Task Force on Tall Buildings: "The Future"

October 15, 2001

Council on Tall Buildings and Urban Habitat

COUNCIL ON TALL BUILDINGS AND URBAN HABITAT

"TASK FORCE ON TALL BUILDINGS: THE FUTURE"

TRANSCRIPT OF PROCEEDINGS of the
above-entitled matter, held at Chicago O'Hare Hilton

on the 15th day of October, 2001,
commencing at 9:00 o'clock a.m.

PRESENT:

MR. RON KLEMENCIC and
MR. DAVID MAOLA
appeared on behalf of Council on Tall Buildings Urban Habitat

MR. BOB WILLIAMS
MS. VALERIE E. RICHARDSON
MS. CLAIRE HEAP
appeared on behalf of Invensys Energy Solutions;

MR. RICHARD CHACE,
appeared on behalf of Security Industry Association;

MR. TOD J. RITTENHOUSE,
appeared on behalf of Weidlinger Associates, Inc.;

MR. JEFFREY E. HARPER,
appeared on behalf of Rolf Jensen & Associates;

MR. NABIH YOUSSEF,
appeared on behalf of Nabih Youseff & Associates;

MR. WILLIAM F. BAKER and
MR. ADRIAN D. SMITH,
appeared on behalf of Skidmore Owings & Merrill, LLP;

MR. JON D. MAGNUSSON,
appeared on behalf of Skilling Ward Magnusson Barkshire;

MR. NORMAN D. KURTZ and
MR. RANDY J. MEYERS,
appeared on behalf of Flack & Kurtz, Inc.;

MR. PAUL KATZ,
appeared on behalf of Kohn Pedersen Fox & Associates;

MR. THOMAS K. FRIDSTEIN,
appeared on behalf of Tishman Speyer Properties;

MR. JOHANNES de JONG,
appeared on behalf of KONE Corporation;

MR. ROBERT PRIETO,
appeared on behalf of Parsons Brinckerhoff, Inc.;

MR. MAHADEV RAMAN,
appeared on behalf of OVE ARUP;

MR. RICHARD KEATING,
appeared on behalf of Keating/Khang;

MR. STEVEN D. EDGETT,
appeared on behalf of Edgett Williams Consulting Group, Inc.;

MR. JERRY R. REICH,
appeared on behalf of Horvath Reich CDC, INC.;

MR. JOHN HARRIS and
MR. DAVID J. WICK,
appeared on behalf of Hines Interests Ltd. Partnership;

MR. ROBERT E. SOLOMON,
appeared on behalf of NFPA;

MR. BRUNO J. SPIEWAK,
appeared on behalf of Cosentini Associates, Inc.;

MS. NADINE M. POST,
Engineering News-Record.

Council on Tall Buildings and Urban Habitat

FACT SHEET

- The Council on Tall Buildings and Urban Habitat is an international organization sponsored by architectural, engineering, planning and construction professionals, designed to facilitate exchanges among those involved in all aspects of the planning, design, construction and operation of tall buildings.

- The Council's mission is twofold:
    1. To maximize the international interaction of professionals and
    2. To make the latest knowledge available to the professional in useful form

- The Council is today recognized worldwide as the source for information on tall buildings.

- The Council also has a major concern with the role of tall buildings in the urban environment and their impact thereon. Providing adequate space for life and work involves not only technological factors, but social and cultural aspects as well.

- While not an advocate for tall buildings per se, in those situations in which they are appropriate, the Council seeks to encourage the use of the latest knowledge in their implementation.

- The Council also publishes the "CTBUH Review," which includes papers submitted by researchers, scholars, suppliers, and practicing professionals who are engaged in the planning, design, construction, and operation of tall buildings and the urban environment throughout the world.

- Additionally, the Council operates the "High Rise Buildings Database" which contains data on thousands of tall buildings: the latest facts and statistics, visual images and video, and listings of professional firms linked to specific buildings and specialty categories.

- The Council is launching a campaign to establish a "World Building Competition." Every four years all those involved in the construction industry throughout the world will be invited to participate through competition and exhibition.

- The Council hosts global conferences on the topic of tall buildings and the urban habitat.
    - The next world conference is on the topic of "Building for the 21st Century: Technology, Liveability and Productivity" in London, December 9 through 11, 2001. Please see the fact sheet on the conference for more details.

- For more information, please see www.ctbuh.org.

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David Maola, executive director, Council on Tall Buildings and Urban Habitat

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Paul Katz, principal of Kohn Pederson Fox Associates
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Bud Spiewak, director of Chicago office, Cosentini Associates
Cosentini Associates was established to provide consulting services in the mechanical and electrical engineering disciplines. It has grown to be one of the largest and most respected consulting engineering firms in the US. Cosentini's practice is international in scope with offices in New York, Cambridge, Chicago, Orlando and Washington DC.

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# # #

I N D E X

MR. KLEMENCIC: Good morning. First off, thank you for attending this Task Force meeting. I view this as a very important meeting, not only for our industry, but also for the country. The people in this room represent the best and the brightest of the building industry, and we appreciate your participation immensely.

This morning, we will go around the room and ask each of you to speak. Please introduce yourself, your affiliation, and then if you would spend five or six minutes presenting your bullet points:

- What do you think is important?
- What do you want to say to this group?
- What response to September 11 is appropriate from our industry?

After this initial round of comments, we will reconfigure the room and have more of an open dialogue that David and I will moderate.

So why are we here? There are a lot of people in the industry, many of our colleagues, in fact, talking to the press saying all sorts of things. Some of them very intelligent, many of them not so intelligent. But there isn't a collective voice that represents the building industry, not just the structural engineers, not just the architects, not just the mechanical engineers, but our industry.

The Council on Tall Buildings and Urban Habitat, whose charge it is to bring together all of the disciplines under one organization, is the perfect organization to pull you all together, have an interdisciplinary dialogue, and hopefully set a direction and an agenda that the industry can then follow in response to September 11^{th}. That is our goal today. In the aftermath of the terrorist attacks of September 11th, noting there's a likelihood of additional events, what, as a building industry, should be our response?

Let’s begin our morning session. Bob Williams, from the building controls industry, if you would introduce yourself, your company, and provide your opening comments to the group.

BOB WILLIAMS

INVENSYS ENERGY SOLUTIONS.

MR. WILLIAMS: I'm Bob Williams. I work for Invensys, PLC. Invensys is what you all would traditionally know as a building controls company. Building controls have expanded significantly over the last several years, and we also provide traditional HVAC equipment, systems, and services. Like others in our industry, we provide access systems, energy systems, utility management, utility procurement and marketing, occupancy, security, lighting, and egress systems. We are working as rapidly as possible to have all the systems integrated into a single solution, a single system. We also are the host, as Ron said, and the co-organizer of the December Building for the 21st Century conference in London, December 9-11. I'm joined by two other colleagues from Invensys: Ms. Valerie Richardson our vice president of marketing. Also Ms. Claire Heap from our London office.

From perspective, there are two bullet points that we would like to have addressed and considered here. As a controls industry, we must speed up the process of integrating all the control systems that go into a building. Invensys, in addition to providing Control systems, is also an occupant of mid and high-rise facilities in over 300 facilities world-wide. We have significant interests in ensuring that all the service, control, exit, and occupancy systems are all fully integrated. The technology is available to know where people are in a building at any given time, ensure they can get in and out of specific places in the building safely and as quickly as possible.

So, the first point is a challenge to the building industry: that is to step up the integration of all building systems, even competing systems. The second point is that those of you who are in the design and build sectors should insist that companies like Invensys step up the integration process. All of our systems, services, and solutions should be fully integrated, working together so we can truly have intelligent buildings. Thank you very much.

MR. KLEMENCIC: Thanks, Bob.

We're going to move on to building security, and Richard Chace from the Security Industry Association.

RICHARD CHACE

SECURITY INDUSTRY ASSOCIATION.

MR. CHACE: My name is Richard Chace. I am the Executive Director for the Security Industry Association. We're a trade association. We represent manufacturers, distributors, suppliers, integraters of security products and systems. And some of what I'll say today will certainly echo what Bob is talking about, and I appreciate the opportunity to come here and speak with you.

First and foremost, the way we approach security is probably the way you approach a lot of your jobs and how you look at things. We need to assess the situation first, before any recommendations are made.

We also look at security from a very humanistic point of view, because security is extremely psychological in scope and nature. What is secure to you is not necessarily secure to me or anybody else in this room, and we must keep that in mind when we're designing buildings. The security system might not be what it's intended to be based on who the occupants are in the future. So it's important that all those considerations go in at the outset.

Security is subjective, as I mentioned, and it's based upon real and perceived needs. What the building occupants think they need and what they have are two different things. It's traditionally viewed as a stand-alone system that could prevent or detect problems, and that's what the public perceives it as.

Public perception of security traditionally has just been about guards and cameras. Whatever they can see they believe is typically the security of the building, and we know full well that that's not true. If there's a camera, the perception is that somebody is behind it, and that's not necessarily accurate.

Traditional public perceptions of security typically have security as an HR function, it's costly, and usually separate from other building operational functions.

Bob's company and other companies similar to Invensys are really advancing the notion of integrated systems and intelligent buildings. That is absolutely the future of integrated security systems. We must, at the architectural design phase, think of all aspects of the building. Security is a complete solution from the outset that is discussed, and considered throughout the design process.

Designing too much security into a building does not really solve the problem either. Often it will compound it. If you don't have proper education in place, or training, or protocols, you have problems, and ultimately the systems can fail and not be as helpful as they should be.

Building security is often the oversight of a second tier or mid-level director rather than first tier or senior-level director. We find quite often that security is not represented at the top quadrants of building management companies or corporations, but it needs to be at the very highest levels in order to be taken seriously and be integrated fully with the other systems.

What is probably most important, though, is assessment -- there are no standards or best practices or codes that currently regulate building security. The nature of security is that it is subjective. That is what makes it extremely difficult. How do you codify technology that is inherently subjective?

Security, at its core, is about education and knowledge that focuses on human behaviors in a social situation. What needs to be taken into consideration is how people in the buildings might behave and how they interact with the knowledge level they have based upon the systems that are in the buildings. There are several approaches we can take to this.

All effective security depends on the following:

- Thoroughness of the initial security assessment prior to and throughout building construction; development of a policy; what will the security be designed to secure; who will be in charge of it; what are the protocols before technology is purchased;
- making an assessment of the available technology and then the appropriate selection of the technology;
- integration of physical and electronic technology with other building systems.

Most systems now can operate on local area networks or wide area networks. When thinking about the building, we should be thinking about it in terms of land -- in land use. And we should think of the building as a local-area or a wide-area network all hooked up together, all operating off a single or multiple systems that can communicate effectively.

The systems should have fluidity and adaptability to allow for growth of the occupants of the building. Ongoing allocation of resources, capital to maintain and upgrade the system on a regular basis, and regular system audits and surveys are all part of appropriate security surveys and installation procedures and assessments.

Finally, we're participating with the National Crime Prevention Council to develop a survey of best practices or protocols for schools, to help them become more secure. Thank you.

MR. KLEMENCIC: Next, let's hear from to Tod Rittenhouse from Weidlinger Associates, Inc. Tod is a blast mitigation specialist.

THOMAS J. RITTENHOUSE

WEIDLINGER ASSOCIATES, INC.

MR. RITTENHOUSE: I'm Tod Rittenhouse, managing partner at Weidlinger Associates, New York City. We're a firm that provides structural engineering services. In addition, we've developed expertise blast mitigation over the past 50 years.

My experience started by writing the guidelines on how to design an embassy after the Beirut incident. As the events in the world changed, we became involved with organizations like GSA, helping them write a protective criteria specification. What we've learned is there are no hard-and-fast rules as to how to protect a building, or what the threat is to a facility. We spend a lot of time trying to educate our clients regarding risks.

