needs to be zoning the uphill areas from there to allow those neighbourhoods to be absorbed into that area, but not to be redeveloped into something completely else. It precludes those communities from joining together. So there is an opportunity to do zoning, forward looking zoning that potentially sets up - and I were gonna do it I would like to work directly with the communities and say,		

	"Right. How do you merge communities? What does that need to look like?" And then build the zoning around that. Cities still are not doing that. Reference 6 - 0.70% Coverage The classic example in this case is the city of Miami. In Miami traditionally, in the last 40 years – it's not much of a tradition, maybe 50 – the wealthy white people live at the beach, right. They call it Miami Beach. And the coloured people, the people with colour live up on the hills because that's the place where the white people didn't wanna live. Now… Reference 7 - 3.10% Coverage So we have two concepts – sustainability and resilience. How are the building codes (laughs) managing this? Well the building codes are sort of interesting, in our neck of the woods the building codes have been relatively stringent in driving reductions in energy use, driving reductions in water use and improving building envelopes and they're not bad, they're not terrible. They haven't really addressed resilience issues from a sort of building level perspective, you know, which is what they're looking at. That's been a - And does that outline that with a few words? Is that adaptability buildings? Is it robustness of buildings? Is it being able to actually transform a building? It's more about robustness. And the reason that's the case is because building		

	codes are about safety. We have building codes because of safety, that's what they do. And so the adaptation, the resilience issues are rapidly being framed as safety issues and they're gonna rapidly make their way into building codes, but they haven't yet. There's a recommendation – I don't think they've done it, but there's a recommendation in New York out of the building and resiliency task force. One of the recommendations is that everyone has to do as part of their, as part of the New York City energy code, they have to do passive survivability modelling. I don't think they've adopted that, but they adopted a bunch of the recommendations out of the building resiliency task force. But I don't think that one has made the cut yet. That kinda stuff is gonna start to happen very quickly within building codes. Reference 8 - 0.62% Coverage But then the building codes are place specific are they? Or is there gonna be some sort of localisation needing to take place? Building codes are run either by city or by state which is reasonably place specific. There is the IBC, you know, the International Building Code, but everybody adopts it for themselves.		
Bos 03	have these sustainable charades on every project we work on. So, what we do is we get people excited about it by almost inviting the client and we bring in some experts who are focused on a particular topic, and we try and have	1. Company design practice 2.Designer activists- Urban Land Institute, AIA 2030 3. acknowledgement of resilience and sustainability concepts has lead to	1. Leading discussions with clients and experts and using CBA to highlight change of use issues (i.e. how to build in resilience responses).

	a good conversation and we try to frame it around the cost benefit analysis, almost saying, if you do this, then it's going to have this great benefit and it's going to impact this community, in this way. Reference 7 - 0.30% Coverage There's this report called Building Resilience by the Urban Land Institute, and that report highlights some pretty interesting facts. Reference 8 - 1.46% Coverage Some of those facts are that – so the Spalding Rehabilitation Hospital, Charlestown, which is very close to Boston, is considered one of the first flood resilient projects in the city of Boston, and we're really honoured that we were part of that. So, we had this great team and the client had a great vision and mission of pushing the bar. So, essentially, what we ended up doing was, we helped build the perception around it and work with pushing the climate change considerations into account. So, for example, the landscape acts not only as a space for retail therapy but it also acts as a barrier for tidal – some type of extreme disaster. Reference 9 - 0.49% Coverage A lot of the mechanical systems are elevated on the roof of the building and a lot of various details of the design are elevated to a certain level, so that way, if the water does come in, it doesn't make an impact.	opportunities for designers to do more 4. codes out of date 5. Institutional clients	2. implementation of designers knowledge on project work- including tidal water response, where to M&E systems to cope in emergency and also use of natural ventilation systems when power is lost. 3. doing good design and having "conversations" not silo-ed mentality 4. decisions made to get made by pushing boundaries and using information that is available to make decisions, not waiting for the code to catch up. 5. People who own their buildings and have a long term vision are more willing to discuss CBA projections.

	Reference 10 - 1.27% Coverage So, for example, what happened in Hurricane Sandy in New York, is that a lot of hospitals, when they were hit from this storm, they weren't designed effectively to essentially allow for proper air filtration if mechanical systems shut down. So, something as simple as allowing the buildings windows to be operable in case of a storm, to allow some airflow into the building is really critical. So, the Spalding Rehabilitation Hospital did that. So, I would really encourage you to look at that report, because it would really help you to understand that project. Reference 11 - 0.97% Coverage I believe, and you can't quote me on the actual dollar amount, but I think I know it. There was an initial $1.5 million investment around resilience measures, and so Spalding reported, based on that report, that they're seeing the $500,000 yearly return, based on a number of different things. One of those things is enhanced reputation within the community. Everybody wants to go there because they know it's a great facility. Reference 12 - 1.50% Coverage *So, what you're saying to me is that there isn't really any identifiable obstruction. There's a will to do something? There's a will to do something better, so you're not having issues*		

	with the planning and design process, if your client is prepared to go down that route? I think that everybody is still figuring this out. I think a lot of people don't really know the answer. We're all in this together and it's really a global conversation. I think that there's a lot that we can learn from countries that have dealt with these issues for a longer period of time than we have, but we also have our own identity and our own political situation to deal with. Reference 13 - 1.51% Coverage So, we do have – there are new things. The good thing is that people are talking and times are changing and if you were to talk about climate resilience ten years ago, I don't think we would have the same conversation. It was a farfetched concept at that point in time. So, now, we literally have people who are paid, administrators that are focusing on this, which means that it's time to – almost all coastal cities across the United States, as well as coastal cities across the globe, are literally redrawing their city maps, and they're looking at those as, how can I see this as an opportunity for this change. That's kind of the conversation that's happening. Reference 14 - 1.25% Coverage As a designer, there is more frequent events, flooding events happening, probably even a greater storm surge than the 100		

	year event. How does a designer manage that in their planning or design process and basically, are you finding the building codes are helpful or not? The building codes are catching up. There is – my understanding is that AIA is in the process of advocating for these policy changes and these building code changes. So, when will they actually catch up, I don't know. I don't know exactly when we'll have these mandated upgrades. Reference 15 - 1.39% Coverage So, I think one of your questions was, what's one of the challenges of a 100 year storm, and how do you talk about that with your clients? Well, I think the hard part is that some clients aren't really interested in the long term investment. They want to build it quick and sell out, and some clients are. So, a lot of our institutionally focused clients for example, really are interested in owning the building long term, so it's a lot easier to have those conversations when there is a long term investment, but it's hard to have those conversations with developers that really want to do a quick turnaround. Reference 16 - 1.56% Coverage What I can tell you about RELI is that it's pretty fascinating because it's essentially a consensus building standard. The standard is essentially – there's all these checklists across the globe. People love checklists and they love checking boxes and accomplishing something.		

	So, essentially, what RELI is, it took the best credits of a lot of different checklists across multiple disciplines within development or health, or wellness or however – whatever category you want to put it in which relates to the bigger picture of climate change, like social economic or environmental conditions, and it took a lot of them and brought it together under one umbrella, and that's what RELI is. Reference 17 - 1.76% Coverage Do you think the – just to put that in to a number, do you think the number of stakeholders to have that conversation has started to increase? Yes, I do. I think that it is starting to change. When we talk about working in developing cities on a big urban scale, we have a lot more stakeholders and a lot more people that come to the table for these projects. But when we're talking about a small inferior renovation project, on the 15th floor of a high rise, it's a little different and it's not the same. But it doesn't mean that the conversation can't happen. In general I think that the conversation is scaling up and out. Up as in more people are coming to the table, and out, as in, we're starting to have these conversations with our neighbours, which is a good thing.		
Bos 04	Reference 1 - 0.51% Coverage "Oh by the way, if it's 140 degree day in Dubai that's exactly when you're gonna have brownouts. That's exactly when the	1. Lack of scenario planning 2. scope of works, client liaison and finances 3. mnemonic decision making for code compliance	1. M&E systems are being designed to be efficient and work within limits. Working capacity for cooling systems gets reduced, and power sources are taken for

	system is gonna be like, whoa!" "You know, my maintenance hasn't been perfect, I'm gonna fail now. So then what?" Reference 2 - 0.33% Coverage And I've seen that because of a lot of professional pride and years of training, there's a natural tendency where engineers love to optimise their systems. Reference 3 - 0.45% Coverage So why should, you know, is it even safe for them to think about contemplating some things that might be viewed by others as treading outside of their legitimate professional authority and their licensing domain? Reference 4 - 0.73% Coverage I think drive people to create cracks for communication to fall through, to create breaks between a systems level continuity of planning and analysis and decision process. And also I think people like to think about with pride and comfort, personal sort of confidence and comfort levels, that their work is going to turn out in a positive way. Reference 5 - 0.90% Coverage I mentioned this already, things start with a scope. So let's say you're a private building owner or let's say you're the City of Boston making some kind of infrastructure upgrade. The first thing that happens is you either have staff who know things – or let's		granted. Climate change planning needs to be taken into account now for buildings to cope with increases in temperature (esp. glass ones). 2. designers can only deliver what is in the scope of works. If the design codes do not allow for scenario planning, then this is out of scope. Sometimes there may be the insight but not actually being able to action it, due to lack of engagement and information to inform the client. For example, naturally ventilated building has a different design approach to an air conditioned one, but if the air conditioning fails then the building come redundant because of a transition can not be made.

