

## National Transportation Safety Board

Washington, DC 20594

## **Highway Accident Brief**

#### Fire Damage to Bridge and Subsequent Collapse, Atlanta, Georgia, March 30, 2017

Accident Number:	HWY17IH012
Accident Type:	Bridge collapse
Location:	Interstate 85 north overpass, Piedmont Road, Atlanta, Fulton County, Georgia
Date and Time:	March 30, 2017, 7:14 p.m.
Fatalities:	0
Injuries:	0

#### **Event Description**

On Thursday, March 30, 2017, about 6:05 p.m., construction materials stored under an Interstate 85 (I-85) overpass in Atlanta, Georgia, were set on fire. The fire propagated throughout the storage area. Just over 1 hour later, at 7:14 p.m., span 30 NB—a 92-foot-long elevated span of I-85—collapsed. No fatalities or injuries were reported from the fire and subsequent bridge collapse. One person was arrested and later charged with criminal damage to property. The Georgia Department of Transportation (GDOT) had been using the area as storage for 76 reels of high-density polyethylene conduit and nine racks of fiberglass conduit. The materials were left over from an earlier project on State Route 400 (SR-400) and were secured inside a chain-link fence.

The interstate bridge is located over Piedmont Road, 4 miles northeast of downtown Atlanta (see figure 1). GDOT determined that five bridge spans adjacent to the collapse—two in the northbound direction and three in the southbound direction—required removal due to structural damage from heat exposure. The \$15-million replacement project required 43 days.

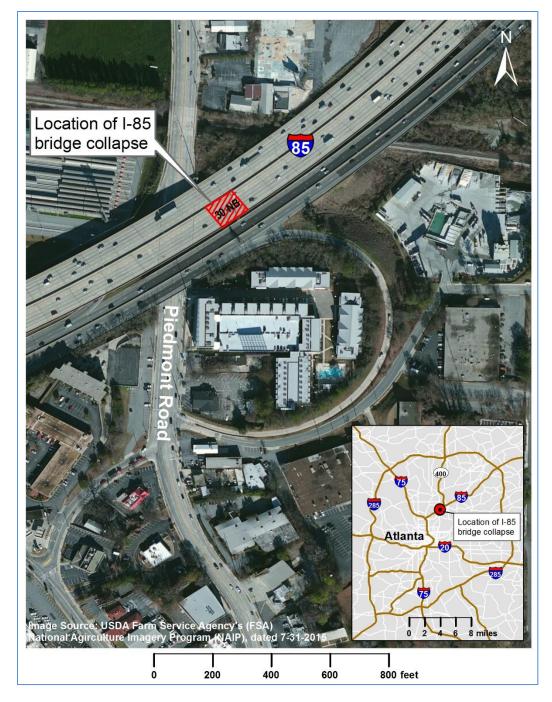


Figure 1. Location of I-85 bridge collapse, Atlanta, Georgia.

#### **Bridge Information**



Figure 2 shows an aerial view of the I-85 north collapsed bridge span on March 30, 2017.

At this location, the bridge consists of four northbound travel lanes and four southbound travel lanes, with an additional high-occupancy-vehicle (HOV) lane in each direction adjacent to the highway's center divider. Figure 3 presents a plan view of the I-85 bridge deck. It shows the collapsed bridge span and the spans that were replaced due to fire damage. Span 30 NB was located between bents 30 and 31 on I-85 north.<sup>1</sup> GDOT determined that spans 29 NB and 31 NB and spans 28 SB, 29 SB, and 30 SB required replacement, because excessive heat had caused the loss of pretension of the bridge reinforcement bars, and the bridge spans exhibited delamination and cracking throughout the bottom flanges.<sup>2</sup>

**Figure 2.** Aerial view of collapsed bridge span 30 NB and fire on I-85 north. (Source: Internet media modified)

<sup>&</sup>lt;sup>1</sup> A bent is a rigid frame commonly made of reinforced concrete or steel that supports a vertical load and is placed transverse to the length of a structure. Bents are commonly used to support beams and girders.