Our firm focuses on the Physical aspects of buildings. There is the operational, technical security which others will mention, but the physical security is the perhaps the more expensive system that goes into the building to prevent catastrophic failures.

One of the things we would like to change is to educate people as to what you can do for a building to make it safer and respond better to an attack, whether it's a car bomb, a letter bomb, or some kind of explosive device.

Some of the issues that come into physical security are the perimeter protection, the structural integrity, and facade and glazing protection. It is a collaborative and integrated effort to design effective systems.

One of the most important things we learned from Oklahoma City and witnessed again with the World Trade Center this past month, is that 256 buildings or so were damaged in Oklahoma City, about 18 seriously and 10 either came down or had to be torn down because of the damage they sustained.

In the case of the World Trade Center -- I don't have the exact numbers, but I think it's in excess of 300 buildings sustained some kind of damage. What I am trying to say is it's not just the target buildings that we need to be thoughtful of and try to protect, it's all the other buildings that are involved.

You could be across the street from the United Nations, or near an embassy. You could have been across the street from the World Trade Center or Oklahoma City. As we move forward, I want you to consider not just the next superstructure or the next building, but all the other buildings that are in the neighborhood or around the corner.

As mentioned earlier on, we wrote the guidelines on how to design an embassy against terrorist attack, and we came up with a design that met the threat. These designs have 2 1/2 inch thick glazing. They have a 12-inch-thick cast concrete walls. This is a very heavy design because we don't know who or what the threat may be.

After the attack on Oklahoma City, we began working on a building, the federal courthouse in Brooklyn. The result was a much thinner, a much less expensive glazing system compared to traditional embassy design.

This allowed the architects to provide a high degree of windows. We worked with the architects and the owners to find the right mitigation for their system or for their building.

We took it a step further with the GPO in Brooklyn, which is a historic building. We came up with a building design such that if an event occurred, the occupants would be safe.

Finally, on the Las Vegas courthouse, we worked again with the owners and the GSA to design a curtain wall system that would survive a blast threat as defined by that client. We thought that was one of the most significant achievements, not for us, but for the industry to be able to design buildings that would protect the occupants against terrorist attacks and yet have a curtain wall.

That what it's really about, is trying to come up with a building design that works for the architects, works for the owners, works for the occupants, while offering the level of protection that it desired.

MR. KLEMENCIC: Thanks, Tod. Next is Mr. Robert Solomon with the National Fire Protection Association.

ROBERT E. SOLOMON

NFPA INTERNATIONAL

MR. SOLOMON: Good morning, I'm Robert Solomon with NFPA. I'm a chief building fire protection engineer and manage one of our engineering departments, the group that works on documents like the Life Safety Code and the proposed NFPA building code.

Between my group and some of my colleagues at NFPA, we have already internally identified five fairly substantial areas that we're going to be looking at.

The first one is codes and standards. The New York City events have shaken to the core the whole idea of the goals and objectives as established by building codes or life safety codes.

I think the public has come to expect certain levels of protection from a variety of perils. I think we're going have to ask the questions about what society wants now? What can society expect from us? What are we willing to pay for? That is going to be one of the first discussions. Along with that, we'll have to discuss the possible consideration of new design scenarios. Right now, we look at a mean return between events. We look at selected types of fire events to occur in buildings. Now, we are potentially playing with a whole new set of rules.

Secondly, means of egress. Issues to consider in this area include discussions that have been on the table for a number of years. Egress capacity in stairwell widths in buildings protected with automatic sprinklers is an obvious area of focus. This relates back to a tall building environment where a normal, staged or partial evacuation has been the rule. I think we're seeing a heightened sensitivity to egress right now. We're going to be looking at other reasons that people might evacuate the building other than a routine fire.

We also are planning to conduct human behavior studies. We conducted a human behavior study following the 1993 World Trade Center bombing, and we want to go back and look at things that have changed. In this study we want to look at the actions taken in the two towers, the Lehman building, the Marriott Hotel, Building 4 and Building 7. There are a number of things that went on, a number of decisions that were made. We want to try to find out why those decisions were made as early on as they were in starting to evacuate those buildings.

With means of egress we also want to look at the success stories. There are some positives in this. It's been reported by the Mayor of New York that upwards of 25 to 30,000 people were in that complex. There were a lot of people that were protected, that were saved by efforts undertaken by the fire department and the police department.

Related are the improvements made after the 1993 bombing. There were about 12 specific recommendations relating to means of egress and building egress design in the two towers, and it appears that a lot of those recommendations have paid off. I think it's going to be important for the group to stay focused on some of the positives.

The third item is going to be systems performance. We, will want to look at performance of things like automatic sprinkler systems, building standpipe systems, as well as the fire alarm and communications systems. There are peripheral systems that other experts will discuss like emergency power and elevator use which also have a direct impact on occupant safety in these types of environments.

The fourth item will probably relate more to the urban habitat side of the Council on Tall Buildings and Urban Habitat. That has to do with operations and incident management systems.

There's a new set of rules that fire departments are going to be playing by and are going to be forced look at. This obviously is a -- very much outside the box event. It's much different than the 1911 Fire in New York City. There are going to be a number of issues that fire departments are going to look at. We have an entire public fire protection division at NFPA that will be working with fire officials.

There has been work underway for the past four years on fire department response to WMD incidents. Again, I think they've been focusing primarily on traditional truck bomb, car bomb, and nuclear, biological, and chemical attacks. We've now have a new weapon of mass destruction that fire departments may have to deal with in the future.

The fifth item is public education. We obviously have seen a new attention level from the public with respect to building emergencies and building fire alarms.

We are seeing more people taking action in the event of an alarm, instead of disregarding it as another nuisance or another false alarm. There is an opportunity right now to educate building occupants, and we already have been contacted by a number of building owners and manager groups to start to look at some of those issues.

A case in point, about a week after the September 11 attack, there was a relatively small fire at the Prudential Building in Boston. A decision was made to completely evacuate the building. If that had occurred on September 10, the traditional staged or partial evacuation and relocation process still would have been in place. Today we're looking at a completely different response. Those are my five main areas, and I look forward to the rest of today's meeting.

MR. KLEMENCIC: Thanks. Next is Jeff Harper with Rolf Jensen in here Chicago, life safety consultants.

JEFFREY E. HARPER

ROLF JENSEN & ASSOCIATES, INC.

MR. HARPER: My name is Jeff Harper. I'm the engineering manager for the Chicago office of Rolf Jensen & Associates.

As Ron pointed out, we specialize in life safety, and that's kind of an all-inclusive term. We are fire protection engineers and building code consultants, so we implement some of the standards that Mr. Solomon and other code bodies generate.

I would like to start off by reading a quote that the president of our company Mickey Reese made following the September 11th:

"Buildings in the United States are the safest in the world when they comply with the nationally recognized buildings and fire codes. The means of egress and fire protection features will provide safe exiting from buildings when these codes are adopted, implemented, and inspected by the local authorities having jurisdiction."

I think that's important for a couple of reasons. This is the history part of my presentation.

Dating to the late '60s and early '70s, when the original committees were developed to evaluate fire safety in high-rise buildings, it was determined that exiting an entire hi-rise building is not functional or feasible as a Building Code standard. I think as we all realize, it takes quite some time to evacuate 10,000 people out of a building.

What was developed for tall buildings is essentially a defend-in-place strategy: Provide people enough protection in the building to allow them some time when they're intimate to the incident to get out quickly. If they're not intimate with the incident, give them time to further evacuate if the fire department feels it necessary. That defend-in-place strategy also provides the fire department time to deploy to the incident. As a former fire fighter myself, it's not easy hiking up 60 flights of stairs to get to a given incident.

As a result, some of the key features that are provided in buildings include fire-resistant construction and orchestrated egress. Orchestrated meaning, again, we're not evacuating the entire building.

Recently Identified, as a result of the American with Disabilities Act, are the areas for evacuation assistance. These are areas that are identified to be in a fire-protected envelope, for persons with disabilities to locate themselves and await assistance.

Other obvious enhancements are fire detection and notification systems, automatic sprinkler systems, and then other fire containment within the structure.

One of the things I think this group and society, in general, will need to determine is just exactly what burdens will society decide to bear. I think if we want to begin to evacuate an entire structure, we're going to lose all the retail occupancy on the first floor to stair discharge doors. We're going to lose a lot more floor plate to exit stairs if we're going to increase stair capacity to evacuate the entire building. I'm not saying we shouldn't do some of this, but I think we need to make a statement about the need for a controlled approach in response to the overall incident.

I think there was an engineer that made a statement regarding the building being designed to withstand the impact that it realized. I think one of the things that may have contributed to the ultimate collapse of the towers -- and this is purely speculation, is that the fireproofing on the steel was likely blown off by the impact and explosion. Bare steel was then exposed to the fire.

There are a number of studies that have shown when the steel loses its fireproofing, even in chunks, it is detrimental to the structural stability of the steel.

Other issues we're going to need to consider relative to the philosophy of evacuating the entire building, include increasing stair capacities. That will result in a need for increased number of discharge doors on the first floor grade level.

Means to evacuate people with disabilities is also an area to consider. I think we've heard of numerous stories from the September 11 incident where people tried getting their friends in wheelchairs downstairs, and not very effectively.

Fire-resistive construction Methodologies is another area to consider. I'm hoping that concrete fortresses in the sky isn't our ultimate answer.

I think we need to consider public education a priority. Education within the construction industry, as well as the architectural and engineering design communities. Proper application of spray-applied fireproofing is one area of focus.

I think we should consider a better coordinated stair door locking system. any doors from stairwells do not unlock properly to allow the occupants back into the building as needed.

Security does seem -- and fire alarm systems seem to be relatively uncoordinated throughout buildings in the typical core and shell building and tenant buildout. That's something that, I think, we in the industry need to focus better on.

We need to educate building management, the construction industry, and the public, in general, about the fact that buildings are not designed for mass evacuation. Thank you.

MR. KLEMENCIC: Thank you. Next is Mr. Jerry Reich is an exterior wall specialist in Chicago.

JERRY R. REICH

HORVATH REICH CDC, INC.

MR. REICH: Good morning. My name is Jerry Reich. I'm a principal of Horvath Reich, CDC, Inc., exterior wall consultants in Chicago. We are also an architectural firm and a subsidiary of Curtain Wall Design and Consulting, CDC out of Dallas, Texas.

A couple things that came to mind this morning as I was making some notes include a few things that Tod mentioned about blast resistant construction. A lot of the exterior walls that we're seeing today on high-rise buildings are typically glass systems, net walls, tension walls, all the glass structural systems. I'm not sure exactly how you would handle a wall like that in terms of blast resistant design. I'm sure maybe Tod's worked on some. I have not.

One of the things that we're finding is of concern in Chicago and elsewhere is fire containment and smoke containment at the perimeter of building. The Chicago Building Code, as an example, does not fully address this concern because there is a lot of dependency on sprinkler systems. The IBC, International Building Code, which is being put forth in a lot of cities does have requirement for perimeter fire containment and smoke containment. Chicago, as I said, is more reliant on sprinklers. Since the aftermath of September 11th the issue is being rethought. One of the key issues with fire containment is that a lot of the codes that are being heavily influenced by specific products. There are several manufacturers of fire containment type materials, insulation, fire safety, and so forth that are actually on ASTM committees and doing a lot of testing of exterior walls to promote their products. There are also some walls out there that are pressure equalized that are utilizing back gain construction. There's a lot of controversy about what is an appropriate test for a back gain and pressure equalizing wall for fire safety because this metal, usually galvanized steel, can warp after a short fire load temperature and displace the fire safety.