	assume you’re hiring an outside professional team to handle your problem. It all starts with the initial contract and the scope of services that is negotiated. Reference 6 - 1.33% Coverage Yeah, there are a lot of things like people didn’t used to have to think about, maybe arguably they could. But there was no cultural awareness that the past knowledge of our weather or our ocean levels or our climate and people, you know, heat or cold conditions. These were not things that people thought were gonna be different. This idea of stationarity was implicitly or explicitly baked into every aspect of the decision process. So how do we now move forward if we don’t assume that the future inherently is bound to resemble the past? And whose responsibility is it to figure out what the future might look like? Reference 7 - 0.41% Coverage After Hurricane Katrina hit in Greater New Orleans there was a huge amount of lawsuits and it was again private architecture firms who designed hospitals where there were no operable windows. Reference 8 - 1.32% Coverage So when the power went down people did start to bake and steam inside of these buildings and there was no availability even to get natural ventilation. People had elevators that were used, but when the power when out regionally		

	and the generators all failed and there was no way to get diesel fuel in etcetera, etcetera. They couldn't even get hospital gurneys down the stairwells. The radius of the stairwells was inadequate to actually carry a patient down. In other words the whole facility had been designed so that of course you would have to use the elevators. And you know, in hindsight this was egregious. Reference 9 - 1.00% Coverage So for example, if somebody has been – I think the way it works to paraphrase under most of these circumstances is there's a period of time after – not after the architecture and engineering firm is finished but after the work product that they've designed is finished and is open for services. Then there's a six year period where if something hasn't been identified as a screaming shortfall (laughs) during that period, then you can't say it was an obvious problem. Reference 10 - 0.92% Coverage In the US people generally say 30 years because that's normally the longest mortgage and the culture of the US. I've lived and worked and studied in Europe, so I have a bit more of a sense of some of their cultural differences (laughs) and absurdities even I would say. So we're very short-term and we tend to be again absurdly driven by legal considerations – more-so than a community based		

	ethical set of standards driving us. Reference 11 - 1.59% Coverage Actually there's one aspect of resilience that I – a couple of characteristics. I sort of talked about resilience meaning how sustainable do things look when you view them through the lens of shocks to the system? How does it look when bad things happen, when all that stuff we're uncomfortable really playing out in our minds? Maybe we haven't seen it before so it doesn't seem that real. Maybe we're not well-read on some of these – especially climate or other non-climate based natural disasters. What is it – if we don't know what that stuff looks like because it hasn't been part of our life experience, many people do not readily go there. So planning is not universally informed by that kind of risk and resilience planning perspective. Reference 12 - 1.41% Coverage But there's also this idea of recovery. So when things happen the question is - maybe the bridge is inundated during a flood and you couldn't drive across it for the three days of peak flood elevations. But maybe the bridge is fully designed to remain structurally sound after the water recedes. That's one thing. Or maybe the bridge is elevated but the road is a low spot and it allows a flood plain conveyance to occur and bypass the vulnerable bridge, for example. The people of Iceland do that all the time.		

	They have a very ad-hoc kind of tactical approach to resilience infrastructure, very improvised and, I don't know, I think it's pretty effective. Reference 13 - 2.15% Coverage I bring this up because I had another conversation just in the last week or so with an attorney who was talking, basically doing interviews as part of Boston's climate change policy and regulatory like, what's good bad and indifferent about policy affecting climate resilience in Boston. And she finally got someone, the guy was the head of the, I guess the State Building Code Authority and she was trying to walk him through a set of interview questions about basically how things were working with – yeah. She was like, "What is your organisation that develops and enforces and educates people about the State Building Code? What are you guys doing to help make it easier and help move the ball forward so that everyone's… So do you think there would be… …and he was clueless. It was described to me that this man was like, well I'm not one of these people that doesn't think that climate change is real, even though I don't think it's man-made. But I don't think it has to do with a building code. Reference 14 - 0.41% Coverage Of course it does. But what happens if the dude who's responsible for the building code for the entire state doesn't know and		

	remains oblivious and I mean that's a judgemental word I'm afraid. Reference 15 - 0.80% Coverage So instead it's like, okay. So in the value methodology this time we're actually talking about life-cycle value over the duration of the project performance period. You know, what's the surface life of this project? And we're also saying, how's it working under this type of shock and this type of shock and this type of shock and what would the potential loss avoidance be?		
Bos 05	So you have to be careful to watch a building and call them on that. Some developers are very committed to sustainable practice, but there are some that like to take that action and so making sure that you identify that action when you see it. There might be opportunity in the code in the future to change the way they give credit for activities like that, and a glass curtain is a good example of an activity like that, it's less than sustainable. Reference 2 - 2.20% Coverage So what you're basically saying, just for my understanding, is that the glass curtain walking scenario is not necessarily being used in the passive house, or passive whatever way of designing. [0:33:23] opposite of a passive house design, yes. So people are maybe – not all, but some people are designing to aesthetics and then treating sustainability	1. architectural trends in glass buildings	1. developers like trends

	mitigation as that extra thing they have to do; where if you were really focused on sustainability or focused on reduction of energy use, you would design from the ground up a different kind of building. So I would be interested in ways we can promote that type of design principle and thinking from the baseline		
BOS 06	So you have to be careful to watch a building and call them on that. Some developers are very committed to sustainable practice, but there are some that like to take that action and so making sure that you identify that action when you see it. There might be opportunity in the code in the future to change the way they give credit for activities like that, and a glass curtain is a good example of an activity like that, it's less than sustainable. So what you're basically saying, just for my understanding, is that the glass curtain walking scenario is not necessarily being used in the passive house, or passive whatever way of designing. [0:33:23] opposite of a passive house design, yes. So people are maybe – not all, but some people are designing to aesthetics and then treating sustainability mitigation as that extra thing they have to do; where if you were really focused on sustainability or focused on reduction of energy use, you would design from the ground up a different kind of building. So I would be interested in ways we can promote that type of design principle and thinking from the baseline.	1. Architectural trends in glass 2. zoning criteria 3. State building code	1. Increase in energy demand (due to cooling) 1. Ineffective planning restrictions 2. Leading to design practice taking on responsibility of providing resilient solutions but are restricted (and probably not mobilised at the right time to have a greater impact). 2. Prescriptive requirements on flooding needing to be adopted (addressing risk)

	Reference 1 - 2.99% Coverage I think they are taking on the burden of making decisions based on guidance rather than the city telling them, if you are in this area, you must design this way. So, the city will provide a performance standard and say you must figure out how to get to a resilient design that will protect you from the 2070 flood and here are some options how you can get there. If you think you're not in that flood zone, you can also take the opportunity to prove that you're not. So, it puts the burden on the project proponent and it also gives more flexible to design it the way that fits better for them. I should say, there is one other thing that we have in Massachusetts that's kind of weird. We have a state wide building code which isn't unusual. But what is unusual about it is that no individual municipality can create any local rules that impose more stringent standards. Reference 2 - 0.84% Coverage Interest in public health, welfare and safety, you need to make sure that your building will be protected. So, then it's up to the developer to figure out how to do that. It's an end run around the building code until we change the building code. Reference 3 - 1.09% Coverage And is that going to happen? Is the building code going to get changed?	4. Responsibility to create "safe" buildings is given to the design team and dictated by the building code 5. Mnemonic practice of decision making due to the building codes 6. desire for a uniform code 7. Resilience policy in Boston 8. Position of developers and ability to take on land use risks 9. lack of systems management to storm water. 9. Development out of sync with land use and perhaps the whole site	3. State codes restrict; Individual municipality can not create local rules that impose more stringent standards. 4. Design team (structural or civil engineer) is given a limited scope of works to make something 'safe' and this ends up being about 'the building' and not its context. Things become limited in vision unless certain aspects are thought about 'earlier' in the design process. 5. Building codes need to adjust but attitude to change of how decisions get made using the building codes needs to change too the "way by grandfather did it" can be a delimitator to practice. 6. what type of uniform code? A framework that allows individual nuances to get managed or a blanket code- this is only one way to do things? 7. Mobilisation of knowledge and power to designers. 7. if designers have knowledge will their power increase?

	I think it's going to have to. I think there's more and more pressure, but the board – I saw that you're an engineer. The board is made up of engineers, contractors, builders, who say well this is the way that my grandfather did it. (Laughs) Reference 4 - 0.79% Coverage The other thing is that the board that oversees the building code, it's their mission to make sure all cities and towns have a uniform code and they don't want to see any variation, because it's harder for the designers and builders. Reference 5 - 1.09% Coverage What you're suggesting is that there is obviously an issue of resilience in Boston and the governance at Boston is putting policies in place and mobilising people to facilitate those policies and that the designers are also being empowered in how to manage the future built environment. Is that a fair assumption? Yes. Reference 6 - 1.73% Coverage It's not all plain sailing. There are conflicts. The development community is somewhat onboard if they want to develop in a location that they know will be flooded, they know they have to take measures and design their building a certain way. So, they've accepted that reality. But in general, there's a very strong lobbying group that represents the developers,	should be permeable, not just 25%... 9. archaic infrastructure 10. Attitude to regulations 11. resilience safety impacts standards of care in design 12. management of outcomes	8. Sites in flood zones are getting built on and developers are aware of taking on measures. More prescriptive measures are needed (is this where sustainability can be used more effectively??) (are these being managed systematically and sustainably- SUDS etc) Codes has become more stringent on how to manage storm water because the existing water and sewer infrastructure can not cope. Current methods to do this are now not enough. Is it that 'more' needs to be done? As sea level rises, the ability of stormwater to be held in the system is reduced. (this needs a change- does it mean that more forestation needs to happen up stream? Does it mean that boston needs to flood and that developments should be raised above existing ground levels- if so how much- 1.5m??

	and they are pushing against more requirements and more regulation for resiliency. They are saying that their constituency doesn't want it. Reference 7 - 3.59% Coverage No, the people who oversee the storm water are different entities than the building code folks and for example in the city of Cambridge, there is already a requirement that every [0:32:45] that's developed has to keep a certain amount of storm water on site and have 25% of the [0:32:50] has to be impervious, as to allow rain water – you either have to hold it on site in a detention basin on some kind of mechanism, or let it infiltrate in to the ground. Boston has a very strong water and sewer agency that is panicked, because they've been gauging how much rain we've been getting since the 1960's and they've seen a huge increase and they know that the pipes and the systems are not sized to manage it properly. They also know that a sea level rise – it's going to back up. The storm water will back up in to the city. So, they need to put back flow preventers on every outfall and there are hundreds, maybe thousands of them. So, they're in a panic and trying to figure out what to do and working with the city, so they're very in tune to this. Reference 8 - 1.56% Coverage I think it's what is in the regulation, but then it does also go to personality, because there are some	Sustainability and resilience are concepts that 'change', so targets are changing. Money is tied up in managing legal challenges	10. Some say lets change the regulations to be more effective 10. Some say the regulations are the regulations they do not need to be changed. 10. not changing the regulations leads to negative incremental change (context and site influencers are changing). 11. Where are the limits to standard of care and can professional institutions and codes 'regulate' it? 12. no evaluation and no metrics because there isn't full knowledge and understanding yet. Need adaptable measurement systems to cope with shifting targets Shifting targets are due to mnemonic decision making that has exacerbated climate change.

