How NIST Avoided a Real Analysis of the Physical Evidence of WTC Steel

(Full length version)[1]

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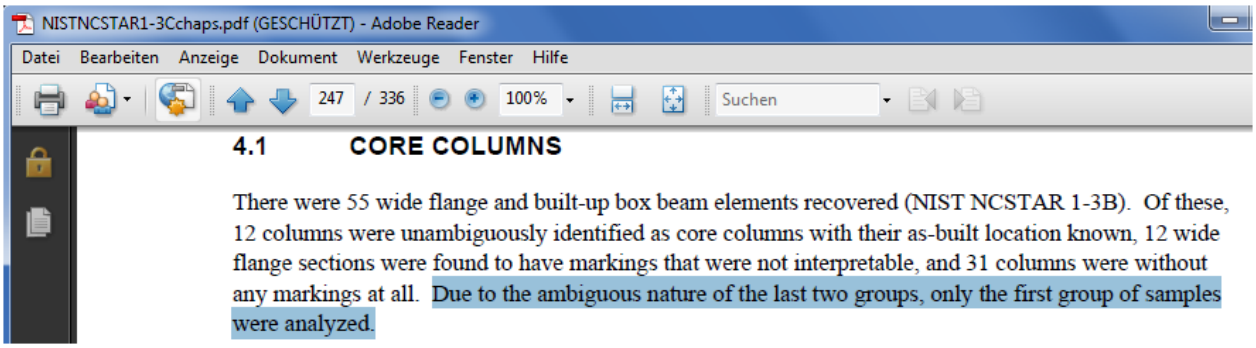
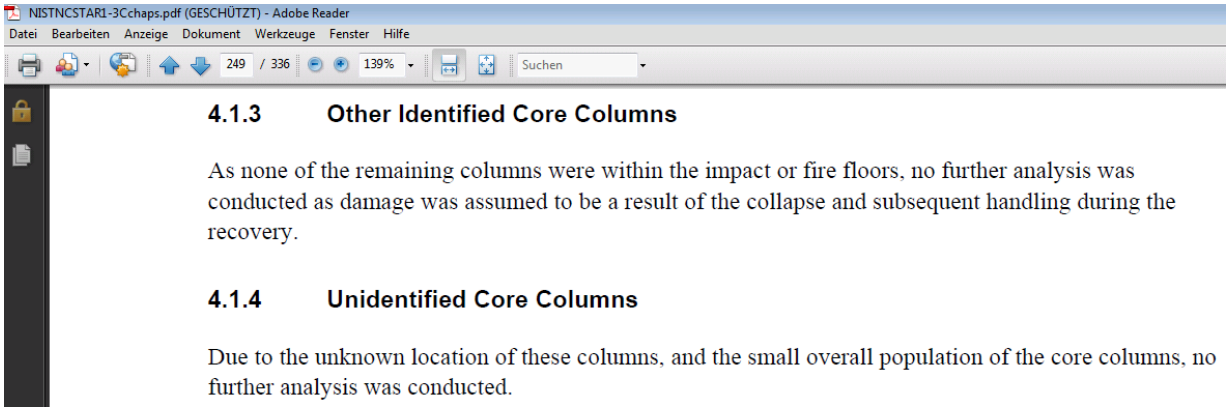
(I) NIST's exclusion of most of the recovered structural steel from being adequately examined for their damage and failure modes

The 236 pieces of structural WTC steel that the National Institute of Standards and Technology (NIST) "catalogued"[2] for its WTC investigation[3] included 55 columns that NIST discuss in paragraph 4.1 "CORE COLUMNS" in NIST NCSTAR 1-3C.[4] NIST analyzed only four of these 55 columns for damage and failure modes. The remaining 51 columns were excluded from being examined for damage and failure modes based on the argument that only columns with a known as-built location[5] in or near the impact and fire areas were of interest for the WTC investigation. See two quotes/screenshots

[1] An abridged version of this article can be found on the website of AE911Truth.org.
[2] The term "catalogued steel" is used by NIST to refer to the 230 pieces of recovered WTC steel stored at NIST's location in Gaithersburg, Maryland, and to 6 pieces stored in hangar 17 at JFK airport. This "catalogued steel" was the steel that was – at least in theory – to be examined by NIST as part of their WTC investigation. Much more steel was saved than the 236 pieces, but excluded by NIST from being examined or at least "catalogued" (see below).
[3] "Federal Building and Fire Safety Investigation of the World Trade Center Disaster," http://wtc.nist.gov/NCSTAR1/, published 2005 and 2008.
[4] NIST makes ambiguous statements if it considers all these members as Twin Tower core columns or not. See NIST NCSTAR 1-3C, "4.1.4 Unidentified Core Columns", and NIST NCSTAR 1-3B, Table 3-4. "Other built-up box columns and wide flange sections from WTC 1 and WTC 2 with ambiguous stampings and/or markings", and NIST NCSTAR 1-3B, 3.2 "IDENTIFICATION OF WTC STRUCTURAL STEEL ELEMENTS'.
[5] Every column was supposed to have a code (stenciled, stamped or handwritten), dating back from the time of the erection of the Twin Towers, that stated its intended as-built location in the building and other data. In some cases these codes were missing or not complete for various reasons. In such cases the size and other characteristics of a column can support a deduction of its possible as-built location.

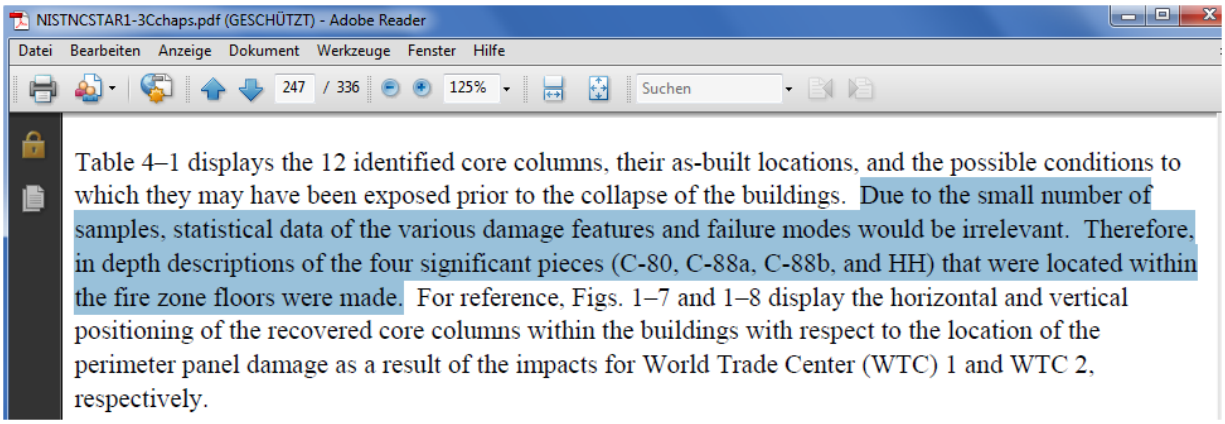
from NIST NCSTAR 1-3C, “Chapter 4. PHYSICAL DAMAGE OF CORE ELEMENTS (COLUMNS AND CHANNELS),” blue highlight added.





NIST’s argument for exclusion involves two steps: First they state that only the 12 core columns with known as-built locations were of interest. Next, they exclude 8 of these 12 columns because they were located outside the fire and impact areas, arguing implicitly that their damage and failure modes can be only of statistical interest.[6] See quote/screenshot from NIST NCSTAR 1-3C, 4.1 “Core Columns.” [7]

[6] Even NIST’s argument that statistical data “would be irrelevant” due to the “small overall number” of core columns is questionable. At least, NIST would have had more core columns available if they had not deliberately



A similar argument was applied by NIST to the 90 “catalogued” perimeter wall panels[8] and their columns. NIST describes only those 5 of the 90 panels “in-depth” that were located in the airplane impact zone of WTC 1. See two quotes/screenshots from NIST NCSTAR 1-3C, blue highlights added.

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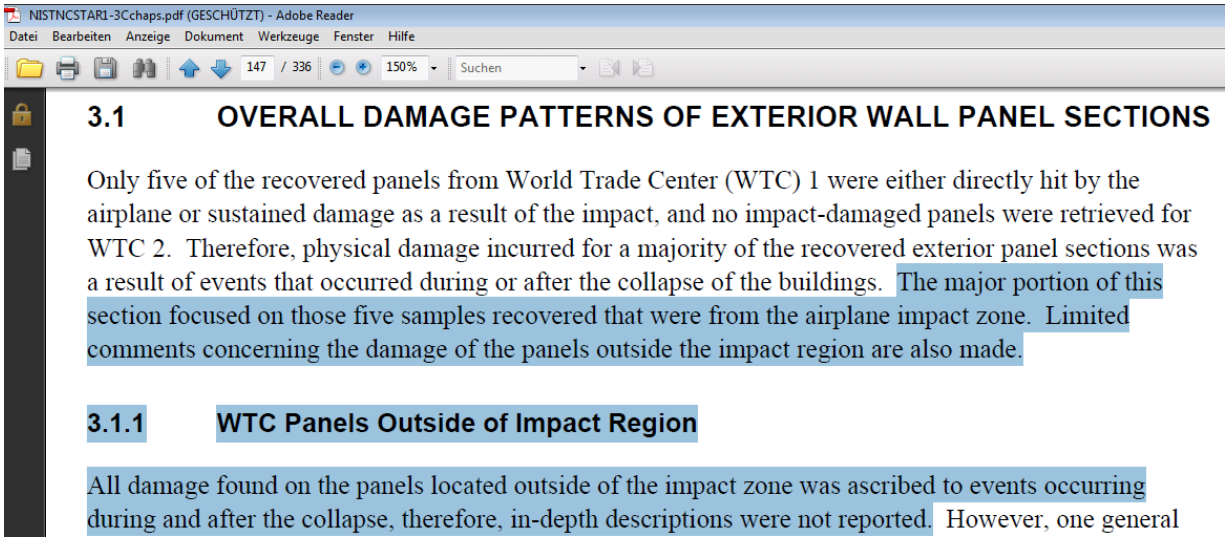
excluded almost all of the WTC steel saved by PANYNJ (see below). The implicit argument that failure modes can be only of statistical interest was also used to exclude the unidentified columns from further examination. See above screenshot from NIST “4.1.4 Unidentified Core Columns.”

[7] Table 4-1, mentioned in this screenshot, lists as “possible conditions to which they may have been exposed prior to the collapses” only if the columns have as-built locations in impact and fire floors, but gives no information that was based on the actual failure modes of the columns.

[8] When the WTC was built prefabricated perimeter panels were used. A standard panel consisted of three perimeter columns, stretching over three stories, its three spandrel plates (which made up parts of the web of the columns), the seats attached to these parts, and the end plates of the columns. There were also other kinds of prefabricated panels used, for example, for the mechanical floors. Many of the recovered panels are not complete. The term perimeter panel is used in this article (in line with NIST's use of the term) also for the pieces when only a part of the panel was recovered.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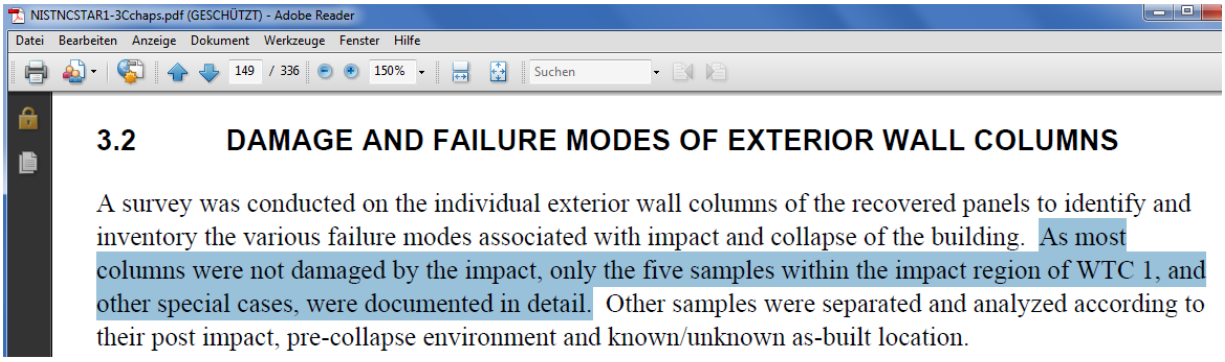
3.1 OVERALL DAMAGE PATTERNS OF EXTERIOR WALL PANEL SECTIONS

Only five of the recovered panels from World Trade Center (WTC) 1 were either directly hit by the airplane or sustained damage as a result of the impact, and no impact-damaged panels were retrieved for WTC 2. Therefore, physical damage incurred for a majority of the recovered exterior panel sections was a result of events that occurred during or after the collapse of the buildings. The major portion of this section focused on those five samples recovered that were from the airplane impact zone. Limited comments concerning the damage of the panels outside the impact region are also made.

3.1.1 WTC Panels Outside of Impact Region

All damage found on the panels located outside of the impact zone was ascribed to events occurring during and after the collapse, therefore, in-depth descriptions were not reported. However, one general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3.2 DAMAGE AND FAILURE MODES OF EXTERIOR WALL COLUMNS

A survey was conducted on the individual exterior wall columns of the recovered panels to identify and inventory the various failure modes associated with impact and collapse of the building. As most columns were not damaged by the impact, only the five samples within the impact region of WTC 1, and other special cases, were documented in detail. Other samples were separated and analyzed according to their post impact, pre-collapse environment and known/unknown as-built location.

NIST provides indeed only “limited comments” regarding the damage and failure modes of most panels and their columns except for the named few pieces. The damage and failure modes of most perimeter columns are reported in summary fashion in just a few sentences and in one table with statistical data. This table (see screenshot from NIST NCSTAR 1-3C) is the most detailed information that can be found in NIST’s report regarding the damage and failure modes of those about[9] 128 perimeter columns that were

[9] The number of columns of the identified panels (60 columns from WTC 1 and 38 columns from WTC 2) and of the unidentified panels (55 columns, the table counts 56) is stated in NIST NCSTAR 1-3C (page 99; PDF-page 149). Nine identified columns from three WTC 2 panels were not analyzed due to their storage in hangar 17, JFK airport. The five WTC 1 panels from the impact area comprised 13 columns. NIST does not state which panels or columns are meant with the “other special cases” (see screenshot above). The damage of three perimeter columns from outside the impact area is described in NIST because they were analyzed for their possible exposure to high temperatures. These three columns are considered here also as described “in depth” (though NIST only describes such characteristics that are possibly related to high temperature exposure).

outside of the “focus” of NIST’s analysis.

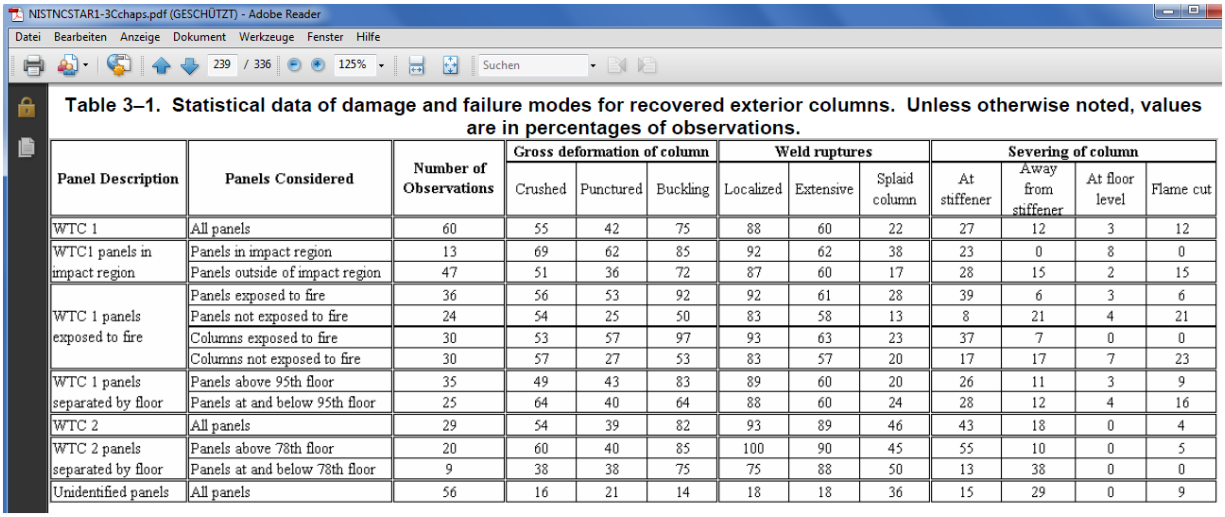
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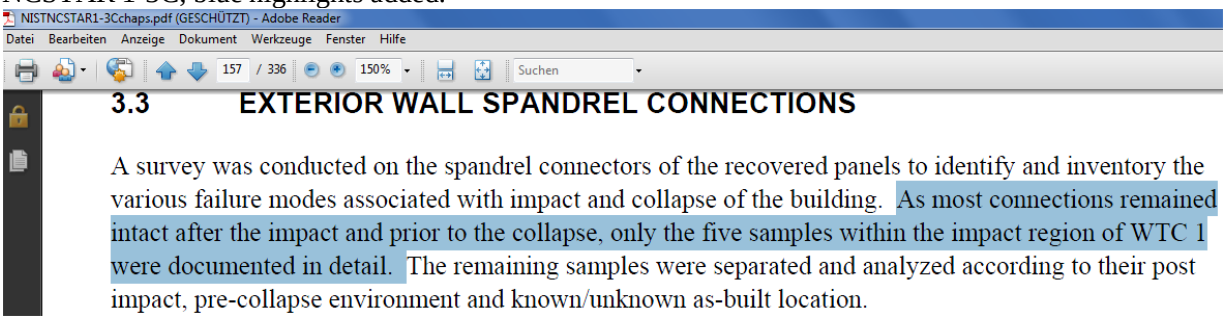
Table 3–1. Statistical data of damage and failure modes for recovered exterior columns. Unless otherwise noted, values are in percentages of observations.

Panel Description	Panels Considered	Number of Observations	Gross deformation of column			Weld ruptures			Severing of column			
			Crushed	Punctured	Buckling	Localized	Extensive	Splaid column	At stiffener	Away from stiffener	At floor level	Flame cut
WTC 1	All panels	60	55	42	75	88	60	22	27	12	3	12
WTC1 panels in impact region	Panels in impact region	13	69	62	85	92	62	38	23	0	8	0
	Panels outside of impact region	47	51	36	72	87	60	17	28	15	2	15
WTC 1 panels exposed to fire	Panels exposed to fire	36	56	53	92	92	61	28	39	6	3	6
	Panels not exposed to fire	24	54	25	50	83	58	13	8	21	4	21
	Columns exposed to fire	30	53	57	97	93	63	23	37	7	0	0
	Columns not exposed to fire	30	57	27	53	83	57	20	17	17	7	23
WTC 1 panels separated by floor	Panels above 95th floor	35	49	43	83	89	60	20	26	11	3	9
	Panels at and below 95th floor	25	64	40	64	88	60	24	28	12	4	16
WTC 2	All panels	29	54	39	82	93	89	46	43	18	0	4
WTC 2 panels separated by floor	Panels above 78th floor	20	60	40	85	100	90	45	55	10	0	5
	Panels at and below 78th floor	9	38	38	75	75	88	50	13	38	0	0
Unidentified panels	All panels	56	16	21	14	18	18	36	15	29	0	9

Likewise, the damage and failure modes of the spandrel connections and end plate connections are summarized for panels from outside the impact area and for unidentified panels in only a few sentences and in tables with statistical data.[10]

[10] While NIST examined the column splices and spandrel connections of all “catalogued” perimeter panels, NIST reports in detail only for the five panels with as-built locations in the impact areas. See screenshots from NIST NCSTAR 1-3C, blue highlights added.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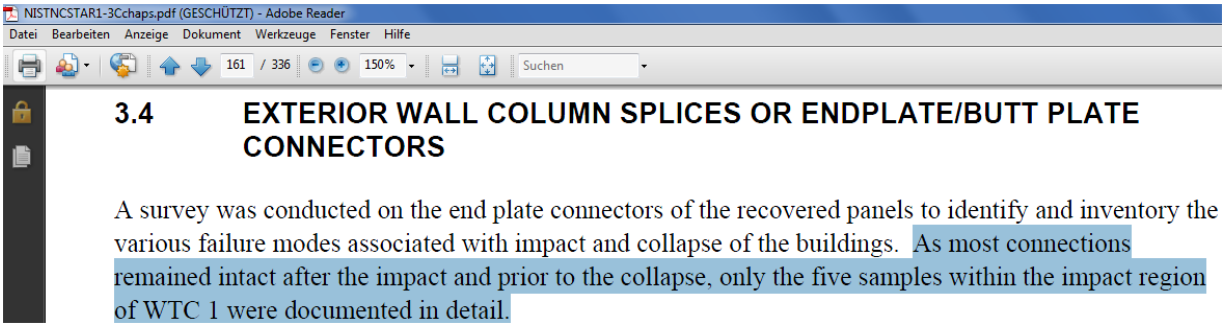
3.3 EXTERIOR WALL SPANDREL CONNECTIONS

A survey was conducted on the spandrel connectors of the recovered panels to identify and inventory the various failure modes associated with impact and collapse of the building. As most connections remained intact after the impact and prior to the collapse, only the five samples within the impact region of WTC 1 were documented in detail. The remaining samples were separated and analyzed according to their post impact, pre-collapse environment and known/unknown as-built location.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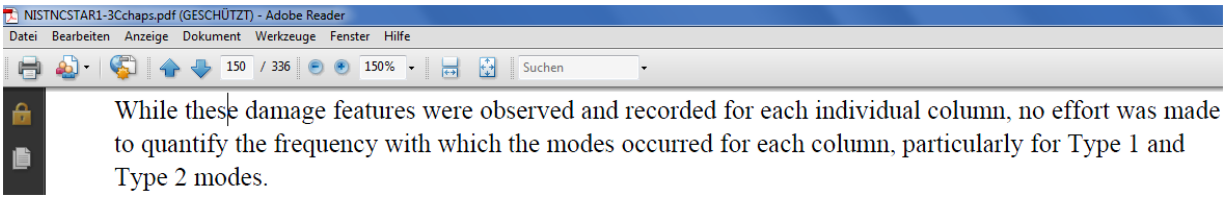
3.4 EXTERIOR WALL COLUMN SPLICES OR ENDPLATE/BUTT PLATE CONNECTORS

A survey was conducted on the end plate connectors of the recovered panels to identify and inventory the various failure modes associated with impact and collapse of the buildings. As most connections remained intact after the impact and prior to the collapse, only the five samples within the impact region of WTC 1 were documented in detail.

NIST excluded over 90% of the catalogued columns that are not perimeter columns from any examination for their damage and failure modes. This is different in the case of the perimeter columns. Due to the collection of the data necessary to provide the table with the "statistical data," all perimeter columns were examined to some degree for their damage characteristics. But the provided "statistical data" are not an adequate analysis of the damage and failure modes of the single pieces. The following quote by NIST (screenshot from NIST NCSTAR 1-3C)[11] underlines that no adequate damage and failure analysis was conducted for about 90%[12] of the perimeter columns.



