



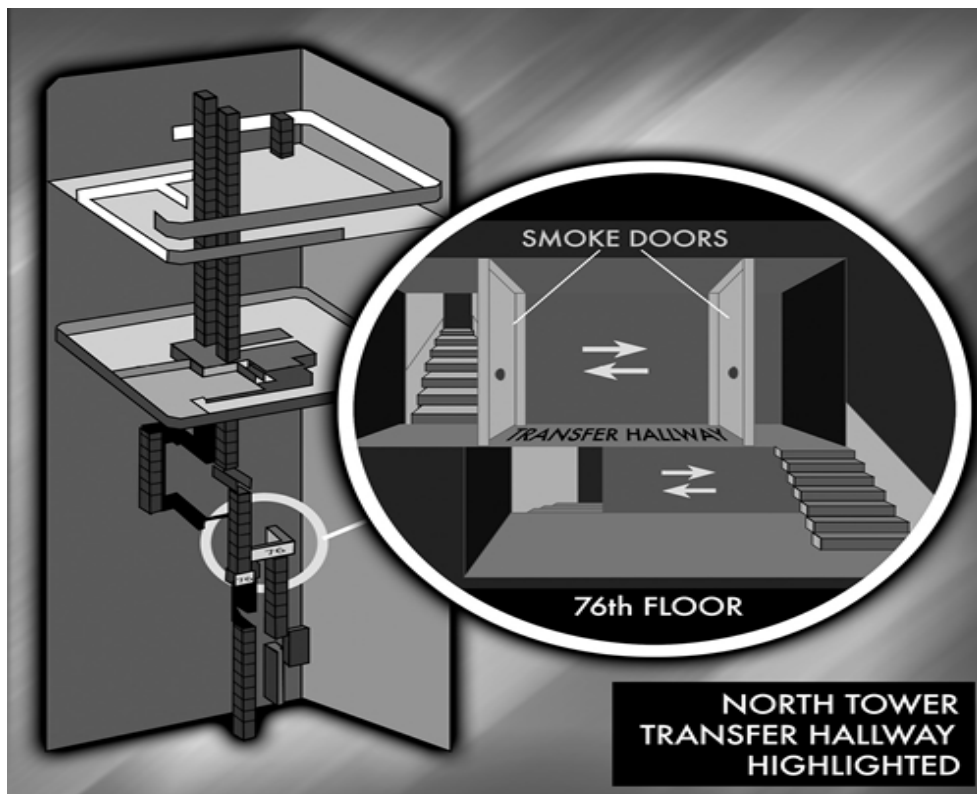
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World Trade Center 3 (the 22-story Marriott Hotel) collapsed on September 11, 2001 as did WTC 1 (the North Tower, in the left-background) and WTC 2 (the South Tower, seen in the right-foreground). Photo by Kafziel; online via Wikimedia Commons. License: CC BY SA-3.0.

When he designed the twin towers, Minoru Yamasaki calculated the damage that could result from a plane striking the buildings.

Air traffic controllers permitted planes to travel at 180 miles-per-hour within New York City's air space. Using a Boeing 707 in his model, and factoring in the maximum speed of 180 mph, Yamasaki determined that seven floors on one side only would be demolished, but the building would stand.

Why, then, did the towers collapse with so many people from so many countries trapped inside? (This rendering, of the North Tower's stairway, with its deviation, is by Marco Crupi and is part of the government's 9-11 Commission Report).



In the early stages of the investigation, people believed that fire and intense heat killed the buildings. Nothing, it was thought, could survive the temperature and heat generated when about 18,000 gallons of jet fuel exploded in each tower. The metal structures would have weakened, perhaps melted, and failed.

By December of 2001, MIT Professor Dr. Thomas Eagar had a theory about the collapsing towers. When the jets crashed into the buildings, the force of the explosion blew off the insulation which protected the steel infrastructure from fire. Unprotected steel, which had lost half its strength, likely deformed and began to give way. It did not melt.