	people who are saying, this is a problem we need to fix. If we need to change our regulations, we'll do it. Then there are others who say, these are the regulations that have been handed down to me and I don't have the ability to change it and I'm not going to fight that fight. So, it really depends on who you talk to, so it's a little bit of both. Reference 9 - 0.64% Coverage For designers and engineers, I've also heard some talks about what is the standard of care that you need to meet and does that need to take in to consideration these issues of resiliency? Reference 1 - 2.28% Coverage How are projects, and in this I mean building and infrastructure in the environment of a city, being managed with resilience outcomes at the moment? How are the resilient outcomes being managed? You mean evaluated? I don't think they're really being evaluated. I don't think we have good metrics and I think part of this latest project on sustainability which they haven't even awarded the contract yet but I assume part of that will be to figure out how to – what metrics they want to track and how to track it and then how to use that information to improve. But that contract has not yet been issued so I don't know if in fact, that's what they're going to do. Reference 2 - 2.47% Coverage		Money is wasted in legally challenging the changes rather than implementing them

	On the metrics, do you think it is important to use metrics with the term resilience and sustainability? And if so, why? And also, if not, why? I think the answer to this is yes and also no. So, I'll start with yes. You always need to know how well you're doing, so that if you're not doing well enough because we don't have time to waste, you can correct and adjust, and if you're doing something well, you want to know that too so you can replicate it. But, the no is that our targets are changing. We don't really know what we need to do. So, to develop metrics, I guess any metrics you develop would have to be adaptable to changing targets. So, for example, when working in – this isn't sustainability, this is – Reference 3 - 0.74% Coverage More expense and they've invested all this money and then they'll feel that they unnecessarily had to make that expenditure and may on a legal basis challenge those decisions. So, that's what we're struggling with.		

Boston Discussion Points

BOS 01 and 02, when peeling back the rhetoric, they are outlining what a sustainable development really means, what these responses suggest is that resilience has been born from sustainability's failure to meaningfully change design and planning practice (this means beyond LEED), so now passiv-survability means off grid to cope with emergency weather rather than being able to live in a building that can sustain life (food,water, energy). People need to become more engaged in their communities to be able to cope with a disastrous event and everyday flooding. The design process is trying to change in Boston with the BRDC and creating buildings that allow flooding,

also creating a city where they can cope with downtown flooding. Both BOS01 and BOS 02, see the solutions as more than armouring the city to cope with the risks which are mostly about climate change adaptation. BOS 02 and 03, see that buildings need to be better thought about, i.e. to have openable windows and manage with natural ventilation, and build to passiv-haus standards. Passiv-haus coupled with LEED-RELi, would be quite an impactful tool to those with the appropriate sustainable practice knowledge and pushing the boundaries of the planning process to make way for better practice. Once you have the building responses improved, work also needs to be done to build sustainable- resilient communities where social inequalities are reduced and investment occurs into infrastructure that is not subjected to political jurisdictions.

The next issue is centred on the scope of works and client relationship, a designer can not deliver a naturally ventilated building that can cope with loss of power without it being in the scope of works. If the client wants a cheap solution with air conditioning and not to think about resilience or sustainability, it will still get built unless the building codes stipulate that scenario planning and risks must get taken into account. Intelligent buildings with passiv-survability require more work, the knowledge is there but are clients willing to pay for it? This becomes a policy issue for tax revenue…

BOS 06 highlights that changing the design systems takes time and creates legal challenges. The design management systems need to have an overhaul to manage ‘change’ and not be restricted by targets. It appears that the targets set are not enough and that to have a real impact on urban flooding then all projects should have a negative stormwater runoff, not keeping 25% on site. Afterall, it is the urbanisation footprint that has created the urban flooding. This is where policy needs to support these changes but not be held back by the Massachusetts State decision practice and blanket approach to solutions.

New York

Group NYC	What/ who has been identified	Interpreted Cause	Interpreted Effect or impact or action required
NYC 01	if you are building a building in a flood plain, then the code will tell you that, the code requires for residential	Building code and zoning	The code’s frequency of event and worst case scenario is out of date. Areas will get built 2ft above sea level, others won’t.

	structures to build 2 ft above the flood plain, what we call the 100 yr flood event, that can't be right can it? But you've built to code. I don't think that is value, I don't think that is effective. We are already seeing more frequent events than that, so the risk is on your part, if you that 2 ft is enough, but it has got to be done by code right? So you'll have to charge for the whole things because it has been built to code. We have to figure out whether that ot not that is effective, but again this is approval reality. One of the things I think is missing, is why is it only government code and why aren't the financial entities behind the city property planning, they should be asking big questions. They are only looking at it from a short term perspective.		
NYC 02	Are we going to build towards, you know we used to, at least always look at the hundred year storm, but when you have several hundred year storms and for a certain period of time, I'm not sure what that tells us, we need to address things differently going forward. What are the forecasts of sea level rise, how was	Building code is out of date Sea level rise Multiple infrastructure failure Knowledge of younger professionals and LEED needs to be mobilised Mnemonic design code practice of "safety"	Designing for 100year storm is not current enough. Some buildings are being made more resilient and others aren't. But infrastructure needs to be following these principles too. You can't have a building that can cope with flooding and no one get to it (unless by boat?) If one infrastructure system goes, they all go- efficiency has led to systems sharing trenches – power and water, sewerage in the roads. If the roads go, the whole lot goes. Younger professionals need to be empowered to think more differently and almost be

	going to be factored into the future design of careful airport facilities, how are they putting critical parts of infrastructure, were they being protected by maybe elevating control centers, etc. so they were there were factoring things like in that into the considerations of the plans going forward. The real challenge is getting appropriate funding and a priority on resilience as part of the critical aspects. I see agencies like the Port Authority take great attention to that. But I've seen a lot of the agencies within New York. DEP (dept of environmental protection) factors that into a lot of their facilities of 'how can they do it more sustainable' and how can they continue to protect resilience? Because, the challenge with infrastructure is that when one system fails multiple system fails. An example; if a water main fails in the roadway collapses that you've lost water in transit. The power line comes down and I've seen that happen on occasions, you have no energy, no transportation, no water supply and they are all interactive and yet you've got to factor		supported by senior colleagues, the senior colleagues may have more experienced knowledge but have become mnemonic in their approaches to problems. Design practice needs to work more collaboratively. Development of performance based criteria (however resilience and sustainability needs to be a part of this process).

	that in of trying to make the facilities more resilient so they withhold withstand failure, but the challenge you have, if you have not maintained it, when you have a water main at the hundred years old. It's a matter time, before it will fail. Well, a couple things.. number one in the US, i think we need to continue to emphasize this starting out in the education process. I think of we'll be talking about and it is talked about more in schools, turn that into the training and education of the next generation of engineers, the thing is really very positive to me, is that young engineers really eat this up, they really care about their future,*future* environment and I find it quite interesting to hear young professionals and frankly, those that choose to be certified with things like LEED, envision you find that really grabbed by the young professional which is which is exciting. You see that they know and care about their future. The impact on society. I'm pretty optimistic that we think we need to continue to emphasize that the college level, at these young professionals are getting the ability to		

	to grow, to learn, to the experts in this area. Well, I think codes and standards are evolving. One of things that we've been talking about at Mott MacDonald and ASCE is getting away from performance-based standards which evolve into codes, excuse me, getting away from prescriptive based codes to be more performance-based instead of making, the rules 'A,B,C' measure more on outcomes as opposed to being very prescriptive in the way the codes are written. This is becoming more of a discussion going on in the profession. I think it's a step in the right direction. We need to get look more at the performance as opposed to just measuring, the way that were going, this part of the grand challenge that I mentioned a little while ago.		
NYC 03	1. it's really to plan, to plan and engineer smarter, and based on the risk, on qualitative risk understanding. 2. We were in the past designing infrastructure based on standards, on – and now we're really looking at systems, I mean resilience, so looking at systems, not necessarily just a road, not a neighbourhood but,	1. mnemonic approach to infrastructure design 2. historical use of design code standards based on 'need' 3. planning process 4. understanding risks and vulnerabilities to inform decisions 5. Client's lack of understanding 6. FEMA (zoning) 7. Federal investments (and	1. innovative practice- plan smarter based on qualitative risks 2. Systems approach to solutions to include communities to reduce the exposure of risk but also to enhance ecological and economical wellbeing 3. design practice is using bottom up initiatives, by developing public outreach framework where actually the locals can be heard actually and can – and that's really helped us to gather data, which is really the first steps in those resiliency projects, gather a lot of data on the assets, on the vulnerabilities.

	you know, looking at the larger scales to determine how we can build up and plan for infrastructure and communities smarter, to reduce the exposure of risk but also to enhance ecological and economical situation as well. 3. Yes, so usually the project here, especially the large-cap project that the city or town level on the public side, they usually start by a planning process, where we really try now to develop what we call like bottom-up initiatives, where we really, you know, develop like public outreach framework where actually the locals can be heard actually and can – and that's really helped us to gather data, which is really the first steps in those resiliency projects, gather a lot of data on the assets, on the vulnerabilities. And in the US we have a lot of – we're very lucky where we have a lot of data available, physical data like digitalisation model, for instance, when I worked a lot on flooding project and that's very important to understand the risks. So it's really start by pretty intense effort in gathering information at the city level, so we, you know, all the –	relating scope of works) 8. out of date design standards	4. Digitalisation tools on city areas 5. use of CBA and digital mapping to illustrate scenarios for flooding 6.FEMA's tools are not sufficient enough to manage scenario planning at a detailed level. This leads to a designers creating their own tools. 7. Designers knowledge is being used to manage costs, designers create schemes to support 'resilience' but designers interpret this differently, so there are nuances in approaches and costs, the- scope of works needs to be really tied down accurately. 8. with codes out of date, this leaves to a spectrum of management of risks and scenario planning.