The superficiality of the data provided by NIST is illustrated by NIST's use of the term "crushed," which is used in the provided table to describe a damage characteristic of perimeter columns, for very different damage patterns. To explain the use of this term NIST provides two photographs,[13]

[11] "Type 1" refers to "gross physical distortion of flange/web material" (crushed sections, punctured flanges and/or webs, buckling of flanges and/or webs). "Type 2" refers to "fracture near fillet welds" (localized or extensive fracture associated with welded joints; or columns that were "splayed open").
[12] See above, footnote # 9. The 9 catalogued columns stored in hangar 17 at JFK airport, which are not included in NIST's table 3-1, raises the overall number of not adequately examined perimeter panels to about 137.
[13] The two photographs with caption (screenshots from NIST NCSTAR 1-3C):

but the “crushed column” from panel K-1 (see photograph below, paragraph “Perimeter Panel K-1”), the failure mode of which is described as “crushed” by NIST too, has a completely different quality of “crushed.”[14]

Any serious investigation into the reasons why the Twin Towers were completely destroyed would attempt to find out why the strong steel frames below the impact and fire areas lost their strength and gave way. But NIST deliberately decided not to do this. NIST excluded – quite systematically and based on the explicit argument that only the few columns with a known as-built location in the impact and fire areas were of interest for the investigation – the columns from the parts that failed and gave way so unexpectedly, i.e., the columns with as-built locations below the impact and fire areas, from

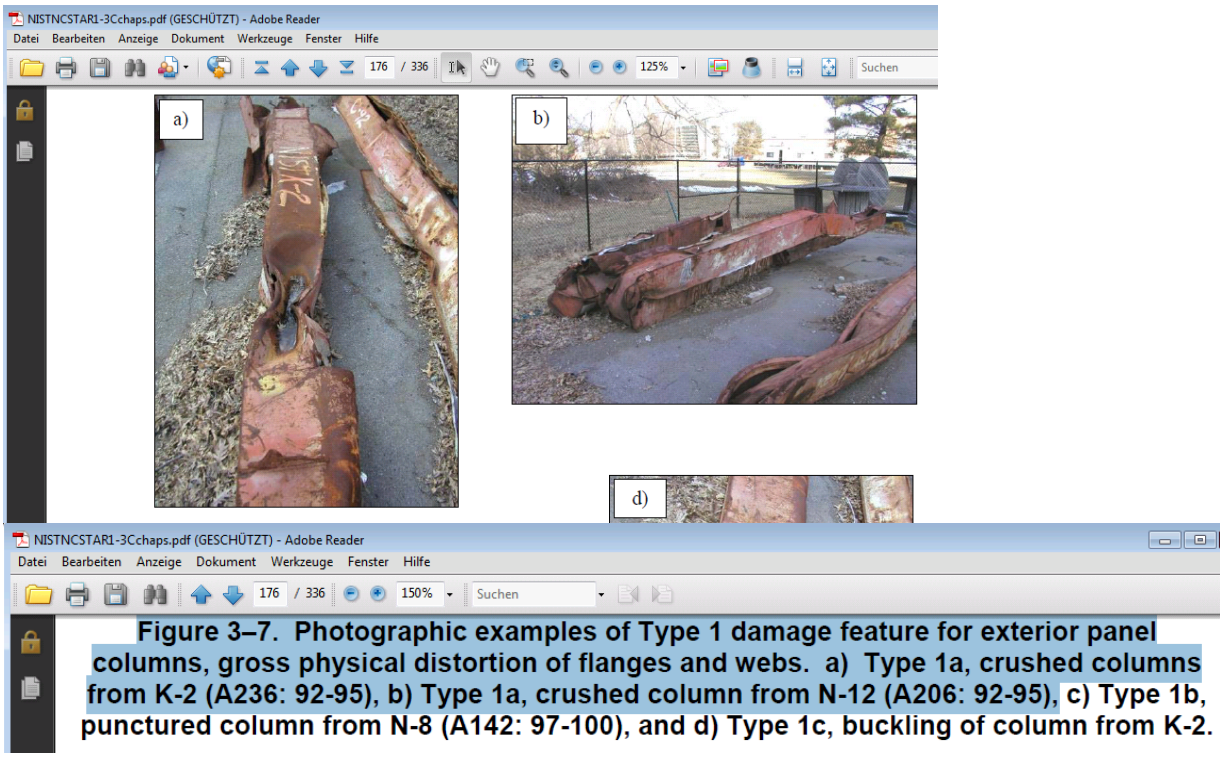


Figure 3–7. Photographic examples of Type 1 damage feature for exterior panel columns, gross physical distortion of flanges and webs. a) Type 1a, crushed columns from K-2 (A236: 92-95), b) Type 1a, crushed column from N-12 (A206: 92-95), c) Type 1b, punctured column from N-8 (A142: 97-100), and d) Type 1c, buckling of column from K-2.

[14] See NIST NCSTAR 1-3C, page 219 (PDF-page 269) for NIST’s description of K-1

being adequately examined for their damage and failure modes.[15] Scientists and engineers in relevant fields should know that those parts of the structure that gave way need to be included in the investigation of a building failure.

There are many indications that NIST's scientists and engineers have been actually well aware that the failure of the load bearing structures of the Twin Towers cannot be investigated by focusing exclusively on the collection of data concerning the impact and fire areas. For example, NIST developed a "structural database" that included the data for the structural members from bottom to top (and not just for the structural members in the impact and fire areas). They developed "global structural models" for both Towers that stretched over their full heights (based on the named structural database, blueprints and other documents). And they analyzed the performance of the undamaged structures (using its global structural models) for three loading cases, and checked the demand/capacity ratio for the structural components.[16] NIST examined (as part of the same "Project 3: "Mechanical and Metallurgical Analysis of Structural Steel," which systematically excluded steel from outside the impact and fire areas from being adequately examined) samples of all steel qualities used throughout the buildings to check if they complied with the demanded quality standards.[17]

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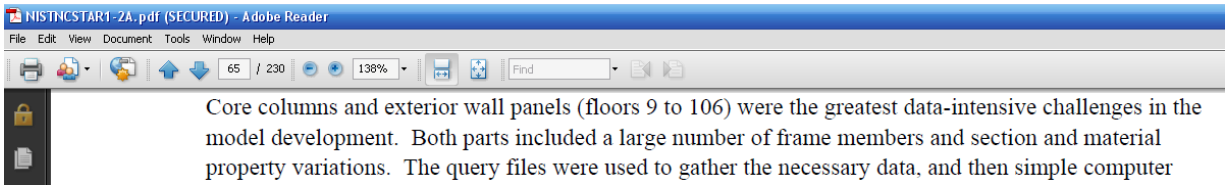
[15] One exception is perimeter column K-16, which is examined by NIST in detail despite its as-built location below the impact and fire area. The column was already discussed (as "sample 2") in Appendix C of the FEMA/BPAT study, that called for further examination of its two samples. See J. Barnett, R. R. Biederman, R.D. Sisson, Jr.: "Limited Metallurgical Examination" in FEMA/BPAT, "World Trade Center Building Performance Study," 2002, Appendix C, http://wtc.nist.gov/media/AppendixC-fema403_apc.pdf, C.6, page 13.

[16] See NIST NCSTAR 1-2 and NIST NCSTAR 1-2A. As one example, see the following quote/screenshot from NIST NCSTAR 1-2A:



[17] NIST NCSTAR 1-3 and NIST NCSTAR 1-3E As one example, see the following table/screenshot from NIST NCSTAR 1-3E. The last numbers given in the table-column "Column ID" specify the as-built locations (stories) of the columns, from

NIST cannot justify the exclusion of the steel from being adequately examined for damage and failure modes by its published result of the investigation, i.e., the "how the point of collapse initiation was reached" models and the few lines with suggestions why "global collapse ensued." The named models and suggestions were presented by NIST as results of the investigation, so they should not have influenced decisions at the beginning of the investigation. Examining the evidence and collecting data based on the evidence was a task that NIST needed to perform before any hypotheses were formulated. But NIST excluded identified core columns and perimeter columns that where built-in outside the impact and fire areas, and columns with an unknown as-built location, from being adequately examined for their damage and failure modes at the very beginning of the investigation. Thus, by a process of circular reasoning NIST avoided an adequate analysis of the physical evidence of the steel for data that might have answered the question why the strong steel frames below the impact and fire areas gave way as completely and quickly as they did; by proceeding on the basis of a preconceived premise, NIST compromised the validity of the investigation.

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which the examined steel samples were taken. The three columns in the first lines of the table were, for example, once located in stories 15-18, 33-36, and 12-15, i.e. far below the impact and fire areas.

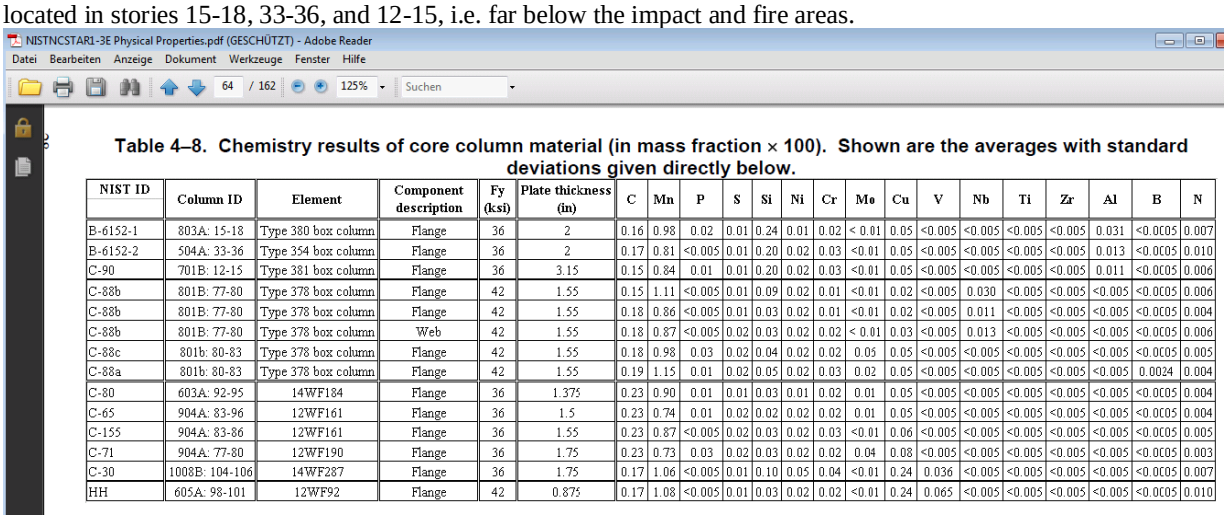


Table 4–8. Chemistry results of core column material (in mass fraction × 100). Shown are the averages with standard deviations given directly below.

NIST ID	Column ID	Element	Component description	Fy (ksi)	Plate thickness (in)	C	Mn	P	S	Si	Ni	Cr	Mo	Cu	V	Nb	Ti	Zr	Al	B	N
B-6152-1	803A: 15-18	Type 380 box column	Flange	36	2	0.16	0.98	0.02	0.01	0.24	0.01	0.02	< 0.01	0.05	<0.005	<0.005	<0.005	<0.005	0.031	<0.0005	0.007
B-6152-2	504A: 33-36	Type 354 box column	Flange	36	2	0.17	0.81	<0.005	0.01	0.20	0.02	0.03	<0.01	0.05	<0.005	<0.005	<0.005	<0.005	0.013	<0.0005	0.010
C-90	701B: 12-15	Type 381 box column	Flange	36	3.15	0.15	0.84	0.01	0.01	0.20	0.02	0.03	<0.01	0.05	<0.005	<0.005	<0.005	<0.005	0.011	<0.0005	0.006
C-88b	801B: 77-80	Type 378 box column	Flange	42	1.55	0.15	1.11	<0.005	0.01	0.09	0.02	0.01	<0.01	0.02	<0.005	0.030	<0.005	<0.005	<0.005	<0.0005	0.006
C-88b	801B: 77-80	Type 378 box column	Flange	42	1.55	0.18	0.86	<0.005	0.01	0.03	0.02	0.01	<0.01	0.02	<0.005	0.011	<0.005	<0.005	<0.005	<0.0005	0.004
C-88b	801B: 77-80	Type 378 box column	Web	42	1.55	0.18	0.87	<0.005	0.02	0.03	0.02	0.02	< 0.01	0.03	<0.005	0.013	<0.005	<0.005	<0.005	<0.0005	0.006
C-88c	801b: 80-83	Type 378 box column	Flange	42	1.55	0.18	0.98	0.03	0.02	0.04	0.02	0.02	0.05	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	0.005
C-88a	801b: 80-83	Type 378 box column	Flange	42	1.55	0.19	1.15	0.01	0.02	0.05	0.02	0.03	0.02	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	0.0024	0.004
C-80	603A: 92-95	14WF184	Flange	36	1.375	0.23	0.90	0.01	0.01	0.03	0.01	0.02	0.01	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	0.004
C-65	904A: 83-96	12WF161	Flange	36	1.5	0.23	0.74	0.01	0.02	0.02	0.02	0.02	0.01	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	0.004
C-155	904A: 83-86	12WF161	Flange	36	1.55	0.23	0.87	<0.005	0.02	0.03	0.02	0.03	<0.01	0.06	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	0.005
C-71	904A: 77-80	12WF190	Flange	36	1.75	0.23	0.73	0.03	0.02	0.03	0.02	0.02	0.04	0.08	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	0.003
C-30	1008B: 104-106	14WF287	Flange	36	1.75	0.17	1.06	<0.005	0.01	0.10	0.05	0.04	<0.01	0.24	0.036	<0.005	<0.005	<0.005	<0.005	<0.0005	0.007
HH	605A: 98-101	12WF92	Flange	42	0.875	0.17	1.08	<0.005	0.01	0.03	0.02	0.02	<0.01	0.24	0.065	<0.005	<0.005	<0.005	<0.005	<0.0005	0.010

In addition, the exclusion from adequate examination of columns with unknown as-built locations, and of columns from above the impact and fire areas cannot be justified. Any column could hold conclusive evidence; one cannot determine that a piece does not yield any useful clues before it has been adequately examined.[18]

Several statements by NIST, for example, "… only the first group of samples were analyzed" (paragraph "4.1.3 Other Identified Core Columns", see above), "… no further analysis was conducted" (paragraph "4.1.4 Unidentified Core Columns", see above), or "While these damage features were observed and recorded for each individual [perimeter] column, no effort was made to quantify the frequency with which the modes occurred for each column, particularly for Type 1 and Type 2 modes." (paragraph "3.2.1 Types of Failure Modes", see above) show that the exclusion of steel from being adequately examined is not just a reporting problem in the published final report but a problem of NIST's study design. The named steel was indeed not adequately examined, but excluded from the very beginning.

NIST's published report even contains a systematic examination of the damage and failure modes of a certain group of parts, but in line with its premise NIST chose floor truss connectors to demonstrate its ability to conduct a systematic analysis of damage and failure modes, i.e., NIST examined in a much more adequate manner a group of parts that were attached to the main load bearing structural components, but failed to examine the main load bearing components themselves in an adequate manner. The damage and failure modes of any floor truss connector from identified panels are documented with photographs; even for parts from stories below the impact and fire areas. But most of the columns are featured in NIST's report

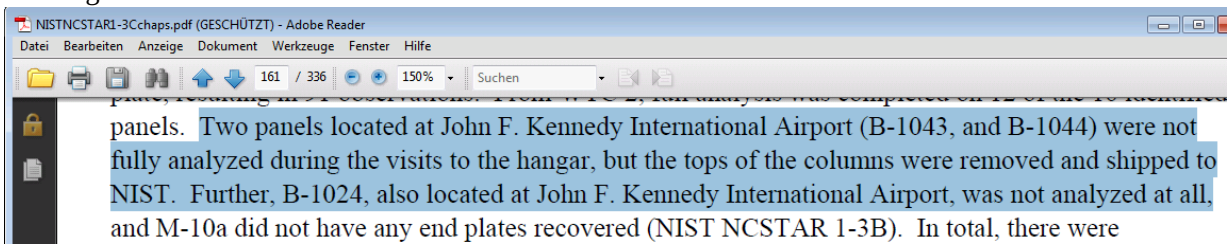
[18] For example, if a box-column would show evidence that incendiaries or explosives severed the bolts that connected it with the column below, it would not matter if the as-built location of this column is unknown; it would constitute nevertheless relevant evidence.

as single pieces only in tables that list their as-built location, size, and sometimes also the steel quality used.

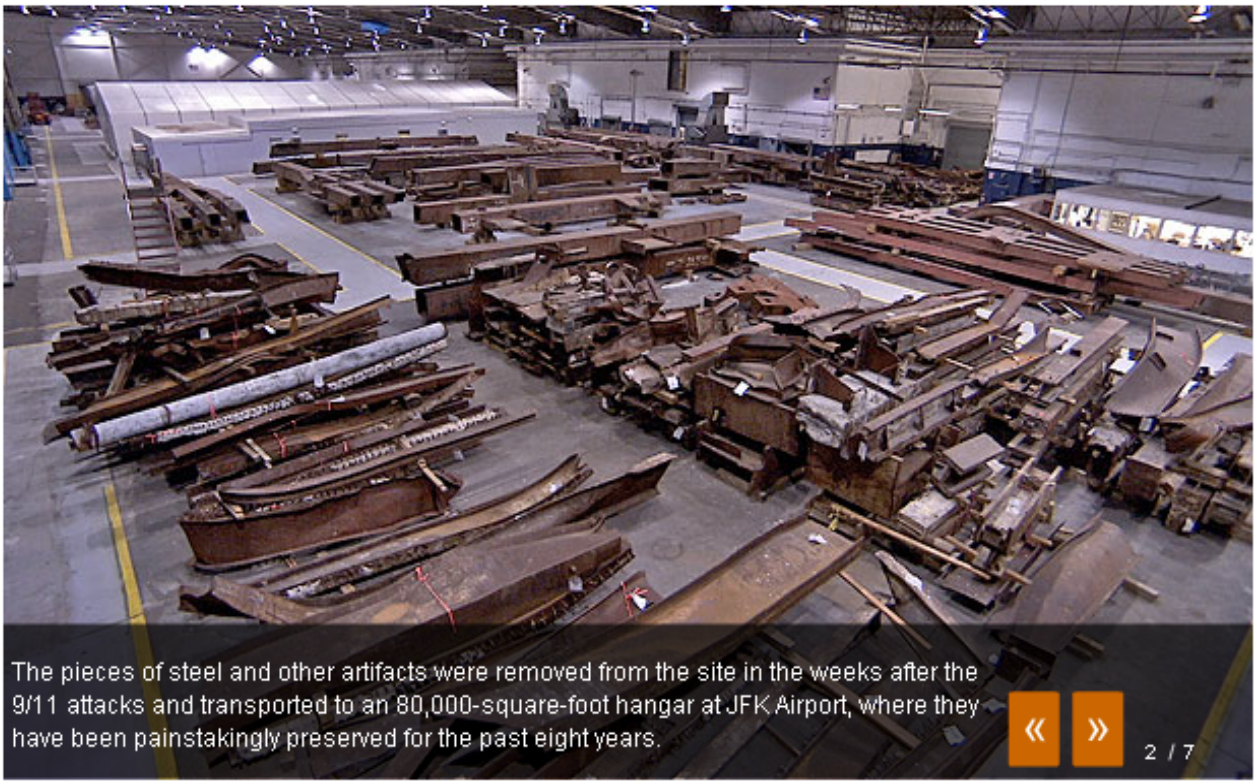
Indeed, NIST excluded not only most of its "catalogued" core columns and perimeter panels from being adequately examined, it excluded the majority of the recovered WTC steel pieces even from being "catalogued" for the investigation. Of the large number of structural steel members collected by the Port Authority of New York and New Jersey (PANYNJ), located in hangar 17 at JFK airport, only 6 whole pieces, and portions of a further 6 pieces were shipped to NIST's location in Gaithersburg and "catalogued" for NIST's WTC investigation. NIST does not attempt to justify the exclusion of so many pieces of saved WTC steel from its investigation with any arguments, circular or not, but reports only that "NIST personnel visited the hangar and identified 12 additional pieces that were considered important to its Investigation. Six of these samples were moved whole to the Gaithersburg campus. The remaining pieces had portions removed and sent to NIST …"[19] The reader is left to conclude that NIST's personnel considered most of the steel stored in hangar 17 as not being important for the investigation.[20] No

[19] Quoted from NIST NCSTAR 1-3B, page 4 (PDF-page 32). The term "additional" refers to the steel pieces already catalogued by NIST. The term "[t]he remaining pieces" refers to the remaining six pieces, see NIST NCSTAR 1-3, page 28 (PDF-page 76).

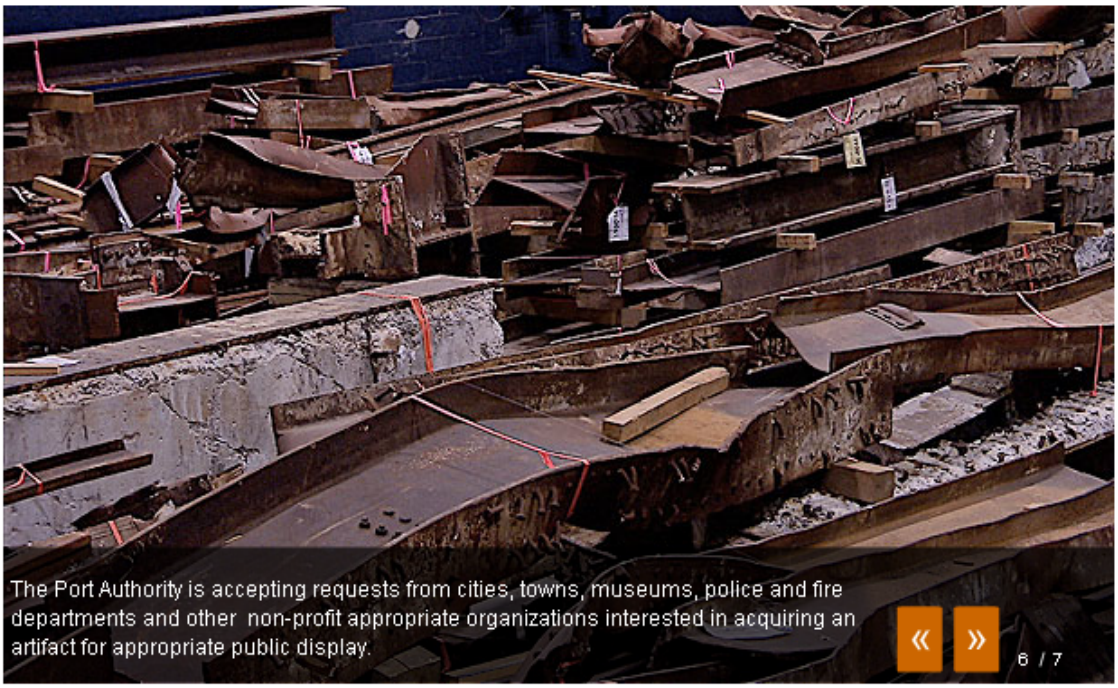
[20] The visit to hangar 17 cannot have involved an adequate examination. There is no mention in the NIST report of any such examination, nor of any results. In addition, NIST states repeatedly in NIST NCSTAR 1-3, in respect to three perimeter panels that had portions removed, that they were not fully analyzed, and, in another paragraph, that two were not fully analyzed, and one not at all. See one quote/screenshot from NIST NCSTAR 1-3C, blue highlights added. Note that these "not fully" and "not at all" analyzed panels were panels that NIST at least "catalogued."



evidentiary justification is given why NIST's personnel "considered" the bulk of the steel as not important. The photographs below show recovered WTC steel, held in hangar 17 at JFK airport. All the steel pieces on these photographs, except the 6 pieces from which NIST had portions removed, were not "catalogued" by NIST[21] and were thus de facto excluded from NIST's WTC investigation.