The spandrel dimensions at the exterior wall has never really been addressed in Chicago in terms of what the dimension should be to prevent fire from going from Floor A to Floor B above. There's been a lot of leeway in relying on the sprinklers, as I said, in letting the glass, in some cases, basically go floor to ceiling. It's something being considered and probably will be changing in the Chicago code.

I'm a member of one of the committees that's rewriting the Chicago code based on the IBC. Chicago for years has had their own building code, and they still want to do that. They do not want to just take the IBC code or BOCA or any other code and follow it verbatim. So there's code committees like safety committees, structural committees in Chicago that are rewriting it on behalf of the city based on their existing code and what they feel is appropriate from the IBC. But the fire containment concern is something that's probably going to change.

That's what we're working on. Thank you

MR. KLEMENCIC: Thank you, Jerry. Let's move into the world of vertical transportation.

JOHANNES de JONG

KONE CORPORATION

MR. de JONG: My name is Johannes de Jong. I'm with KONE Corporation in Finland.

I must say I was extremely shocked by the events of the 11th. Seeing towers coming down is something incredible. It's unbelievable. We never expected this. What it did do to me the next week, the next two weeks is simply gave a lot of thought to what can be done to get those people out. There were a lot of people killed there, and what could be done to really help those people get them out. And vertical transportation is definitely one of the things which has remained more or less the same since the early 1900s.

When we looked at elevators some 30 years ago we had a label there "do not use in case of fire." We still have that label today. It's still there. And if we would have been able to use elevators even more as that was used during the evacuation during the Towers, I believe we could have saved a lot of people. That's a lot of lives we could have saved.

I think a lot of thought should go in to what can be done to empty the building. I hope this is going to be the last case of towers coming down because of airplane strikes. I know a lot can be done to prevent airplanes coming into buildings, and I think that's where we should start first before we start with buildings themselves.

As we heard earlier, buildings are not made to be evacuated, to be completely evacuated. They're not made for that. Still, I could quote some of our people at -- our friends at Ove Arup. They have done quite a lot of studies lately checking what can be done, the use elevators in case of fire. There's a lot of work, for example, in UK looking at what can be done to use elevators. We are also looking at that very carefully, and there's a lot we can do. Technology has gone on for years and years and years since we have "do not use elevators in case of fire." We have new technology. We have new materials. I do believe we can use elevators in case of fire, and I do believe we need to change those rules.

If you think about evacuating through stairways, it's going to take hours and hours and hours to get it empty. If you use the elevators for evacuation, you can find that you can very well evacuate the building within a half an hour, and that's quite dramatic. The handling capacity of elevators is practically doubled in peak when you evacuate buildings. If you can handle 15 percent of the population in 5 minutes and you double that, that's 30 percent in 5 minutes. Within half an hour you can empty the building, and that's a lot. We do have to think what to do.

If you think about the poor people in wheelchairs, how do they get down the stairs? There's no way. They can't get down. If you have fire hoses going through the stairwells at the same time and if you know that roughly 10, 12 percent of the people in the building have some kind of disability at any moment -- you know, you can be hurt in sports, you could have something in your eye. Going down 60 flights of stairs with an eye patch, that's very difficult, without stumbling, without hurting someone else.

So I do think we have to look very carefully at what we can do with vertical transportation in buildings like this, and we do have to first consider whether we really have to evacuate those buildings. I think the events of the 11th may changed our minds. Thank you.

MR. KLEMENCIC: Thanks, Johannes. Next, Mr. Steve Edgett is with Edgett Williams from California.

STEVEN D. EDGETT

EDGETT WILLIAMS CONSULTING GROUP

MR. EDGETT: I'm Steve Edgett with Edgett Williams Consulting Group in San Francisco.

I think to expand on what Johannes said, the point has been in all newspapers. The fireman didn't have access to sufficient data on the building. It wasn't that it wasn't available. It was that no one had working drawings. The fire fighters' access to upper floors in the building -- just listening to fire fighter accounts of climbing 20, 30 floors of stairs is absurd.

The same is true having handicapped access, handicap evacuation ability from the building. I think the building performed admirably, including the sky lobby concept where a lot of people came out of the building. I think in the end we'll see that having the building separated into compartments, vertical compartments, was actually a life saver in the case of the World Trade Center, and I think for a tall building it really makes a great deal of sense.

In terms of potential solutions, I think that it's a question of gathering data about buildings that already exist, making sure that emergency personnel have access to that information. I'm hoping that this group can help to avoid knee jerk code reactions with simply applying lots of technology, lots of added cost, lots of areas to buildings just out of saying what we're going to prevent this from happening again. I think we can mitigate what happened, but I hope we will look at using information more effectively for the buildings that we have.

The buildings did perform admirably. Thanks.

MR. KLEMENCIC: Let's move to infrastructure. Mr. Robert Prieto of Parsons Brinkerhoff is our next speaker.

ROBERT PRIETO

PARSONS BRINKERHOFF

MR. PRIETO: We have focused on the building itself so far, but buildings don't stand in isolation. They're part of a larger urban setting.

For those of you not from New York, I'll go through briefly what the impacts were on the associated infrastructure as a result of the attack.

The 1 and 9 line trains, the link to South Ferry which is where the Staten Island Ferry commuters come in are out of service. System operation is limited because there's no turnaround track. That's impacting other lines in the city. Coral Street station was crushed on the 1 and 9 lines. The E and F tubes of the PATH which are the lower two tubes, some of those tubes are out of service. The south end of the World Trade Center station is damaged. The north end is serviceable however. The PATH wide system operation has been impacted because there's no turnaround capability on the southern end.

TV broadcasting has been relocated, cell towers relocated. Switching centers were knocked out for Verizon and others. The power distribution system is severely impacted. Had this happened at the beginning of summer, we'd have rolling blackouts. And the emergency operation center of New York City was also destroyed. So the impact on the infrastructure in economic terms is as extensive as the damage to the buildings, probably more so. I'm going to go through ten points.

First, the need for integrated planning with development infrastructure is again highlighted. That's before the buildings are built, during the construction and operation of the buildings and certainly for after that. We have an opportunity now to do that, and we'll see if that happens. Tall buildings, concentrated developments increase the risks associated with infrastructure concentration to meet those buildings' needs. Transport, utilities that I mentioned, communication. If you look to the train lines, subway lines of lower Manhattan, they were basically pulled to the west side to the World Trade Center site. Immediately following the attack, 40 percent of the track to lower Manhattan were knocked out of service, to put some scale on this. In high density infrastructure settings, I'll argue that's all the city of New York, but, quite frankly, wherever you have high density as you did at the Trade Center site, the need for core capacity in your infrastructure is required. That means flexibility, redundancy.

In late August I had met with Senator Patty Murray making the case for inside access to Second Avenue funding and was trying to explain core capacity enhancement. It's going to be a new line, it's going to go from A to B. How many new riders? What we saw and are seeing is system flexible, and redundancy becomes important in very complex systems such as you have in cities in general and specifically you have in a city of high developments, tall building type projects.

Intermodal transportation is a must in high density areas. The ability to integrate with ferry service and most of our transportation system trains the level. The impact of deferred or underfunded maintenance on each structure is coming home to roost right now, primarily in Pennsylvania station where we have 20,000 additional passengers a day for about a two-hour rush hour period in the morning and evening. Lack of funding has been a consideration. The time needed to get off the platforms has increased dramatically with another 20,000 riders there. Just in terms of risk, contemplate what a fire in Penn Station, just a routine old fire would do right now to the economy in New York.

Weaknesses in integrated passenger information systems were highlighted. We really don't have information sharing between transport modes. Many of the information systems were outdated, and I'll come back to that. The ability to do dynamic reconfiguring. As you reconfigure your systems, as the events unfold and the aftermath unfolds is really not well provided for.

Mass evacuation from high density areas needs more emphasis. In this case there was an evacuation from lower Manhattan which was primarily accomplished on foot. Quite frankly, had the wind been blowing in a different direction, we would have had to evacuate a much larger area of Manhattan and that would not have been a very attractive option. Better utility coordination and improvement coincident with development of projects such as tall buildings or other large scale developments. An example I like to use is the Central Artery project in Boston while it was an infrastructure development, the utilities that were impacted in the area were all coordinated as part of the process. This same thing could not happen to the same degree when lower Manhattan was built up.

First responder team training. After the first plane went in and before the second plane went in, I remember the comment that was made by Ray Monte who was the chief engineer of the Port Authority during the '93 bombing and later on worked for our firm. I asked Ray what was the one thing he wanted in the midst of all the confusion that he couldn't find. And what he said was a structural engineer that I knew I trusted. We sent three structurals down after the first plane went in. They never made it to the site until the second building came down. Went down by subway, caused the trains to be deferred. By the time they walked to the site, it was too late anyway.

Security will be a heightened infrastructure requirement. Two years ago we had worked with SAIC and complete work on risks associated with transit stations in the vicinity of high profile buildings. Looking at it from the other direction an attack on a transit station. Four targets were identified at that time, two of them were destroyed on the 11th of September.

We have previously looked at blast, and that was an issue as well. The issue really here is risk for collateral damage either from an attack on a piece of infrastructure or in the vicinity of a high profile building or territory is something we need to address.

Integrated safety. We had a number of people both in the building as well as under the building. We are doing passenger counts down in the Path Station. While the notification to the transit systems operators seemed to work well, the trains were stopped from coming in there. The only one was the one parked in the station had three of the cars crushed. The other four were fine. There was no general announcement in the station. Our people came up when the smoke got too bad. As they arrived -- they came up out of that just as the second plane hit, but the smoke was fairly heavy already in the Path Station. There were no integrated alarm systems.

Finally, we did have about 20 people in the building in the North Tower on Floors 60, 70, and 80. Comments go generally to the stairways. While the widths of the stairways were designed for two people with parallel access, the reality was because of the lights being out, the water on the stairs, the general conclusion, there was single file access and really limited you to the slowest person coming down.

Second, lighting failed in many portions of the stairways, and these are from folks, as I said, walking down from the North Tower from 60, 70 and 80th floors.

Water, as they got to the lower floor, there were high volumes of water which made the stairways very slick. One of the comments was better traction on the stairways would have been a very simple improvement.

As the fire department and other emergency workers went up the stairs, it slowed the rate of egress from the building, the need for either separate stairs or some other means to bring emergency workers up there.

My closing comment is really the same as my opening comment to this group. Infrastructure and development projects are intimately linked and to not play them together, not to be prepared to respond together is very short-sighted, and we have the best chance ever to change them.

Thank you.

MR. KLEMENCIC: Thank you. Excellent comments. Let's move back into the building itself with Mr. Meyers. Mr. Randy Myers is with Flack & Kurtz in San Francisco.

RANDY J. MEYERS

FLACK & KURTZ, INC.

MR. MEYERS: Thanks, Ron. I'm Randy Meyers with Flack & Kurtz, consulting engineers. I'm an electrical engineer, and I'm the managing director of our San Francisco office. I'd like to, in the context of this group, talk about some of the things that can be improved in the electrical systems in buildings.

My kids were asking, well, are you going to make electrical things that don't fall down when planes crash into the buildings? I'd like to, but I don't think that's the ultimate goal here. I think what you want to do is prevent these things from happening in the first place. Beyond that, we certainly want to build buildings too.

I think the goals that I would have as an electrical engineer is: helping to increase the amount of time that people have to get out of the building, to enable reoccupancy of the building to allow our society to get back to business after these things happen. I think we need to reduce our dependence upon foreign energy.