	as I said, the digitalisation model, all the [tax parts 0:10:11], that information, the [0:10:14] information to understand all the vulnerabilities and also to understand what people want to do, what is the masterplan in the area or that the city wants to develop. And then this is really the first big, big steps. And then there is on that – a lot of the project I worked on are actually flooding projects. So better than that, once we understand the character in the area we worked on, we start developing projects, so we develop production and resilient project. They can be of another different nature that they come from like hard infrastructure. So we look at projects such as like, you know, building dams, building levees, building flood walls, but very important to also look at, you know, restoring, like changing the policies in place. So I was talking about the master planning or like zoning in the United States, those documents were developed liked decades ago without the understanding of risk that we have now when it comes		

	to showing all the natural risks. Reference 4 - 3.49% Coverage So – and this is what is interesting that the engineering in the past, I mean I found myself now with almost – you know, [0:20:55] needs to be lobbies in a way or at least explain and trying to communicate, to clearly communicate the advantage to our client. So this is really our role. What helps us, and we didn't talk about that in the process of resiliency, but it's really the financial like analysis that we perform to prioritise those projects, to determine the benefit of those projects throughout their design lives. So people want to see numbers, so this is a strong tool that we have in our pocket is the final true analysis that backed up our resiliency project, trying to quantify the benefit of those projects and why we should implement them versus status quo or, you know, just doing the bare minimum to solve problems of today. So, you know, that's basically what we use to try to make people understand the real benefit of those projects that look at future conditions.		

	Reference 5 - 5.29% Coverage We use different types of tools, so we work with our design services folks usually to develop those final true analyses. They're sometimes on federal agencies there, like scientifically cost – you know, benefit cost analysis tools. Those sometimes are developed by federal agencies, like FEMA, for instance, or the [Co-op 0:22:36] of Engineers. And with the final project, sometimes they ask us to use their tools so there are a few tools out there, you know, in the public side but we have our own tools that effectively we use in our own way to quantify the benefit of those projects, which is tricky because, you know, what we are seeing now is, you know, the US government, a lot of money is coming from typically like the Department of Housing and [0:23:07] development, US [Hub 0:23:09], they're pouring in $1 billion internally on resiliency project to help communities. And they're pretty flexible in the way we develop those financial strategy cost benefit analyses. So we develop, you know, methods to		

	specifically price out, you know, what are the benefits of restoring wetland in an area that, you know, is always flooded and where we had houses, so we buy out the houses, we restore the wetland, and we quantity not only, you know, the prevented losses, the dollar that we are actually – you know, the [0:23:50], but also the economic goal benefit, the social benefit, the [0:23:58] benefit. And now the US government, they're willing to hear about those additional benefits, right? Reference 6 - 0.63% Coverage So you are saying that the cost benefit analysis tool or process or whatever is becoming more and more prevalent in justifying resilient decisions being made? That's correct, yes. Reference 7 - 4.20% Coverage Yes. I mean definitely. I think that the codes or the guidelines that we have on a lot of our projects, you know, again, I worked on a lot of flooding projects, this is 70% of the damage that we have in the United States from natural disasters, so it's a big, you know, a		

	priority for my group here. But yeah, I mean those codes were again developed like, you know, sometimes 20, 30 years ago. You know, even the way we design bridges, we design dams and other type of infrastructure, the design requirement in terms of flooding, for instance, and what we call design flood for dams or like the [freeboard 0:28:36] requirement for bridge, those, you know, those requirements and those are based on old data and, you know, and now, like on all of our projects, we try to go the extra mile to explain to our clients that, you know, by using more data that we have now available and then looking ahead at projects and, you know, projects in present condition and discharges in rivers and coastal areas, then basically actually they should design their infrastructure not for – you know, not just to quote, but also, you know, but actually be more conservative to include these projected risks. Reference 8 - 2.52% Coverage It's turned out that with this those new regulations, the		

	amount of 7,500 dams, like 70% of those dams, so, you know, 5,000 dams are now – they actually – they don't meet the New York State regulation in that sense. And that's probably, you know, the price of bringing back those structures into compliance is that it has been estimated between 600 million to $800 million actually just in the State of New York. So we see that it is great, you know, to develop infrastructure that can withstand the future risk, but we need a tremendous amount of money, especially because our infrastructures are aging right now, right? So this is in addition of the regular maintenance that we need to perform on those, you know. Reference 9 - 0.71% Coverage That's really what – I mean this is again the paradigm in design where we try to – fighting nature, we have not been very successful so far. No. So, you know, that's the best way for us to reduce risk. Reference 10 - 3.91% Coverage No, it's true. I mean we all develop this. We don't have regulation and		

	guidelines in this space of resiliency, so this is the, I think, the exciting thing is that, you know, we are – we really like developing the practice, developing our framework and, you know, how we deliver and implement those type of projects, so I think that's what makes it exciting to me, absolutely. But it is and exactly, it's true, although we have processes in place because we need to deliver, you know, on projects and obviously it's pretty, you know, I would say it's challenging because we always work with a little bit amount of money and we were talking about having people, you know – we were talking about make our clients aware about the benefit, the financial benefit of, you know, planning for the future, but this is particularly one that we do on our time, right? And so we're also limited by time and money here in the private world, so it doesn't move as quickly as I would like to do. I would love to be able to, you know, just focus on enhancing our resiliency practice, but unfortunately my days are [0:38:31].		
NYC 04	If I say, what do you think about adaptability, robustness, flexibility, ability to	1. Policy's interpretation of resilience- it is robust? Adaptable?	1. Spectrum of Interpretations of resilience as concept into engineering- a robust solution is different to an adaptable one. What are the dominant risks-

	withstand shocks and stresses as a concept of resilience, how would you then interpret that? (Laughs) I would agree with all of those things. Now I think really what your question is about is how do we address those things. And I would say that's one of the things both at a personal level and as a discipline I think we struggle with is how to incorporate those things into our design as structural engineers. Reference 2 - 1.97% Coverage There's various approaches it seems to me. One is the sort of most self reinforcing, the most holistic, to say as a structural engineers we always focus on a minimum number of materials, we always try to anticipate the unknown in terms of environmental loads like hurricanes and earthquakes and things like that. So we're sort of by definition accounting for sustainability and resiliency. But I don't think that necessarily completely fulfils the agenda as you might say or the goals of either sustainability or resilience. I think we have to think a	2. Type-cast design team toles in project work 3. Limitations of LEED 4.Building codes 5. scale of approach 6. design team roles 7. Bias towards climate change-flooding	earthquake?Blast?fire?flood? incremental temperature changes? How do you manage temporal loading conditions and future change of use(of loading scenarios)? 2. Limits design team roles- Civil and Structural engineers have a difference sense of scenario and risk planning (this is what they do); yet the way the industry works is by silo-ed mentality, restricted scope of works and late involvement of these knowledgeable skilled professionals 3. LEED marginalises material use rather than seeing it as a way to reduce transportation, facilitate local economy and business. It also limits the scope of the civil and structural engineer. 4. building codes get revised, but the buildings that got built don't……how do you manage the built assets? 5. buildings need more context in design approach. 6. Not all projects work interdisciplinary from the outset, this may need to change? More transdisciplinary practice and scope of works. 7. Flooding produces images of surface water, but there are also issues under ground that are change the soil properaties and retaining structures of buildings. Where do these fit?

	little bit broader. And so these things like robustness and flexibility, I don't think that we've really come up with solutions yet. We seem to take a pretty direct path to structural design, we try to understand what the loads are going to be as a function of the location. Reference 3 - 2.00% Coverage I mean this as a chartered structural engineer, what are the materials? What's the form? And then we can put all those things into a combination to figure out, is the building going to stand up basically of our understanding of what it would ever see. That's fine and we have a pretty good track record and that's great. But what that perhaps doesn't account for is not just turning up the dial on loads to say, "Okay, now we might anticipate more hurricanes and more tornadoes or earthquakes or whatever it is." But as you say, actually working with all the other design disciplines and the stakeholders and the owners and the developers, to say, "What might it mean to be more flexible, to be more adaptable?" And that I don't think that we've at least from		

	my understanding and what I've seen I don't think we've figured it out yet. Reference 4 - 2.10% Coverage But with the structural engineer approach to how to load or work out the worst case combination, do you think there's scope to stretch that to think about more temporal loading situations? So leading more onto climatic changes, weather changes, sort of opening up that approach to design to help manage what might need to happen to deal with resilience. Are you following my question? (Laughs) I think so yeah. I think that undercurrent is the code, alright. I mean that's what we use, that's our tool. And I think the question as I understand it or at least as I interpret it is sort of asking about our very familiar design approach which is dealing with design codes. And I think if I understand the suggestion right, I think you're right. I don't think the codes necessary completely account for this. They're trying, I mean there's nothing against the design codes.		