[21] See the table "A.1 DATABASE OF RECOVERED STEEL" in "APPENDIX A: DATA on RECOVERED WTC STEEL"; NIST NCSTART 1-3B, page 59ff (PDF-page 87). From this table it is clear that NIST lists as "recovered" only pieces stored at NIST's locations and in addition the few pieces from hangar 17, JFK airport, which were not shipped in their entirety to NIST, but only portions of them.



Photographs from http://www.panynj.gov/wtcprogress/wtc-9-11-steel.html

The recovered WTC steel constitutes physical evidence. It was NIST's duty to do what they claim to have done, namely to perform an "[e]xtensive failure analysis of the recovered steel,"[22] but NIST did not do so. NIST's decision to exclude most of the steel from being adequately examined, based on circular arguments in the case of the "catalogued" columns and perimeter panels, and without any evidentiary justification in the case of the PANYNJ steel, is one of the reasons that NIST's report does not comply on even a very basic level with what is widely accepted as good practice in science.

(II) NIST's exclusion of a common examination method

When steel deforms at high temperatures it can have distinctive deformations and/or characteristics that are easy to note with the naked eye. The method of unaided visual examination uses such deformations and

[22] NIST NCSTAR 1-3, pages xxxviii and 2 (PDF-pages 40 and 50)

characteristics to detect steel that was, or that might have been subjected to high temperatures. The named method is not only useful; it is also established common practice. See, for example, that the "NFPA 921 Guide for Fire and Explosions Investigations"[23] refers to the "deformation" of a material, defined as a "change in its shape,"[24] and to "the bending and buckling of steel beams and columns"[25] when "changes that have occurred in materials due to fire" are discussed.[26] The method of unaided visual examination was also used by one of NIST's contractors, Wiss, Janney, Elstner Associates, Inc. (WJE), which

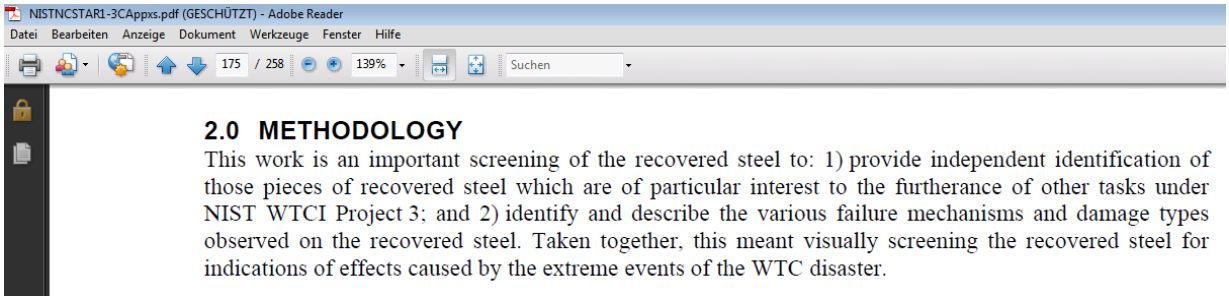
[23] Published by the National Fire Protection Association (http://www.nfpa.org). The 2008 edition of the NFPA 921 Guide is cited here and in the following quotes. NIST participates in the Technical Committee that is responsible for the statements in the NFPA 921.

[24] NFPA 921: ***6.2.2 Temperature Estimation Using Fire Effects.*** *If the investigator knows the approximate temperature required to produce an effect, such as melting, the color change, or deformation a material [sic], an estimate can be made of the temperature to which the material was raised. This knowledge may assist in evaluating the intensity and duration of the heating, the extent of heat flow, or the relative rates of heat release from fuels.*
(The same statement can be found in the 2011 edition, which is the current approved national standard.)
6.2.9 Thermal Expansion and deformation of Materials.
Many materials change shape temporarily or permanently during fires. Nearly all materials expand when heated. […] Deformation is the change in shape characteristics of an object separate from the other changing characteristics defined elsewhere in this chapter. Deformation can result from a variety of causes ranging from thermal effects to chemical and mechanical effects. […]
(The same statement can be found in the 2011 edition, which is the current approved national standard.)

[25] NFPA 921: ***6.2.9.1*** *Bending and buckling (deformation) of steel beams and columns occurs when the steel temperature exceeds approximately 538 ºC (1000 ºF). At elevated temperatures, steel exhibits a progressive loss of strength. When there is a greater fire exposure, the load required to cause deformation is reduced. Deformation is not the result of melting. A deformed element is not one that has melted during the fire, and therefore the occurrence of such deformation does not indicate that the material was heated above its melting temperature. On the contrary, a deformed as opposed to melted item indicates that the material's temperature did not exceed its melting point. Thermal expansion can also be a factor in the bending of the beam, if the ends of the beam are restraint.*
(The same statement can be found in the 2011 edition, which is the current approved national standard.)

[26] NFPA 921: ***6.2 Fire Effects. 6.2.1*** *To identify fire patterns, the investigator must recognize the changes that have occurred in materials due to fire. These changes are referred to as fire effects, which are the observable or measurable changes in or on a material as the result of a fire.*

was tasked[27] to examine WTC steel; see quotes/screenshots from NIST NCSTAR 1-3C where the WJE report is published as Appendix F: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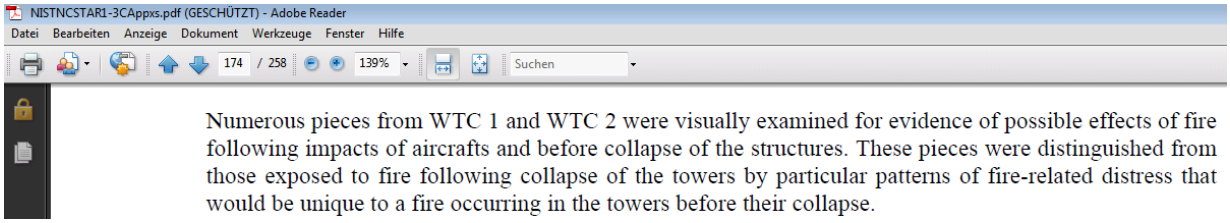
2.0 METHODOLOGY

This work is an important screening of the recovered steel to: 1) provide independent identification of those pieces of recovered steel which are of particular interest to the furtherance of other tasks under NIST WTCI Project 3; and 2) identify and describe the various failure mechanisms and damage types observed on the recovered steel. Taken together, this meant visually screening the recovered steel for indications of effects caused by the extreme events of the WTC disaster.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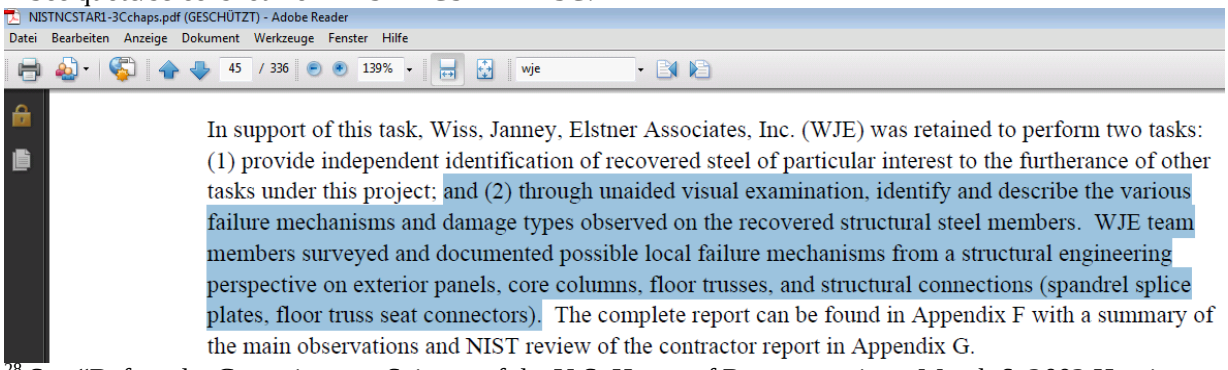
Numerous pieces from WTC 1 and WTC 2 were visually examined for evidence of possible effects of fire following impacts of aircrafts and before collapse of the structures. These pieces were distinguished from those exposed to fire following collapse of the towers by particular patterns of fire-related distress that would be unique to a fire occurring in the towers before their collapse.

The statements made by WJE's engineers in their report make it clear that they had no doubt that unaided visual examination is the first thing one does when searching for clues as to whether high temperatures affected the WTC steel. The method was also used by A. Astaneh-Asl, professor at the Department of Civil and Environmental Engineering at the University of California, Berkley, who started to search through WTC steel in September 2001, supported by a grant from the National Science Foundation.[28] The

[27] See quote/screenshot from NIST NCSTAR 1-3C: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In support of this task, Wiss, Janney, Elstner Associates, Inc. (WJE) was retained to perform two tasks: (1) provide independent identification of recovered steel of particular interest to the furtherance of other tasks under this project; and (2) through unaided visual examination, identify and describe the various failure mechanisms and damage types observed on the recovered structural steel members. WJE team members surveyed and documented possible local failure mechanisms from a structural engineering perspective on exterior panels, core columns, floor trusses, and structural connections (spandrel splice plates, floor truss seat connectors). The complete report can be found in Appendix F with a summary of the main observations and NIST review of the contractor report in Appendix G.

[28] See "Before the Committee on Science of the U.S. House of Representatives. March 6, 2002 Hearing on 'Learning from 9/11: Understanding the Collapse of the World Trade Center,'" http://911research.wtc7.net/mirrors/guardian2/wtc/astaneh-wtc.htm

statements by Astaneh-Asl, as reported in mass media articles, refer clearly to the method of unaided visual examination, used to detect WTC steel pieces that were affected by high temperatures:[29]

[…]But to Astaneh, the contrast is clear. One clue is fire damage. Only those members that were subjected to very high temperatures - hot enough to burn away fireproofing and scorch metal – could soften to the buckling point.

But the main clue, he says, is shape. "If you drop something from that 1,000-feet elevation, the bend will be random. But if a structure buckles, the buckle shape is exactly like a wave shape. That shape is a mathematical equation. It's a nice curve," he says.

"It must have happened somewhere up in the building. It can't have happened when it dropped. This must have buckled up there. When it buckles up there, it's important," he says. About half of the steel members are stamped with an identification number, so Astaneh can pinpoint exactly where in the towers they originated. […]

He also came across severely scorched members from 40 or so floors below the points of impact. He believes that the planes obliterated the elevator walls, allowing burning fuel to pour down into the building, igniting blazes hundreds of feet below the main fire. "When the plane hit," he says, "the walls around the elevator shaft were gone, just thrown away." These lower-floor fires may have contributed to the collapse, and certainly added to the death toll.

Further:[30] *To support his theory,[31] he [Prof. Astaneh-Asl] cites the way the steel has been bent at several connection points that once joined the floors to the vertical columns. If the internal supporting columns had collapsed upon impact, he says, the connection points would show cracks, because the damage would have been done while the steel was cold. Instead, he describes the connections as being smoothly warped: "If you remember the Salvador Dalí paintings with the clocks that are kind of melted -*

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[29] D. Kohn: "Culling Through Mangled Steel. Engineer Becomes World Trade Center Detective," CBS News, March 12, 2002, http://www.cbsnews.com/stories/2002/03/07/terror/main503218.shtml
In line with the media reports at this time, Astaneh-Asl attributes the very high temperatures to which some steel pieces were exposed to the effects of jet-fuel fires. But jet-fuel fires can reach maximum temperatures of about 1200ºC only (this temperature can only be reached when a larger pool of jet-fuel burns in a well-ventilated area). According to NIST's FAQ's (http://wtc.nist.gov/pubs/factsheets/faqs_8_2006.htm) "maximum upper layer air temperatures of about 1,100 ºCelsius (2,000 degrees Fahrenheit)" were reached in the jet-fuel and office fires. (Note that these are the temperatures in the air, not in the steel.)

[30] J.R. Young: "Scholars Work to Rebuild the World Trade Center Virtually.
Computer models could help minimize destruction from earthquakes or terrorist attacks," in "THE CHRONICLE OF HIGHER EDUCATION, December 7, 2001 issue, http://chronicle.com/free/v48/i15/15a02701.htm

[31] The term "his theory" refers to: "*He says the buildings might have survived the plane crashes if the ensuing jet-fuel fires had not weakened the upper floors and started a 'pancaking collapse.'*"

- it's kind of like that. That could only happen if you get steel yellow hot or white hot -- perhaps around 2,000 degrees.

Further:[32] *One piece Dr. Astaneh-Asl saw was a charred horizontal I-beam from 7 World Trade Center, a 47-story skyscraper that collapsed from fire eight hours after the attacks. The beam, so named because its cross-section looks like a capital I, had clearly endured searing temperatures. Parts of the flat top of the I, once five-eighths of an inch thick, had vaporized. Less clear was whether the beam had been charred after the collapse, as it lay in the pile of burning rubble, or whether it had been engulfed in the fire that led to the building's collapse, which would provide a more telling clue. The answer lay in the beam's twisted shape. As weight pushed down, the center portion had buckled outward. "This tells me it buckled while it was attached to the column," not as it fell, [sic!] Dr. Astaneh-Asl said, adding, "It had burned first, then buckled."[…] By comparing the beam's specifications with architectural drawings, Dr. Astaneh-Asl said he would be able to tell roughly where the beam came from. "I want to know which ones buckled and which ones did not," he said. "That will lead you to the sequence of events. I can tell you exactly what happened there." […] Dr. Astaneh-Asl said that in some places, the fireproofing melted into a glassy residue.*

WTC steel must have displayed distortions and characteristics typical for exposure to high temperature that were so easy to note by the common method of unaided visual examination that it made sense for Astaneh-Asl to *"enlist[…] the help of workers at the recycling center, training them to spot metal beams that might yield clues. Among the features he asks workers to look for are intense "fire burn" and any unusual bending patterns in the metal. Workers take digital photos of the steel that they process, he says, and save pieces that look unusual."*[33]

Nevertheless, NIST's scientists and engineers excluded the method of unaided visual examination, which includes the screening of the steel for such easy-to-note distinctive deformations and characteristics, when they examined

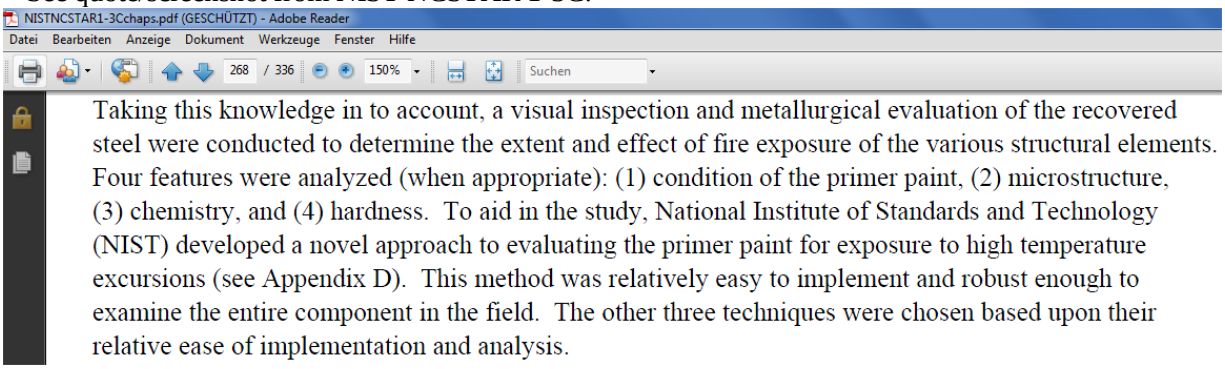
[32] K. Chang: "Scarred Steel Holds Clues, And Remedies," in New York Times, October 2, 2001, http://www.nytimes.com/2001/10/02/science/scarred-steel-holds-clues-and-remedies.html

[33] Quoted from J.R. Young: "Scholars Work to Rebuild the World Trade Center Virtually …," see above. Easily noted deformations on WTC steel typical for exposure to high temperatures were also described in a History Channel documentary ("Relics from the Rubble", see below), and on the website of PBS, featuring their program "America Rebuilds." (http://www.pbs.org/americarebuilds/artifacts/artifacts_09.html, http://www.pbs.org/americarebuilds/artifacts/artifacts_10.html. Note the photographs and the narratives below the photographs.) See also the following statement: *"The big beams that have obvious fire damage, we're putting aside for now,"* by *"Robert Kelman, senior vice president and general manager of Hugo Neu Schnitzer East of Jersey City, one of the two companies that are recycling the steel."* Quoted from K. Chang: "Scarred Steel Holds Clues …;" see above.

WTC core columns and perimeter panels for exposure to high temperatures.[34] NIST used instead a microscope-aided visual examination of the condition of the primary paint of the steel when they systematically screened WTC perimeter panels and core columns as to whether they were possible affected by high temperatures.[35] The microscope aided, paint-based method (the primary paint is examined if it shows a certain kind of crack pattern) is new; it was specifically developed by NIST for the WTC investigation.[36] It might be of some advantage to use a microscope-aided visual examination of the

[34] NIST excluded the common method of unaided visual examination when screening core columns and perimeter panels as to whether they were subjected to high temperatures. NIST used unaided visual examination with respect to other questions, for example, to check if columns were affected by the airplane impacts, if welds were fractured, etc. When in the following NIST's exclusion of the common method is discussed, terms like "the common method" refer always to the exclusion of this method in respect to the question as to whether steel was exposed to high temperatures.

[35] See quote/screenshot from NIST NCSTAR 1-3C.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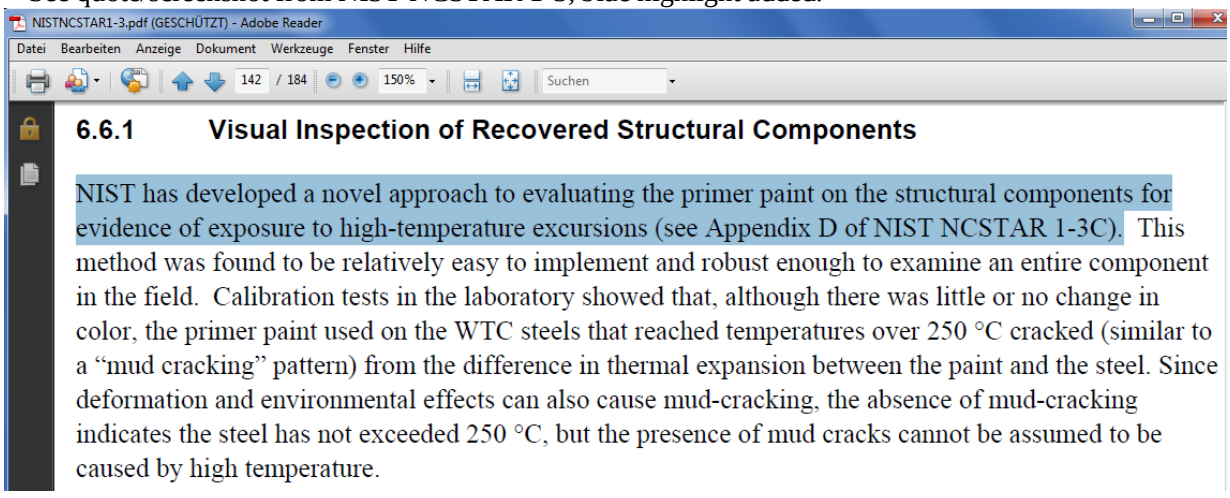
Taking this knowledge in to account, a visual inspection and metallurgical evaluation of the recovered steel were conducted to determine the extent and effect of fire exposure of the various structural elements. Four features were analyzed (when appropriate): (1) condition of the primer paint, (2) microstructure, (3) chemistry, and (4) hardness. To aid in the study, National Institute of Standards and Technology (NIST) developed a novel approach to evaluating the primer paint for exposure to high temperature excursions (see Appendix D). This method was relatively easy to implement and robust enough to examine the entire component in the field. The other three techniques were chosen based upon their relative ease of implementation and analysis.

Microstructure, chemistry and hardness were only examined in a few pieces where the paint based screening process suggested a possible exposure to temperatures above 250 ºC, and in sample (2) of FEMA Appendix C.