Utilities supplied to the building. We certainly want the power to stay on in buildings in the event of a terrorist attack. I think we want to look at things like two service entrances in the buildings from the utility companies to separate them in case one of them gets hit. A lot of transformer vaults in downtown metropolitan areas are installed under the sidewalks with nothing more than an open grate separating them from the outside world. I think we need to look at moving those to within the building and protecting them. We need to locate these services, transformer vaults and main switch boards, away from sensitive areas of the building where these types of attacks may occur, loading docks, main entrance of lobbies. And I think we need to start looking at providing two electrical risers in the building, at least two, and the core where we can separate some of the essential services and protect them with some special treatment to survive certain types of attacks.

Emergency power. More than likely in these types of events, the normal power supply is going to go out and we're going to be depending upon emergency generators in the building to enable us to get people out of the building. I think we need to look at more than one generator. Separating them from each other in case one goes out the other one will still be intact, locating them away from sensitive areas of the building and protecting them in hardened, more secure areas, so they have some chance of going on should there be an attack on the building.

I think we need to put battery packs in the light fixtures in stairwells. If the generator goes out, we need to have lights in the stairs for people to be able to see as they descend. We need to put, I think, more elevators on emergency power. Currently the codes generally require one per bank on the generator. And, I think in concert with some comments made about possibly using the elevators for evacuation, we're going to want to look at more generator capacity in the buildings to do that. Putting the window washing grid on emergency power, too, as a way to get people off the roofs of buildings or fire fighters off the tops of buildings.

Fire alarm systems are usually designed by the electrical engineers. They, too, need to be looked at from the point of view of safety. Probably we want to look at two fire control centers in the building, again, in case one of them is taken out, that we have one from which fire fighter operations can proceed.

We probably want to look at providing exterior access directly to these rooms so fire fighters can get to them from the outside without having to go through the building. Technology is readily available to loop the wire into fire alarm devices so if there is a break in the system wiring that the system can continue to function. The use of distributing processing equipment, smart systems where each panel forms its own system if it's disconnected from the main system. This is crucial -- The part of the fire alarm system that is crucial is the voice evacuation system. It's the one that we depend on in a high-rise building to facilitate an orderly evacuation from the building.

I think we also have to look carefully at protecting the wiring systems, both horizontally and vertically in systems within the building and perhaps looking at the use of some special fire protection cables. Insulated cables are used, for example, in Australia on a regular basis where all their emergency systems are provided.

All of these suggestions cost money and take up space in buildings. I agree with Steve Edgett, we shouldn't have knee-jerk reactions to this. We should be prudent about spending our money and our space to improve the reliability of the systems.

Finally, energy conservation. We've had something in California called Title 24 energy regulations which went into effect about 20 years ago and continue to become more stringent. I believe California has the most stringent energy code and produces the most energy efficient buildings in the world, and I would challenge other states to look to California as a model as a way of reducing energy consumption in buildings so that we can start to clear ourselves from our current dependence on foreign oil sources.

Thank you.

MR. KLEMENCIC: Thanks, Randy. Next is Mr. Bud Spiewak from Cosentini in Chicago.

BRUNO SPIEWAK

COSENTINI ASSOCIATES, INC.

MR. SPIEWAK: Hello, I'm Bud Spiewak with Cosentini Associates. We're mechanical, electrical, plumbing and fire protection engineers. I'm the principal director of the Chicago office.

A couple points, some questions that continually come up that we hear from people outside this industry is are tall buildings going to be built again as a result of this? Our reaction is, definitely, tall buildings are going to continue to get built. It's a result of continuing investment and land values.

What we do think is going to happen is we're going to need to make a reevaluation of the safety that we have put into buildings. Looking at the history of tall buildings and high-rises in the 50 years Cosentini has been in business, we've continually seen buildings get safer. The engineering systems become more sophisticated and more reliable, so the general direction has been positive.

We believe that buildings are safer now than they have been in the past, and they continue to get safer. But we're probably going to make a reevaluation of these and look at them from a different perspective. The codes and designs have been assembled based on different types of Occurrences and hazards.

As it was mentioned before, we think that the integration of systems is going to be critical. Buildings are more sophisticated, and the ability for the basic systems in the building and the emergency systems to communicate with each other will become more and more critical. I believe we're going to have to ask and demand of both the industry and the code officials accept this in order to push it along.

We understand that there are issues involved with proprietary systems, but the more that this language gets opened up and these systems are able to communicate at a cost-effective basis, we believe that much of the systems can be improved without adverse cost impacts to the owners and developers of buildings.

We don't believe that the improvements in these systems should overburden the budgets on buildings and cause undue impacts, We believe there's going to be a re-evaluation of the safety concerns during normal operation and during an emergency event. We're going to look at different emergency events.

We also believe there should be uniformity in codes on a safety basis nationally. Having offices in Chicago and New York, Boston, and Orlando we see a lot of differential between codes. While some issues can be different on an individual building basis; on a life-safety basis we believe there should be more uniformity. No matter where you're designing in the country, or maybe even in the world, there are more commonalties on the safety issues of the building.

We believe there should be reconciliation of project budgets to effectively implement these safety issues.

Lastly, we believe there needs to be an emphasis placed on teaching the occupants of the building and the operators of the building how to properly react to emergency conditions. I think we take this too lightly. There's a lot of safety systems built into buildings; however, they're largely unknown to the operators. Education, is paramount.

When board an airplane, we always review emergency procedures, yet in the different buildings that you've occupied, how many times have you ever gone through emergency procedures? You're lucky if some of them go through them once a year. In many buildings you never review them.

Thank you.

MR. KLEMENCIC: Thanks, Bud. Next is Mr. Mahadev Raman of Ove Arup in New York city.

MAHADEV RAMAN

OVE ARUP

MR. RAMAN: I'm Mahadev Raman, mechanical engineer and principal with Ove Arup in New York. Clearly, as we go through the day, many of the points that one can make get covered. I must say the comments made by Johannes and Steve regarding elevators in particulare were very poignant in terms of their use in an emergency, and Randy's comments on all of the electrical issues certainly strike a deep cord.

So I would like to actually take a slightly different tact. We've been thinking about the World Trade Center issues, but as we broaden our view to the anthrax and biohazard realm, it raises all sorts of other concerns.

Particularly, as a mechanical Engineer, it is possible to conceive of the systems that one designs in terms of ventilation and water supply and so on being used by terrorists to spread harmful agents through a building. I think this area needs just as much investigation as these other issues such as evacuation and fire protection.

Conventional wisdom has had it that it is safe to recirculate air within buildings. Certainly under normal circumstances that is perfectly true. You can take about 75 percent of the air that you circulate in a variable volume system and send it right back round again provided you put in enough fresh air. You meet all the codes and standards, you keep the air fresh, there's enough for people to breathe, et cetera. But if you start inserting into that air stream some kind of a biohazard, then basically a system that allows recirculation is much less robust in dealing with the fallout than a once through ventilation system that would just supply fresh air and take it straight out.

The debate between fan coil systems, for example, and variable volume systems is always that fan coil systems tend to keep contaminants localized. With a VAV system you create an even level of contamination. Put in the context of what we're talking about today, that really raises a lot of very important questions that we have to address.

The locations of fresh air intakes, access to mechanical equipment, and ductwork systems, how do you supply the air, if there is contamination, how do you keep it localized and ensure that your systems do not actually help the spread of these agents throughout the building, are all questions. Similarly, with water supply systems I think one has to be increasingly cognizant of the fact that these could be polluted by those with malintent.

The level of security that one applies to the systems both in their initial conception and during the life of the building, maintenance procedures and so on, need to be added to the security and safety aspects of the discussion.

Thank you.

MR. KLEMENCIC: Thanks Mahadev. Next is Mr. Norman Kurtz of Flack & Kurtz in New York.

NORMAN KURTZ

FLACK & KURTZ

MR. KURTZ: Good morning. I'm Norman Kurtz. I'm president of Flack & Kurtz. We're mechanical and electrical engineers. You've heard from Randy Meyers, who is my partner who runs our San Francisco office. I, personally, am in New York, and I'm president and founder of the company.

Obviously, since I'm the last mechanical/electrical engineer to speak, there's been some redundancy of what we're talking about; however, I guess I'm the oldest of the group, so I do provide a certain amount of perspective. I do recall when the World Trade Center bombing occurred in 1993, we were in the midst of designing what is now called the Petronas Towers in Kuala Lumpur.

There was at that time, a knee-jerk reaction about what should we do, much like what we're seeing today. In the end we had came up with a list of things we would do to modify the design of Petronas Towers to respond to terrorist plots. I think we're much in the same role here today except on a much grander scale and much more pervasive. Plus, since it's on American soil, there's an element of fear and panic.

Fortunately or unfortunately, I watched this whole thing from the window of my office. You can feel the fear and the surrealistic response. You've got to assume that all our clients are going to go through that and question what are we going to do to protect them?

So one of the questions I have is what are we reacting or overreacting to? When we design a high-rise building, which I feel is quite safe and quite refined, if they were designed to a certain type of fire condition, whether the elevators go out of service or whether we have smoke evacuation, or alarm suppression, it's a coordinated response of the building as a whole.

In working for developers, the resultant is a very optimized response between the architects, the codes, the economics, the esthetics, and the performance of the building. For instance, the services that occupy the core of a building is a magnet of scrutiny. The common debate is focused on "how much do we have to do"; whereas if you ask the same question today, the focus may be different. Now, all of a sudden the price tag comes in and we all respond. Well, much of the same happened in '93 with the Petronas Towers. We ended up with something.

Right now we're in the midst of designing a building that had some paranoia before September 11th. The New York Times headquarters. In New York City all the transformer vaults are located underneath the sidewalk. What happens if a guy comes and just drops a bomb into the transformer vault through the grating? What do we do? So we talked about bringing the transformers inside the building.

We're still in the midst of designing that building, and I've got lists of items that we recommended to enhance the safety and security. At the end of the day, how far can we raise the bar before the economics start to come in? How far can you go?

If you double the size of the stairways for instance, you will have a building that you can't afford to move into.

And as I look at it, an incremental response, which is not that big a deal financially is a better approach.

Randy raised one issue of emergency generators. You have to put an emergency generator in a high-rise building. If it's a million square foot building, you're probably going to put in one 1500 or 1700 kilowatt, generally, the generator is located down in the basement or up on the roof with a fuel tank and a protected fuel. Maybe an appropriate response is to put in two, so there are two at 800 kilowatt or something like that. That's not a huge impact. This is an example of an incremental response.

Stair pressurization systems interestingly enough, were not present in the World Trade Center. In New York City, you don't need a stair pressurization system if your building has sprinklers. In Denver, I think even in Chicago, stair pressurization is required. There are some code issues to discuss.

If you had stair pressurization in the World Trade Center, you'd probably want to have a top, middle, and bottom as opposed to just top or bottom. Not a huge impact on cost; however, there are some major things which Mahadev referred to.

I've got to tell you, with this anthrax threat my wife has asked me 100 times, what would you do if somebody dropped it into the system of a building? How would you handle it?

Clearly filtration is one method, once-through systems similar to laboratories is another. But, can you imagine the impact of and louvers on a high-rise building?

I remember when ionization smoke detectors came to be as a response to smoke. That was a major technological breakthrough, responding to the need to sense smoke early. That was a technological response to market demand.

My reaction is that there's going to be a technological response to the biohazard threat as well. I've been reading some literature about sensing biohazard material in air systems. One question remains; what do you do to respond to the sensing of it? You could take continuous samples, you run through some electronic testing. It's not today, and it's not tomorrow, but maybe it's the direction we're heading to deal with the bio/chemical threat.

As we travel around the world, , you've got a more belt-and-suspenders approach to high-rise buildings. It's not unusual to have vestibules at stairwells, for instance.

The stairwell is pressurized and the vestibule is pressurized. You have this two-step protection to the stairway system. However this consumes square footage on a typical floor. It's not required in the U.S. so we don't do it. We probably are going to have to consider these are things.