<sup>&</sup>lt;sup>2</sup> (a) Pretension is a condition created by stressing the reinforcement bars or tendons prior to placing concrete.(b) Delamination is a mode of failure in which the reinforced concrete separates above and below the reinforcement bars.

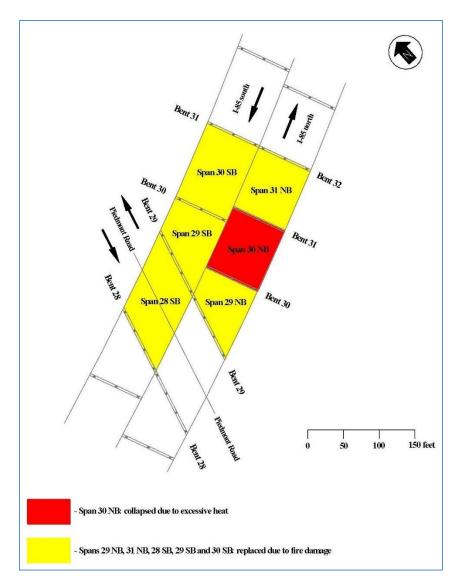
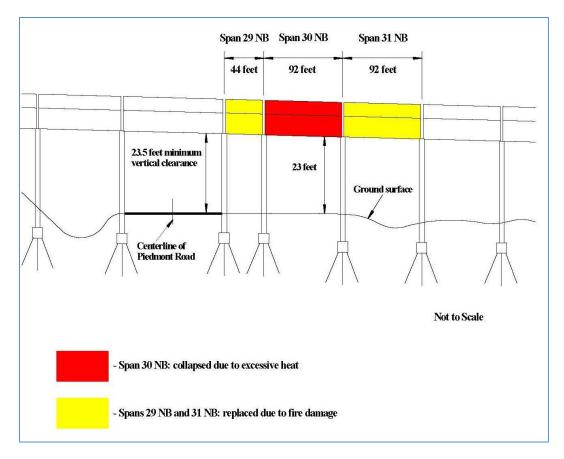


Figure 3. Plan view of I-85 bridge deck, showing location of collapsed span and damaged spans.

The bridge deck for span 30 NB was 79 feet wide and 92 feet long.<sup>3</sup> Spans 29 NB and 31 NB—the adjacent bridge spans that were removed—measured 79 feet wide by 44 feet long and 79 feet wide by 92 feet long, respectively. The vertical clearance from the ground surface to the underside of the collapsed bridge span was 23 feet, and the minimum vertical clearance from Piedmont Road to the underside of the northbound bridge span was 23.5 feet. Figure 4 shows a profile view of the I-85 north bridge deck.

<sup>&</sup>lt;sup>3</sup> The bridge deck is measured from outer edge to outer edge, which includes the width of travel lanes, the HOV lane, and the shoulders.



**Figure 4.** Profile view of I-85 north bridge deck, showing collapsed bridge span 30 NB, adjoining spans 29 NB and 31 NB, and vertical clearance to ground surface.

### Conduit Storage Under I-85 Bridge

Seventy-six reels of high-density polyethylene conduit and nine racks of fiberglass conduit were stored under the bridge span. The materials were intended for use in an earlier project on SR-400, but the contractor defaulted. Figure 5 shows a view of the high-density polyethylene conduit stored under elevated span 30 NB.