	Reference 5 - 1.98% Coverage Like for example, here in the States they're trying to incorporate tsunamis into the code which have not been there before. But thanks to some very good research by a number of Professors demonstrating that this is a phenomenon that first of all is not going to be rare moving forward. And second of all, potentially understandable as it pertains to design. Now we start thinking of tsunamis, particularly on the West Coast of the United States where they're more likely let's say. But I do think that we have to have designers, as conscious thoughtful designers, we have to ask, "When it is appropriate to just follow that familiar path? And when might it be more appropriate to think in terms of things like flexibility or the temporal aspect of loads and things like that?" I think there's a tremendous opportunity there. Reference 6 - 1.78% Coverage But the other thing again and I think this is our real challenge is one of collaboration. It's of		

	like sustainability to me and one of the beautiful things and challenging things about sustainability is that no one discipline can claim ownership, right. Architects can't say that they're going to be the ones to solve it. Mechanical engineers can't be the ones to say that they're going to solve it. I think we all have to work together. And this is, my frustration as a structural engineer and particularly with some of the codes like LEED, is there's really nothing in there, there's very little in there for structural engineers to make a contribution. So we have to figure out, "What's our contribution? And how can we work with others?" Reference 7 - 1.84% Coverage So for example, if you're a structural engineer who's working on a large house on the Atlantic Seaboard that's right by the beach, is that the most resilience solution to begin with? I mean, yes, we can maybe come to an understanding of more frequent hurricanes and we can reinforce it. But if you're looking at not just the loads on the structure itself, but changing		

	patterns in terms of soil erosion and changing tides and dunes and things like that, I think that's where we have to think a little bit more broadly. We actually want a seat at the table to talk to the other stakeholders to understand not just, "Can we do it?" But, "What is the right thing to do?" I think that's the real challenge in terms of dealing with things like sustainability and resilience. Reference 8 - 1.76% Coverage That's a great question. I think there are various approaches to understanding our discipline of structural engineering. I've heard certain structural engineers refer to the job as, "Sizing beams and columns," and it makes me very sad (laughs). Because (clears throat) even though that's what we do, what it suggests is a very reactive process I would say in which we're sort of given a site, you might be given an architectural design, you might be given a programme or you might be given a certain traffic capacity, whatever it is. And then you sort of work through this as a series of mathematical		

	exercises to come up with something that's safe and is going to be economical and maybe there's some room for aesthetic considerations. Reference 9 - 1.82% Coverage But again, I think what it misses out on is the opportunity for proactive work. And I can tell you from my perspective, what I much prefer is to think of the structural engineer as an active part of the design process. Now, that's not every project and that's not every collaborator, but I think in an ideal world the structural engineer is providing a contribution to some sort of multidisciplinary team – whether that's architect, mechanical engineer, owner, developer whatever it might be. So what that then suggests is if we are going to be part of this collaborative team then we have to emphasise communication. We have to be able to convey what our emphases are, what our priorities are and we also have to understand what other peoples' priorities are. Reference 10 - 1.03% Coverage		

	Now does that impact the design code? Again the emphasis of the design code should be safety, that's fine and I think that's appropriate. But what it does need, where we do need the flexibility I would say is in the design process to say, "When are you following the path of the code and following that reactive process?" And, "When are you taking a more proactive process to actually be the one to advocate for sustainability?" Reference 11 - 1.40% Coverage Yeah. So what's your equivalent in the US? The equivalent in the US is – what you're bound to is the local building code and that's largely IBC – the International Building Code. Now some municipalities and localities have their own building code like… Do they? …New York City for instance. Yes. And actually it's interesting that there is a New York City code and there's a separate New York State code. And you might find yourself as we do occasionally working on a project in New York City which is actually the New York State		

	code and not the New York City building code. Reference 12 - 1.80% Coverage The differences arise in terms of who the controlling authority is. So for example in California, California was one of the first states at least in the US to really think carefully and thoughtfully about earthquakes, because they experience them more frequently than other localities. And so they saw a need to incorporate earthquake design into their building code. Whereas while we see them on the East coast, we see them not as frequently and so it took us a little bit longer. We do now have seismic requirements on the East coast and other parts of the United States, but it took a little bit longer because we just weren't as cognisant of the risk and actually had a design for it, so different municipalities will have different building codes. Reference 13 - 4.66% Coverage Do they relate to one another? Like if I come along from the UK with not knowing any stuff and I pick up the local building code		

	and I design along to that, but then find out I'm supposed to be using a municipality code, what issues does that actually create? Well there are a number of issues. We also, don't forget, we still tend to use as a somewhat outdated system of units which we sometimes call the English unit system, you guys have figured it out ahead of us. What are the issues? The issues are first of all, "What are the regulations? What code are you designing to, to make sure you're designing to the correct code?" They also go through revisions as well. So you might be designer to ASCESEI7-05, which is 2005 and come to find out that you actually should be designing to 7-10 which is a version of ASCEESEI7 which came out in 2010. And as these – just as they do in Europe, as these codes get revised, the approach to loads get revised sometimes, the probabilistic approaches get somewhat modified. So you have to stay cognisant of what the changes are. And I would say you do have to be very careful and very thoughtful and they can change on you in projects.		

	I mean, you could have for example a building in New York City which you would be completely reasonable in assuming would be designed to the New York City building code and find out that because it's a building that's going to be owned and maintained by the State of New York that you're meant to be designing to the New York State building code. And there might be some subtle differences there that you need to be aware of. And then the same in other regions of the country. So for example, my understanding in California is certain critical facilities like hospitals and schools are to be certified not by a registered professional engineer but a registered structural engineer, which is a different set of tests and qualifications or credentials as well. Reference 14 - 1.73% Coverage Yeah. I mean a couple of qualifications I guess. One is my understanding is it's gotten better. I think there used to be, particularly in the US and Europe too for that matter, it was much more scattered in terms of lots of different		

	regions had their own code. Now fortunately we've started to converge in the US and I think that's true with the Euro code as well on a sort of unified code. So when you're going from country or state to state or region to region you're not completely out to sea, there is some unifying thing. When you're in a diverse region like Europe or like the United States where you have some regions that are more seismic probably than others, whatever they might be, it's reasonable too that… Reference 15 - 2.28% Coverage I think the process by which codes come about where it's not one individual making a decision by THEOD, it's a group of individuals probably from very different regions and backgrounds coming together, so it takes time to change the codes. So I'm with you, I agree. I think we have to think to the future, we have to think about things that maybe we haven't thought so well about before like resilience and sustainability. But we also have to realise the sort of nature of the beast of what we're		

	dealing with. They can't move so swiftly, they can't turn so adeptly. We just need to figure out ways to sort of incorporate things into there, or to let engineers very carefully and very thoroughly, to be able to adapt somehow. Now that's a little bit scarier because a lot of engineers will feel like they're flying without a net if they're not having the background of a code to work with in that case. So I think that's the tricky territory we're in. Reference 16 - 1.01% Coverage We have these grand challenges that we're dealing with that we're not quite sure how to solve yet. We know we need to, we know we have to. But how do we do that? how do we go about doing that while at the same time adhering to our principles of safety, of economy, of dealing with codes so that we're not just completely making things up. And I think that's where it's difficult to come up with real solutions for people. Reference 17 - 1.88% Coverage I think it's too rarely to be honest with you. I think we tend to get a project which is at the		

	Building Scale, it might be even less for that matter – it might be a façade on a building or it might be some element of a building. But generally we work at the Building Scale, unless somehow by happenstance your firm is also working on the building next door, or it's part of some large scale development where you're working on a number of them together. I don't know think structurally you'd tend to think of them, unless well there is an exception. I guess wind tunnels would be the exception there, where when they do a wind tunnel study, they don't just do the one building they do the buildings around it to understand how the wind affects of certain buildings working together. Reference 18 - 1.70% Coverage So that's the legal side of things that – the technical one would be understanding, at least from a structural perspective, how your structure and your building would relate to the structure of another building. Again we tend to think of these things in isolation with the exception of		

	examples like wind tunnel testing and things like that. But to imagine somehow that buildings could share – whether that's in the structural system or in the foundation system, work together somehow. Or some other emergency response like egress or elevators or whatever it might be. That would also be a technical challenge because we're just not used to doing that. I think that would require some very innovative thinking. Reference 19 - 2.31% Coverage Would you think it was for city planning to help you with? Or would you think it was the city buildings department? Do you just think it's, "Hold on a minute, we'll run this thing together and we've got to start reducing legalities so we can actually look at the building, build environment as a system?" That's a very good question, I'm not sure. I suppose in an ideal scenario what would be interesting is, especially thinking about it as a structural engineer and then thinking about how this collective of buildings is working together at the		

	urban scale, not just at the individual element or Building Scale. I guess what might be productive is a discussion where the different types of buildings are going which would be a sort of planning scale, what types of buildings those are and what program they have which could be an architectural scale. What are the uses and how do we connect them, which would be again planning or even transportation engineer scale. Reference 20 - 1.24% Coverage The government authorities and owners and developers would certainly want to contribute in terms of what this might mean for I don't know liveability or economic vitality. And then thinking about how we might contribute in terms of the location, orientation of the building, what type of building it is, what's the structural system? Then it starts to get into the area of the structural engineer where once you're a part of that discussion and what type of building and where it's going to go and what's it going to do? Reference 21 - 2.22% Coverage		