[36] See quote/screenshot from NIST NCSTAR 1-3, blue highlight added.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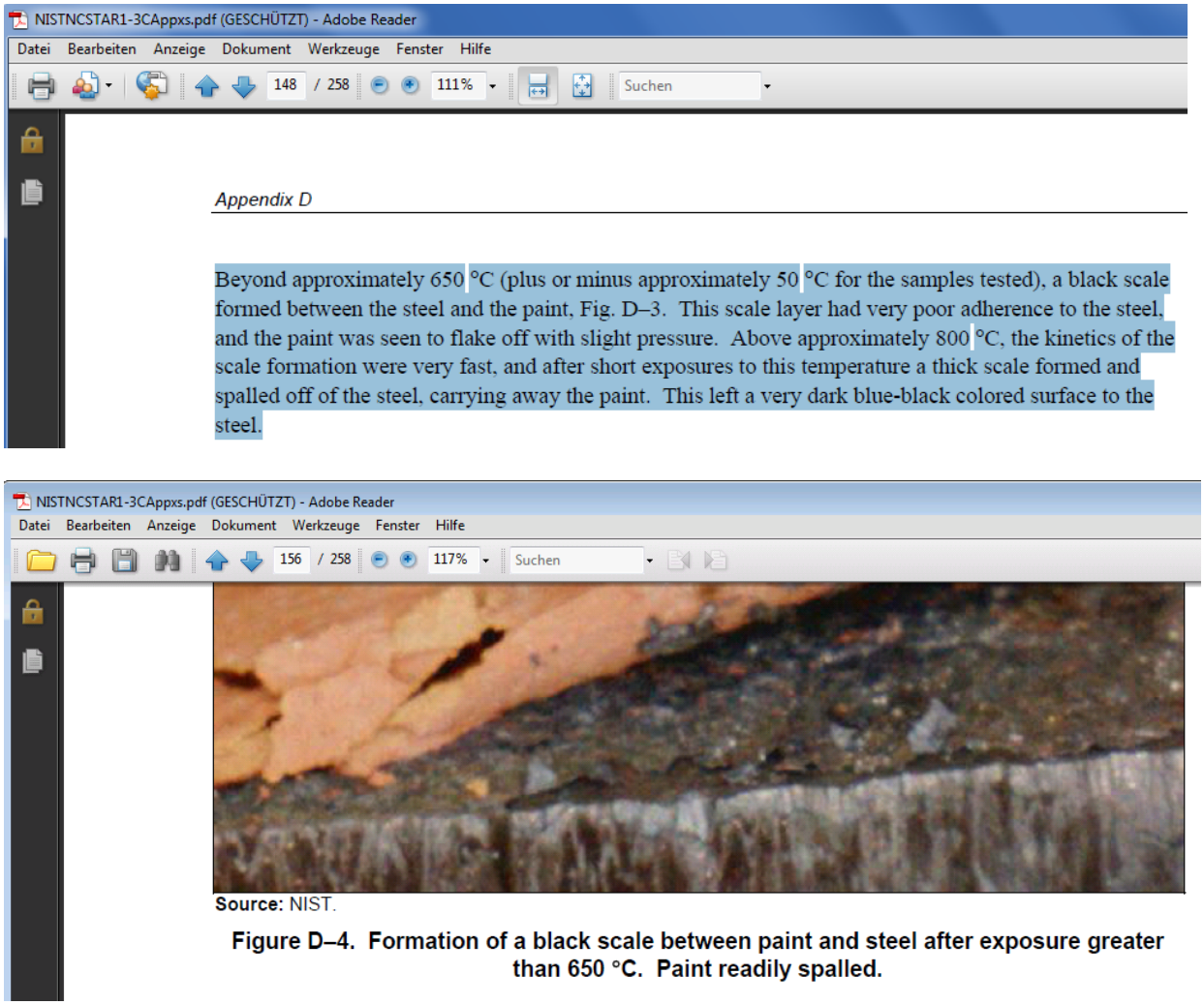
6.6.1 Visual Inspection of Recovered Structural Components

NIST has developed a novel approach to evaluating the primer paint on the structural components for evidence of exposure to high-temperature excursions (see Appendix D of NIST NCSTAR 1-3C). This method was found to be relatively easy to implement and robust enough to examine an entire component in the field. Calibration tests in the laboratory showed that, although there was little or no change in color, the primer paint used on the WTC steels that reached temperatures over 250 °C cracked (similar to a "mud cracking" pattern) from the difference in thermal expansion between the paint and the steel. Since deformation and environmental effects can also cause mud-cracking, the absence of mud-cracking indicates the steel has not exceeded 250 °C, but the presence of mud cracks cannot be assumed to be caused by high temperature.

protective paint on the steel in addition to the common unaided visual examination (where not just the paint *on* the steel but also the *actual* steel is examined) when examining WTC core columns and perimeter panels systematically for high temperature excursions. But this is not what NIST did. Instead NIST substituted for the common method of unaided visual examination of the steel the microscope-aided examination of the paint as the systematically used tool when screening the "catalogued" columns as to whether they were subjected to high temperatures. The paint-cracking method is the only method that is used by NIST to screen the named "catalogued" pieces as to whether they were subjected to high temperatures.

NIST's paint cracking method has two relevant limitations: First, NIST's method is, per design, most likely useless on all those areas of a steel member that experienced temperatures above approximately 650ºC, and almost certainly useless on all those areas of a steel member that experienced temperatures above approximately 800ºC. As NIST reports, a scale forms from 650ºC upwards between steel and paint,[37] and both are likely to fall off easily. See quote/screenshot from NIST NCSTAR 1-3C, blue highlight added, and photograph (cropped)/screenshot from NIST NCSTAR 1-3C.

[37] At least if heated slowly. That NIST does not validate and/or report what happens in the case that the steel is suddenly subjected to high temperatures is an additional problem of NIST's method. Astaneh-Asl describes in the quote cited from the NYT (see above) that the SFRM (sprayed fire-resistive material, which was on top of the paint) was melted into a glassy residue, indicating that the SFRM experienced very high temperatures while the paint must have remained on the steel. NIST received the steel saved by Astaneh-Asl but any SFMR melted into a glassy residue is not mentioned in NIST's report. The melting of the SFRM (made up of "'slag wool and inorganic binders' with the 'chemical family' of 'silicates and calcium sulfites'") into a glassy residue indicates very high temperatures (see Chapter 9 in NIST NCSTAR 1-3E for the make-up of the SFRM).



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Appendix D

Beyond approximately 650 °C (plus or minus approximately 50 °C for the samples tested), a black scale formed between the steel and the paint, Fig. D–3. This scale layer had very poor adherence to the steel, and the paint was seen to flake off with slight pressure. Above approximately 800 °C, the kinetics of the scale formation were very fast, and after short exposures to this temperature a thick scale formed and spalled off of the steel, carrying away the paint. This left a very dark blue-black colored surface to the steel.

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Source: NIST.

Figure D–4. Formation of a black scale between paint and steel after exposure greater than 650 °C. Paint readily spalled.

Areas of columns that were heated above 650 or 800ºC were therefore highly unlikely to have any paint left. In NIST's experiments the steel shows a blue-black colored surface after the scale fell off at or above 800ºC. One might assume that the colored surface would have allowed NIST to detect pieces that experienced high temperatures. But WTC steel that lost its paint already in 2001, and not only in a laboratory furnace a few minutes before the examination, was rusty when NIST conducted its investigation, eliminating the possibility to detect any blue-black colored surfaces that would have indicated exposure to high temperatures.[38] NIST would have been able to

[38] There is also no mention in NIST's report that NIST would have screened the steel for blue-black surfaces.

follow up on columns that had no paint left using other methods (paint loss can be due to various reasons), but NIST did not do this[39] – despite the fact that paint loss is interpreted by the common method of unaided visual examination as a sign of possible exposure to high temperatures, and despite NIST's explicit knowledge of the fact that the paint will indeed be lost from 650ºC upwards.

Given that NIST selected only 4 of the 55 columns that NIST discuss in paragraph 4.1 "CORE COLUMNS" in NIST NCSTAR 1-3C, and 21 of the 90 panels to be screened as to whether they were subjected to high temperatures,[40] an inherent characteristic of the microscope aided method had the effect of being a limitation too – one can notice indications for a possible exposure to high temperatures only on such steel members that were selected to be examined. In contrast, the common method of unaided visual examination more or less "forces" one to notice (i.e., whether one wishes to recognize it or not) that certain steel members most likely experienced high temperatures, and works also well for steel members that have no paint left.

For someone who wants to exclude evidence for exposure to high-temperatures that has the potential to falsify NIST's premise, the limitations of the paint-cracking method are clearly advantageous. In fact, NIST went to great lengths to substitute its paint based method for the common method of unaided visual examination of the steel and to safeguard the exclusion of the common method (see below).

By deliberately excluding the data the common method of visual examination can provide in respect to high temperature exposure of steel, NIST is again, i.e., independent of the problem of the exclusion of steel, not in

[39] Except for the case of perimeter column K-16, which was examined already in a study published as Appendix C, "Limited Metallurgical Examination" of the FEMA/BPAT "World Trade Center Building Performance Study" that called for the further examination of its two samples.
[40] For NIST's selection method see NIST NCSTAR 1-3C, page 218 (PDF-page 268).

line with basic requirements of the scientific method. Using the paint-cracking method as the only systematically used tool to screen the steel, NIST was able to "miss" recognition of all indications for a possible exposure to high temperatures on those many pieces that were excluded from the microscope aided screening process, and all indications for an exposure to very high temperatures on areas of steel on the examined steel pieces. Based on its exclusive use of a microscope-aided screening method NIST felt free to turn, for example, a blind eye on the remarkable S-shaped deformation of the "catalogued" wide flange section that is by chance visible on one photograph in the NIST report, and on the possible high-temperature exposure of the steel that reminded Astaneh-Asl of Dali's melted clocks, and on the heat damaged steel from floors below of the impact areas collected by Astaneh-Asl,[41] and on the deformation of the structural steel visible on the photograph 1/7 from hangar 17, JFK airport, and on the horse-shoe bend column documented in "Relics in the Rubble." See a photograph from the S-shaped wide flange section[42] and from the named steel in hangar 17, JFK airport,[43] and a still frame from "Relics in the Rubble." [44]

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[41] Regarding the high temperature exposure of these parts, see the above statements in the media reports about Astaneh-Asl's work. That NIST held the steel collected by Astaneh-Asl during its WTC investigation is suggested by NIST's statement in NIST NCSTAR 1-3B, page 4 (PDF-page 32): "Facing concerns that the identified steel [i.e., steel that was collected by various teams] may not be properly preserved in the recovery yards, NIST arranged for the steel to be shipped to its campus in Gaithersburg, Maryland, starting in March 2002. Professor Astaneh-Asl also granted NIST permission to take custody of the steel that he had personally marked."

[42] Photograph (cropped) from NIST NCSTAR 1-3B, page 41 (PDF-page 69) Not even the "NIST-name" of this wide-flange section (very likely a core column) can be deduced from NIST's published report.

[43] Photograph from http://www.panynj.gov/wtcprogress/wtc-9-11-steel.html

[44] This piece, most likely a core column, should be part of the PANYNJ steel (see narrative below). "Relics from the Rubble," History Channel, 2002, broadcast as "THIS WEEK in HISTORY. SPECIAL," Senior Producer Robert Sharenow, Produced and written by Molly Thompsen. Narrative: "[Voice of narrator:] This eight-ton steel I-beam is six inches thick. It was selected to be preserved for future generations for the near perfect horse-shoe like bend formed during the collapse. [voice of person to the right hand side:] I got it hard to believe that it's actually bent because of the size of it and how it has no cracks in the iron. It bent without a single crack in it. It takes thousands degrees to bend steel like this… [voice of person to the left hand side:] There should be buckling and tearing at the tension side, but there is no buckling at all."


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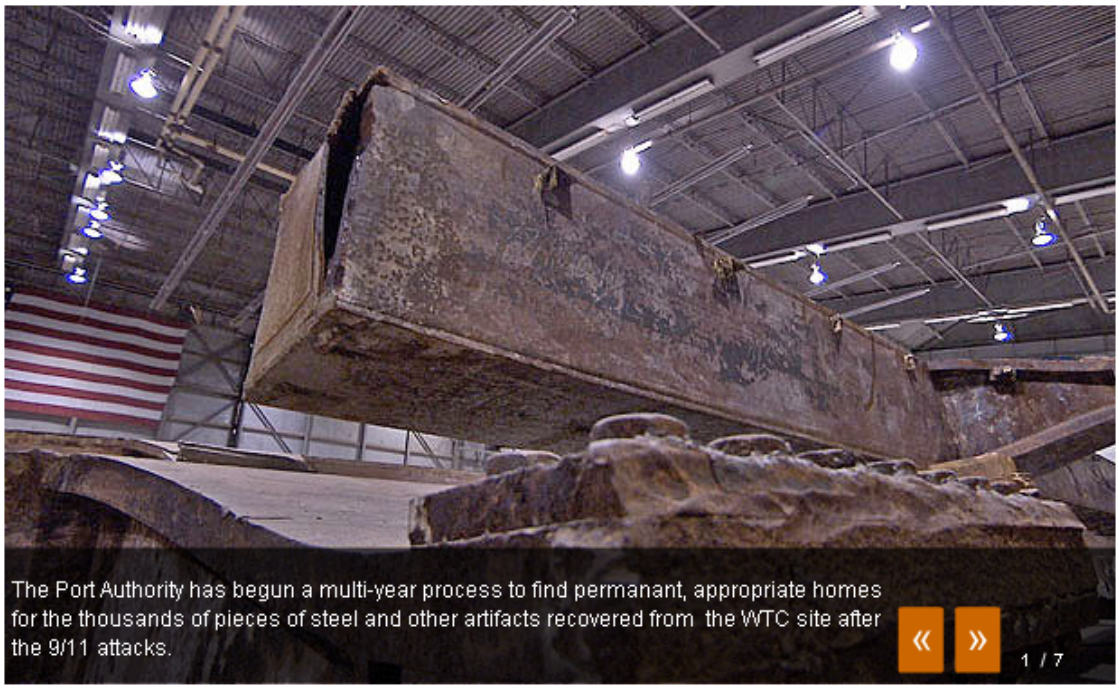
The Port Authority has begun a multi-year process to find permanant, appropriate homes for the thousands of pieces of steel and other artifacts recovered from the WTC site after the 9/11 attacks.
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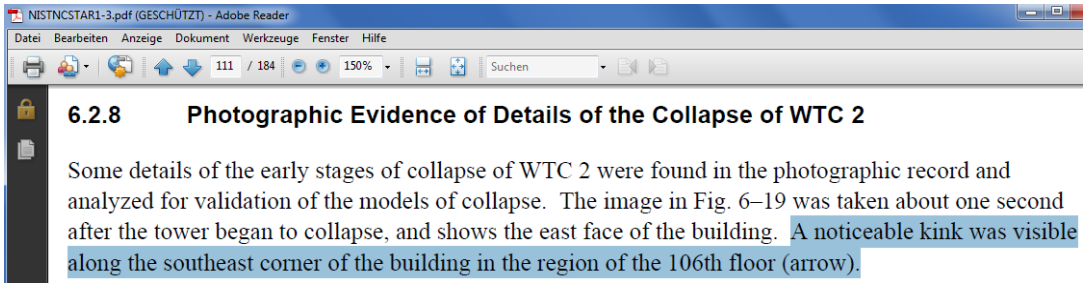
Another example of the effect of NIST's exclusionary tactics and of the poor quality of NIST's investigation is NIST's failure to adequately examine core column C-30.[45] The as-built location of C-30 was in WTC 2, stories 104 to 106[46] at the north-east corner of the core. The column displays obvious signs indicating that it was bent at high temperatures and while it was still restrained in a frame. C-30 shows for most of its length a smooth bend without cracks and without buckling of the flanges, indicating that the smoothly bent part was at high temperatures when it was bent. In addition, the column is bent only along one axis; the flanges are still in one plane,[47] indicating that the column was still well restrained in the frame when it was bent. See photographs from NIST NCSTAR 1-3B (page 44) and NIST NCSTAR 1-3D (page 258) that show C-30.

[45] NIST used C-30 when evaluating the quality of the WTC steel (see NIST NCSTAR 1-3D "Mechanical Properties of Structural Steels"), but did not examine its damage and failure modes.
[46] NIST NCSTAR 1-3B, page 10 (PDF-page 38)
[47] See also NIST NCSTAR 1-3D, page 254 (PDF-page 288)

Since it is indicated that the deformation of column C-30 happened at high temperatures and while the column was still in the building, and since the indications are so obvious to notice when the common method of unaided visual examination is employed, it would have been NIST's duty to follow up on the possibility of a high temperature exposure of column C-30 while it was still in the building. But C-30 was located far above the fire areas; following up on these indications had the potential of falsifying NIST's premise. If further examinations would have supported what is indicated by the deformation and characteristics of C-30, NIST would have documented data that prove that a fireproofed core column was exposed to very high temperatures outside of the fire areas. Both the circular argument described above (which excluded C-30 from any examination regarding its damage and

failure mode) and the exclusive use of the new-developed paint based method when screening the columns "allowed" NIST to act as if they did not notice the obvious indications of possible high temperature exposure of C-30 while restrained in the frame.

Any institution conducting a real investigation into the reasons of the Twin Tower destruction would have found the damage and failure modes of C-30 very interesting at least for the reason that it stretched over those stories where the top part of WTC 2 started to disintegrate, with no apparent reason, early in the final destruction; the edge of the building showed a "sharp kink"[48] in the south-east corner well above of the impact and fire area that degraded "into a gentle curve" in the north-east corner.[49] The kink and the curve are documented in NIST NCSTAR 1-3 and NIST NCSTAR 1-3C[50] – i.e. by "Project 3", which was responsible for steel examination,[51] and in NIST NCSTAR 1-6. See quotes/photograph/screenshots from NIST NCSTAR 1-3 and NIST NCSTAR 1-6, blue highlights added.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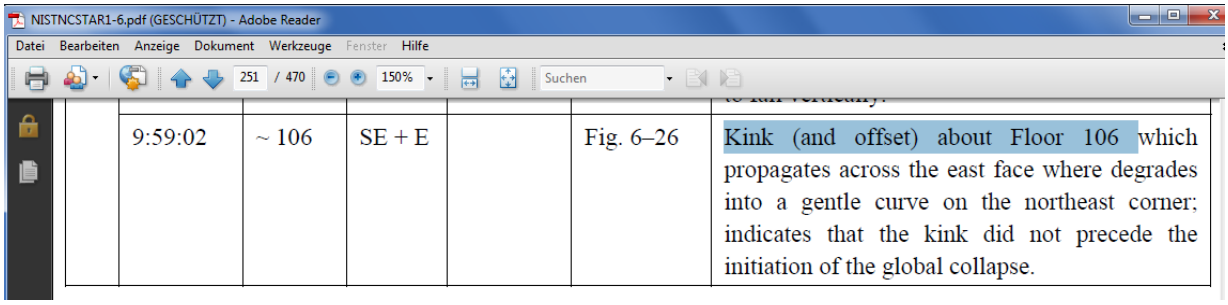
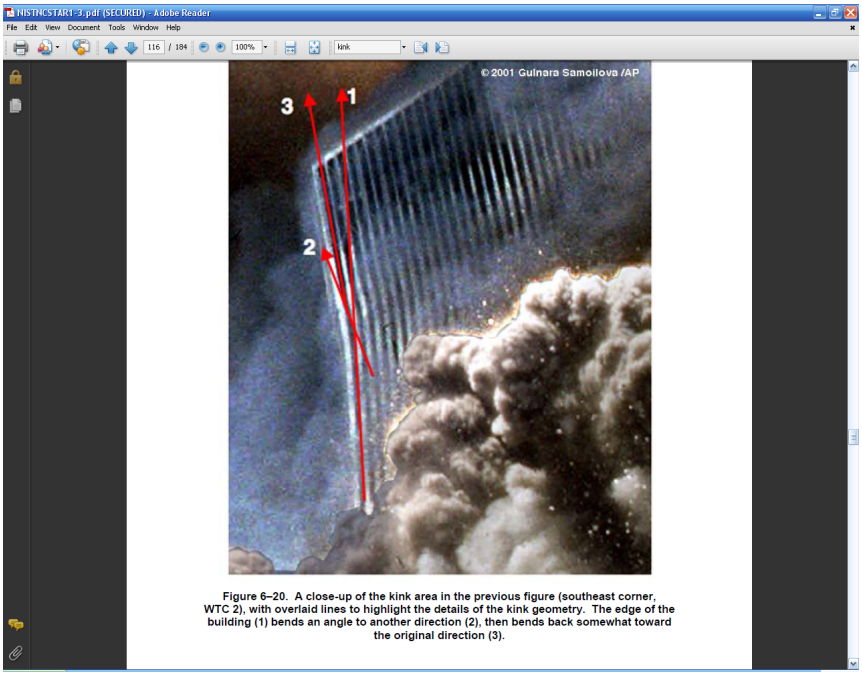
6.2.8 Photographic Evidence of Details of the Collapse of WTC 2

Some details of the early stages of collapse of WTC 2 were found in the photographic record and analyzed for validation of the models of collapse. The image in Fig. 6–19 was taken about one second after the tower began to collapse, and shows the east face of the building. A noticeable kink was visible along the southeast corner of the building in the region of the 106th floor (arrow).

[48] NIST NCSTAR 1-3, page 63 (PDF-page 111)
[49] NIST NCSTAR 1-6, page 169 (PDF-page 251)
[50] NIST NCSTAR 1-3, pages 63 and 67f (PDF-pages 111 and 115f); NIST NCSTAR 1-3C, page 25 (PDF-page 75).
[51] The kink and the curve are not explicable with the change in how gravitation acted on the building due to the leaning of the upper section; the Twin Towers were designed to withstand high wind loads (i.e., large lateral forces).

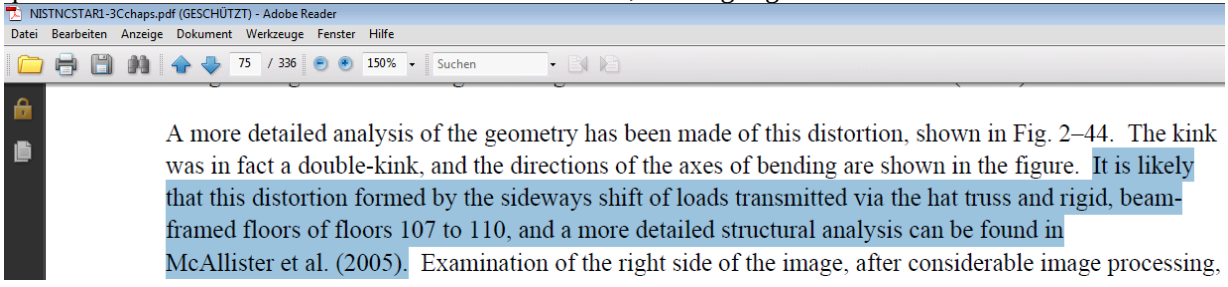


	9:59:02	~ 106	SE + E		Fig. 6–26	Kink (and offset) about Floor 106 which propagates across the east face where degrades into a gentle curve on the northeast corner; indicates that the kink did not precede the initiation of the global collapse.



The authors of the final report concerning the steel examination even expected that NIST would publish a discussion of the kink by T. McAllister (co-leader of Project 6 "Structural Fire Response and Collapse Analysis) as part of the final report, [52] but the scientists and engineers responsible for the steel

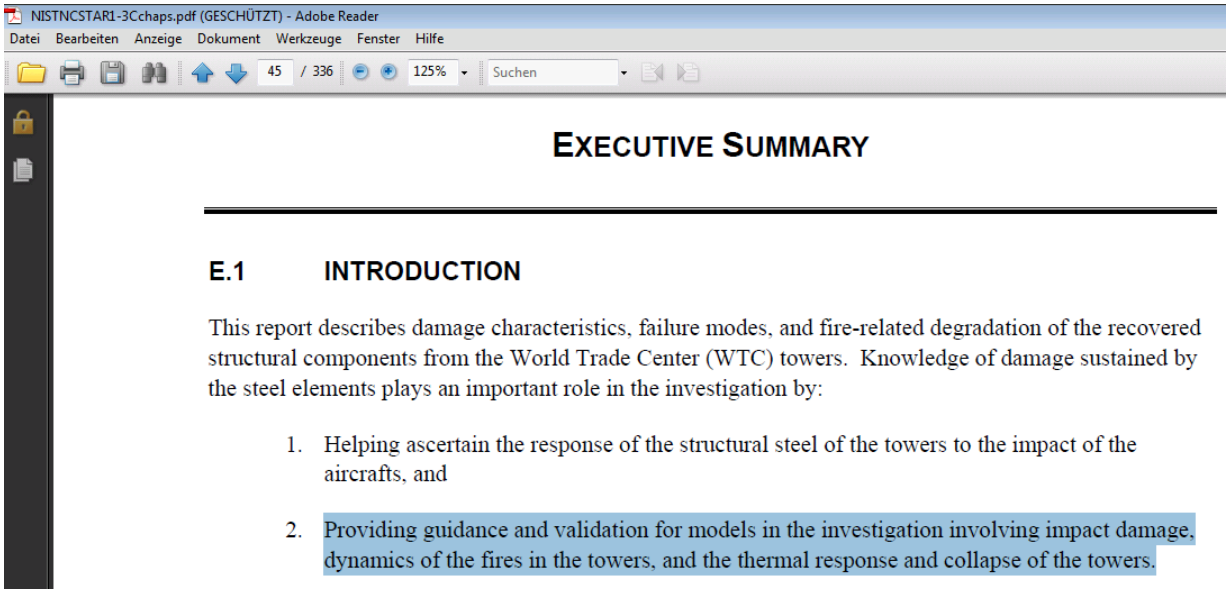
[52] The analysis of the "kink" was supposed to be published in a sub-file NIST NCSTAR 1-6E. See two quotes/screenshots from NIST NCSTAR 1-3C and 1-3, blue highlights added.



examination nevertheless neglected to examine C-30 for its damage and failure modes, and NIST failed to discuss C-30 in relation to the kink.