Another enhancement that's not too burdensome is to loop the standpipes. I think in the World Trade Center when the plane hit, it must have severed the fire risers. In New York, typically, you've got a tank on the roof and you've got pressure from the top and bottom; but if the riser loses the water, there's nothing left to fight a fire. Redundancy is going to be a clear philosophical approach to these kinds of systems. In a typical office building with a 20,000 square foot floor, you would probably have two electric and telephone closets. We might begin to duplicate the whole system using the sonic ring approach where you link together top and bottom so with any break, you could feed both ways. It costs money, but it’s not a huge difference.

The World Trade Center did have central air systems feeding up -- I believe 15 to 20 floors, and down 15 to 20 floors with huge shafts. When I saw the attack, I was thinking about all the fuel from the jet planes dribbling down the return air and supply air shafts.

I've heard stories that when someone opened a door at the ground floor a huge puff of fire just burst out of the door. I'm thinking the fuel must have just come down anything vertical; elevator shafts, toilet chasers, fresh air shafts, return air plenums. It will just find its way down and explode. I think some of this may have occurred

Clearly decentralized systems, which is what's in the World Financial Center, may be a better way to go. This approach is quite popular in high-rise buildings. That's not an innovation by any stretch of the imagination.

Battery packs in the stairwells, so if you lose power altogether, there's a battery pack on those lights so you do have lights as you go down the steps. Again, it's money, but you're not talking about big items.

One of the bigger questions is pressurization of elevator lobbies. Maybe it’s a good idea. If a coordinated approach with the elevator people is taken, some of these things may start to make sense.

Thank you.

MR. KLEMENCIC: Thanks. Let's move into the structural realm and Mr. Youssef from Los Angeles.

NABIH YOUSSEF

NABIH YOUSSEF & ASSOCIATES

MR. YOUSSEF: I'm Nabih Youssef of Nabih Youssef & Associates, structural engineers in California. I had the privilege of practicing in New York City in the late '70s and early '80s. I come to this meeting from a structural engineering perspective with an extensive background in disaster mitigation of earthquakes worldwide. I have served on several committees for the development of the national and international earthquake hazard reduction programs by FEMA. I also participated in California Vision 2000, performance based codes for earthquake engineering. Both experiences are pertinent background that will help us today. Having lived the success of these coordinated programs, what I would like to propose is the development of a similar national hazard reduction program.

The idea is not to overreact. We've heard a lot of concern about knee-jerk reactions; hardening all the existing or every critical building. The idea is to understand and establish to certain reasonable levels of attacks.

It really comes down to, as we've all learned in earthquake engineering, we don't make earthquake-proof buildings. We develop a balance between acceptable risk exposure and desired and acceptable performance through a probabilistic approach. You cannot meet the extreme peaks. This is obviously open for debate. All of this has to be developed through realistic cost models similar to what has been developed, as I said, for the earthquake engineering probabilistic approach.

As a by-product of this is the issue of response and recovery. Based on our knowledge of progressive collapse and failure mechanics for different types of structural systems, we can begin to establish appropriate criteria. Shifting to technology, systems with potential contributions would be what we label "passive energy dissipating systems." Appropriately used for protection of buildings against major shocks due to earthquakes, these systems could help in making our buildings more resilient.

Overall, we need to develop and understand tougher systems against progressive internal collapse. The issue, for example, of floor joist systems providing horizontal stability to the vertical perimeter frame column systems. Thank you.

MR. KLEMENCIC: Thank you, Nabih. Next is Mr. Bill Baker of Skidmore Owings & Merrill in Chicago.

WILLIAM F. BAKER

SKIDMORE, OWINGS & MERRILL, LLP

MR. BAKER: My name is Bill Baker, and I'm the partner in charge of structural engineering for SOM here in Chicago.

I spent quite a bit of time at the World Trade Center site in the last month. In fact, last week Jon Magnusson and I spent the week crawling through the buildings down there. I know the title of this session is about future, but I think, as a structural engineer, we have to look back to September 11th before we can look to the future.

As a structural engineer who is involved in high-rise building design, I was not surprised that the towers survived the airplane impacts. It wasn't a given by any means, but it wasn't a surprise. We knew they were a highly redundant lateral system. The ability for it to bridge over local failures. And so that was self-evident.

I was very disturbed by the fact that both towers completely collapsed. You can imagine what the world would be like today if the towers had not totally collapsed. if they had become unusable, had to be demolished, but had not collapsed? The effect on our economy and the lives lost would be quite a bit different.

Several of the buildings in the World Trade Center performed very well. The Bankers Trust Tower took a big hit, a column was ripped out of it. The collapse was very localized and arrested.

The American Express Headquarters took a hit on a corner column. The floor sagged, but it held together. It didn't come down.

Tower 7 fell onto 30 West Broadway, which is a 15-story building from the mid '50s. It knocked off several bays, but, once again, the collapse arrested itself.

The Verizon building took some big hits. Some columns just knocked into large deformation, but the collapse was arrested.

Buildings 4, 5, and 6 did pretty well. Those are the low-rise buildings that are around the tower. Much of these buildings were smashed and burned up, but, generally, you could say that they survived.

Obviously World Trade Centers 1, 2, and 7 did collapse, and those need to be understood. Particularly, Tower 7, which was a more conventional building. It was not hit directly by the airplanes. It's not clear what kind of damage it did have.

I keep hearing from fire engineers -- I'm not a fire engineer -- that prior to September 11 there was no known record of a building collapsing that included conventional modern fire protection systems. It's a different world after September 11 that we need to understand.

It's also important that we understand that World Trade Center Towers 1 and 2 were very unique structural systems. They were the world's tallest buildings at the time they were built. They had very unique exterior systems. They had unique core framing systems. They had very unique floor framing systems and very unique connections.

I think it's important for the industry to understand how more commonly used systems performed? Did they perform better or worse? That's what we need to understand. Would enhanced conventional framing systems perform better?

In London, for instance, there are certain regulations that you have to design buildings for, that have to do with tying the building together. Tying actions are key element provisions, which are not all that expensive. They also improved the robustness of the structure.

The study of the failure is going to be important. Structural engineering was invented by the British in the 19th Century through the railroads. They would build bridges, and they had several major failures, major collapses. From each one of those incidents, the industry and the technology was advanced. Understood by the study of these failures. So it's important that we look at the World Trade Center as an opportunity to make buildings safer and learn from them.

Also think it's very important that we recognize that normal high-rise buildings have had a tremendously good track record. The matter of lives lost in normal fires in high-rise buildings is very small. The issue of overreacting to the events of September 11th has to be considered very carefully. Having said that, it's not a bad thing to go back and re-examine our practice. Are there things that we can do in a reasonable manner which will make buildings more robust?

Finally, I would like to mention the management of the city in the case of a disaster. I think it is a good thing for the city to have access to building drawings at a remote site, perhaps two sites. If someone needs to find out how a building is put together they can do so quickly.

After the attack, I had engineers at the building department try to find drawings for buildings of unknown damage. This proved to be very difficult. A lot of the engineering firms couldn't get to their offices because they were too far south. They were located inside of the buildings that were reported in danger of collapsing. False reports it turns out, but trying to get a hold of drawings was very difficult.

We also need to understand the loading capacity of our streets. We spent a huge amount of time on-site trying to figure out where you could locate a crane. New York City happens to have a rule that sidewalks be designed for 600 pounds a square foot. When you're trying to locate a big crane over a sidewalk there, you're grateful to have a sidewalk that takes 600 pounds a square foot.

Plazas, major city plazas need to be well-understood so that the authorities know what they can put on large plazas. Where the columns are below and if they have to reinforce the plazas if they bring in heavy equipment. This is not a major activity. If this data could be put in a central, perhaps two locations, where we could gain access quickly, this would be beneficial.

There needs to be Good Samaritan laws for for structural engineers, contractors, and for people who are out there trying to do their best in an emergency situation, who are clearly unprotected from a liability claim.

I understand on the west coast there are Good Samaritan laws. Engineers are essentially deputized as “building officials” and do what needs to be done on the fly without having to worry about alerting your attorney

Having said that, I don't know of any bad calls that were made by any of the firms out there or any of the engineers out there. I think it was all helpful, and nothing negative came out of it. With that, that's the end of my remarks.

MR. KLEMENCIC: Thanks, Bill. Next is Mr. Jon Magnusson from Skilling Ward Magnusson Barkshire in Seattle.

JON D. MAGNUSSON

SKILLING WARD MAGNUSSON BARKSHIRE

MR. MAGNUSSON: I'm Jon Magnusson with Skilling Ward Magnusson Barkshire, and we're consulting structural and civil engineers based in Seattle. Our firm, in its earlier years, were the engineers for the World Trade Center towers.

There's been two successor firms that grew out of the firm that did the engineering, our firm and Leslie E. Robertson & Associates. I can't help but just take a moment and think about Les Robertson, John Skilling, and Minoru Yamasaki.

As I look around this room, if each one of you think about the greatest achievement of your career, your most outstanding building; how devastated you would feel. I think that we need to be sure that we keep clear the event that we're discussing is an airplane attack against a building. The ramifications of this attack versus other kinds of terrorist threats against buildings is important to keep in context.

The reason I say this is I think that the fact the World Trade Center Towers stood, fooled many people in the profession, certainly most people in the public and most public policy makers about what our expectations should be when an airplane hits a building. I can say without exaggeration, 99 percent of all buildings would collapse immediately if hit by a 767.

This is not a problem of structural steel versus concrete versus composite systems or so on. The Pentagon it was hardened concrete construction. A couple of things you need to consider include: The 767-300 that hit each of the towers it had a wing span of 156 feet. It had 24,000 gallons of fuel. The approximate weight was about 300,000 pounds.

You can say the towers survived the initial impact but if the problem that we're addressing is, in fact, airplanes hitting buildings, we need to think about the airplanes. A 767 has a 156-foot wing span. A 747 has a 213 foot wing span. A few years from now, the Airbus A380 Superjumbo will have a 261 foot wing span. The Trade Center Towers were only 209 feet across, and they're some of the biggest buildings in the world, with large floor plates (43,000 square feet).

A couple of other facts: The fuel in the 767, 24,000 gallons; 747, 54,000 gallons; A380, 82,000 gallons. We're talking almost four times as much fuel in the A380. And then the weight of the plane that you saw was 300,000 pounds. A 747 400 is about 800,000 pounds, and the A380 will be 1.235 million pounds.

So, with those facts you have to be drawn to the conclusion, it's not about concrete, it's not about steel to stop the plane that you saw flying. To stop the plane in five feet, which is something that you might consider if you're going to protect a building from an airplane, it takes 400 million pounds of force applied in under a tenth of a second to arrest the aircraft.

The entire wind load on the World Trade Center Towers, some of the tallest towers in the world, was 15 million pounds. That's what they're designed for. Stopping a plane in five feet is just not in the cards at 400 million pounds compared with 15 million pounds. In some ways this is the bad news, but actually, it's the good news. The good news is, if we understand this, buildings should not and cannot be designed for airplane attack. It's a problem, really, about airplane security.

I am optimistic about airplane security. I truly believe that we can solve that problem. As we look at where we should spend dollars and shape public policy, it needs to be on airplane security and not on changing things in buildings. Frankly, it doesn't matter what sprinkler system you have, or how many stairwells you have, or how wide they are, or what the response time is if the building has been cut in half by an airplane.

So, the really good news is we can solve the airplane problem. That's the specific event that triggered this discussion. There certainly are other terrorist threats that we should be thinking about and address. In terms of the specific hazard of airplanes and buildings, we've just got to keep those two things apart. Thank you.

MR. KLEMENCIC: Thanks, Jon. Let's move to the architects who have to take all of this into account and help us make something of it. Mr. Adrian Smith of Skidmore Owings & Merrill in Chicago will speak first.