	For all of us to be at the table making these decisions – I mean this is maybe getting a little naïve and a little too blank slate. Because then on top of that you have to think about the history of the city and things like that. But it could be very interesting at least in a hypothetical sense to think about everyone being a part of this discussion to think in terms of the things that we concern ourselves with. What's the structural material? What's the structural system? What's the form? All those sorts of things. Now that's part of a larger algorithm where it's also, where do people live, where do they go, what happens in case of emergency? What needs to be a critical facility and what doesn't and where do we want to orient that? That could be a really fun exercise. Like I said that might be getting too video game approach to it (laughs). But I can imagine it would be a very, very interesting discussion. Reference 22 - 0.81% Coverage More nuance for you if I thought a little bit harder about it, we do work on transit facilities. We		

	work on larger scale transportation, infrastructure, the types of buildings we do occasionally are connected to trying to make it at its most broad a better city a better environment and more directly and more sustainable and resilient one. Reference 23 - 0.67% Coverage So I would say the nuts and bolts of what we do of designing the structures, it hasn't impacted the code, it hasn't necessarily directly impacted our design approach. But there's probably a little bit of that attitude in the atmosphere that maybe gets down to us at this scale too. Reference 24 - 1.73% Coverage Other times we might be a little bit more closely aligned with the architect or the owner or the developer in which we feel like as our role as consultants, that doesn't again just include sizing structural elements. That includes talking about the project and how we can make the project better in a lot a different ways. But because all of these projects are different and all the owners are different, then the		

	amount of change I guess you might say that we can affect, changes as well too. It's just different projects and different amounts of affect I guess you might say. There are cases where it's pretty clear that we are hired to do a solar project and then it's pretty clear that that would be a sustainable project. Reference 25 - 1.35% Coverage But in broader terms, would it be just an engineering practice or does everyone get involved with the hazard planning? I would say that's changed over time too. We used to, well used to – I guess traditionally what are the environmental loads on a structure depending on where you are and let's design for that let's use the code and also use our engineering judgement and figure out what's right for the project and certainly design a safe structure or as safe as we feel it can be under the understanding of what the anticipated loads might be. That's changed. Reference 26 - 2.06% Coverage I mean there are new types of loads that maybe weren't		

	as well understood, things like blast and impact and things like that that become more and more a part of our job because we don't know what's going to happen and there are a lot of bad things that can happen for structures and to structures, depending on what it is. And that adds even more uncertainty and that is becoming more and more of what we see as trying to consider the truly unforeseen in terms of like a blast or something like that on a structure. And so in that case we have to think not just in terms of the resiliency, and this is maybe a slight modification of the interpretation of the term. But the resiliency of the structure with things like making sure people in certain public spaces are going to be safe and not impacted adversely. And this I would say is becoming more of what we do. Reference 27 - 2.02% Coverage Now again, there's specialisations and sub-specialisations. So there are things now where people do crowd flow simulations to say well if something bad does happen how does everyone get out? We don't		

	do so much of that. There's certainly some sophisticated work that's being done in that area. But I think what you're finding is as we start to deal with these both – malicious loads like blast and things like that as well as an increase of extreme and environmental loads like hurricanes and things that it impacts our understanding of how do we design safely and what is safety. It's very difficult to justify the most robust designs economically. So then we have to get very thoughtful in terms of what could we reasonably expect? How can we make sure that this is as safe a structure as possible? Are there parts that might be sacrificial? Reference 28 - 0.63% Coverage If you're designing a glass structure that's composed of multiple plies or laminates, certain outside of laminate of glass might be sacrificial as long as the whole thing stands up or another element may be able to be sacrificed so long as people can get out safely. Reference 29 - 0.44% Coverage		

	Generally our approach is still with ASCE 7 – actually ASC/SEI 7 which is the loads on buildings. It's pretty thorough in terms of different chapters covering different types of loads. Reference 30 - 2.37% Coverage Safety design and things like blast is much more specialised, there's not really established codes. The defence industry and the military have some guidelines and codes. But generally that tends to be more specialised and there are specialised firms that do that. So being able to actually do simulations for certain amounts of blast and things like that are very specific. Again, individual safety like crowds being able to egress and get out of buildings, again that tends to be more specialised. And often times, I mean quite frankly that's a discussion with the owner. Does this building need to be designed for blast, is not necessarily a municipal code issue. That's the owner determining this is something that they feel like is high profile, that there would be a lot a people in it and so		

	I want to make sure my building is safe should some unforeseen thing happen to it. Or someone wanting to do something to it for that reason – it is high profile and there's a lot of people. Reference 31 - 0.84% Coverage And so there it's I would say more of a combination of understanding the needs of the project, conveying technical aspects to owners who may or may not come from a design, architecture or engineering background. And then trying to determine what safety means in those contexts - a combination of sort of social and political and economic and technical.		
NYC 05	**Reference 1 - 1.25% Coverage** **But right now it's very fo – city mandates are so focused on carbon emissions and reducing energy loads of buildings. And it think that plays into the resilience factor because obviously we wanna be consuming less energy to prevent black-outs or in scenarios when we don't have access to power, like a Hurricane Sandy type of scenario.**	City policy is energy and carbon dominant Cost- Peoples need for luxury Mnemonic codes of practice	Neglected sustainable development principles but is focused on reducing energy for emergency reasons. The impetus on reduction of energy has bought attention to 'passiv-haus'standards and 'off-grid' potential I.e. tread the earth lightly (a sustainable building). Incentives for renewable technology Incentives to get around the way of measuring space in ftsq so that walls can be made thicker. 2030 district development, seen as a transdisciplinary example of future projects (but these are quite unique- what about all the small projects working on different financial scales- the damaging ones).

	It's been interesting because in New York specifically this has driven Passive House to be the top of everyone's list when they think of sustainability it seems like. **Reference 2 - 1.57% Coverage** **For example, we are analysing this kind of incentive basically to make your walls thicker, so 18 inch walls for a zoning allowance per square footage. So you're basically allowed to increase your square footage or not have to pay for it with the assumption that your building is probably more energy efficient because the walls are so much thicker. And they also have incentives for wind turbines, solar panels, and a few other items. And I know developers are starting to take advantage of this, us as well. Some of the developers have really taken advantage of this and do it on every single project now is what I've heard a lot.** **Reference 3 - 0.99% Coverage** **There are I guess private collaboratives I**		Cost of development gets driven by luxury not its ability to withstand disasters. Zone Green- revisions of building code with a bias towards energy reduction, this is seen as 'examplary' but from a sustainability and resilience perspective, is it limited? Passiv-haus code becoming more prominent

	would call them in the city. If you're familiar with a 2030 District through Architecture 2030 I believe, there's a 2030 District that's basically inclusive – including all projects or property below 14th Street which is the area most likely to be flooded in sea level rise. And I'm happy to put you in touch with someone there if you haven't already. **Reference 4 - 0.75% Coverage** **But if it had started now I would be in the design meetings encouraging probably energy conservation measures and at least being able to reduce the energy load in the building if nothing else, because there's not much other impacts we can have. I guess I say that because we're always told that, right?** **Reference 5 - 0.71% Coverage** **I think that understanding is there, but I think that so much of it comes down to the – just costs of the building up front, that sometimes it's thought of but as kind of a second thought. Like it would be nice if…**		

	but first we need to sell the condos, to tick all of these other boxes. **Reference 6 - 0.26% Coverage** **even if there's no cost, like trying to figure out what type of product you want to offer is still tough.** **Reference 7 - 1.41% Coverage** **So in an emergency response in New York there's so many challenges in trying to navigate the fire codes and things like that. They come from the city and with good intention, but sometimes get in the way of what you actually want to build, because there's so many restrictions and I think even more so now. You know, people are starting to think about when they design things are there areas where someone could feel unsafe or be trapped somewhat. So starting to think that way, New York has been very relevant. So I don't know if there's ways to overcome that really.** **Reference 8 - 0.92% Coverage**		

	I think a lot a times the city is probably more open to different types of projects than people may guess, but it takes a cohesive team to present that idea in a scenario. And I think that so often that just doesn't happen because it's just seen as such a challenge and then nobody ends up trying it. I think yeah, I guess that it happens on any scale of project too. **Reference 9 - 1.34% Coverage** **I could see it going down that path because the point of Zone Green is that it eventually gets incorporated into the building code. Right now it's just an option to basically test out the challenges, but then they'd want to incorporate it into the code. I think the goals of the building code in New York are quite aggressive and they do want to continue to improve. Like I said, a lot of that is geared more towards energy efficiency right now. But there's so much existing building stock that that's only gonna affect the new buildings.**		

	Reference 10 - 0.26% Coverage **Because everyone's saying this is the way the building code is going, it's moving towards Passive House.**		
NYC 06	Reference 1 - 1.55% Coverage A lot of the buildings had different codes, and that's a long topic about how the New York City building codes can grandfather things in. So, if it was built in a certain way, then you only need to upgrade it if you're actually doing a certain percentage of work, either based on the value of your home or the surface area that you're changing. So, it's a grey area in terms of if someone infills a wall, that may have been a wall that allowed water to come in and out. Reference 2 - 0.94% Coverage Yes, I do. To your point and question, there are lots of things in New York City infrastructure, trying to implement and almost immediately after Sandy, they re-released the flood maps, first temporarily but almost immediately were seeing that we're designing to a different standard.	Mnemonic decision making with building codes and QA After disaster effect Focus on building safety NYC building code focuses on energy Lack of sustainable development Fragmentation of responsibility of design and construction	As building owners change, how does the building knowledge transfer- i.e. did you know that the basement wall that you want to use, is actually designed to allow water through and fail? Realisation that M&E systems need to be on the roof rather than 'out of sight' in the basement. Building safety is generating a 'robust' response to buildings, not necessarily an adaptable one. Increase in passiv-haus responses (but limited due to public safety response to building design). Building codes need to drive a change to achieve sustainable building approaches and change the system within. Things get changed during construction due to finances or issues with constructing. Does this change the resilience or sustainable goal of the building? Is it purely looked at as a way to get over a construction issue?