Figure 5. View of storage area under span 30 NB. (Source: Google Street View, February 2017)

The SR-400 project included installing changeable message signs, microwave radar detection coverage, closed circuit television cameras, and a conduit/fiber optic cable communications system from I-85 to Interstate 285. The contractor, TDC Systems Integration, Inc., began work on February 19, 2007. However, the project was suspended on April 25, 2008, because the contractor could not obtain the mandated bonds. At that time, the contractor had completed 27 percent of the work.<sup>4</sup> GDOT had originally stored the unused reels of high-density polyethylene conduit and racks of fiberglass conduit at a site along Sidney Marcus Boulevard. On January 10, 2012, GDOT moved the materials to the area under the I-85 bridge. GDOT chose this location because it offered shelter from the sun; and it was state-owned, fenced, and adjacent to another GDOT facility on the opposite side of Piedmont Road.<sup>5</sup> The materials remained under the I-85 bridge for more than 5 years, up to the time of the collapse.

#### **Fire Response and Investigation**

The Atlanta Fire Rescue Department was dispatched at 6:14 p.m. and arrived on scene at 6:20 p.m. Department personnel fought the fire for nearly 1 hour until the span collapsed at 7:14 p.m. and then continued working until the fire was reported under control at 10:56 a.m. on March 31. Heavy equipment operators subcontracted to GDOT uncovered many burned and crushed reels of conduit material in the area of the fire. The fire department's incident report indicated that the high fuel load underneath the bridge contributed to the spread of the fire. Once ignited, the large quantity of combustible conduit material provided significant fuel to the incipient fire, resulting in an increase in the overall heat released by the fire.

<sup>&</sup>lt;sup>4</sup> GDOT formally closed the project on March 29, 2012. A new contract was awarded to R. J. Haynie & Associates, Inc., and that work was completed on October 10, 2015. The contract specified a change to the layout of the duct bank and new conduit that was easier to install.

<sup>&</sup>lt;sup>5</sup> GDOT believed that sun exposure could degrade the materials.

The fire department investigated the source of the ignition. Witnesses reported seeing a man start the fire. He was subsequently arrested and charged with criminal damage to property, a first-degree felony.

#### **Conduit Examination**

At the request of NTSB investigators, GDOT recovered partial reels of the high-density polyethylene and fiberglass conduit while removing the collapsed bridge deck and debris from the scene on April 2, 2017. The material was transported to a secure location at a nearby state maintenance yard. On April 4, GDOT cut the material into 1-foot-long samples, and nine pieces were packaged and delivered to the NTSB materials laboratory for analysis of material composition. The samples were hollow and did not contain fiber optic cable.<sup>6</sup>

Figure 6 displays the nine samples submitted to the NTSB. The analysis confirmed that three samples were composed of fiberglass (numbered 1 through 3), and six samples were composed of polyethylene (numbered 4 through 9).



**Figure 6.** Nine submitted samples of conduit material, with samples 1–3 fiberglass and samples 4–9 polyethylene.

<sup>&</sup>lt;sup>6</sup> Fiber optic cable is typically inserted into conduit onsite at the time of construction. The fiber optic cable was stored separately from the conduit material and was not located under the I-85 bridge.

High-density polyethylene conduit and fiberglass conduit have different flammability characteristics.<sup>7</sup> Flammability is tested using UL-94 specified flame classifications.<sup>8</sup> Two tests are performed on plastic materials: the first determines the material's tendency to either extinguish or spread a flame once the specimen has been ignited, and the second measures the resistance of the plastic to electrical ignition sources. Twelve UL-94 specified flame classifications are assigned based on the results of these tests.

According to the manufacturer's data sheet, fiberglass conduit material (samples 1–3) does not meet the UL-94 flame classification "HB" (the lowest flammability classification), because the flame does not extinguish by the time prescribed in the UL standard. High-density polyethylene the same material from which samples 4–9 were manufactured—typically meets the UL-94 flame classification HB. However, when exposed to sufficient heat, burning polyethylene liquifies, which can spread fire through dripping or flowing of the flaming polymer liquid.