ADRIAN D. SMITH

SKIDMORE, OWINGS & MERRILL

MR. SMITH: I'm Adrian Smith from Skidmore, Owings & Merrill, a design partner in the Chicago office.

On September 11th, right around 9:00 o'clock I had a number of drawings pinned up in the conference room for a 2,000 foot tall tower, I was meeting with the Trump organization, We actually never started the meeting. Instead we went over to the television set and proceeded to watch what happened the rest of that morning. And our building was evacuated because it's a landmark structure on Michigan Avenue. We met the next day and went through the drawings we had on the wall, discussing a lot of the conceptual issues that deal with tall buildings, somewhat the nature of the structure, the shape of the building, the uses of the building, et cetera. This project is deemed to be a mixed use tower.

Later that week, we stopped design on that building and instead had a revised program which took out the hotel component, the observation component, and the communications component and lowered the building considerably down to roughly 1200. We have been proceeding on the design of that structure since.

Is there a future in any major tall building? I think not, if the criteria for designing tall structures has to be anything to do with airplanes hitting buildings. I'm wondering what the future is in terms of mixed-use buildings. Several of the tallest structures in the world now are mixed-use structures, and the Trump Tower was deemed to be a mixed-use structure. In terms of mixed-use structures, when you create residential or hotel uses on the top or bottom of a building, you give a major portion of that building considerable more access than you do for an office building. You can control who comes in and out of an office building pretty easily. If it's a residential building, how do you control who moves in and what they bring into their apartment or condominium from time to time and what they do with that material? They could blow the building up from within. I think mixed-use structures will have a new challenge.

Another topic that hasn’t been discussed here yet is what do the insurance and reinsurance companies say about tall buildings? Will they even consider them again in terms of insuring for the risk that these buildings could be taken down either by airplanes or internally with bombs?

There are only 15 to 20 tall buildings in the world that are considered “icons.” They tend to be owned mostly by governments or government agencies, and they're done primarily for ego purposes, to create a new landmark for a city or a new symbol for a country. They're usually not built from market forces. I think the effort of this group shouldn't necessarily focus on the 100-story buildings. It should focus on the 50-story buildings and 40-story buildings that are much more common and can still create a tremendous amount of damage if taken down.

Thank you.

MR. KLEMENCIC: Thank you Mr. Smith. Up next is Mr. Paul Katz of Kohn Pederson Fox in New York city.

PAUL KATZ

KOHN PEDERSEN FOX ASSOCIATES

MR. KATZ: Thank you. I'm Paul Katz with Kohn Pedersen Fox.

I think as an industry we face quite a crisis. I think we face a tremendous challenge in that I don't think this is the last event. It is probably the last event of planes flying into the buildings. I agree with the comments made by Jon Magnusson earlier. I think we need to take a lesson from the financial industry. The financial industry, after the events of '93, have been taking security to a higher level. They have been very nervous about their security and have built in a tremendous amount of redundancy into their systems. In their words, the financial industries survived the attacks. Had the same attack happened in '93, from what I read, the financial industry might have collapsed.

We face the challenge of making people believe that going into big buildings is safe. If we don't do this, I think the entire future of the cities in the United States will be uncder threat. People are not going to feel safe going into cities. Living in New York City, I didn't believe that people living in the city, especially people with families would consider moving to the suburbs out of fear. The devastation in lower Manhattan is basically total. I question how long it's going to take, if ever, for lower Manhattan to recover. I don't believe from an urban planning point of view the future viability of lower Manhattan is assured, however much money we put into it. How do you do that realistically over a period of time?

Part of the challenge to us is that terrorism, in some form, will continue. For us to rise to the challenge is imperative. If another event happens, and the codes haven't changed or we haven't taken this into consideration, we as an industry will be questioned much harder than we are this time.

One of the issues that this country faces is complacency. Are the tall buildings in this country safer than any other part of the world is a question I ask you as a group, do you really believe this? I certainly don’t. I know that the codes in Hong Kong, London, and Tokyo are much safer in terms of predicting the possible hostile events. The English have been living with terrorism for 30 to 40 years. They have addressed these threats in their plans for office buildings and have succeeded in building a financial center despite the threat. We need to learn from the English.

The Japanese have been living with earthquakes forever. You certainly feel safe in a tall building in Japan, safer than you do in a small building. The reason for that is that every tall building in Japan has numerous torches or flashlights dispersed throughout the building. Should there be a disaster, there are flashlights easily accessible. Simple things like this they have ingrained into their culture.

In Hong Kong, they have experienced numerous fires, so the Chinese codes have addressed refuge floors and firemen’s lifts. In Hong Kong, every second floor there is an escape hatch in the elevator shaft so you can actually escape through bathrooms. Simple things like that. We really have to learn from other countries because the technology and the organization, and the codes probably exist to improve our codes very quickly.

Finally, it all boils down to education and response. The airline industry has been tremendously quick in responding to this attack. They got $15 billion within a week of the event. If what we could do as an industry with maybe $1 billion in research to really improve buildings would go a tremendous way toward saving lives in the future. So to save the cities, the inner cities of this country, we need to apply government funding to research these terrible situations.

This education -- this funding could also go into energy research. Every 20 years or so, it seems there's another reason why we should apply greater technology or investigation to energy uses in buildings. Whether it's oil prices, or conflicts, the dependency on oil is part of the problem

Those are a few of our ideas in this field.

MR. KLEMENCIC: Thanks, Paul. Next is Mr. Richard Keating of Keating/Khang in Los Angeles.

RICHARD KEATING

KEATING/KHANG

MR. KEATING: I'm Rick Keating with Keating/Khang Architects in Santa Monica, California. I started out architecture actually wanting to be an architectural historian. I will use a little of that background rather than my role as a designer of tall buildings to remind us where we have come from and where we might go.

The greatest force we all deal with is, of course, gravity. If you consider prehistory and early man, the simple difference of taking that stone and lifting it vertically is the antecedent for what we're dealing with today. interestingly, the Assyrian peninsula, not far from modern day Afghanistan, was the beginning of cities. I really would like, with all due respect, to disagree with the role of cities in the future.

If you consider history and project it towards the future, it's very clear that cities, in fact, are about security and about collective activity and about protection.

With regard to buildings, we're sitting in one of the greatest cities of all time (Chicago). This city has led the world in terms of developing technology like elevators and structural technology, to allow buildings to get ever taller.

So what is the future? The future, I believe, has a lot to do with this trajectory of the past. We have a society in which the forces of our demography, the birth rate, the evolution of new people coming to our cities are outstripping the capability of the politicians to accommodate those forces. We're not building enough freeways or transit systems, to accommodate the densities that we're building up in the cities. All of you have experienced this in each one of your cities

In Los Angeles it's the 405 story. I'm sure it's true with the Dan Ryan story here, et cetera. We don't have access or mobility any longer to the degree we started out with in our careers.

I think one of the most interesting points today was the connectivity of buildings to the other urban infrastructure systems. The city is certainly about collective energies coming together to forward our society.

I think the role of the architect in this conversation is to portray the poetry of these tall buildings and what they mean to us. In my opinion, the attack on September 11th had to do with a symbol that was extraordinary in its imagery. It represents not only our country but our financial system. I think it would be foolhardy for us to attempt to protect all of our buildings against airplane attacks

MR. KLEMENCIC: Thanks, Rick. Next, we're going to have Mr. Fridstein speak. Our two esteemed owner/developers are the people that have to balance the economic equation for all of this.

THOMAS K. FRIDSTEIN

TISHMAN SPEYER PROPERTIES

MR. FRIDSTEIN: First, Ron and David, I want to commend you for pulling this together in a very short period of time. We realize that tomorrow is the fifth week anniversary of the event of the World Trade Center. I think you have done a great job in pulling this together.

I think we want to assure the public that buildings are safe and that buildings are an important part of our society and our life. They are safe and we are going to make them safer.

I actually believe that tall buildings are inherently safe. I think they're one of the safest forms of buildings. Of course, there is no defense for somebody flying an airplane into a building, whether it's the World Trade Center or the Pentagon. There is no defense. That should not be the focus of our discussions nor should it be the focus of our society.

Tall buildings have always been designed to a stricter life safety criteria than other buildings. Perhaps we have to re-examine our design criteria, but certainly the building I work in is a much safer place than the house that I live in. One of the key reasons is all of the engineering systems and the code systems that address tall building systems.

Tall buildings have always been designed to withstand many potential hazards, fire, wind, seismic, weather, energy use, et cetera. I think we do have to consider malicious acts are also a hazard and must now be designed for. I'm not talking about flying an airplane into a building but other types of hazards. I think we need to re-examine this in a prudent way. We need to examine our structural, fire protection and exit requirements are sufficient when subject to this additional hazard.

What's the cost of all this? I think we all have to remember in the end the tenants are the clients of all of us. I'm not your client. Our client is your client. If the tenants are concerned, and they are concerned, then the tenants are going to be glad to pay increased rent if they feel safer.

I think the key thing, and we're seeing it happen instantly, is a secure control of access to buildings. We have been very fortunate in this country that we have had open buildings. It's the only place I travel to around the world where you can walk into an office building, get on the elevator and go up without passing a security desk. This is changing rapidly.

As many people have mentioned, training and practice of evacuation procedures in buildings is also going to be very important. There are many things that are in practice in many other countries that I think we should look at, not that we should adopt all of them. People have dealt with terrorism before, and deal with it quite effectively.

What's the future of the tall buildings, 100 story buildings? From a real estate point of view, the 100-story building as an office building, has long been impractical. None of these had been built to be practical from a real estate investment point of view. To address the economics, recently people have been proposing mixed-use buildings so you don't have one type of product coming on the market at one time. I think Adrian makes a very good point why that's going to be difficult in the future.

I also think that people today are very timid about entering tall buildings, and they're extremely timid about buying a very expensive condominium at the top of one of the world's tallest buildings. Tall buildings have relied upon demand as the economic factor to make them viable. I don't think for quite a while we're going to see many more super tall buildings.

Thank you.

MR. KLEMENCIC: Thanks, Tom. Finally, Mr. John Harris of Hines will address our group.

JOHN A. HARRIS

HINES INTERESTS LTD. PARTNERSHIP

MR. HARRIS: I'm John Harris with Hines Interests, a real estate developer all across the country.

15 to 20 years ago a movie came out called The Towering Inferno. After that came out every fire marshal in the United States went crazy in demanding more life safety. Much of that additional life safety was proper and correct, but a lot of it was tremendous overkill, and there were a lot of really stupid things that were written into building codes. Now we have our own towering inferno.

Before September the 11th, I would bet that everybody here in this room saw that their business was about ready to take a downturn. This disaster will affect everybody in a much bigger negative way. As a developer we were having difficult times. Costs are very high and tenants are very scarce and very tight in their pricing. After September the 11th, there's been almost a complete shutdown of tenant activity across the country.

I have been listening to a lot of suggestions here, and a lot of them sound great and wonderful but I am concerned about all the cost implications for those suggestions. I also know every code department out there in every city is just chomping at the bit to start rewriting their code to put more and more into it, and I'm very concerned about those cost implications.

I have heard the word what does society want? If that means what does the marketplace want, then we can handle that. But if it means what does every code writer want, then we're all in trouble. We have to do the right thing in our buildings. We must have proper and safe buildings, but we can't do everything. Thank you

MR. KLEMENCIC: Thanks, John. That concludes this mornings session. We will break for lunch, then pick up out discussion this afternoon.

A F T E R N O O N   S E S S I O N

MR. KLEMENCIC: From this mornings session, I generated some questions for our group to discuss.

The first question addresses the concerns expressed this morning about an overreaction to what, in fact, was an act of war. Do we design buildings to withstand war?.