(III) NIST's lack of quality data for validating their models

Providing data for the validation of the temperature models and for the validation of "modeling efforts" of the "collapse analysis" was among the stated goals of NIST's steel examination. See quote/screenshot from the "Executive Summary" of NIST NCSTAR 1-3C, blue highlights added.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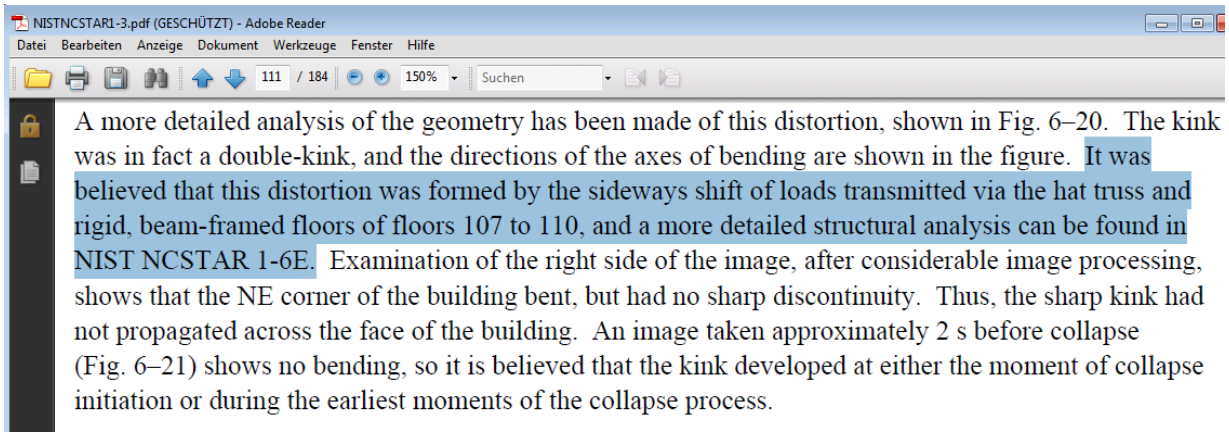
EXECUTIVE SUMMARY

E.1 INTRODUCTION

This report describes damage characteristics, failure modes, and fire-related degradation of the recovered structural components from the World Trade Center (WTC) towers. Knowledge of damage sustained by the steel elements plays an important role in the investigation by:

1. Helping ascertain the response of the structural steel of the towers to the impact of the aircrafts, and

2. Providing guidance and validation for models in the investigation involving impact damage, dynamics of the fires in the towers, and the thermal response and collapse of the towers.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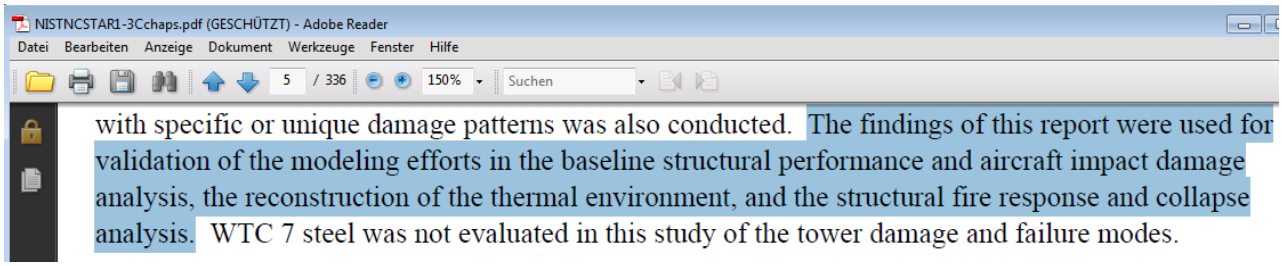
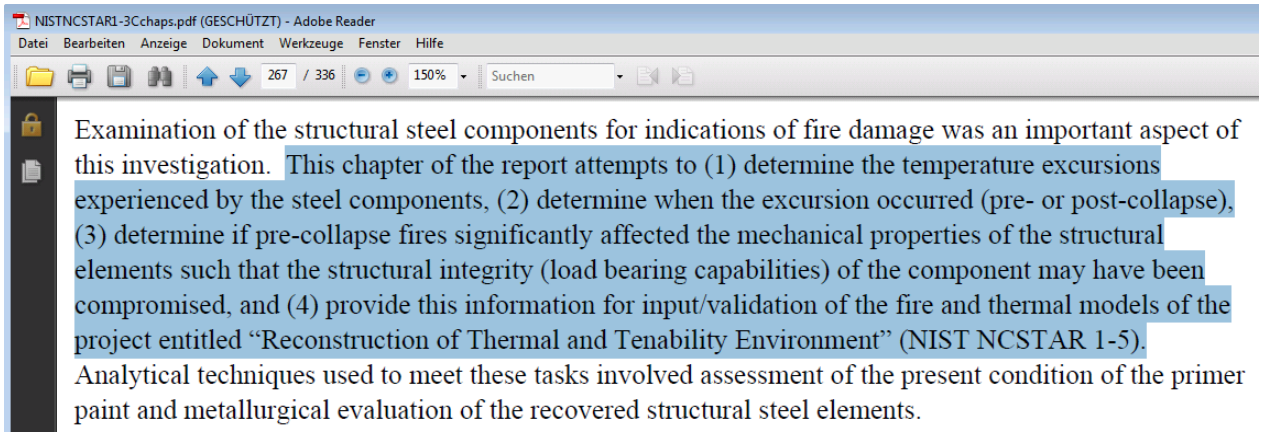
A more detailed analysis of the geometry has been made of this distortion, shown in Fig. 6–20. The kink was in fact a double-kink, and the directions of the axes of bending are shown in the figure. It was believed that this distortion was formed by the sideways shift of loads transmitted via the hat truss and rigid, beam-framed floors of floors 107 to 110, and a more detailed structural analysis can be found in NIST NCSTAR 1-6E. Examination of the right side of the image, after considerable image processing, shows that the NE corner of the building bent, but had no sharp discontinuity. Thus, the sharp kink had not propagated across the face of the building. An image taken approximately 2 s before collapse (Fig. 6–21) shows no bending, so it is believed that the kink developed at either the moment of collapse initiation or during the earliest moments of the collapse process.

The file NIST NCSTAR 1-6E has not been published.

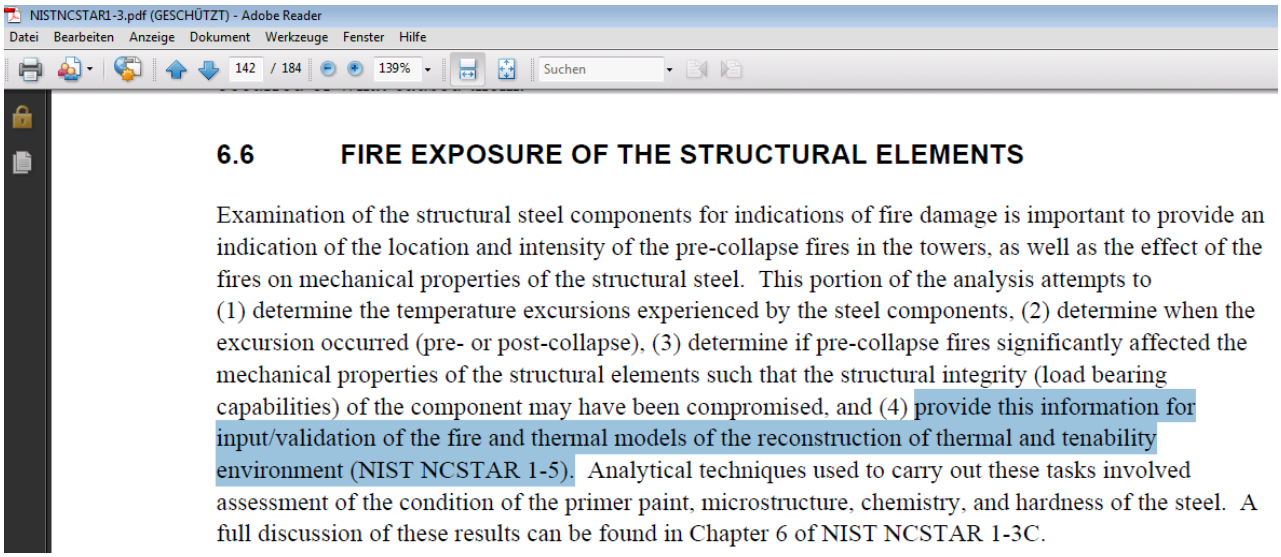
See also quote/screenshot from the “Abstract” of NIST NCSTAR 1-3C “Damage and Failure Modes of Structural Steel Components” (blue highlight added).



And, quote/screenshot from “Chapter 6. FIRE EXPOSURE OF THE STRUCTURAL ELEMENTS” of NIST NCSTAR 1-3C (blue highlights added).

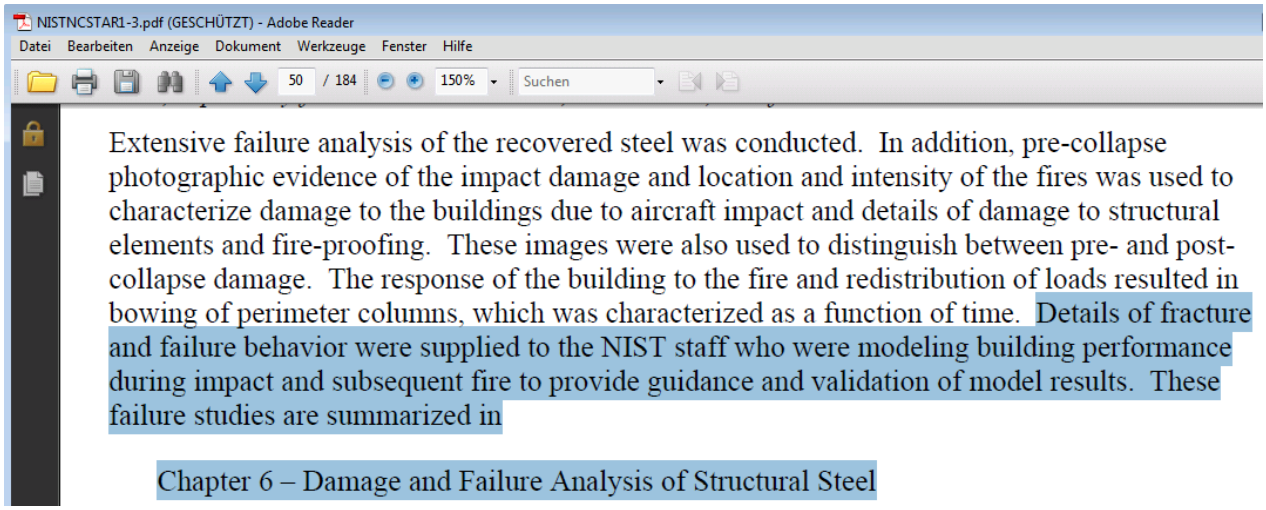


And, quote/screenshot from NIST NCSTAR 1-3, respectively NIST NCSTAR 1-3C, blue highlights added.



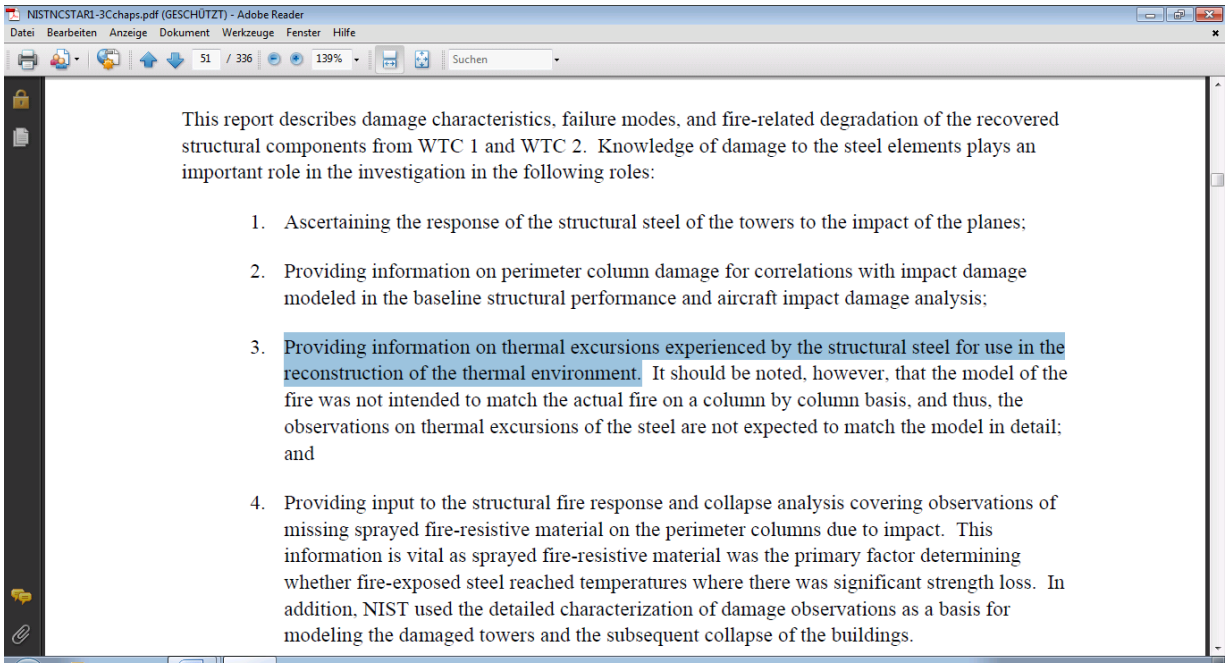
6.6 FIRE EXPOSURE OF THE STRUCTURAL ELEMENTS

Examination of the structural steel components for indications of fire damage is important to provide an indication of the location and intensity of the pre-collapse fires in the towers, as well as the effect of the fires on mechanical properties of the structural steel. This portion of the analysis attempts to (1) determine the temperature excursions experienced by the steel components, (2) determine when the excursion occurred (pre- or post-collapse), (3) determine if pre-collapse fires significantly affected the mechanical properties of the structural elements such that the structural integrity (load bearing capabilities) of the component may have been compromised, and (4) provide this information for input/validation of the fire and thermal models of the reconstruction of thermal and tenability environment (NIST NCSTAR 1-5). Analytical techniques used to carry out these tasks involved assessment of the condition of the primer paint, microstructure, chemistry, and hardness of the steel. A full discussion of these results can be found in Chapter 6 of NIST NCSTAR 1-3C.



Extensive failure analysis of the recovered steel was conducted. In addition, pre-collapse photographic evidence of the impact damage and location and intensity of the fires was used to characterize damage to the buildings due to aircraft impact and details of damage to structural elements and fire-proofing. These images were also used to distinguish between pre- and post-collapse damage. The response of the building to the fire and redistribution of loads resulted in bowing of perimeter columns, which was characterized as a function of time. Details of fracture and failure behavior were supplied to the NIST staff who were modeling building performance during impact and subsequent fire to provide guidance and validation of model results. These failure studies are summarized in

Chapter 6 – Damage and Failure Analysis of Structural Steel



But NIST cannot have data of sufficient quality to validate the temperature models they developed and applied for the fire areas. The paint based method fails above 650ºC and NIST did not follow up on parts like core columns C-88a and C-88b and on all three columns of panel S-10 where the paint method yielded “no conclusion” as “results” because no paint was left. [53] This means that NIST's Twin Tower “how the point of collapse initiation was reached” computer models, which are at the core of NIST’s presented results regarding the examination of the reasons for the failure of the structure of the Twin Towers, were run by NIST without any adequate validation of their temperature input-data. [54]

[53] NIST NCSTAR 1-3C, Appendix E, pages 447ff (PDF-pages 161ff in NISTNCSTAR1-3CAppxs.pdf); and NIST NCSTAR 1-3C “Chapter 6 FIRE EXPOSURE OF THE STRUCTURAL ELEMENTS”, pages 217ff (PDF-pages 267ff), especially page 226 (PDF-page 276)

[54] NIST’s temperature models not only lack proper validation due to NIST’s failure to adequately examine and analyze the steel, but they are also not in line with evidence (“glowing carets” that glow bright white, a “metal fire” with a “very bright white flame” “generating a plume of white smoke” and “molten flows” in the vicinity of the “metal fire”) that NIST documented in NIST NCSTAR 1-5A, Chapters 8 and 9.

In addition, the named models were run without adequate validation with respect to the "fracture and failure behavior" of the steel in the models too – at least when one wants models that are not bound by a premise that allowed only the consideration of the "fracture and failure behavior" of those steel pieces that were directly compromised by the airplane impact.

(IV) NIST went to great lengths to exclude the common method

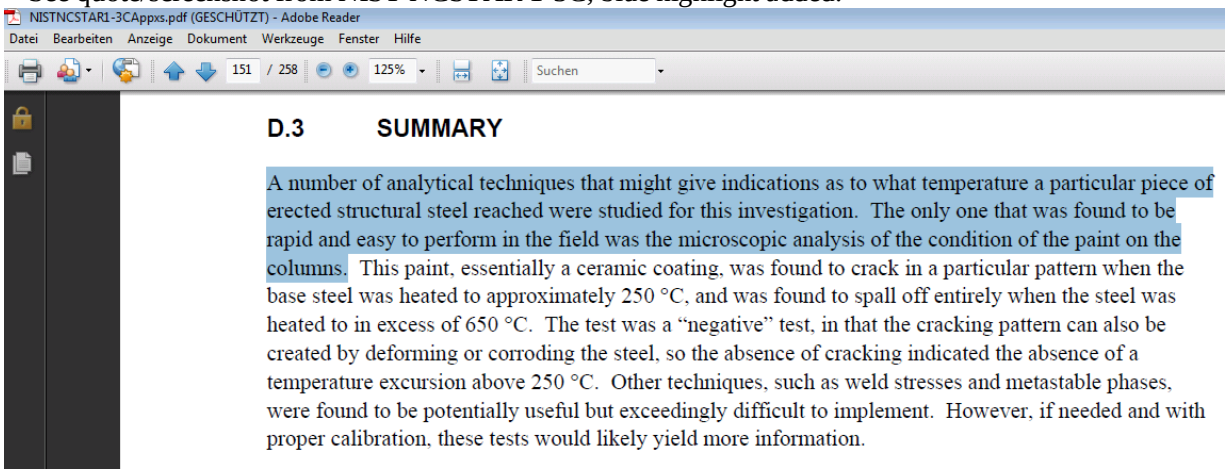
The method of unaided visual examination is indeed common to detect steel possibly exposed to high temperatures,[55] and NIST even used it – but just once on two small truss rods. In NIST's "Appendix D. FORENSIC THERMOMETRY TECHNIQUE DEVELOPMENT,"[56] methods are listed that might possibly be available to screen steel as to whether it was exposed to high temperatures. Conspicuously, the common unaided visual examination of the steel is not mentioned in this list. One might argue that the common method of unaided visual examination was not mentioned because the headline of the section is "FORENSIC THERMOMETRY TECHNIQUE DEVELOPMENT" and the common method is an existing method that does not need to be developed. But also no other section exists in NIST's report

[55] See above (reference to the common method in the NFPA 921, use of the common method by Astaneh-Asl and WJE). It may also be assumed that unaided visual examination was the first method of choice when "members of the Federal Emergency Management Agency (FEMA), American Society of Civil Engineers Association of New York (ASCE) and of the Building Performance Study (BPS) Team, and of the Structural Engineers Association of New York (SEAoNY)" started in October 2001 "to identify and collect World Trade Center (WTC) structural steel from the various recovery yards." They searched, inter alia, for "exterior column panels and interior core column from WTC 1 and WTC 2 that were exposed to fire" and for "badly burned pieces from WTC 7;" the Co-Project leader of project 6 of NIST's WTC investigation, Dr. J.Gross, "was involved in these early efforts." (The quoted parts are from NIST NCSTAR 1-3B, page 3 (PDF-page 31); similarly in NIST NCSTAR 1-3, page 27 (PDF-page 75). NIST's scientists and engineers must have had an idea how one searched in 2001 for fire affected and badly burned pieces of WTC steel. Given that they conclude in NIST NCSTAR 1-3C that all such methods like examining microstructural changes in the steel, or measurement of the residual stresses in welds, are not "easy to perform in the field"[(*)] they will not have assumed that these methods were performed in the recovery yards. [(*)]NIST NCSTAR 1-3C, "FORENSIC THERMOMETRY TECHNIQUE DEVELOPMENT", pages 433ff (PDF-pages 147ff in NISTNCSTAR 1-3CAppxs.pdf)

[56] NIST NCSTAR 1-3C, pages 433ff (PDF-pages 147ff in NISTNCSTAR1-3CAppxs.pdf)

where the method of unaided visual examination would be discussed by NIST as a possibly useful method to check whether steel was affected by high temperatures. Instead, NIST let it appear as if the new paint-based method would be the only one that was "easy to perform in the field";[57] and NIST even states: "Perhaps the most obvious physical indicator of a component's exposure to high temperatures is the condition of the paint."[58] This statement

[57] See quote/screenshot from NIST NCSTAR 1-3C, blue highlight added.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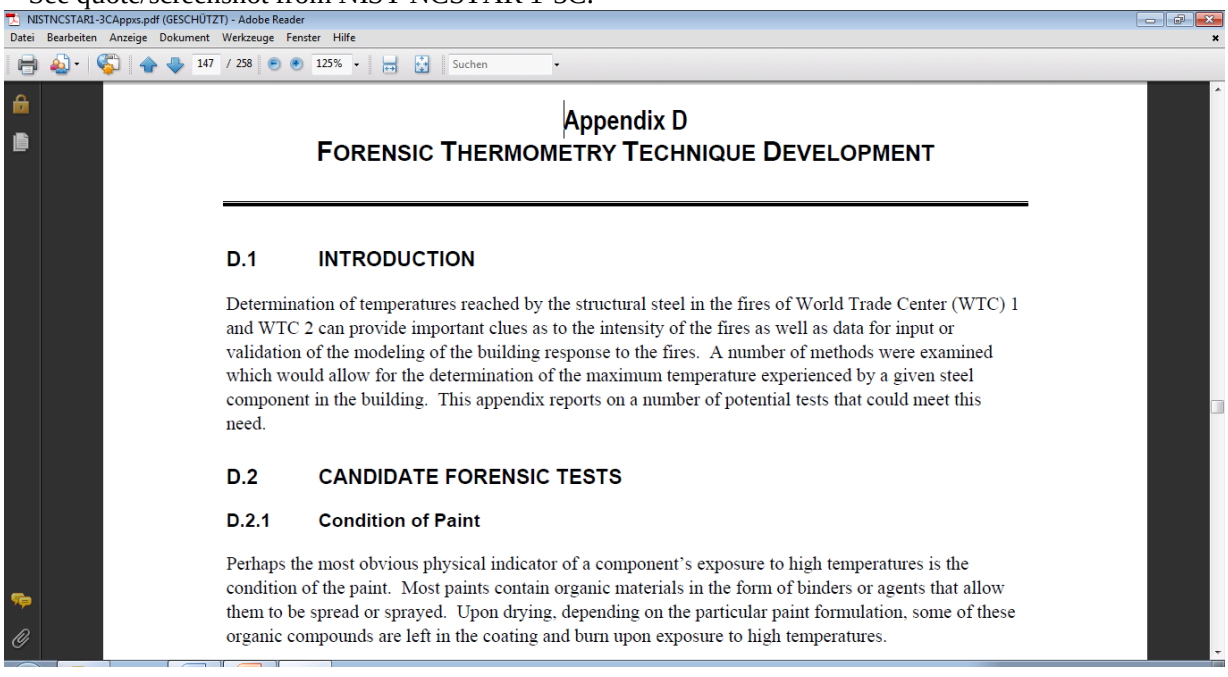
D.3 SUMMARY

A number of analytical techniques that might give indications as to what temperature a particular piece of erected structural steel reached were studied for this investigation. The only one that was found to be rapid and easy to perform in the field was the microscopic analysis of the condition of the paint on the columns. This paint, essentially a ceramic coating, was found to crack in a particular pattern when the base steel was heated to approximately 250 °C, and was found to spall off entirely when the steel was heated to in excess of 650 °C. The test was a "negative" test, in that the cracking pattern can also be created by deforming or corroding the steel, so the absence of cracking indicated the absence of a temperature excursion above 250 °C. Other techniques, such as weld stresses and metastable phases, were found to be potentially useful but exceedingly difficult to implement. However, if needed and with proper calibration, these tests would likely yield more information.