	Reference 3 - 1.50% Coverage We also had a huge increase in resiliency studies where we would go in and – it could be as simple as moving your mechanical system from the cellar up to the roof, but that kind of thing wasn't done as often after Sandy and now everybody – if you make significant changes to that code, you're going to be mandated to do that, but even if you're not, it makes sense in a lot of cases, because there were so many businesses that were effectively shut down. Reference 4 - 1.07% Coverage And that code is, what, New York Building Code? That's what it's called yes? It is. The thing is it always did, it's just redefined the number of buildings it now applies to because the maps have changed and that is because of what we've learned during Sandy and the climate continues to cause these kind of super storms. Reference 5 - 2.50% Coverage So, you're saying that the New York Building Code has actually become		

	more stringent and has been revised to facilitate more resilient outcomes. Do you think it's leaning towards more sustainable outcomes or does sustainability not come in to it? I mean, it's more sustainable in that the buildings that receive this will have a longer service life, absolutely. I think building codes – there can be the risk that then there's a decision made to not save a building because it would be so expensive to upgrade it to a certain code requirement and then you're losing the embodied energy in that, but in certain cases that might be the right choice. Yeah, I think it is, but I don't know that is – the primary goal is life safety and what comes with that. Reference 6 - 2.47% Coverage How New York is relative to say – even New York City versus New York State is different. New York State is different to California, regionally, it's all by the local governance but we're all – same as you would be in a Europe code, we're all under the international building codes which is mostly just		

	used by the US. But each jurisdiction has its own local requirements and they can be very different even 100 miles away. But to your research and your point of what New York City is trying to do, the resiliency has then had an impact on our local codes and what gets triggered. So, the level of design continues to be increased but it's also that more buildings are affected because they redefined the maps and where the flooding could occur. Reference 7 - 3.74% Coverage So, is New York almost getting to the point where – you said it's got the same building code. Could that building code become – does it have its own local green building code for example? No. Anything that is codified is directly related to design criteria. So, you know, you're tied in to resiliency, it's really just all one level, flood we would design to are one level and protection we would provide, what r-value of insulation we need to put. And in the US, we're also a bit behind in terms of we still look at all that very two dimensionally. I worked very briefly		

	in Switzerland, and even for a small renovation project, they do a 3D model of the heat coming in and out of the building, and that's just basic requirement. We look at a table and – I'm not an architect, so I don't do this but – you look and you say, these are the components, we've met this value, that's fine. But you're not looking at the big opening over here for a skylight and how's its thermal bridge. Thermal bridging is something structural and we do get very involved in, just because of the challenges of bridging between inside and outside. Reference 8 - 2.72% Coverage Yes. I think in theory (laughs). I mean I think the hardest part is we're dealing usually with something that already exists. For instance, for new construction, yes, I think that would work, because you can look at it from the beginning and consider all of it holistically. It's a little harder when you have a constraint that you're then trying to build around. So, there's a level of resiliency when you consider it from an earthquake design perspective. It does come down to cost		

	as well. How much damage do you really want to see in the event of an earthquake? And in terms of floods, similarly, a lot of people choose to have their basement flood. It's cheaper. They say, I don't care. I would rather just have a couple of openings and design [0:25:06] joints and then it is what it is. (Laughs) It's true. Reference 9 - 1.06% Coverage Well, they design it so that it won't. So, you would leave openings so that the pressure is equalised. So, those levels of compromise between an existing building – and it's the same with earthquake and upgrading for that. If we had to upgrade every single, existing building for that, it would be massively difficult. Reference 10 - 2.52% Coverage I think in theory, yes, but it doesn't happen – when a new building site is looked at and say it's somewhere in Queens where it has poor soil, and it has flooding, then it would be like, okay, maybe this isn't the right place. But if you're in Manhattan or Brooklyn, where there is so much of		

	a demand for estates and real estate, you usually – owners, developers are going to be willing to pay for the extra deep foundations, or special flood proofing that would be required in order to have the locations. So, I think it's just balance of – here we have such a limited building stock, and such a dense city, that it's not really going to apply for Manhattan. But it could apply I guess in other areas. But they're just looking to make [0:29:10] really here. Reference 11 - 1.71% Coverage This is where, when you start to understand resilience and sustainability more, there is – the temporal scale comes in to play and the spatial scale comes into play, or what do you have to do to make this building withstand what is coming? And yes, do some more retrofit, but also it's got to change that for example, you can't be using the first floor, or the ground floor of buildings. Yes, and some of the codes actually already say that for certain buildings that just can't be		

	occupied up until a certain level. Reference 12 - 2.54% Coverage What do you think could be done to enhance more resilience and more sustainable buildings within the planning process and design process? That's a tough one. I think it has to come down to the codes, which part of that has already happened, but also defining the area of expertise, who is really signing off on the building. We have something here where an architect can sign off on a structural – if it's a one or two storey family home. So, a lot of the lessons with Sandy, were that the lapses were with the building permits, the inspections, the code requirements. So, the code requirements, they've already started to look at that, and already – I mean it'll never be fixed, we're going to learn something else, and then it's going to be perpetually updating. Reference 13 - 1.68% Coverage So, unfortunately, that means more beaurocracy and all of that, but in this case it ties to safety and I think		

	continuing to make – some of the lessons learned from Sandy and some of the other events like that – to make that more of a – to make climate change a more integral part of the discussion within the building community. It should be a metric in the same way that other things are metrics like earthquake design, wind design, obviously appropriately for the zone. And it is a metric now but it's– Reference 14 - 2.90% Coverage I think it would be interesting to know – I actually think New York has very strict rules about special inspections, which came from various building regs, especially in the 70s, that as you say, with the concrete and now – and other places in the US do this, but I don't know if this is typical in Switzerland. I know a little bit about how they do it there/ But we have like a third party special inspector that takes all of the concrete and tests on a project and [counts the rebar 0:35:22] and there's a strange delineation between where the design professionals role stops and that inspector's role		

	begins. So, we – and we also have this delegator process where the contractor submits to us shop drawings and then we check them, whereas I think in other countries, the detail is done all by the structural engineer, so not through construction. I know it varies a lot.		
NYC 07	**So, on the building code, I do think this city has done a very good job of incorporating design elements into its code requirements and they've addressed a number of issues from the city planning department that deals with the planning and zoning works of the building department, and the building code. I think they've done an awful lot of work and I can't speak to specific elements that may still be in need of updating, but it's one avenue that this city pursued very attentively and aggressively to ensure there are requirements that will allow the city to increase resiliency and help achieve its carbon mitigation goals.**	zoning	Addressing issues around flooding
NYC 08	**In our case, and [0:17:58] my portfolio, right, because we mostly occupy in [0:18:05] facility, I would not put this much of a barrier.**	A shift in building ownership- i.e. an increase of interest	Owners taking on responsibilities (I guess so that they know what they are dealing with), therefore more interest in resilience

	On the contrary actually because [0:18:14] opportunity, because [0:18:19] flexibility. So there is quite a variety of options within a field like New York, especially as we're seeing more and more landlords investing in their property so they're becoming a better product from a resiliency and sustainability perspective, right. Obviously [0:18:39], right, and [0:18:44] that definitely promote better use of the [0:18:52]. I wouldn't put it as a barrier really, other than that we have to deal with. [0:19:04] in majority of the cases I would probably say it goes down to cost.		

NYC Discussion Points

NYC is clearly sea level rise focused and is considering infrastructural systems, but at the expense of the domestic scale building- the ones that have adapted their basements into living spaces rather than maintain the structural integrity of allowing the building to flood. There is a real conflict between the codes and scenario planning with what the designers think is best practice. The mnemonic approach to designing buildings is a real issue, although there are plans to work on this, governance spending is limited. So getting a hotch-potch of approaches, of buildings that can cope but are cut off due to infrastructure failures and lack of investment in infrastructure. Where is the obstruction in the code? Or who?

What also comes through here, is how the design team actually is mobilised by clients. There is a real difference in how big projects get managed

compared to domestic ones due to cost. This is where building owners and design teams lose sight of the bigger picture….

Chicago

Group Chicago	Working Policy Data	Interpreted Cause	Interpreted Effect or impact or action required
Chic 01			
Chic 02	Reference 1 - 1.85% Coverage So some of the things I do are like I said building analysis, so doing particularly early studies that's kind of before the engineer comes in. Like a bridge to the engineer, because the way it works here is we work mainly in big cities like San Francisco, Chicago, Oakland, Boston, Dallas, Detroit, Houston and places like that. So larger cities in the US. And they usually have some kind of development policy that requires you to get permission for the building before you can proceed. And usually in those cases we don't have engineers. So we've built the capability here to do a lot of building analysis. So we look at you know, early radiation studies, how that impacts administration. Sometimes there's possibilities for natural ventilation.	Development policy – building to permit C40cities Energy policy Building codes out of touch- slow to change	Development policies do not require engineers (or those with value to understand that the development might not be the most appropriate work) [same as UK- planning permission does not consider the engineering or systematic issues of developing a site, unless there is protest). This has led to early phase analysis to demonstrate how to proceed with sustainable design to gain planning permission……(but not every project has that benefit of skills). Energy Codes have become more stringent City energy policy has created the issue of whether air conditioning is viable for a project, this has created opportunities for natural ventilation.naturally ventilate buildings are more resilient in terms of emergency and infrastructure demands. {passiv-haus can control the thermal envelope]. Need to jump to Passiv-haus standards in building codes

	We've done some buildings here in Chicago with natural ventilation. Reference 2 - 0.51% Coverage Our energy codes in the US have become more and more strict over the past decade. I've done some research around topics like biking and how that impacts our buildings out here, we do a lot of high rise residential buildings. Reference 3 - 0.69% Coverage And I will say that most our projects are in the very densely built urban areas anyway. So there's limits to what you can do. So it's going to usually be some kind of storage tank anyway. We haven't seen a huge shift in how that's done, just because it was that requirements have been there for a while. Reference 4 - 0.92% Coverage The other issue with climate change is just increasing temperatures right? Because we're a fairly mild climate. When I moved here in 1988 hardly anyone had air conditioning and almost everyone has air conditioning now. Then that impacts us because we've seen you know the energy codes are getting		

	stricter and stricter and so we're still, you know we're providing that air conditioning but we're trying to do— Reference 5 - 2.40% Coverage Not very often. We have done more than anybody. We work for a University called Loyola University, it's on the very North edge of Chicago and we worked with the German engineer, they have an office in New York which we work with, but they're called Transsolar. And we have buildings that take advantage of the natural ventilation they have, either automatic operable windows, atriums, air intakes, building management systems that work with that. In a residential building we have operable windows, so it's actually very hard in a residential building to induce natural ventilation because you run into different – you know, you've only got one side. You can't really do an atrium because it's very expensive. But also you run into issues with fire code and privacy and all that and noise. So it's really single-sided ventilation which is not great. We've definitely seen a few projects that have tried to address the single		