Prior to September 11^{th}, in commercial building design there wasn't much dialogue about terrorist threats or blast protection. Post-September 11th, what is appropriate?

MR. HARRIS: We've been meeting with all of our building managers and engineers over the past three weeks addressing the bio-terrorism threat not only of new buildings, but for all of our existing buildings. We believe unanimously that we owe the tenants protection. Exactly what that means and what it boils down to, we don't know. We believe that we are going to make a very big, very expensive investment in refitting a lot of our old buildings. Of course, terrorists could get into the water and the air. So, yes, I think our industry has to make big strides in that area.

On the other hand, I say you shouldn't change a word in any code on structural engineering. It's not the building's fault, it's the plane's fault.

MR. EDGETT: I think it's worth noting that the guys who did this played by the rules. There was a set of rules that were established, and despite showing ID, asking them twice if they packed their own bags and not being allowed to carry a gun on an airplane, they used those rules and still did it. I think that a measured response is most appropriate.

MR. CHACE: I think the world has changed. Prior to September 11th, the systems we designed for buildings did not typically address terrorist threats. Now this will change. We will come up with a new criteria or set of assessments that will go into designing buildings. Buildings will react more to what the state of things are now.

I agree we shouldn’t overfortify our buildings, but in some cases there are different considerations. We have to be conscious of the weaknesses and Achilles' heels of our buildings in the world of terrorism.

That’s how we start to re-focus ourselves. How can we make things change in light of to this new dynamic. Keeping our response real, keeping it within the framework of what is here and now, and try to plan as much as we can to the future.

MR. KEATING: I guess there's two thoughts on my mind, one is that as soon as we protect the air intakes, the next thing you're going to do is protect whatever else comes along next. Do we want to go down this road? Second, I think if there's a moment that we could exert the political power to go for a national building code on a series of issues, the moment is now.

If we can use the leverage of this meeting, and all of the people here, to try do something more sane, that's really the best thing we can do.

MR. PRIETO: If you look at how we've designed high-risk targets in the past, whether they were a defense facilities or nuclear plants, we used, risk-based design factors. We didn't try to design for everything. We made assessments of what the threats were, what the probabilities were, and developed appropriate design criteria. September 11th has expanded the range of facilities that I think you want to consider in this way.

My second comment supports Rick’s comments concerning a national building code. This is our single best opportunity. If you can narrow the scope to a couple of critical areas within the code such as structural integrity, bioterrorism, or counter-terrorism, then, you begin a process that raises these items to a national standard.

MR. MAGNUSSON: I think that there also needs to be attention given to the scaleability of the response. You can't treat all buildings the same. The World Trade Center, a high-rise tower, certain high profile tenants have different demands than a 10-story speculative office building in Everett, Washington. We can't just take one-size-fits-all on these things, there needs to be scaleability to the kinds of measures that we take.

MR. PRIETO: That's my point exactly on risk-based design, because the risk for a 100-story building is different than the risk for a single family house.

MR. MAGNUSSON: One message I hope comes out of the discussion today is that this particular attack was on a high-rise building, but our concern is about all of the built environment. It's not simply high-rise issue. Tenants shouldn't be afraid high-rise buildings. Cathedrals, concert halls, sports facilities, any place where large numbers of people gather are potential targets. We need to think about the hazards in terms of, I call it the demand side, the side where the evil originates. We need to focus on that, rather than on the capacity side, on trying to harden our facilities.

MR. RITTENHOUSE: We're all aware of six events that have occurred over the last ten years. That's because they've been very, large events. Whereas, there's about 1,000 small events each year in the United States. Usually they're around a one-, two-, and three-pound letter bomb.

What we need to do is evaluate what is the threats? Is the facility a target? What is the threat to a target in your neighborhood, across from the U.N. around the corner from wherever, a cathedral or museums?

If there's one area that we've studied the most that would be most beneficial, it's the glass. It's, perhaps, laminated glass. Laminating glass really helps. If glass shatters on a large scale you've got to replace all the HVAC system because you have glass shards throughout the ductwork.

You have to replace all the carpeting, replace all the windows, replace everything in the building except the concrete and the steel.

MR. KLEMENCIC: I would like to pursue a comment that Mr. Harris made. What do we with the existing stock of buildings of which there are thousands and thousands?

John stated that Hines is considering an effort to upgrade some or all of their existing stock of buildings. What do we do we do with all the existing buildings?

MR. RAMAN: I think it behooves learned bodies like this one to come up with some kind of methodology to standardize an evaluation of risks in the existing buildings.

MR. MEYERS: I think one of the great resources in all the existing buildings in the country are the people who work in the buildings.

I think it's important for people in the buildings to work with the building owners to become educated agents of the rights of the people who live or work in the building, ensuring that when people see something that they don't look the other way. In addition, tenants should know about safety procedures in the building and security. think that we need to take advantage of all those people that are in the building and help us all protect ourselves.

MR. SMITH: How much of this is management-oriented versus physical modifications or physical improvements to the structures that we have?

MR. HARRIS: I think there's going to be a lot of physical modifications. There's no doubt that we have to change millions and millions of dollars worth of our mechanical equipment and access to clean air and water. All of that has to be completely redone. We're going to have a comprehensive list of all these things within a very short period of time. I'll be happy to share it with the Task Force.

MR. KLEMENCIC: John, let me pursue that particular topic. Ultimately someone has to pay for all of this. What will building tenants or occupants accept in terms of cost, whether that's actual dollars or whether it's some lost freedom because they don't have free access to everything now? Do we answer this question through trial and error?

MR. HARRIS: I think on existing buildings the owner will pay for it. I think you would have a hell of a time going back to the tenants -- maybe if you had one big tenant that had 300 or 400,000 square feet, maybe you could go negotiate something with him, but I think all the retrofit work is going to be paid by the owner.

On new buildings, whatever we have to do to upgrade the new buildings, other owners are going to have to do the same thing. So neither one of us are hurt, and that cost will be paid by the future tenants.

MR. WICK: One of the points I would like to make is in line with what Tom was saying earlier. The only thing, today that's unacceptable to tenants is that we do nothing. They are looking for a response, which is why we're doing this research.

MR. KLEMENCIC: As building owners, how do you decide what is appropriate?

MR. WICK: It occurs to me that a lot of what's being talked about around this table, is appropriate. There needs to be some research done, relatively quickly, and then a measured and adequate response that comes out of that research.

MR. KEATING: But are we going to define something that has only to do with what we know today? We cannot know what's going to happen in the future, so we'll have another round of this next time something is committed?

MR. FRIDSTEIN: I don't think we should concern ourselves about who pays for these measures. I think that will work itself out. I think we need to determine things that need to be done and then how do we, as a group, go about helping make those things happen.

MR. HARPER: I think there were a number of success stories that are evident out of the whole September 11th event. And I think those things need to be emphasized to the general public as a whole.

There obviously were failures, and over time those will be identified. Hopefully, we'll be able to develop measures to specifically address those failures. I think one of the things that can be done rather quickly is to identify the success stories in these buildings and transmit information that to the general public.

MR. CHACE: I'm looking down the list of today’s participants. We've got 14 specialties represented. If we were to identify the top 10 items you should be looking at to assess your building right now for security, this would be very helpful. This could become an incredibly valuable compendium from all of our different perspectives.

MR. KLEMENCIC: Let me direct the conversation in a little different direction. How do we make our industry's response a truly collaborative response?

Mr. Edgett. MR. EDGETT: If we look at the rules of politics, there are only a few things we can get done. Maybe the point of this is to set a triage. There are a lot of topics everyone is interested in. If we look at a triage, there's perhaps two or three things from this that really we need to focus on.

MR. YOUSSEF: Look at the hospitals as a role model of performance as measured in California for earthquakes. I'm looking at hospitals not only from a structural point of view, but all the systems that are supposed to serve the community after a measured disaster. Jon Magnusson put it very clearly when he made a distinction about the demand side, referring to terrorism, versus what we always talk about, demand of an earthquake versus capacity in a building.

My example is if we have a chance to effect public policy is to preempt the prescriptive codes.

MR. BAKER: I want to point out the Pentagon is only a five-story building. We have to be careful about overreacting in implying to the public that our buildings are unsafe and we need to do all these fixes to make them safe. Quite frankly, I think the danger from this type of thing has to do with the icon value or occupant of the building rather than with the building itself. I'm very comfortable knowing what I know about tall buildings to live in a tall building or work in a tall building. I feel no greater danger than I did before September 11th. If I happened to live next to the Pentagon, I might be nervous. That's the source of danger, the icon value or the occupant that's in the building.

MR. KLEMENCIC: Let me follow that. What happens when the attack comes on the random building?

MR. FRIDSTEIN: We can't get too hung up on the terrorism aspect of the event. We had a building that had a major fire in it. The fire stairs didn't work properly. The sprinkler systems didn't work properly. A lot of systems in the building didn't work. People couldn't get out by on the stairs. The lights were out. There were all kinds of systems that were supposed to keep people safe that didn't work. Yes, 25,000 people got out of the building. That's great. But I think it does point out to the industry, there are certain aspects we took for granted we really ought to think about. Are the stairs wide enough? Should there be battery lights in the stairs? John's talking about moving air intakes. Those are easy, logical things. I think there is a terrorism side, which is the air intakes; and there is the other which is just life safety in the buildings in a disaster and are the precautions we're talking the right ones.

MR. KATZ: Just to discuss the urban habitat side for a moment. While, of course, life safety is the primary concern in an event like this let us not forget the toll on businesses and lives. My observations of the Kobe earthquake and its ramifications was that while there was relatively low life loss in Kobe, the economic devastation to the city was overwhelming. The fact that businesses that were located in these buildings were shut down because they couldn't use the buildings after the earthquake was devastating. The lessons learned in London from truck bombs and minor events are that buildings are put out of business and tenants inside those buildings could not function. Those tenants demanded in the newer buildings, greater levels of safety so that if there was an event in the street, the business could function the next day.

MR. PRIETO: You have two issues here. You have a set of engineering issues. But I think overarching them just as much is a set of confidence issues. Are we safe? When you go and meet with folks that are directly impacted, one of the three questions they ask you is am I safe. I think we missed an opportunity or maybe we haven't missed it yet. There are two heros in this story that really haven't got their due yet, and it's those two buildings.

Those two buildings let 25,000 people get out. The egress systems and safety systems that were there allowed 25,000 people to get out. They didn't allow 30,000 people to get out. And the engineering challenge is how to improve the survivability of the tenants of those buildings the next time some event of whatever cause happens. That's where the engineering focus comes in I think telling the story about those two tall heros that let 25,000 people out of the buildings is a story that needs to be told. If this group doesn't tell it, no other group will. It's not to say that everything was right. It's to say that much was right and more will be right in the future.

MR. MAGNUSSON: One thing I heard mentioned a couple of times is that there are some valuable lessons to learn from response to earthquakes. But there are some big, big differences. When we design a building in earthquake country, there is a 100 percent chance that the building will experience an earthquake in its lifetime, of some magnitude. It will experience an earthquake, where if you take just a random building in the country, the chance of it being hit by a meteorite is higher than being hit by an act of terrorism. We need to be sure that we keep that in focus. There are some things we can do to enhance buildings, and many of the things do not cost a lot more to enhance them, but there is not a gigantic problem with our buildings that we need to field.

MR. KLEMENCIC: There's been a lot of dialogue today about the notion of what I'll call performance-based design. The sentiment of this group seems to be that a performance based code is a good and logical direction to proceed. How might we foresee or influence that.

MR. MAGNUSSON: On the performance-based question, all the performance-based codes still specify some sort of a criteria that you need to match your performance against. The performance-based codes by themselves will not address the issue we're talking about here because you have to define what kind of events you need to design for. Performance based design may give you more freedom in design for an event, but the fundamental question is what does society need as the event that we design for?