From the analytical techniques NIST selected to study, the paint based method might in fact be the best to use "in the field." What NIST does not mention is that it excluded the common method from its list.

[58] See quote/screenshot from NIST NCSTAR 1-3C.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Appendix D
FORENSIC THERMOMETRY TECHNIQUE DEVELOPMENT

D.1 INTRODUCTION

Determination of temperatures reached by the structural steel in the fires of World Trade Center (WTC) 1 and WTC 2 can provide important clues as to the intensity of the fires as well as data for input or validation of the modeling of the building response to the fires. A number of methods were examined which would allow for the determination of the maximum temperature experienced by a given steel component in the building. This appendix reports on a number of potential tests that could meet this need.

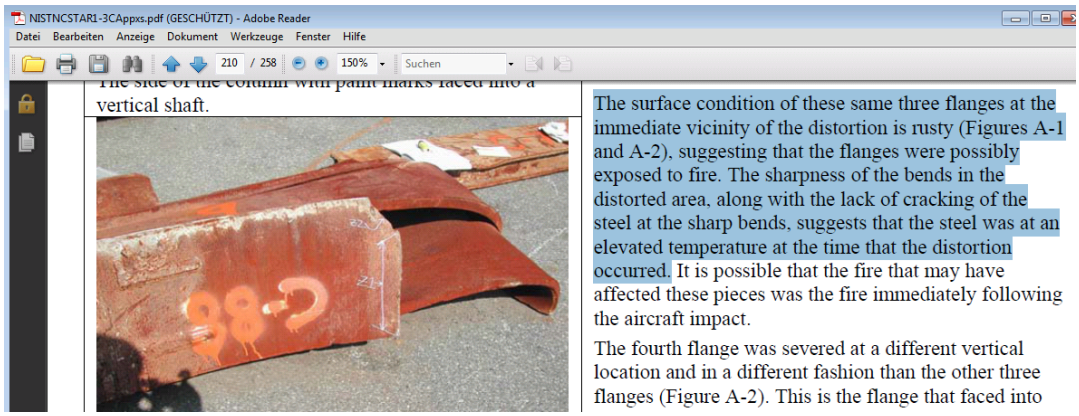
D.2 CANDIDATE FORENSIC TESTS

D.2.1 Condition of Paint

Perhaps the most obvious physical indicator of a component's exposure to high temperatures is the condition of the paint. Most paints contain organic materials in the form of binders or agents that allow them to be spread or sprayed. Upon drying, depending on the particular paint formulation, some of these organic compounds are left in the coating and burn upon exposure to high temperatures.

by NIST is especially remarkable when one considers the fact that the paint was likely to fall off steel that reached temperatures from 650ºC onwards, a fact NIST is well aware of. NIST's alleged "most obvious physical indicator" can – per design – hardly work on all those areas that experienced temperatures of approximately 650+ ºC, while the common method yields results at higher temperatures. If NIST would have included common visual examination as a possible method in its discussion, there would have been no way for NIST to argue that the paint based method was a good substitute for the common method. So it makes sense that NIST acts and writes throughout the report as if there was no method of unaided visual examination to screen columns and panels for exposure to high temperatures.

But NIST was not able to get rid of the common method just by pretending that it did not exist. NIST's contractor WEJ delivered, already in November 2003, the above mentioned report where the common method was used to examine whether selected WTC steel members, including core columns and perimeter panels from the impact and fire areas, might have experienced high temperatures. WJE used unaided visual examination as the only method applied, and based all results, including those related to the subjects "elevated temperatures / fire damage of steel," on the common method. For example, WJE relied on the shape of the bends, and on the lack of cracking in the bent area of core column C-88b when discussing its possible heat damage; see quote/screenshot from NIST NCSTAR 1-3C, blue highlight added.

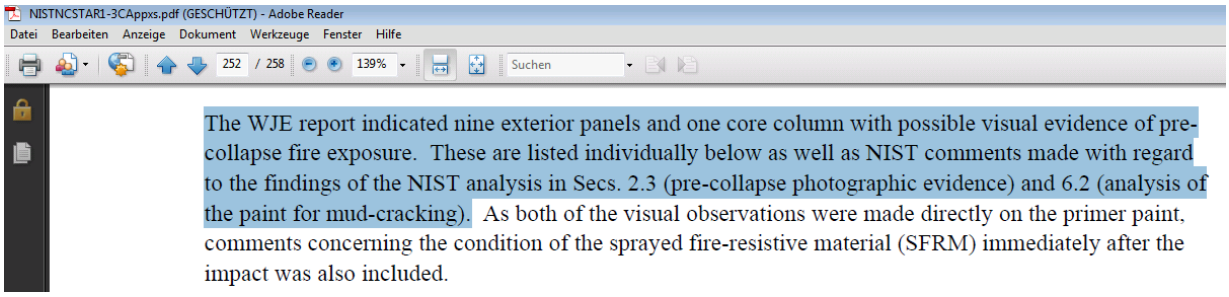


WJE's report confronted NIST with two problems: the existence and general acceptance of the common method is acknowledged by this report, and WJE provided some results that had the potential to cause a problem for NIST's premise.[59]

NIST reacted with a "review" of the WJE report, the "Summary" of which is published as Appendix G of NIST's sub-file NIST-NCSTAR 1-3C

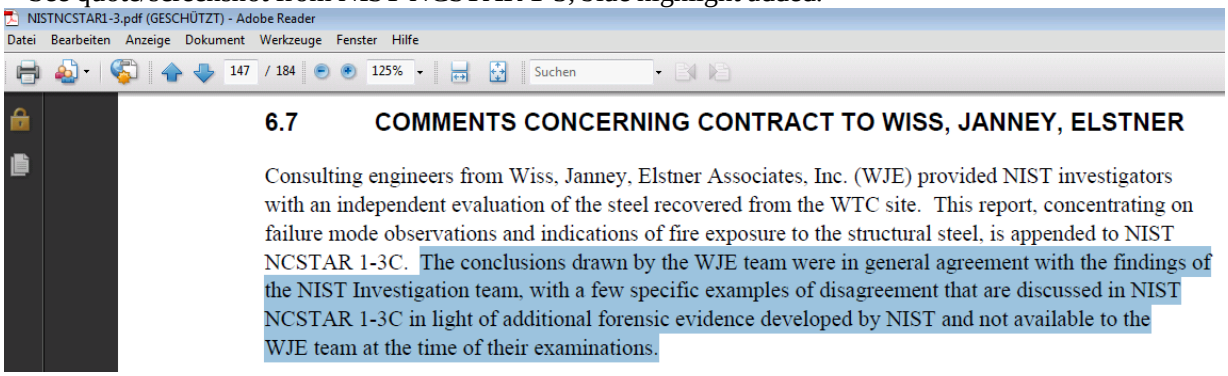
[59] There is no indication that WJE deliberately wanted to cause NIST and NIST's premise any problems. In contrast, WJE made sure to report mainly about pieces from the impact and fire areas. Interesting pieces like C-30 or the wide flange section visible on the photograph behind C-71, and parts from the lower stories are not mentioned in WJE's report. WJE states in this respect, that, while they "observed" all 236 pieces "in a general fashion," the allotted on-site time made it impossible "to make detailed observations on all 236 pieces." WJE further states: "Therefore, the priority was to examine pieces identified by NIST to be from close to the aircraft impact locations on WTC 1 and WTC 2, and pieces that had obvious visual indications of the effects of fire following aircraft impact and before the collapse of the towers. A limited survey was made of connections on exterior column pieces from WTC 1 and WTC 2. WJE also included observations on a limited number of pieces believed to be recovered from structures other than WTC 1 and WTC 2." (NIST NCSTAR 1-3C, Appendix F, page 462; PDF-page 176 in NIST NCSTAR1-3CAppxs.pdf). With this argument WJE excluded from their report steel from below the impact and fire areas from being systematically examined despite its relevance to determine the cause of the complete destruction. As it was stated already, one can expect that engineers and architects are aware that the relevant question related to the WTC destruction is why the Towers were completely destroyed, and that they must be aware that detailed descriptions of airplane impact damage on steel columns in an airplane impact area, and of fire damage to pieces in the fire affected area located on top of the huge and strong part that gave way are rather unlikely to answer this question. WJE was even tasked to provide "independent identification of recovered steel of particular interest to the furtherance of other tasks under Project 3." (Quoted from NIST's review of WJE's report; NIST NCSTAR 1-3C, page 473; PDF-page 249 in NIST NCSTAR1-3CAppxs.pdf). WJE chose - in line with NIST's premise - to spend the allotted on-site time mainly on documenting the kind of damage one would expect anyway and that is rather unlikely to give any clues why the Towers were completely destroyed.

(pages 473ff). It's not surprising that NIST agrees in general in its "review" with all observations made by WJE that are not related to the subjects "elevated temperatures / fire damage of steel."[60] The general problem that WJE used the common method was "solved" by NIST by listing "WJE observations" and "NIST observations" next to each other for those pieces where WJE noted the possibility that the piece was damaged by the jet-fuel and office fires. See the following quote/screenshot from NIST NCSTAR 1-3C, blue highlight added.



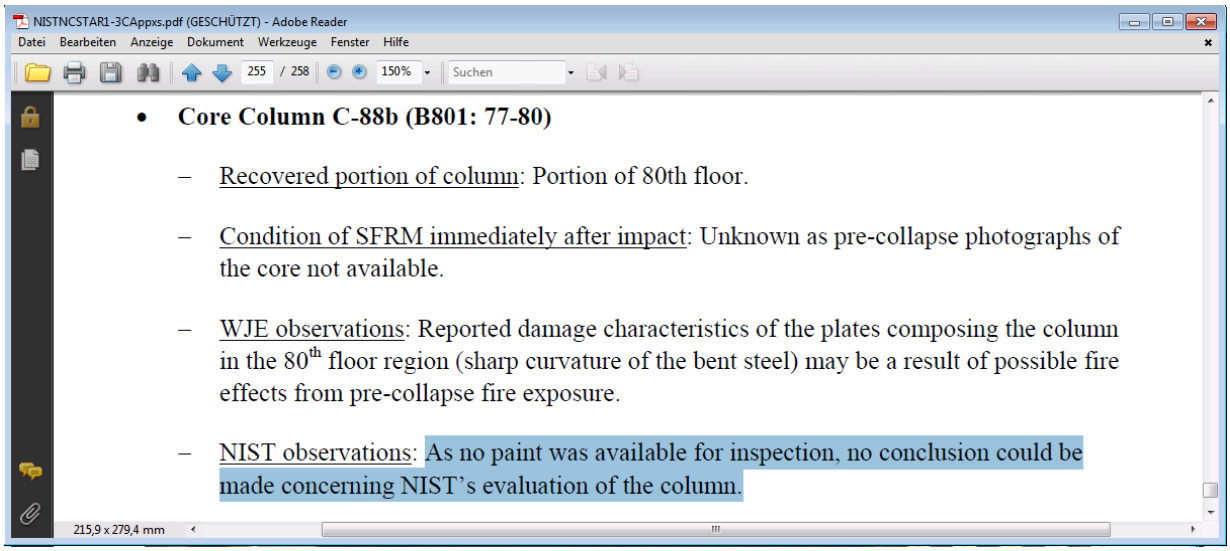
NIST's "observations" in these list are not based on the condition of the actual steel, but on the paint-cracking method. NIST notes whether a mud-cracking pattern of the paint was observed or not, and if paint was left on the piece. In addition, NIST lists the results of its fire exposure maps (which are based on videos and photos from September 11, 2001), and if the SFRM was lost or more likely not (based on the named photos and videos too). When no paint

[60] See quote/screenshot from NIST NCSTAR 1-3, blue highlight added.



The "additional forensic evidence" mentioned by NIST refers to the results of its paint-based method, and its fire exposure maps (based on videos and photos from September 11, 2001). See NIST NCSTAR 1-3C, Appendix G, page 475 (PDF-page 251 in NISTNCSTAR1-3CAppxs.pdf)

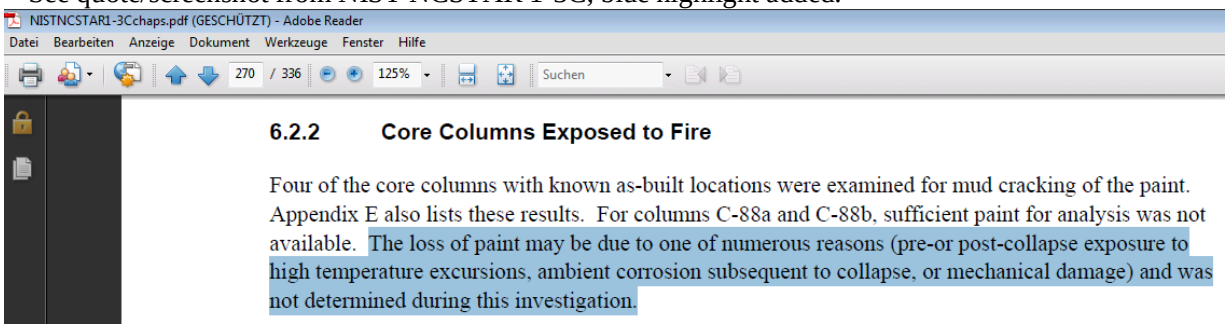
was left on a certain piece of steel, NIST states that they were not able to make a conclusion. See as an example a part of NIST's "review" regarding column C-88b (quote/screenshot from NIST NCSTAR 1-3C, blue highlight added).[61]



By doing so, and by not following up on pieces like C-88b[62] just for the reason that no paint was available, where WJE saw possible evidence for heat damage, NIST implicitly determined that the only examination method it considered reliable when screening the columns was their paint test, and that the results of their paint test "beat" results that are based on the common

[61] The not captured part states: "Pre-collapse photographic evidence: While the column was located within the fire floors, no direct information was available on the exposure of pre-collapse fires."

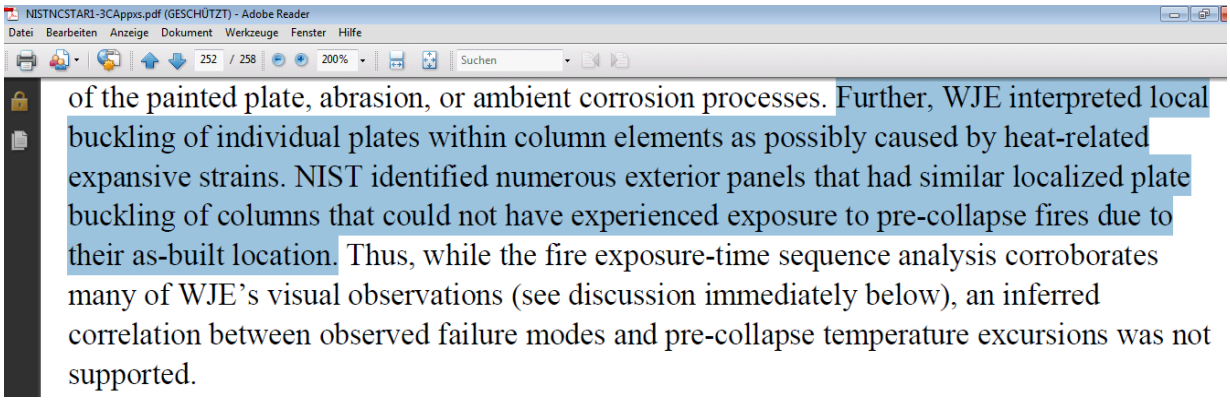
[62] See quote/screenshot from NIST NCSTAR 1-3C, blue highlight added.



NIST established only for two of the 55 "catalogued" columns discussed in that NIST discuss in paragraph 4.1 "CORE COLUMNS", NIST NCSTAR 1-3C, a result regarding their possible exposure to high temperatures.

unaided visual examination, even when no paint was left to be examined. It fits well that NIST does not really discuss the differences in the results (between WJE and NIST "observations") further; NIST needed to get rid of the common method without making the general problem it has with WJE's report too obvious. The result, that NIST substituted for the common method its paint based method, becomes only clear when one checks NIST-NCSTAR 1-3C to see whether NIST followed up on pieces like C-88b, which they did not.[63]

Another result of WJE was rejected by NIST explicitly, namely, WJE's interpretation of buckled plates of exterior columns as possibly heat damaged while in the building. See quote/screenshot from NIST NCSTAR 1-3C, page, with NIST's argument regarding the buckled column plates (blue highlight added).



If NIST would have accepted WJE's interpretation, NIST would have needed to conclude that numerous perimeter panels from stories outside of the fire areas "that had similar localized plate buckling of columns" might have been affected by high temperatures while still in the building, and to follow-up on this. To avoid this NIST determined – without any experiments or at least references from the literature – that WJE's interpretation of the localized plate buckling was unreliable (See last sentence in quote/screenshot above). When

[63] C-88b and C-88a were the only WTC 2 core columns NIST considered as relevant for its investigation.

different methods yield conflicting results one needs to assess possible reasons for this by validating the methods side by side and/or by following up using additional methods. NIST did not do this, but instead determined based on its premise that results based on the common method were unreliable. NIST cannot provide any proof that the columns in non-fire floors cannot have been affected by high-temperatures while still in the building. On the contrary, the deformation of column C-30, the horse-shoe bend column from "Relics in the Rubble," or Astaneh-Asl's observations, for example, suggest that steel members from outside the impact and fire areas were affected by high temperatures while they were still in the buildings. It was NIST's duty to examine pieces like the buckled plates of exterior columns from outside the fire areas in depth, but NIST instead determined that these pieces cannot have experienced heat damage while in the buildings[64] and dismissed WJE's results, and by this also the reliability of the common method, without any evidentiary justification.

There exists enough evidence in general for very high temperatures – too high to be caused by office and jet fuel fires – before and during the final destruction of the WTC.[65] With "glowing carets" that glow bright white, with a "metal fire" with a "very bright white flame" and "molten flows" in the vicinity of the metal fire,[66] NIST even documents evidence for extremely high

[64] NIST, which cooperates closely with the NFPA (see, for example, http://www.nfpa.org/assets/files/pdf/biechman.PDF), should be in general well aware of the fact that heat sources other than mere fires can affect a building. NIST also has a building and fire research facility http://www.nist.gov/building-and-fire-research-portal.cfm, http://www.nist.gov/bfsi-portal.cfm), and NIST employees are even members of the "Technical committee on fire investigations" that has been developing the cited NFPA 921 Guide for Fire and Explosion Investigations. See also the NFPA 921 Guide: ***6.2.2.2**** *[…] Burning metals and highly exothermic chemical reactions can produce temperatures significantly higher than those created by hydrocarbon- or cellulosic-fueled fires.*

[65] See, for example, S.E. Jones, J. Farrer, G.S.Jenkins, et al.: "Extremely high temperatures during the World Trade Center destruction," in Journal of 9/11 Studies 2008, http://www.journalof911studies.com/articles/WTCHighTemp2.pdf

[66] NIST avoids addressing the bright, whitish-yellow glowing color of the molten material at the point where it flows out of the building, which shows its very high temperature, but instead speculates about its composition. One of the photographs below shows also whitish smoke next to a "flow" (near the inserted number "79").

temperatures in the still standing buildings, though without acknowledging the implication of the documented evidence. See quotes and photographs (screenshots) from NIST NCSTAR 1-5A and NIST NCSTAR 1-5, blue highlights added.

