ОБІЖНИК - NEWSLETTER

ТОВАРИСТВСО УКРАЇНСЬКИХ ІНЖЕНЕРІВ АМЕРИКИ – *НЮ ЙОРК*

UKRAINIAN ENGINEERS' SOCIETY OF AMERICA – *NEW YORK BRANCH*

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From the President's Desk

This is the first newsletter in what I hope will be a steady stream of bi-monthly newsletters covering topics ranging from technical to social. For example, in this 'premier' issue I've included an article I wrote about the engineering reasons behind the collapse of the Twin Towers. The most important thing that I think people can draw from this piece is that engineers work very hard to make sure high-rise buildings perform safely in everyday life.

Thus I invite our members, whether they are students, practicing professionals, or retired professionals, to submit articles on topics of interest. The material can be presented in either English or Ukrainian. Remember that our bylaws state that in addition to engineers, our members can be architects, financial professionals, computer professionals, and general students of science. The topics we can cover are vast, but we can only achieve this if everyone contributes.

I'll also try to include news items of what's happening in our chapter. These news items will include announcements of new members, births, obituaries, preview of events, company promotions, changes of address, etc. Please note that I alone am not able to discover everything that's happening around the chapter. I need your help to collect the information. The health of the organization is a direct reflection of the participation of all of its members.

Finally, I just want to touch on the topic of "current addresses." UESA's current database has numerous outdated addresses. People move and occasionally forget to notify organizations such as us. Thus, if you know of people that are members of the Ukrainian Engineers' Society of America but have not received any correspondence in years, then please ask them to drop us a line to verify that we have the correct address.

Marko Shmerykowsky

The New York Chapter of the Ukrainian Engineers' Society of America would like to express its sincerest sympathies and condolences to all who were affected by the September 11th attack on the World Trade Center in New York City and the Pentagon in Washington.

The Collapse of the Twin Towers

Marco J. Shmerykowsky, P.E.

It has been two weeks since the terrorist attack on the World Trade Center and like most New Yorkers I still can't fully comprehend what happened. When you look south on the island of Manhattan you expect to see two massive skyscrapers rising up. Instead, however, your eyes fall on empty sky and lingering smoke. "How could two massive buildings simply vanish in an instant?" was the question a close friend who happened to be across the street from the Twin Towers at the time of the attack asked of me that day. Although the aviation fueled fire was a major factor in the collapse, there were other factors which draw from the basic elements and theories of high-rise building design.

The basic function of the structural elements of any building structure is to provide a route for loads from higher floor levels to travel into the supporting ground. The loads supported by the building can be separated into the two general categories of "gravity loads" and "lateral loads."

Gravity loads are the forces which are due to the weights of all the materials supported by the building including the weight of steel, concrete, plumbing pipes, electrical wire, office partitions, furniture, and people. Lateral loads are due to the horizontal forces from events such as wind pushing against the walls of a building. While "lateral loads" may play a comparatively minor role in the design of a sheltered, low rise building, they have a significant impact on the design of a high-rise building. This is due to the simple fact that a tall building provides a large surface for collecting the wind which in turn translates into a large horizontal force. In addition to directing these large horizontal forces into the ground, the structural engineer needs to ensure that "serviceability" requirements are met. These requirements simply state that the building must be comfortable to occupy. Thus, for example, the building should be stiff enough that under normal wind conditions it does not sway as if it was a ship caught in a hurricane. The building must be designed to control the sway, the frequency, and the acceleration so as to be comfortable and not perceptible to the people occupying the building.

Photo by Shmerykowsky Consulting Engineers

All high-rise buildings have special portions known as "lateral load resisting systems" which are specifically designed to address the issues due to lateral loads. These systems consist frames composed of beams, columns and diagonal members which are specially connected to transmit lateral forces. The frames can be located anywhere within the building.

The Twin Towers used a lateral load resisting system known as a "tube system" where a series of closely spaced perimeter columns and deep perimeter beams are used to create a shell which has the strength and stiffness of a large square steel "flagpole." This system is attractive for very tall buildings because it removes the large members needed for carrying the lateral loads from the interior of the structure. Thus, the perimeter columns are designed to carry both lateral loads and gravity loads and the interior columns are designed to carry only gravity loads. The net result is that the designers obtain a larger area of usable floor space.

The gravity forces on each floor level of the Twin Towers were collected by a floor system which consisted of open-web joists which spanned 60 feet between the perimeter and core columns. These joists were spaced at approximately 3'-9" on center (ie. the distance from the center line of one joist to the next). An open web joist is basically a long truss which has top and bottom members or "chords" which are connected by diagonal members in a "zig-zag" pattern. These members are attractive from a design perspective because they can span long distances without incurring weight penalties which would exist with comparable solid steel beams.