MR. KLEMENCIC: Who determines that list of events? For instance, who decides what size the truck bomb is?

MR. MAGNUSSON: Exactly.

MR. EDGETT: The issue of probabilistic design really is very important. Jon's point that the building is more likely to be hit by a meteorite than by a terrorist is an excellent point.

MR. PRIETO: You asked the question, what size truck bomb? To the defense establishment, it's defined depending on where you are or what throw weight of nuclear warhead if you're designing a strategic underground defense facility. It's defined. If you design a nuclear reactor, the consequences are in radioactive releases and likely doses to large populations. It's defined.

I think the objective is not to design to prevent the meteorite or protect from the meteorite or from the next plane that goes in. The design is to afford an acceptable level of human life to survive following that event. The definition of acceptable level can be wrestled with.

These buildings allowed 25 of 30,000 people to get out. Whether that was the right threshold or it should have been 29 out of 30, that's for others to decide. I think we have to change the basis of this argument from survivability of the building to survivability to an acceptable level of occupants in that building. There may be a second criteria on economic damage and that I think needs to be explored in some other form. You have to change the parameters of debate because you will never design a building that would withstand the next threat I postulate. That's also the greatest risk here. The greatest risk is a set of knee-jerk standards that design for the last war, the last attack. You can't play that game and win. You have to get past that. Your job is to maximize the survivability of the occupants in that building and do that in a prudent and reasonable way. That's your object.

MR. MAGNUSSON: When we're trying to define problems, I always like to look at the extremes to find out what we're talking about. Fortunately, we're sitting here today and we're not talking about one of the extremes, even though you look at that event and you think that was pretty extreme.

Let's postulate a weapon of mass destruction that had been put at the base of the building. The buildings are basically gone. People want to look to us and say, wow, keep me safe, but we have an obligation as we try to shape public policy to let people know we cannot protect them from everything. There are certain hazards that unless we somehow prevent the hazard, we can't do it. And I think that's an important point, we owe it to the public to let them know that.

MR. FRIDSTEIN: I agree with Norman and trying to focus on something tangible. We shouldn't address the issue of terrorism -- preventing that in buildings. We can't. We can't do that. But what we can do is focus on making the buildings behave better in a calamity, whether an earthquake, fire, or plane crashing into it.

To me that's what's been brought up here that we can focus on as a group. I think it's better for the Hines and the Tishman Speyers and everybody else in the world if we can in some way codify what the recommendation is, and then we're all going to do this so that we don't go off and spend a lot of money doing something and somebody does something different and somebody else does something different.

MR. EDGETT: Ron, this is longer term, but out of this I would expect the insurance companies are looking at this loss, and they're going to have their own feedback on it.

I think it's important for us to be able to interact with them, this group, or some people in this group, in a way that's productive and in a way which satisfies their need to understand what happened here. How can a loss have been avoided? That's how we got seatbelts in cars. It came out of insurance.

So if there's a way that we can set up some liaison between ourselves and the insurance industry, I think they're going to come back with questions. This is a huge hit. Not just the buildings that collapsed, but the ones that are on the outside.

MR. KLEMENCIC: Do we want to embark on a lobbying campaign, whether it be with the government or whether it be with the insurance industry?

MR. RITTENHOUSE: I have a comment, It's not tall buildings, it's all buildings. It's all urban habitat. That's the first place we have to start and educate people that's where we're coming from.

MR. KLEMENCIC: Excellent point.

MR. HARPER: I guess just to follow on that comment, I think there has been overall, prior to September 11th, a general lack of concern or interest for your own personal safety in any structure, high-rise, any building.

We see it in college dorms. We send our kids off to college, and they occupy their dorm room. The first thing they do is take the battery out of their smoke detector, because they don't want anyone to know they're having a cigarette in their room.

I can't tell you how many phone calls we've gotten to provide assistance to different buildings in reviewing their emergency procedures and training some of their people on conducting and doing a fire drill compared to those that we got prior to September 11th. We've gotten an infinite number more of those phone calls ever since. I think people are finally becoming aware.

This is a very unusual incident. You look at our history, tall buildings, and any other building that meet codes, there's been a pretty good safety record.

MR. MAGNUSSON: Once again, I want to be sure we're all talking about the same terms. On national television I said, this building appears to have been brought down by a fire. I need define that term much more clearly, because people then start to think, well, maybe our fire systems are inadequate. This wasn't a fire. There were from what some of the fire experts told me as many as three floors that flashed over fully engaged every piece of furniture, paper, curtains in those floors instantly on fire.

The design fire, from what I've also been told by fire safety experts, is about 1,500 square feet. A fire starts somewhere on a floor, and that's when the sprinklers start attacking. Each floor plate in the World Trade Center was 43,000 square feet, and you have three of those fully involved. You're not going to design a sprinkler system to deliver that much water to fight that magnitude of a fire.

If we had had just a fire, everyone in that building would have gotten out. But, we had impact, we had massive fire, we had systems damaged.

MR. KURTZ: I think the question that was asked was what can we lobby for, and I suggest research. There are government research programs, but certainly we should identify some research for the buildings industry that we should push for. The one that's still hanging out there before September 11th is indoor air quality.

Everybody talks about it. It's a big mystery, sick building syndrome. But if you ask somebody to define it, a few people get a sore throat and they go home and the building gets labeled. Now we've got bioterrorism on the back of that. This is an area where some research ought to be done. Testing, identifying, sampling as part of a building system, whether it's the air conditioning system or what. That may be something we can push for.

MR. KLEMENCIC: What are other areas that this group thinks are very important for research?

MR. EDGETT: I think one smoke movement in high-rise buildings, even modeling. There's very little of that. I think there needs to be fundamental research on that, because in a fire smoke can kill more people than the fire.

MR. KLEMENCIC: What are some other topics?

MR. SOLOMON: Time of egress.

MR. KURTZ: Time of egress and that could go to stadiums and arenas. Every time we design a stadium or arena, the code is silent on what the exiting criteria are.

MR. De JONG: Yes, I just want to say one thing. In every terrorist attack, we have two major things. We have people, and we've got the area where the act was done. People are the source. They are the guys who do it. They are the guys who start the attack.

It's always the best to attack and counter-attack the source, do something at the source, prevent the source from doing what it wants to do. It helps in biowarfare, helps everywhere. Stop the source, you stop the attack. And, therefore, I would actually really like to see what's happening in London, what's happening in Singapore -- whenever you want to go in a building, if you want to go to Canary Wharf or you want to go to the consulary in Paris, for example, you have to enter the building through security. You have to give your name. You have to say who you want to visit. If you want to go to the parking lot, you have to say who you're going to visit. You're on record before you even enter the place.

I definitely think if you can stop the people before they can do the damage, you've done most of the protection already. Then the next thing is looking at risk analysis, how we can prevent and how we can improve and act better once something is still happening, because we're never going to stop them 100 percent.

MR. PRIETO: We need to look at what we need to give first responders so they can be successful. There's a set of things -- there's an architect-engineer-constructor component in these kinds of events that did not exist and was put together on an ad hoc basis. That should be planned. That's number 1.

No. 2. Somebody brought up the operating issue, the training of the people in the building. I'll tell you what my biggest concern is today: a biochemical release. I look at it from a transit station standpoint, and the normal tendency will be to evacuate. That's exactly the wrong action. If you want to minimize loss of life, you bottle up the facility, you don't vent it, you don't evacuate.

There's a societal consequence in doing that, and that's a trade-off, and that should not be left to some policeman or transit worker that's standing there deciding whether to keep people in or let them out. Those are hard, societal questions to make.

MR. KEATING: I would just like to reiterate I think that one of the real fundamental things that this group can do is do try to find a way that there's a national code or some sort of overriding set of rules that does deal with the special egress and a few of these things. If we don't, we'll be in a situation where we have excessive bureaucracy moves like we do see in the airline industry checking us for what we've packed and didn't pack.

MR. BAKER: I think there should be research in robustness of structural systems so that they have post-collapse strength -- or post-damage strength, if you will.

MR. MAGNUSSON: One of the things that we saw when Bill and I were going around to all these different buildings was that all of the fireproofing gets knocked off in big sheets due to impact.

MR. HARPER: If I could follow that
on again, just to emphasize that point, I did not do any direct studies there of the World Trade Center, but if you look at two very predominant examples of fires in high-rises in the past 10 years, the One Premium Plaza and, of course, First Interstate Bank Building in L.A., they both experienced quite severe fire hazards.

I won't even begin to venture to say that it was the same as what the World Trade Center saw, but I think you can begin to see that, as Mr. Magnusson pointed out, that there was definitely failure of systems and not a failure that could have been planned for, per se, in that if fireproofing was, in fact, ripped off of the columns like a can opener. I don't know if there's much that we could do to address that in the consequence of normal design of buildings.

MR. KLEMENCIC: After the Northridge earthquake in California a number of years ago, a number of the steel moment-resisting frames were damaged. There was an immediate reaction or an action taken by the engineering community to essentially ban steel moment-resisting frame until additional research could be done.

In the aftermath of what we've seen, is there any quick code action that we should take?

MR. WICK: I would submit that based on what we know today, just the opposite is true. I don't think that there was anything we can put our finger on that said this was a significant building code failure. I think we just don't know enough at this point in time.

MR. SOLOMON: I would say definitely no to that question. This goes back to redundant systems, all of which were taken out of the equation very early on in this event. Whether you're talking about fire protection on steel, the compartmentation of the floors, the enclosure of the exit stairs, the automatic sprinkler system, the standpipe system. When you lose all of those, you know, there's nothing you can do in the code to harden the system to that degree, so I would say no.

MR. WICK: I've heard a number of people throwing numbers around about how many people.

MR. CHACE: Security can't be an afterthought. It has to be something thought of at the ground level. When you're even thinking about designing the building, it should be just as much a thought processing as plumbing, electrical, floor plans, fire, all that stuff that goes into the design of a building. It's extremely important. You have to be very careful when you start specifying what type of equipment is going to go in the building. You have to be talking about policy driving the technology selection rather than technology driving the policy. You get down a very slippery slope very quickly when you have it the other way around. I'd ove it if a bunch of people started buying all of our stuff. That's what we do. We manufacture security equipment. That would be great. But if you get the wrong system or it's poorly designed or you don't have the right person specifying it, it totally backfires on you and it backfires on me.

MR. PRIETO: The role of the designer is given a catastrophic event, what are the things that you can reasonably do to afford the maximum survivability of human life? I think that's the challenge. Whatever you can do to improve the egress or the safety in that building, that's the design challenge. We can sit here and agree that reducing the threat is ideal, but we can't control it. We can provide more time for people to get out of buildings or if we need them to stay in buildings to stay in buildings safer.

MR. SOLOMON: Back on training, it's been widely reported that in Tower 2 occupants were specifically directed to stay in the building, and that decision supposedly was based upon the only thing the floor wardens knew was there was a lot of debris falling on to the street level from the first building, so it made sense that the occupants stayed in there or give that order.

One of our fire analysis researchers indicated that sometimes a good decision can have a bad outcome, and that's probably a classic case for that happening. Norm is right. It does go back to if there is a way to come up with a decision process. The people that got out of Tower 2 successfully were the ones that ignored that order to stay where they were because they were told they were safe. It was a terrible decision for the floor wardens to make -- and we certainly need to look at how you train them, how you give them direction, and how you help them make their decisions.

MR. MAGNUSSON: I think there were also significant number of people killed that had gotten out of the building in the triage area that was set up at the base of 1. I think it was in between World Finance Center and World Trade Center Tower 1. When 2 came down, it came down in the triage area, so there were a lot of fire fighters and medics and police and people that had survived that were then killed. Some of those people actually did get out, but didn't survive.