The large amount of combustible material being stored underneath this section of the I-85 bridge increased the fire risk to the bridge.<sup>9</sup>

#### **Guidance for Storage of Materials Under Bridge Structures**

#### **GDOT Guidance**

The GDOT *Standard Specifications, Construction of Transportation Systems*—approved by the State Transportation Board on June 21, 2001—states the following:<sup>10</sup>

#### **106.08 Storage of Materials**

No inflammable materials or harmful chemical shall be stored within 200 ft (60 m) of a structure nor within 200 ft (60 m) of a roadway open to traffic. Such materials shall be stored in accordance with directions from the manufacturer.

GDOT does not further define "inflammable." Generally, inflammable materials are those that are easily set on fire. The specifications indicate general construction site items that are inflammable, including fuel storage tanks or wooden forms.

<sup>&</sup>lt;sup>7</sup> The materials from the fire damage and bridge collapse were not subjected to flammability testing. The flammability characteristics were obtained from the materials specification literature.

<sup>&</sup>lt;sup>8</sup> Underwriters Laboratories (UL) is a product safety testing and certification laboratory. See the <u>UL website</u>, accessed April 5, 2018.

<sup>&</sup>lt;sup>9</sup> A combustible material is any material that—in the form in which it is used and under the conditions anticipated—will ignite and burn or will add appreciable heat to an ambient fire.

<sup>&</sup>lt;sup>10</sup> GDOT. 2001. *Standard Specifications, Construction of Transportation Systems*, page 34. The specifications apply to construction contracts and, therefore, to contractors. However, GDOT—not a contractor—placed the material under the bridge.

#### Federal Highway Administration Guidance

The Federal Highway Administration (FHWA) airspace guidelines, found in 23 *Code of Federal Regulations* (CFR) 710.405–710.407, include the following:<sup>11</sup>

# Question 710.405\_4: Are there fundamental restrictions against the lease of highway airspace?

Under no conditions shall airspace be used for the manufacture or storage of flammable, explosive, or hazardous material or for any occupation which is deemed by the SDOT/SHA or the FHWA to be a hazard to highway or non-highway users.

Further, 23 *CFR* 710.403(b) requires that any alternative use of the right-of-way be consistent with the "... safety of the facility, and such use must not impair the highway or interfere with the free and safe flow of traffic."<sup>12</sup> Although the FHWA has not defined flammable as used in the frequently asked question cited above, it has indicated that the plain language definition of flammable—"capable of being easily ignited and of burning quickly"—is consistent with the direction and intent of the question.

#### **GDOT Postfire Actions**

NTSB investigators requested that GDOT provide a list of all other locations in the state in which materials were being stored under bridge structures. GDOT determined that there were no other such instances. However, one work unit—the Highway Emergency Response Operators (HERO) unit—was located underneath I-85 near the site of the bridge collapse. GDOT is considering options to relocate this work unit, where staff meet for shift changes and hold team safety meetings. Supervisors have offices in the buildings under the I-85 bridge, and HERO trucks are parked there as well. Following the I-85 bridge collapse, GDOT requested that the State Fire Marshal inspect the HERO unit facility. The HERO unit was found to comply with all state requirements.

As part of GDOT's response to the bridge collapse, its commissioner requested assistance from the Office of Insurance and Safety Fire Commissioner in conducting a state-wide joint agency review of related GDOT procedures, particularly those regarding storage under bridge structures or other transportation infrastructure. The objectives of the review were to develop recommendations for best practice and to review policy on the safe storage and handling of all materials. A task group of engineers and safety professionals from the Greater Atlanta Chapter of

<sup>&</sup>lt;sup>11</sup> (a) Airspace is a legal term used in highway terminology to describe the area above *or* below the plane of a transportation facility and located within the right-of-way boundaries. (b) These guidelines can be found on the <u>FHWA</u> webpage on right-of-way airspace guidelines, accessed April 5, 2018. GDOT owned the space under the bridge; it was not leased.

