

# WTC1 Collapse at Near-Freefall Speed is not Evidence of Controlled Demolition

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## Introduction

First and foremost, the towers did not fall at freefall speeds. The theoretical time required for an object to fall from the top of WTC1 to ground level in a perfect vacuum is 9.22 seconds. Many estimates have been presented as the observed time of WTC1 based on seismic and video analysis. The range of these estimates is between 12-15 seconds (see Table 1). Given the lower range, it would be reasonable to say that the tower fell at near freefall speed, but what does this prove?

## The NIST Case

NIST states in their 9/11 FAQ:

Question: “How could the WTC towers collapse in only 11 seconds (WTC 1) and 9 seconds (WTC 2)—speeds that approximate that of a ball dropped from similar height in a vacuum (with no air resistance)?”

NIST estimated the *elapsed times for the first exterior panels to strike the ground* after the collapse initiated in each of the towers to be approximately 11 seconds for WTC 1 and approximately 9 seconds for WTC 2. These elapsed times were based on: (1) precise timing of the initiation of collapse from video evidence, and (2) ground motion (seismic) signals recorded at Palisades, N.Y., that also were precisely time-calibrated for wave transmission times from lower Manhattan (see NCSTAR 1-5A). [NIST 2006]

Since videos document the first exterior panels hitting the ground at least 1 second (probably more like 3-4 seconds) prior to collapse completion, a valid lower bound for WTC1 would be 12 seconds.

## The Bazant Case

Seismic data has been interpreted corresponding to a so called “crush-down, crush-up” model of the collapses. In this model, the proposed crush-down phase involves the upper section crushing the lower section until the bedrock is impacted by the crushing front. The proposed crush-up phase follows, wherein the upper section collapses on top of the crushed lower section. The duration for crush-down is given as  $12.59 \pm 0.5$  seconds for WTC1. [Bazant, et al. 2007] Since the crush-down phase involves only 104 floors and the PE is significantly higher, this can be taken as a lower bound for total collapse to ground level.

## The Hoffman Case

Other video and seismic analysis has also been done indicating longer fall times of at least 15 seconds. [Hoffman, 2001-2007]

## Energy Analysis

Given the time difference between freefall and the observed times we can see that a significant amount of energy is consumed in destroying the building. Table 1 shows energy dissipation calculations for freefall and the cases described above. The total potential energy above ground level (481 GJ) has been established, based on the NIST reports. [Urich, 2007] Note that kinetic energy is proportional to the velocity squared.

Table 1: Energy dissipated in collapse cases for WTC1

WTC1	Freefall	NIST	Bazant	Hoffman
h	417	417	417	417
t	9,22	12,00	12,59	15,00
a	9,81	5,79	5,26	3,71
v	90,45	69,50	66,24	55,60
v <sup>2</sup>	8181,54	4830,25	4388,14	3091,36
KE <sub>f</sub> / PE <sub>i</sub>	100,00%	59,04%	53,63%	37,78%
E <sub>loss</sub> / PE <sub>i</sub>	0,00%	40,96%	46,37%	62,22%

## Conclusion:

In accord with the above calculations, the least amount of energy is dissipated in the NIST case. This amounts to 1.8 GJ per floor on average, which can easily account for all energy requirements including breaking the structure, comminution of concrete, ejection of debris, air expulsion, adiabatic heating, and other less significant factors. Note that air resistance is not a factor if air expulsion is taken into account. Consequently, while it is reasonable to say that WTC1 fell at near freefall speed, this is in no way indicative of assisted collapse.

## References

NIST 2006: [http://wtc.nist.gov/pubs/factsheets/faqs\\_8\\_2006.htm](http://wtc.nist.gov/pubs/factsheets/faqs_8_2006.htm)

Bazant, et al. 2007:

<http://www.civil.northwestern.edu/people/bazant/PDFs/Papers/00%20WTC%20Collapse%20-%20What%20did%20&%20Did%20Not%20Cause%20It%20-%20Revised%206-22-07.pdf>

Hoffman 2001-2007: <http://911research.wtc7.net/wtc/evidence/timeline/index.html>

Urich 2007: <http://www.journalof911studies.com/volume/200703/GUrich/MassAndPeWtc.pdf>