	side of ventilation and improve it, but it adds cost and complexity. And right now I don't see a lot of people that value that very much. Reference 6 - 1.08% Coverage I would say that when you're trying to look at the feasibility of a project that there's easily a fairly brief effort where you look at how you'll meet the stormwater ordinance. Because there's an ordinance that applied to every project, but then also – like I mentioned there's a – if you're going for a planned development which most of our projects do then there's additional requirements that you have to meet in addition to be organised – or you can meet, it's not mandatory. Reference 7 - 1.26% Coverage We're doing some work on Passive House and that's where we've been bringing up resiliency and that's always something that people raise their eyebrows a little bit. And I know it's maybe slightly different, I don't know it's, you know like, call it thermal resiliency. But that's actually something that seems to resonate a little bit more with people		

	that actually Erik Olsen of Transsolar did a study about passive survivability in buildings in New York City. And some of the famous buildings would be comfortable for about 20 minutes in a power outage. Reference 8 - 2.92% Coverage So that's – interrupted myself. So I forgot what you were asking me, but Passive House is – I know what it was, that's my examp – that's what I was going to use as an example. Is we're working on a Passive House office building and it's, you know, a Passive House office building is different than a conventional office building, no doubt. But it's not really, you know it's more insulation. We know how to do insulation right? Fix the windows with an extra pane of glazing maybe. It's mechanical systems that we're used to using, we've used them on other projects that weren't Passive House. But the biggest barrier is people thinking that it's totally different. Or thinking that, "You really shouldn't bother with that." We have a developer who's pretty committed to doing this office building. And he told us yesterday that every contractor that		

	they interviewed, even though when they were talking to me they were like, “Yeah, we’re looking at Passive House,” when they talked to him they said, “Oh you don’t want to do that.” And they’re – the only reasoning we could figure out is that they wanted there to be a project and they felt like it was too exotic, too risky to do. But again it’s not – if you really know about it it’s not, it’s really not, it’s just kind of basic stuff. Reference 9 - 2.05% Coverage With the design codes and standards that are being reviewed, do you think that they need to be reviewed to come up to date with where energy codes and sustainability is going? Or do you think that business as usual would be okay? Do you mean codes – do they need to be improved? Yeah. Absolutely. The codes in the United States have definitely been improved and some people would say too quickly. But I think it’s been too incremental. I think we need a huge jump. I mean we just need to go with a terminal condition which would be requiring something like Passive House. It would definitely		

	add cost, but those costs would come down quickly I think because the market would respond. I absolutely think, although I'm glad the codes have gotten more stringent and has not been balanced enough given the scope of the problem. I also think we need to look at existing building performance and codes. Reference 10 - 1.67% Coverage So I think that's good but it's fairly toothless right now. Starting next year you're going to have to post the energy performance of your building in the lobby. In California you have to post your health inspection, you know, how many stars you got. I think that's a case where in a restaurant I think it makes a huge difference. In a building? I don't really see that, people don't consume buildings like they do other products. So you know, they're trying to do something though. But I think there needs to be more achieved. Benchmarking is great but I think that because of the incentives that the owner – because of the disincentives that I mentioned the owners will not respond until they have to. And when		

	they do they'll be fine. Reference 11 - 2.23% Coverage And then your second question, I'm saying "No." To me LEED has become sort of a zero sum game, it's really become about compliance. And we don't – particularly with stormwater, I've never LEED inspire sort of a creative solution for stormwater. And in our buildings there's really, because they're zero-lot-line a lot line and it's all paved in the sidewalks. We do have green roofs, partly because they were required before by the city which they're not now. But we do have green roofs but there is so little stormwater to manage, we're talking little postage stamp sized building footprints you know at 30 – you know, you might have a 24000 sq ft side on a 34/40 storey building right? So there isn't a lot of opportunity for it. Even if you go with, even if you do go the Full Monty and do green roofs, permeable paving and all that, you still have to have a tank. To me LEED is never a driver for creative innovative solutions, at least the way it's been used in the industry here.		
Chic 03	Well I think it's also important to – again the US version of	Meeting energy targets	Need to shift towards passiv-haus and performance standards

	Passive House, there's like this kind of gigantism between the German and the US Passive House where we're like using less prescriptive standards, I don't know. So it's technically cost optimised so that some of the – so yeah, obviously we should all be building to Passive House right now.		
Chic 04	But if you've got a building that is then built and owned and then rented out to people like apartments or is it that people own their own apartments? And then would they have a more vested interest as a stakeholder to more resilient and sustainability objectives? Large buildings are usually built and then sold straightaway, so you're completely absolving a certain responsibility for it once it's built. Office buildings are obviously tenanted and usually there's no incentive for the tenants to do anything sustainable because you usually have to pay a set bill and it doesn't matter what energy you're using or how much water you're using anything like that. For apartments you do own the apartment but you don't own the building. So again your incentive, you've got a bit of energy cost but it's		

	low. So your incentive to be sustainable, it is small. Reference 2 - 2.13% Coverage There's two things that need to happen. The regulations need to get much stricter, much stronger, much, much stronger. And also the building needs to be certified every year with its actual energy use, actual sustainability credentials, actual resilience. So every year it has to re-certify itself according to a benchmark set by the city. And if it isn't meeting that then they have to improve. But you can't just do it with design, you have to do it with ongoing construction – ongoing occupation and that's the only way. Reference 3 - 3.26% Coverage Yeah, well in respect to infrastructure with local policy. I wouldn't say there are gaps, I would just say it's not done. I don't know where you would consider it in an American project, where you would consider your environment other than how it affects your building. I guess if you have a district heating connection and a district cooling connection,		

	sometimes you have to connect to it but it's not – yeah. In my experience I've never seen anyone think about next door, let alone two streets down (laughs). And I can't – I don't know where that would be in the planning process, I don't know where it will be unless it was put into a policy where you had to do that and then it would go in I would imagine quite early on, probably a schematic design – we would have to start thinking about that.		
Chic 05	**Reference 1 - 2.56% Coverage** **But in terms of barriers, I think the focus to maintain the zoning code of the city and the building code of the city are very old-school Chicago dudes. Like, exactly, I did some work with the Department of Planning on integrating commercial farming and community gardens into the zoning code so that there was proper uses that were written in the zoning code. So if someone wanted to start a farm on a vacant lot, there was a place for them in the zoning code. And over like a year almost of meetings with the Department of Planning, I got to**	1. Institutional decision making of zoning	Custodians of decision making become entrenched in their mentality and 'institutionalised' in knowledge. Introducing zoning has created a conflict in how decisions are made .

	know this guy and I'd be like – you know, his name was Steve, something Italian, and then he'd bring to these meetings the zoning code, which is like this binder, like this thing, like six inches deep, and he would bring an unlit cigar that he would just have hanging out of his mouth, and that was like his presence in the meeting, right? Like, "You want another zoning code? It's this thing and I'm the only one who knows every word." And I'm like, "No, [0:23:48]," you know, like if you think you'll ever change this, yeah, right. **Reference 2 - 0.77% Coverage** **So do you think that is the biggest barrier perhaps that might be in existence?** **I would say that's a big barrier, yes. Right.** **I would say again the leaders, the governance leadership and the codes, those codes, those are – feel like the least in anyone's control, and especially people who are passionate about these issues.** **Reference 3 - 0.70% Coverage**	Institutionalised decision makers The cities' risks, vulnerabilities and impacts, Archaic infrastructure Increased urban flooding- FEMA Data on storms is out of date in regulations	Institutionalised decision makers find making a change overwhelming. Policy has to overcome institutionalised decision making and investment into the legal challenges. Need strong leadership Designers are aware of heat, heatwaves and urban flooding. It has given impetus/ containment to the concept of resilience. Urbanisation has gone beyond the designed 'limits' for infrastructure Technology has become so efficient in creating a need but the infrastructure is inefficient because it can't keep up with the demand. i.e. why do we have urban flooding, why do we have so many devices that need electricity, now these devices create material demand, and because of carbon dioxide levels need to become more efficient and in doing so, wasteful (circular economy overlapping with infrastructure). Buildings have not been designed with foresight to a shifting world and codes of practice are regulated in a way that does not allow change, and can make something look inefficient

	Yeah, so one thing I get really excited about, so I think I'll also use this as a chance to touch on the climate impacts for the Chicago region, our two big ones are heat, the sort of heatwaves, and urban flooding, so it's not necessarily like sea level rise or even lake flooding, it's [0:27:54]. **Reference 4 - 1.69% Coverage** **And I think London has a similar problem where our pipes, our sewer pipes are too small basically, so when it rains, streets flood, the pipes overflow into the river with sewage and storm water mixed together so it's like poor water quality, and then homes flood, so sewers back up in basements of homes and there's literally like every time it rains here a pocket of the city or multiple pockets of the city, homes have poop and water in their basements. And so this is a real issue because FEMA, as you mentioned in one of your questions, doesn't even acknowledge urban flooding; it only focuses on river rain flooding or coastal flooding, which are just where a body of**		when in fact it is dealing with change. Mnemonic practice to designing to a 100yr storm, is no longer 'resilient' enough because the context i.e. the cities have changed.

	water over, you know, over-tops its edges. **Reference 5 - 1.71% Coverage** **I will say that another barrier in terms of really building resilient kind of resilience is how we – so when we – when our Department of Water Management or our sewer district, so two different entities that manage ins and outs of water, when they're designing pipes, they – and especially storm water pipes, they're using old flood definitions so, you know, the one-year flood, the two-year flood, the five-year flood, so this is probably something – and so ours are from using rainfall data from the '70s. Yeah, it's a little different now. And that's something that, you know, just took somebody saying, "Hey, let's throw some money at the scientists to update this flood, you know, this flood data," and then actually—** **Reference 6 - 0.56% Coverage** **So that's another kind of policy or – that just needed a little investment to like get us into the 21st Century. Yeah.**		

	Goes back to what you were saying earlier, zoning codes and building codes are out of date. **Yeah, exactly, exactly.**		

Chicago Discussion Points

Summary for case study- joining the dots.

Zoning and its uses in each city- this is a common theme in planning

Energy and carbon, from C40 cities? Why is there such a bias, surely it can't be down to LEED accreditation alone?

How to enable design practitioners to be more involved and equal roles in taking on risk and impacts.

Design codes- how out of date are they?

Why such mnemonic decision making?