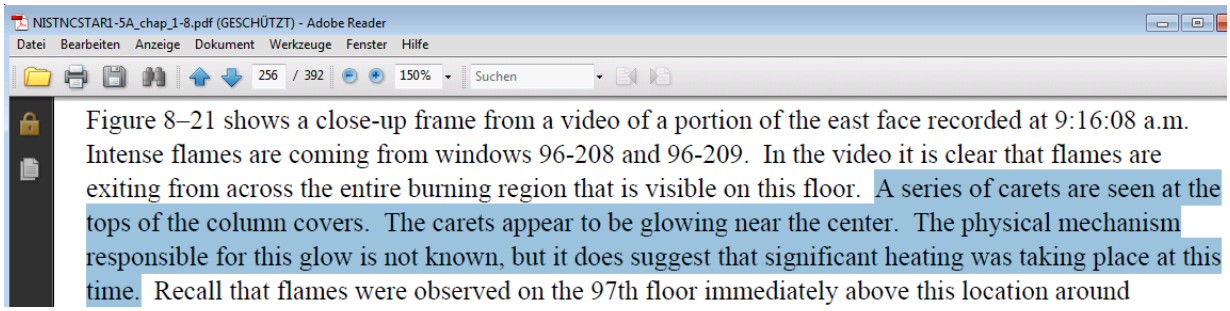
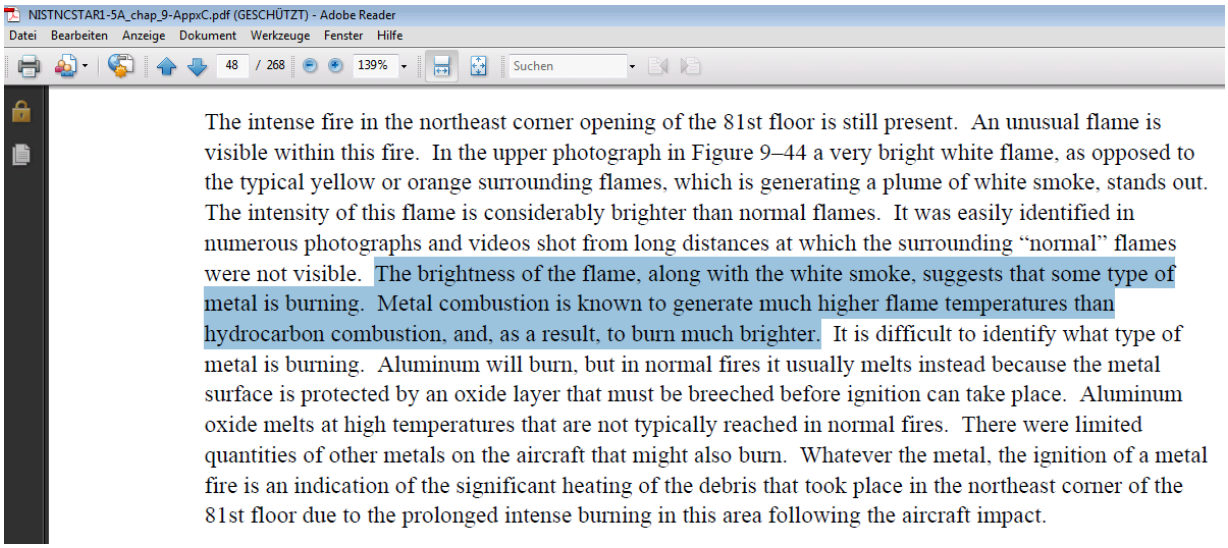
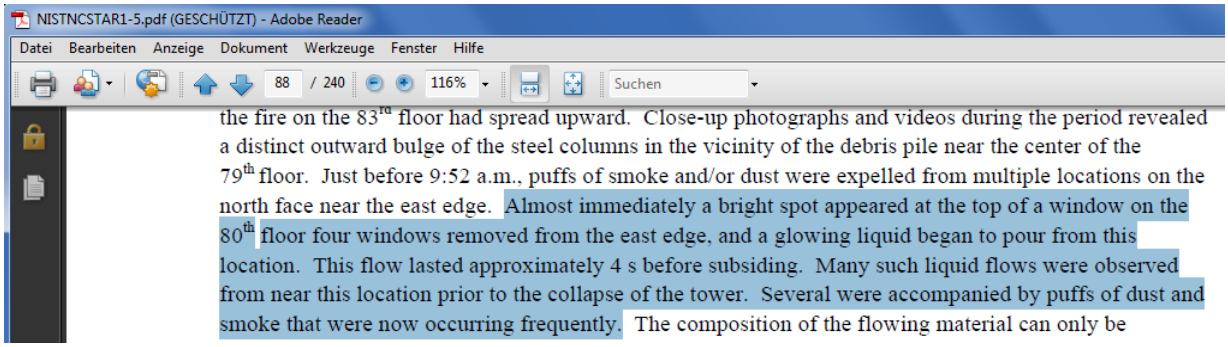


Figure 8–21 shows a close-up frame from a video of a portion of the east face recorded at 9:16:08 a.m. Intense flames are coming from windows 96-208 and 96-209. In the video it is clear that flames are exiting from across the entire burning region that is visible on this floor. A series of carets are seen at the tops of the column covers. The carets appear to be glowing near the center. The physical mechanism responsible for this glow is not known, but it does suggest that significant heating was taking place at this time. Recall that flames were observed on the 97th floor immediately above this location around

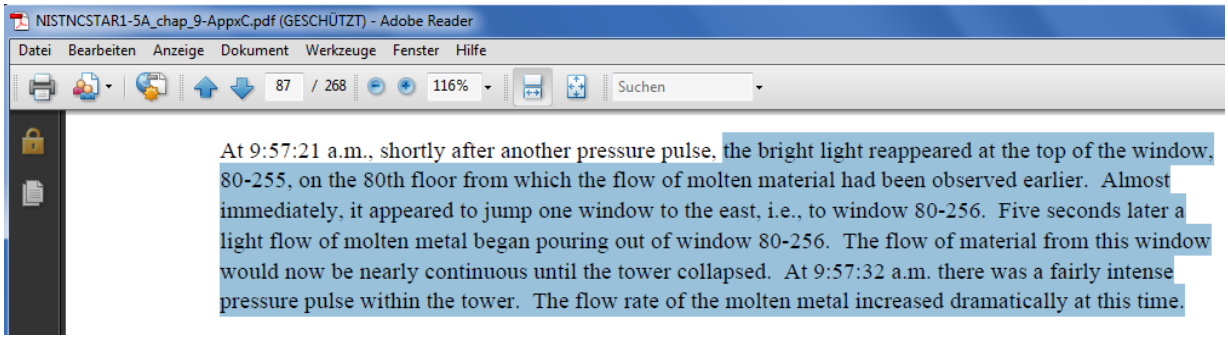
Figure 8-21. A close up of a portion of the east face of WTC 1 is shown. The image is a frame taken from a video recorded at 9:16:08 a.m. Column and floor numbers have been added. The area to the left with the scaffolding is another building in the foreground.



The intense fire in the northeast corner opening of the 81st floor is still present. An unusual flame is visible within this fire. In the upper photograph in Figure 9–44 a very bright white flame, as opposed to the typical yellow or orange surrounding flames, which is generating a plume of white smoke, stands out. The intensity of this flame is considerably brighter than normal flames. It was easily identified in numerous photographs and videos shot from long distances at which the surrounding "normal" flames were not visible. The brightness of the flame, along with the white smoke, suggests that some type of metal is burning. Metal combustion is known to generate much higher flame temperatures than hydrocarbon combustion, and, as a result, to burn much brighter. It is difficult to identify what type of metal is burning. Aluminum will burn, but in normal fires it usually melts instead because the metal surface is protected by an oxide layer that must be breeched before ignition can take place. Aluminum oxide melts at high temperatures that are not typically reached in normal fires. There were limited quantities of other metals on the aircraft that might also burn. Whatever the metal, the ignition of a metal fire is an indication of the significant heating of the debris that took place in the northeast corner of the 81st floor due to the prolonged intense burning in this area following the aircraft impact.



the fire on the 83rd floor had spread upward. Close-up photographs and videos during the period revealed a distinct outward bulge of the steel columns in the vicinity of the debris pile near the center of the 79th floor. Just before 9:52 a.m., puffs of smoke and/or dust were expelled from multiple locations on the north face near the east edge. Almost immediately a bright spot appeared at the top of a window on the 80th floor four windows removed from the east edge, and a glowing liquid began to pour from this location. This flow lasted approximately 4 s before subsiding. Many such liquid flows were observed from near this location prior to the collapse of the tower. Several were accompanied by puffs of dust and smoke that were now occurring frequently. The composition of the flowing material can only be



At 9:57:21 a.m., shortly after another pressure pulse, the bright light reappeared at the top of the window, 80-255, on the 80th floor from which the flow of molten material had been observed earlier. Almost immediately, it appeared to jump one window to the east, i.e., to window 80-256. Five seconds later a light flow of molten metal began pouring out of window 80-256. The flow of material from this window would now be nearly continuous until the tower collapsed. At 9:57:32 a.m. there was a fairly intense pressure pulse within the tower. The flow rate of the molten metal increased dramatically at this time.

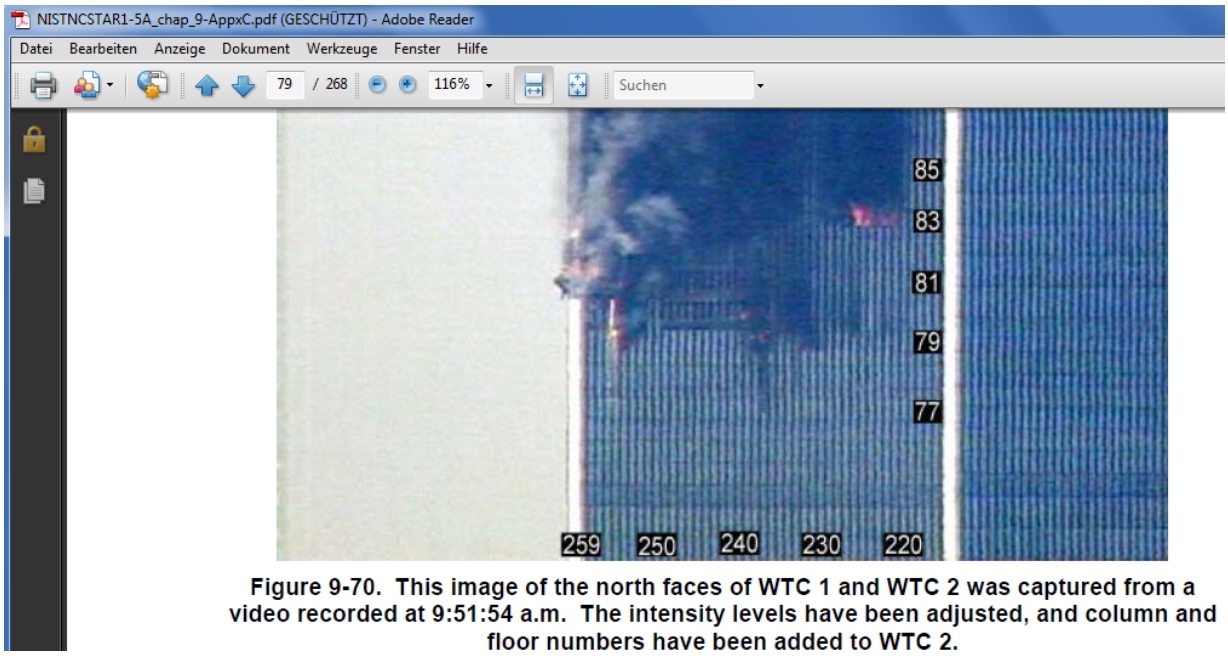


Figure 9-70. This image of the north faces of WTC 1 and WTC 2 was captured from a video recorded at 9:51:54 a.m. The intensity levels have been adjusted, and column and floor numbers have been added to WTC 2.

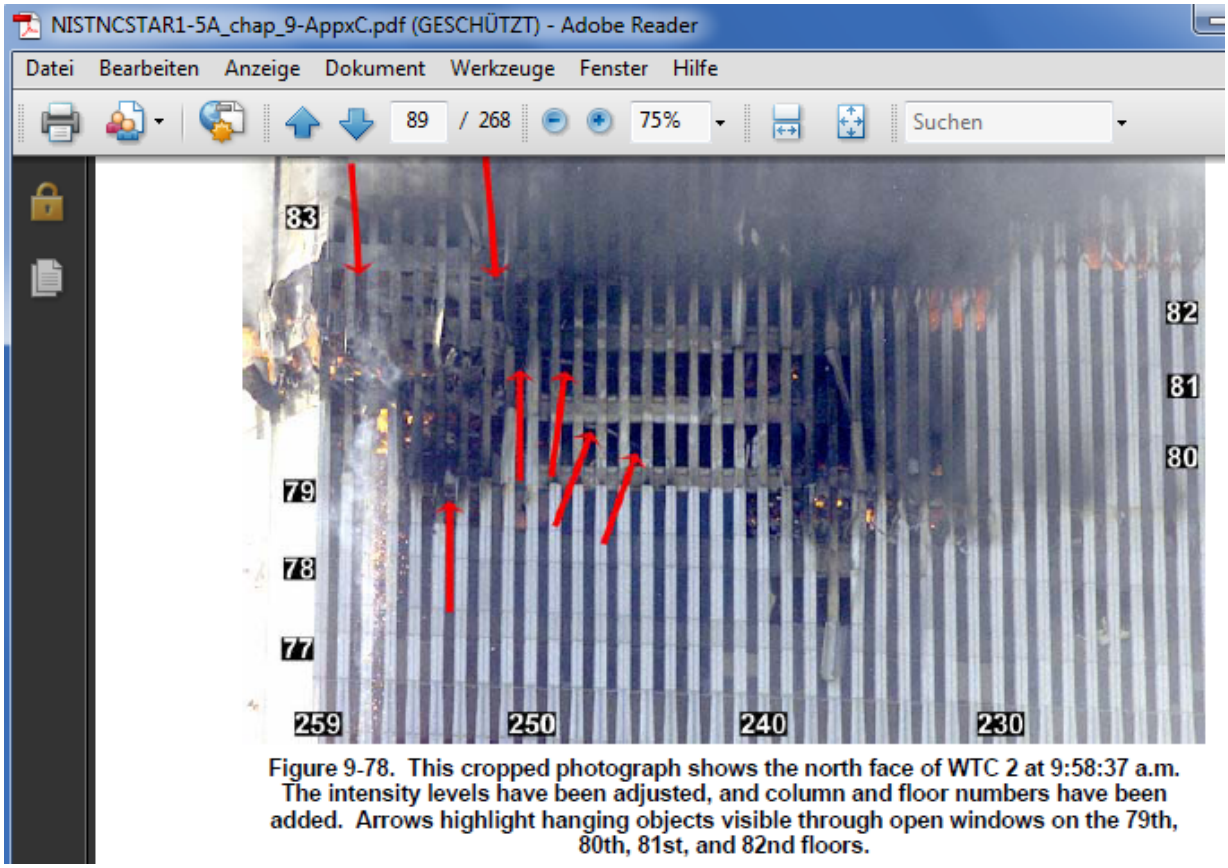


Figure 9-78. This cropped photograph shows the north face of WTC 2 at 9:58:37 a.m. The intensity levels have been adjusted, and column and floor numbers have been added. Arrows highlight hanging objects visible through open windows on the 79th, 80th, 81st, and 82nd floors.

NIST documents also evidence for “unusual fire behavior” in their timelines.[67] Unusual fire behavior is an indication that incendiaries might have been used, and it would have been NIST’s responsibility to follow up on this indication with appropriate tests on the physical evidence steel.[68]

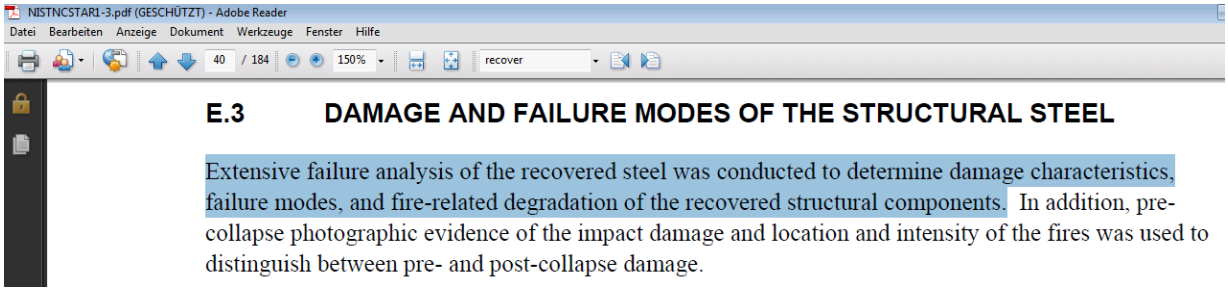
Had NIST not reviewed WJE’s report NIST would have implicitly had to acknowledge that the common method of unaided visual examination was a reliable method to check steel for high temperatures exposure, and the obvious question, like the elephant in the room, would have been why NIST did not follow up on the heat damage on smoothly bent pieces like column C-30, or on the buckling of perimeter column plates that were from non-fire floors but showed a similar buckling pattern like columns that WJE interpreted as being possibly caused by fire damage while the columns were still in the building. NIST would also have to acknowledge that pieces with no paint left needed to be followed up with other methods; WJE interpreted, in line with the common method, the loss of paint as a possible sign for exposure to high temperatures. But NIST wanted to conclude from the loss of paint only that “no conclusion” can be made; respectively, NIST "needed” to conclude this in order to safeguard its premise. One of the two “advantages” of NIST’s new developed paint-cracking method of microscope aided visual examination is exactly that only such areas of steel that experienced temperatures between 250 and 650ºC have to be recognized as possible affected by high temperatures.

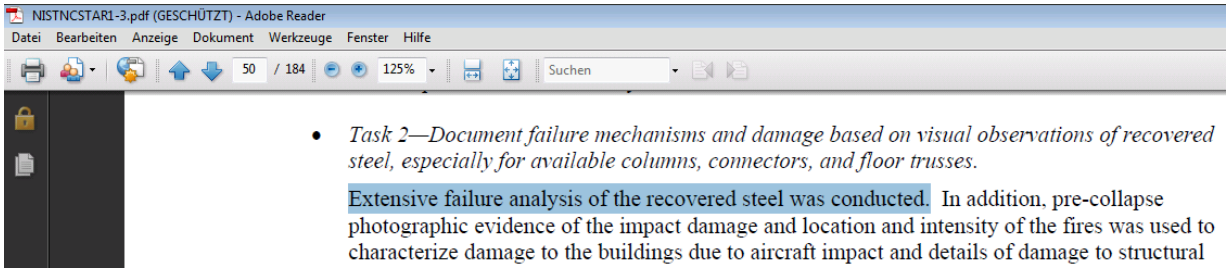
(V) Misleading Statements

Both in the “Executive Summary” and in Chapter 1 of NIST NCSTAR 1-3 it is claimed by NIST that: “Extensive failure analysis of the recovered steel was conducted to determine damage characteristics, failure modes, and

[67] See NIST NCSTAR 1-5 and sub-files, for example, “Chapter 5.3 UNUSUAL BURNING AND SMOKE BEHAVIORS”, NISTNCSTAR 1-5A pages 52f (PDF-pages 148f in NISTNCSTAR1-5A_chap_1-8pdf)
[68] See the NFPA 921, Chapter 22, especially “22.2.5 Unusual fuel load or Configuration”.

fire-related degradation of the recovered structural components." See quotes/screenshots from NIST NCSTAR 1-3, blue highlights added.





Performing an "extensive failure analysis of the recovered steel" was NIST's duty when conducting the WTC investigation; but this is not what NIST did. NIST excluded 51 "catalogued" columns of the 55 columns discussed in paragraph 4.1 "CORE COLUMNS" (NIST NCSTAR 1-3C) and all of the many pieces of Twin Tower steel left in hangar 17 from any "extensive failure analysis." Three examples for "catalogued" and identified core columns for which there is no discussion of the damage and failure modes in NIST's report are given here: Column C-65 (WTC 1, floors 86 to 89, below of the impact and fire area);[69] Column C-71 (WTC 1, floors 77-80, well below of the impact and fire area); Column C-90 (WTC 2, floors 12-15,

[69] See photograph from

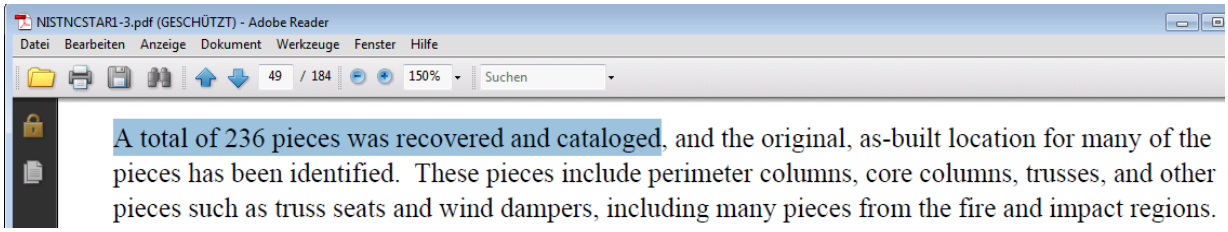
well below of the impact and fire area). See photographs from NIST NCSTAR 1-B.[70]

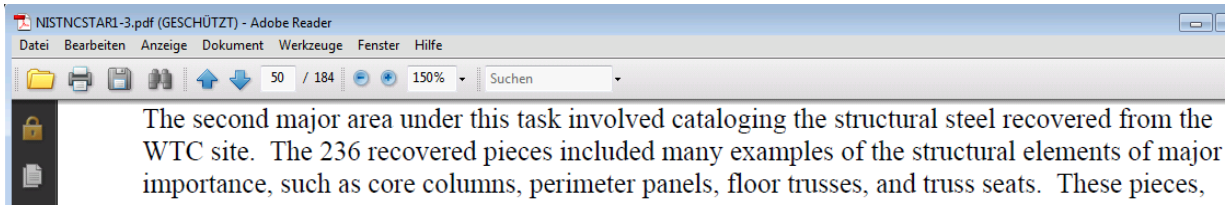
Source: NIST.

[70] C-60 and C-65: photograph from NIST NCSTAR 1-3B, page 40 (PDF-page 68). C-60, an unidentified column (NIST NCSTAR 1-3B, page 10, PDF-page 38) is to the right hand side in the photograph, C-65 is to the left hand side. C-90: photograph (cropped) from NIST NCSTAR 1-3B, page 44 (PDF page 72). For a photograph of C-71, see above, page 22.

These are just a few examples for the many columns for which NIST did not examine the damage and failure modes at all.

NIST is also not eager to let the reader know that it excluded many pieces of steel from its investigation from the very beginning, and how many were excluded. The "Abstract" at the beginning of the report concerning NIST's Project 3 (i.e., the file NIST NCSTAR 1-3 and sub-files) let the reader believe that "the" recovered steel was examined.[71] In the very first page of Chapter 1 of NIST's section on steel, it is misleadingly stated that a "total of 236 pieces were recovered and catalogued." See quote/screenshot from NIST NCSTAR 1-3, blue highlights added.





NIST does not explain the meaning of the term "catalogued steel" when it is first used (which is in the "Executive Summary" of the section on steel, paragraph "INVENTORY OF RECOVERED STEEL," page xxxviii[72]); but the reader has to read an 8-line long paragraph in "Chapter 5, STEEL INVENTORY AND IDENTIFICATION" to become aware that much more than just the 236 pieces were recovered, and that there exists more steel than

[71] See quote/screenshot from NIST NCSTAR 1-3, "Abstract", page 2 (PDF-page 50) above.
[72] Quote: "E.2 INVENTORY OF RECOVERED STEEL
A total of 246 recovered pieces of WTC steel were catalogued: the great majority belonging to the towers WTC 1 and WTC 2."

just the "catalogued" pieces. The large number of steel pieces that were recovered by PANYNJ, but not "catalogued" by NIST and thus excluded from having at least a chance to be examined, is not mentioned by NIST. There are several statements in NIST's report that are likely to misguide any reader who misses the small paragraph about the steel in hangar 17 into believing that only the 236 "catalogued" pieces were saved. See the above quotes, or, as another example, NIST's statement: "Due to the small number of samples, statistical data of the various damage features and failure modes would be irrelevant."[73]

NIST would have needed to write "Extensive failure analysis of the recovered *truss connectors from identified panels, and of two core columns, and of [about] 15 out of 153 "catalogued" perimeter columns* was conducted …" and add something about the number of unexamined pieces in hangar 17 at JFK airport, in order to have a statement that is not gravely misleading.