Once the intense heat caused major structural failure of the no-longer-insulated towers' central cores, they imploded with remarkable speed - almost in a free-fall condition. The steel lattice followed the rest of the structure as the buildings crashed to the earth, one-quarter mile below. As Dr. Eagar concludes:

While it was impossible for the fuel-rich, diffuse-flame fire to burn at a temperature high enough to melt the steel, its quick ignition and intense heat caused the steel to lose at least half its strength and to deform, causing buckling or crippling. This weakening and deformation caused a few floors to fall, while the weight of the stories above them crushed the floors below, initiating a domino collapse.

When the towers fell (first the South, then the North), the impact of the fall was almost like a pyroclastic event. A photo by NYPD's Detective Greg Semendinger shows how the billowing ash clouds appeared from the air when 1 WTC collapsed.



What actually happened during the collapse? We find an answer to this question from NIST (National Institute of Standards and Technology), a non-regulatory agency which had conducted an investigation into the demise of the World Trade Center's twin towers:

The structure below the level of collapse initiation offered minimal resistance to the falling building mass at and above the impact zone. The potential energy released by the downward movement of the large building mass far exceeded the capacity of the intact structure below to absorb that energy through energy of deformation.

Since the stories below the level of collapse initiation provided little resistance to the tremendous energy released by the falling building mass, the building section above came down essentially in free fall, as seen in videos. As the stories below sequentially failed, the falling mass increased, further increasing the demand on the floors below, which were unable to arrest the moving mass."

In other words, the momentum (which equals mass times velocity) of the 12 to 28 stories (WTC 1 and WTC 2, respectively) falling on the supporting structure below (which was designed to support only the static weight of the floors above and not any dynamic effects due to the downward momentum) so greatly exceeded the strength capacity of the structure below that it (the structure below) was unable to stop or even to slow the falling mass. The downward momentum felt by each successive lower floor was even larger due to the increasing mass. (See [Question and Answer 11.](#))

Despite the towers' collapse, their design and construction saved thousands of lives as people had time to exit the buildings before they fell. Keep in mind how large these towers were: They contained enough rentable space to fill 50 city blocks.

By the time the recovery and site-clearing process officially ended on 30 May 2002, 1.8 million tons of debris had been removed from the disaster site. Regrettably, 1796 people were never recovered.

See Alignments to State and Common Core standards for this story online at:

<http://www.awesomestories.com/asset/AcademicAlignment/WHY-THE-TOWERS-FELL-America-Attacked-9-11>

See Learning Tasks for this story online at:

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Media Stream

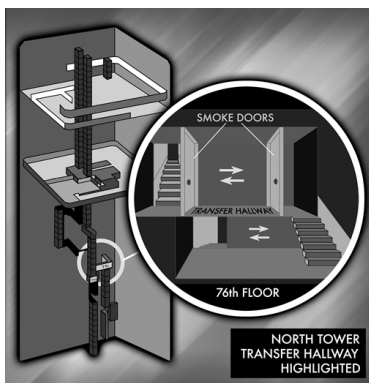


Satellite View - Ground Zero, World Trade Center

View from GeoEye Satellite, September 15, 2001. Image online, courtesy Digital Global.

View this asset at:

<http://www.awesomestories.com/asset/view/Satellite-View-Ground-Zero-World-Trade-Center>



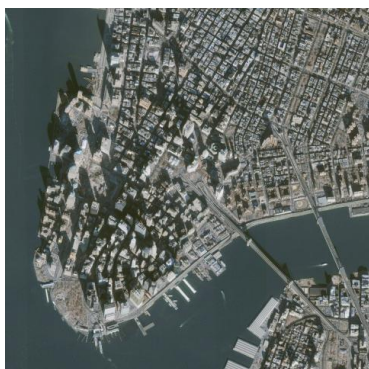
1 WTC Stairway

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1 WTC Collapsing

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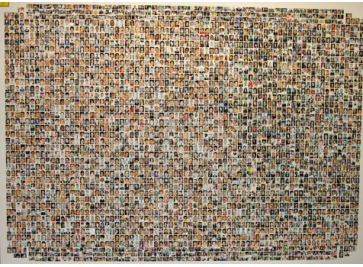
Satellite View - Ground Zero, Four Months Later

Photo, from GeoEye Satellite - 31 December 2001.

Image online, courtesy Digital Global.

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September 11 - Photos of the Victims

Moussaoui Trial, government's exhibit P200336.

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WHY THE TOWERS FELL

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