In addition to supporting the floor, the open web joists interacted with the perimeter columns by providing brace points at each floor level. The "lateral bracing" of a column is an important concept because it has a direct relation to the amount of load a column can carry. As a column becomes "longer," the amount of load it can carry decreases. This is due to the fact that if the column length is too long in relation to the magnitude of the load, the column will want to bend sideways or "buckle." Since beams connect to the column at each floor level and in each direction, the effective design length is considered to be the distance between floors.

With the basic concepts of structural engineering in mind, it is possible to understand both why the towers withstood the initial impact of the airplanes and why the towers eventually collapsed.

When one of the airplanes collided with the towers, the initial impact destroyed a number of the perimeter columns, floor joists, and core columns. Once these structural elements were destroyed, the building essentially "re-wired" itself and redistributed the loads to the remaining structural elements. Since the perimeter columns were designed to simultaneously carry both the gravity loads of a "fully" occupied building and the lateral loads in extreme wind conditions and to provide the building with enough stiffness that the tower would be comfortable for its occupants, the net result was that the members had extra load carrying capacity under normal conditions. Thus after the collision of the airplane with the tower, there was sufficient structure remaining to continue supporting the tower.

The fire due to the aviation fuel, however, served to amplify the damage that was done. Typical high-rise construction requires that the builders provide two to three hours worth of fire protection around main structural members. The aviation fuel fire, however, burned much hotter and quicker than a normal office fire. As a result the fireproofing material most likely disappeared quickly. Once the steel was unprotected and heated beyond 1500 degrees Fahrenheit, it began to weaken and soften. Since

the floor joists are built of thin components, they were most likely damaged by the fire first. As the floor framing failed, the bracing that the joists were providing to the columns was eliminated. Suddenly the remaining already highly loaded columns had their capacity reduced because they effectively became taller. As the fire continued to burn, the combined effect of failing floor members and weakening columns created a condition where the gravity loads from the portion of the tower above the fire could no longer be supported. Once this point was reached, the top portion of the tower acted like a hammer driving a nail into a piece of wood. The levels at the collision point collapsed allowing the upper floors to fall and hit the first undamaged floor. This impact was too great for that level to withstand, so it too failed. This sequence of floors stacking up like pancakes kept repeating floor after floor until the entire structure was destroyed. The second tower to be attacked was the first one to collapse for the simple reason that the plane hit at a lower point. Thus, there was more gravity load pushing on the tower's damaged section.

New York, NY, September 26, 2001 -- Members of Colorado Task Force One and California Task Force Three stand amid the debris of the World Trade Center in lower Manhattan.

Photo by Mike Rieger/ **FEMA News Photo**

The collapse of the towers was a horrific experience for every New Yorker who experienced it first hand and .for millions more who experienced it on television. What should be noted and praised, however, is that the towers were designed so that they stood for nearly an hour after the tragic attacks occurred. This application of engineering principles allowed hundreds of people to escape the towers with their lives.

News Items

- We are saddened to announce that long time member Jaroslaw Horodecky passed away on September 27, 2001. The funeral was held on Monday, October 1, 2001. We extend our deepest condolences to his family members and friends.

- The General Membership Meeting has been rescheduled for Saturday, October 27, 2001. It will be held at the Ukrainian Institute of America at 2 East 79th Street in New York City.

- The New York and New Jersey chapters of UESA, the New York Chapter of the Ukrainian Medical Association of North America, and the Ukrainian Institute of America would like to invite everyone to the first annual ***"Fall Zabava in New York City"***

  The zabava will be held at the Ukrainian Institue of America at 2 East 79th Street in New York City on Saturday, November 10, 2001. Music will be provided by the band "Luna."

  The price of admission is as follows:

Members:	$35 in advance
	$40 at the door
Non-Members:	$45 in advance
	$50 at the door

  Tickets can be reserved prior to October 31, 2001 by sending a check made out to the "Ukrianian Institute of America" to:

  Fall Zabava
  Ukrainian Institute of America
  2 East 79th Street
  New York, New York 10021

- The annual ***"New York City Yalynka"*** is currently scheduled to be held at the Ukrainian Institute of America in New York City on Saturday, December 15, 2001.

New Members

The following people have become members of the New York Chapter of the Ukrainian Engineers' Society of America during the past year:

- Maria Grynychyn
- Jaroslaw Krawczyk
- Wasyl Kinach

Membership

All members are encouraged to become active in helping to recruit new members. Annual membership fees are $35/year ($20/year for those who are retired). Applications can be downloaded from our web site at www.uesa.org

BOARD MEMBERS NEW YORK:

President:	Marco Shmerykowsky
Vice-President:	Temish Hankevych
Treasurer:	Myrosia Dragan

Keep Us Informed!!!

Please send news items, articles, information about our members and other interesting information to the following address:

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ADDRESS CORRECTION REQUESTED