NIST's published report is not clear about how other steel parts (other than core columns and perimeter panels) like core channels and trusses were screened systematically regarding as to whether they experienced high temperatures. In NIST 1-3C it is explicitly stated: "Visual inspection for the fire effects on recovered steel was conducted solely on the perimeter panels and core columns, as they were the only structural elements with known as-built locations." Based on this one would conclude that NIST did not examine pieces other than core columns and perimeter panels (i.e., those with known as-built locations in the impact and fire areas, see above) for their possible exposure to high temperatures.[74] But NIST lists in Chapter 6.3.4, "Unique

[73] See NIST NCSTAR 1-3C, chapter 4.1 "Core Columns." (see screenshot above)

[74] In the case of the "catalogued" core channel pieces, NIST published a list of failure modes, but did not mention exposure to high temperatures in this list, and did not mention in the published report that the channels were examined systematically for high temperatures exposure. NIST also does not mention any results of a systematic

Cases of Damage Possibly related to Elevated Temperatures," two thinned truss rods among the five pieces that "were identified from visual inspection as having unique physical damage that may have been related to elevated temperature exposure."[75]

The visual examination of the other three pieces, referred to in the first paragraph of Chapter 6.3.4, was solely paint-based (as far as NIST's reported examination is concerned, one column is included because of Appendix C of the FEMA/BPAT report), but for NIST's visual examination of the truss rods the common method must have been used.[76] The two rods are the only two

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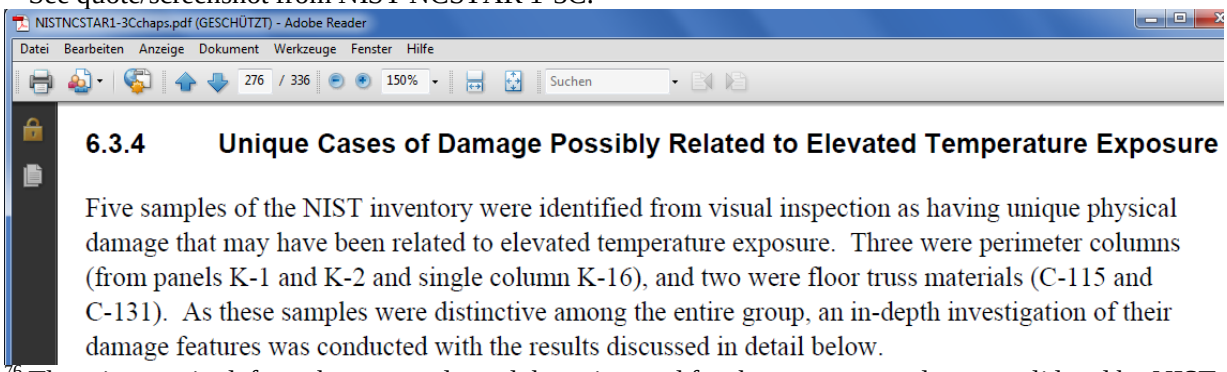
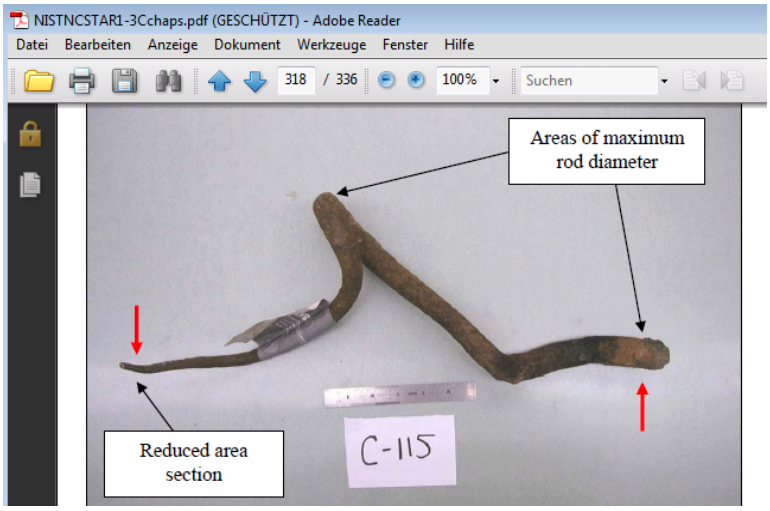
screening of the "catalogued" trusses and the few remaining other "catalogued" pieces for high temperature exposure.

[75] See quote/screenshot from NIST NCSTAR 1-3C.



[76] There is no paint left on the truss rods, and the paint used for the trusses was also not validated by NIST for a possible mud-cracking effect. See photograph/screenshot from NIST NCSTAR 1-3C that shows one of the truss rods.



pieces mentioned in NIST's report where the common method was used to determine which pieces might have been possibly exposed to high temperatures. It is gratifying that NIST used the common method at least on two of the many hundreds of recovered pieces of saved WTC steel, thus acknowledging implicitly its awarness of the usefulness of the common method. But NIST's explanations in Chapter 6.3.4 also have the effect that NIST's systematic exclusion of the common method of visual examination (when examining the core columns and the perimeter panels) and NIST's non-examination of the other pieces for their possible exposure to high temperatures will not be obvious to those readers that choose to read only some selected parts of NIST's published report. The systematic exclusion of the common method of visual examination when the steel was examined for possible exposure to high temperatures is also less apparent as one would expect in a report written by scientists and engineers because NIST uses the term "visual examination" for both the common unaided visual examination[77] and for its microscope aided, paint-based visual examination, without explaining that they use the term for two different methods.

NIST not only excluded most of the physical evidence steel from being adequately examined for their failure modes, and went to great lengths to get rid of the common method of unaided visual examination (and the data that the use of this method might have yielded), but NIST also employs misleading statements to hide these two facts as well as possible.

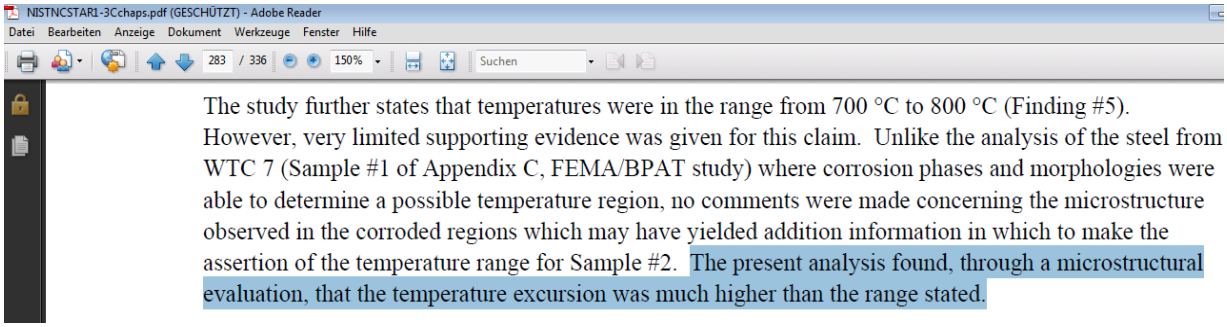
[77] I.e. unaided visual examination regarding questions not related to the examination of steel for possible high temperature exposure, except the statement that relates also to the truss rods in Chapter 6.3.4

(VI) Further Problems

The two samples from Appendix C of the FEMA/BPAT study

NIST was not able to apply its exclusionary tactics in the case of two pieces that were described already in Appendix C of the FEMA/ BPAT report that called for a more detailed study of its two samples.[78]

The Appendix C sample (2), a heavily corroded perimeter column, was examined by NIST (referred to by NIST as K-16), with the result that NIST concluded that it must have been exposed to even "much higher temperatures" than the 700 to 800ºC assumed in Appendix C.[79] See quote/screenshot from NIST NCSTAR 1-3C, blue highlight added.



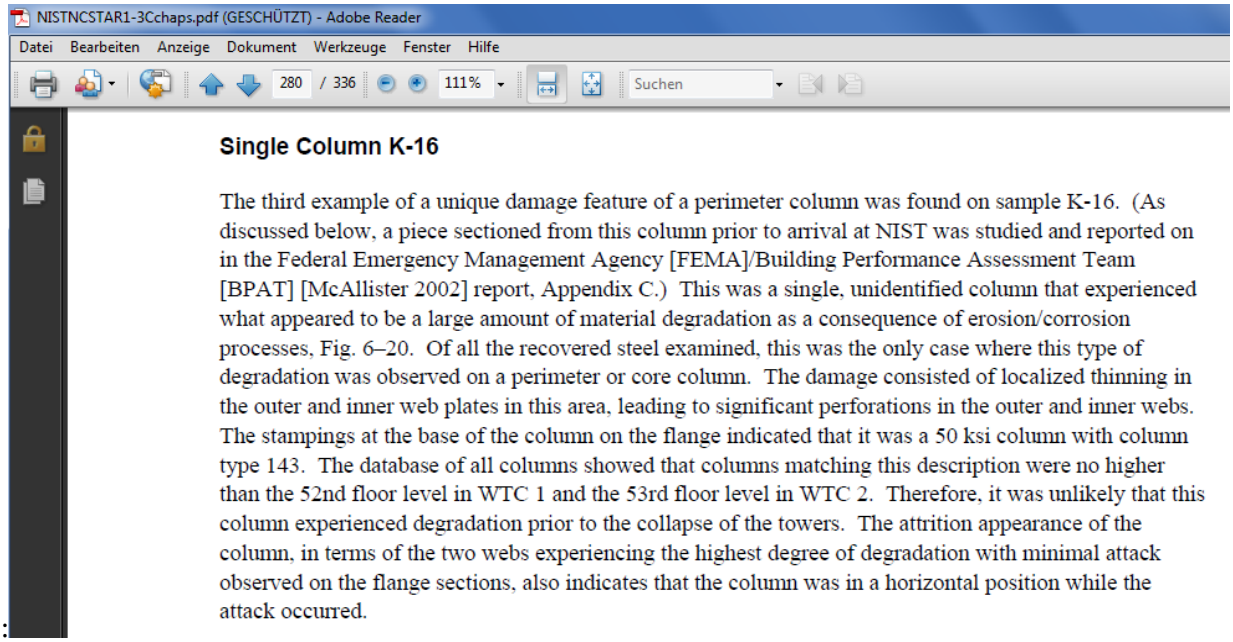
By this NIST acknowledges that a piece with an as-built location far below the impact and fire area must have been at temperatures that were much higher[80] than the range of 700 to 800ºC, either while it was still part of the building, or after the destruction.

Even had there been office fires next to K-16, they would not have had much of an effect on it, because its fireproofing cannot have been damaged by the airplane impact. NIST assumes that K-16 was affected by the high

[78] See above, footnote # 15.
[79] The term "[t]he study" refers to Appendix C "Limited Metallurgical Examination" (see above).
[80] NIST gives only an indirect statement regarding the temperatures reached. The minimum temperature must have been above 830ºC. See NIST NCSTAR 1-3C, pages 231f (PDF-pages 281f)

temperatures in the piles.[81] But a mix of unburnable construction materials and dust covered, shredded office contents cannot sustain fires that burn hot enough to explain the high temperature exposure of K-16[82]. By assuming that the high temperature corrosion process happened in the piles, NIST needed to acknowledge implicitly the high temperature phenomena evident in the piles.[83] But NIST does not do this in their published report. Instead NIST declares the data obtained based on its examination of K-16 as not relevant for its WTC investigation (arguing that the "degradation phenomenon had no bearing on the weakening of the steel structure or the collapse of the

[81] NIST states that the possibility that the steel was exposed to the high temperatures while part of a building was "unlikely." This "unlikely" but not ruled out option is not further discussed by NIST. NIST assumes that the steel was corroded while it was in the piles because of the fact that areas of the two web-plates of the column were corroded heavily by a high temperature attack, while the flanges of the column in the same area were not much affected, concluding that the piece must have been in a horizontal position during the corrosion process. See quote/screenshot from NIST NCSTAR 1-3C:

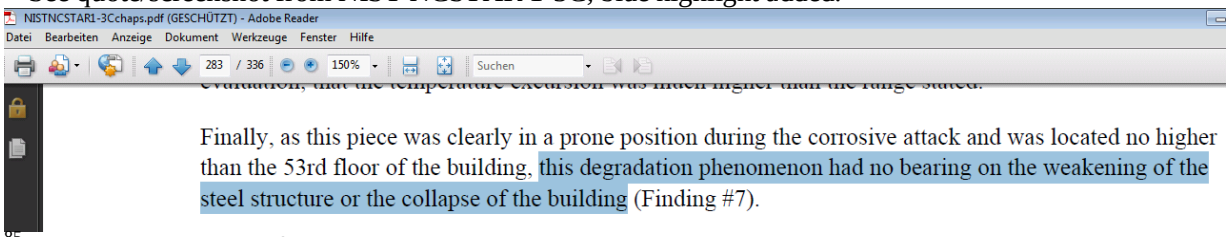


[82] K-16 has also an unusual corrosion scale. Quote: "The darker gray phases in the scale interior appeared to be iron oxides containing high levels of Ca, as well as minor quantities of Cl, Si, and S. The bulk gold-colored phases, as well as the majority of phases in the grain boundaries, were iron sulfides." NIST NCSTAR 1-3C, page 230 (PDF-page 280).

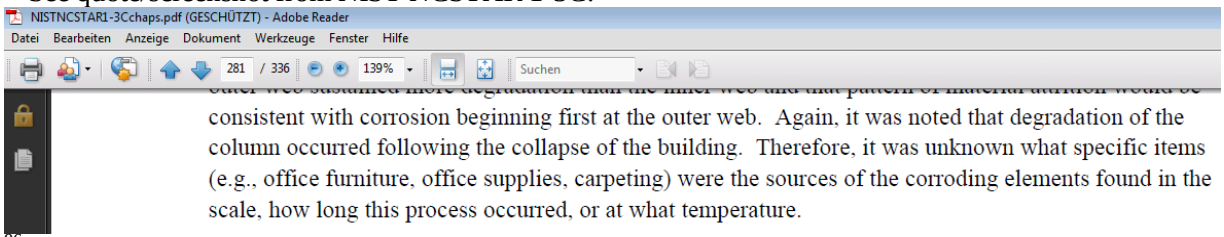
[83] The high temperatures in the piles are documented by many different sources. For some sources see Dreger, A.: "Sources related to exceptionally high temperatures, and/or to persistent heat at Ground Zero. Disinformation regarding the phenomena of "molten steel"/exceptionally high temperatures/ persistent heat at Ground Zero. Pre-collapse pressure pulses" http://911research.wtc7.net/papers/dreger/GroundZeroHeat2008_07_10.pdf.

building")[84] and distracts from the relevant problem that K-16 proves the use of heat sources other than mere fires (either in the building or in the pile) with the statement that it was "unknown at what temperature" the corrosion process occurred.[85] But by determining that the process happened at temperatures well above the range stated in FEMA's Appendix C, NIST provides relevant data regarding the temperatures at which the corrosion process occurred, namely data that show that the corrosion process occurred at temperatures that are much higher than those that fires in dust covered and oxygen starved "collapse piles" can possible produce.[86] By not addressing or discussing this problem, NIST implicitly declares the "incident scene" as not relevant for its investigation of the "incident."[87] But all available data – including all data from the incident scene,[88] – are supposed to be collected and discussed, a fact which is certainly known by NIST, which cooperates closely with the NFPA,

[84] See quote/screenshot from NIST NCSTAR 1-3C, blue highlight added.



[85] See quote/screenshot from NIST NCSTAR 1-3C:



[86] It is also very far-fetched that fire (as assumed by NIST) can affect the two web-plates heavily, but has only minor effects on the flanges.

[87] NIST explicitly declared the "incident scene" as not relevant in their 2006 FAQ's (quote): "The condition of the steel in the wreckage of the WTC towers (i.e., whether it was in a molten state or not) was irrelevant to the investigation of the collapse since it does not provide any conclusive information on the condition of the steel when the WTC towers were standing." http://wtc.nist.gov/pubs/factsheets/faqs_8_2006.htm

[88] The term "crime scene" was more appropriate, but NIST's spokespersons underline in interviews that NIST did not conducted a criminal investigation. See, for example, the statement S. Sunder (Lead Investigator of NIST's WTC investigation) gave in a radio interview in 2008: "This is a technical investigation, it's not a criminal investigation." http://noliesradio.org/archives/Nist%20Dr%20Sunder%20Interview_080821_widmusic-web.mp3

and participates in the Technical Committee that develops the statements in the NFPA 921.

NIST did not examine sample (1) from Appendix C. NIST leaves it to the reader to choose whether NIST wants to justify this because the metallurgical examination documented in NIST NCSTAR 1-3C was done only for recovered Twin Tower steel, or because sample (1) was not unambiguously identified as being from WTC 7. NIST's statements vary.[89] In favor of the first option, NIST fails to analyze sample (1) as part of their WTC 7 investigation; for the second, NIST fails to discuss the possible provenance of sample (1). Just stating that no steel "was unambiguously identified as being from WTC 7" is not an adequate substitute for an analysis of the provenance of sample (1). For both options, NIST fails to give any discussion regarding the failure modes of sample (1), and fails to show how the failure mode of this piece was - independently from its as-built location - possibly explicable in line with NIST's premise.[90]

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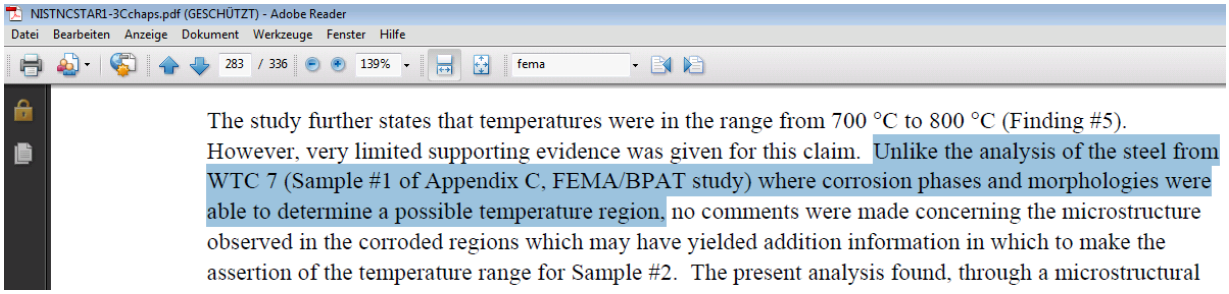
[89] On one hand, NIST NCSTAR 1-3C, "Damage and Failure Modes of Structural Steel Components," mentions sample (1) in one sentence as a WTC 7 sample. See quote/screenshot from NIST NCSTAR 1-3C, blue highlight added.

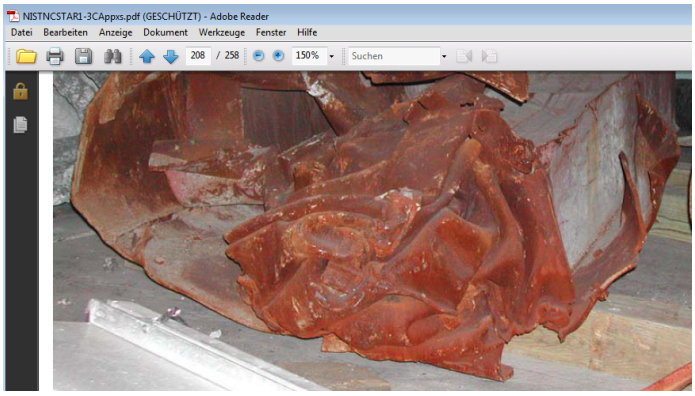


That sample (1) is not examined by them is then explained indirectly with the statement "WTC 7 steel was not evaluated in this study of the tower damage and failure modes." [sic!] (quoted from NIST NCSTAR 1-3C, page xliii, PDF-page 45; similar page 2, PDF-page 53). By this the examination of sample (1) can be understood as just being postponed because it is a WTC 7 and not a Twin Tower steel sample (but the 2008 WTC 7 report gives no discussion of sample (1) either.) On the other hand, NIST states in NIST NCSTAR 1-3 that "no steel was recovered from WTC 7 and in NIST NCSTAR 1-3C that "no pieces could be unambiguously identified as being from WTC 7" (NIST NCSTAR 1-3, pages iii and xliv, PDF-pages 5 and 46, similar on other pages; NIST NCSTAR 1-3C, page 5, PDF-page 55 and similar in NIST NCSTAR 1-3D, page 273, PDF-page 307.)

[90] It might have been justified to omit further discussion of sample (1) if it was shown that the sample was most likely not from WTC 1, WTC 2 or WTC 7. But this was not shown by NIST.

Perimeter panel K-1

A part of the perimeter column 280 from panel K-1 was examined by NIST further for its possible exposure to high temperatures; WJE singled it out as a "unique" piece, and suggested that it might have been fire affected. [91] The "accordion-like collapsed part" of the crushed part of the column "remains in general concentric alignment with the lower portion of the same column, which is relatively undistorted even after salvage and recovery operations."[92] One photograph (cropped) showing column 280[93].



NIST took just one sample and concluded, based on the metallurgical examination of this one sample that the whole crushed part of the column did not experience temperatures above 500ºC. But steel does not conduct heat readily, and the crushed part was at least approximately 2.5 meters high, web and flange plates were approximately 35cm wide. That different areas of the column can have been differently affected is underlined by NIST's description of the different conditions of the surface of the column in the 98th story part:

[91] The crushed part of column 280 was not affected by NIST's "review" because NIST found paint at the crushed part. NIST's statement in NIST NCSTAR 1-3C is not clear whether they found the mud-cracking pattern: "However, there were a few localized areas of remaining paint available that indicated mud cracking did occur as shown in Appendix E." (The table in Appendix E does not "show" anything, but lists the result that mud-cracking was observed.) NIST might have chosen to follow-up on K-1 for the reason that WJE documented it already on photographs in its report.

[92] NIST NCSTAR 1-3C, page 470 (PDF-page 184 in NISTNCSTAR1-3CAppdx.pdf)

[93] Source of photograph (cropped): Figure 22 in WJE's report, NIST NCSTAR 1-3C, page Fig-493 (PDF-page 207 in NISTNCSTAR1-3Appxs.pdf). The part to the left hand side is the spandrel plate. There are further photographs of K-1 in WJE's report and in NIST NCSTAR 1-3 and 1-3C.

"a majority of the paint was missing, with a fair amount of corrosion product on the surface […] However, there were a few localized areas of remaining paint available …" NIST observed on the one examined sample an oxide scale that was "somewhat dense and continuous, but non-uniform in thickness," with the "latter characteristic" due to "localized scale penetration into the flange material …"[94] NIST, which does agree that the damage was sustained in the building,[95] should have been interested in a more throughout examination of column 280 – story 98 was the story where the "collapse" of WTC 1 according to NIST most likely started, and the failure mode of column 280 is indeed unusual (it is so unusual that WJE's report has an extra paragraph about K-1 in its "Discussion" part[96]). Box-columns affected by temperatures of approximately 500ºC and loaded do not typically look afterwards like a piece of fabric that was folded just under its own weight.

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[94] NIST NCSTAR 1-3C, page 228 (PDF-page 278)
NIST declared the scale observed on the sample from the crushed area as "similar in nature to those formed by ambient processes." (NIST NCSTAR 1-3C, page 228, PDF-page 278)
[95] NIST NCSTAR 1-3C, page 226 (PDF-page 276) The lower part is almost undamaged. See NISTNCSTAR 1-3C, page 227 (PDF-page 277)
[96] NIST NCSTAR 1-3C, page 470 (PDF-page 184 in NISTNCSTAR1-3CAppxs.pdf)