<sup>&</sup>lt;sup>12</sup> See the <u>FHWA webpage on real property management, 23 CFR 710.403(b)</u>, accessed April 5, 2018.

the Society of Fire Protection Engineers produced a summary report, which provides information on managing fire risk and storing combustible materials under bridges.<sup>13</sup>

The task group made five recommendations to GDOT, based on National Fire Protection Association (NFPA) standard 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*, and provided prescriptive guidance for managing the storage of combustible materials. On January 1, 2015—prior to the bridge collapse—the state of Georgia had adopted the 2011 edition of NFPA 502 as a recommended practice. NFPA 502 provides instructive fire protection concepts that may be considered for bridges, tunnels, and other transportation infrastructure.

The summary report notes that most bridges constructed of steel and concrete are inherently fire resistant and have a relatively low risk of being seriously damaged by fire. However, the consequences from loss of service should be considered when making fire risk decisions. The fire risk for a bridge is typically based on the potential for vehicle fires above or below the structure. Vehicle fires could include heavy goods or tanker truck fires. Further, a fire resulting from materials stored underneath a bridge could exceed the thermal exposure expected from a vehicle fire. Section 6.3 of NFPA 502 provides the following guidance concerning a structure's exposure to a design fire:<sup>14</sup>

6.3.2 Where it has been determined by engineering analysis that collapse of the bridge or elevated highway will impact life safety or have unacceptable implications, the bridge or elevated highway, including its primary structural elements, shall be protected from collision and *capable of withstanding the time and temperature exposure represented by the selected design fire and its location*. (emphasis added)

NFPA 502 does not specify requirements for the storage of materials under a bridge or elevated structure, nor does it prohibit such storage. However, the task group posited that the concepts regarding design fires presented in NFPA 502 can be applied to the storage of materials. As such, the group recommended that the quantity, nature, and burning characteristics (that is, heat release rate) of stored material must not exceed the design fire exposure that was considered during the structure's design.

#### **FHWA Actions**

The FHWA distributed an event report to the states informing them of the circumstances of the I-85 bridge collapse and its concern about storing materials under bridges. The FHWA indicated that once the NTSB investigation was complete, it would update the report and disseminate any additional information. Further, the FHWA encouraged bridge owners to direct

<sup>&</sup>lt;sup>13</sup> Society of Fire Protection Engineers. 2017. Assessing the Storage of Materials – Bridge Structures and Other Transportation Infrastructure, GAC–SFPE Task Group Summary Report, prepared for the Georgia Office of Insurance and Safety Fire Commissioner, Office of the State Fire Marshal.

<sup>&</sup>lt;sup>14</sup> (a) "Design fire" is an engineering description of the development and spread of fire for use in a fire scenario; see <u>IADC lexicon website on standardization of terminology</u>, accessed April 5, 2018. (b) Excerpt from the 2017 NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*, <u>NFPA webpage on codes and standards</u>, accessed April 5, 2018.

inspectors, during their routine inspections, to be mindful of materials stored under bridges and to communicate any concerns to the bridge inspection program manager.

#### **Probable Cause**

The National Transportation Safety Board determines that the probable cause of the fire and subsequent collapse of the span 30 NB bridge structure on Interstate 85 north, in Atlanta, Georgia, was excessive heat from the ignition of 76 reels of high-density polyethylene conduit and nine racks of fiberglass conduit stored beneath the overpass. Contributing to the bridge collapse was the decision of the Georgia Department of Transportation to store construction materials beneath the bridge and its failure to assess the increased fire risk due to the presence of these combustible materials.

## BY THE NATIONAL TRANSPORTATION SAFETY BOARD

ROBERT L. SUMWALT, III Chairman EARL F. WEENER Member

T. BELLA DINH-ZARR Member

Adopted: March 13, 2018

For more details about this event, visit the <u>NTSB public docket</u> and search for NTSB accident ID HWY17IH012.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person." 49 *Code of Federal Regulations*, Section 831.4. Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. 49 *United States Code*, Section 1154(b).