National Transportation Safety Board
Engineering Factual Report

Accident

Vessel: Ferry *Andrew J. Barberi*
Date: October 15, 2003
Location: Pier B1, South side corner, Staten Island, New York
NTSB No.: DCA04MM001

Engineering Group Chairman

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SUMMARY OF EVENTS

On Wednesday, October 15, 2003 at approximately 1520 (LMT), the 310 foot Staten Island Ferry *Andrew J. Barberi*, one of a fleet of seven vessels owned and operated by the City of New York, Department of Transportation, suffered an allision with the south side of the B1 maintenance pier at the St. George terminal on Staten Island. The vessel had departed the Whitehall terminal in Manhattan at approximately 3:00 PM with an estimated passenger count of 1,500, bound for Staten Island. Upon departure from the slip at Whitehall, the propulsion systems, both forward and aft, were set to maximum ahead thrust, obtaining a speed of approximately 15 knots. This was the normal engine configuration for the trip between Whitehall and St. George. Captain Richard Smith was on the bridge and at the controls of the ferry as it proceeded south through the upper bay of New York harbor. The trip south was uneventful until the vessel reached the proximity of the KV buoy. Instead of the *Andrew J. Barberi* turning to starboard and reducing speed in preparation for docking at St. George, the vessel continued to maintain course and speed until it impacted the south corner of maintenance pier B1. There were 10 fatalities as a result of the accident.

ACCIDENT NARRATIVE

The Chief Engineer arrived for work at the St. George, New York City Department of Transportation (NYCDOT) terminal on Staten Island at 1300 on October 15, 2003. His work hours for his shift that day called for him to be on duty on the ferry *Andrew J. Barberi* from 1330 until 2130 that evening[1].

[1] Covella Interview, Page 5, Line 1

Once it was secured to the dock, the Chief Engineer boarded the Andrew J. Barberi, and met the Chief Engineer he was to relieve that day on the deck in the boarding area. They discussed the status of the engineering plant, as was normal in the course of "turning over" the watch to one's relief. The oncoming Chief Engineer questioned the Chief Engineer being relieved as to boiler and reachrod work he had supervised the day before, inquiring as to whether the work was operating in suitable fashion. The relieved Chief Engineer indicated that it was, and in regards to the general condition of the propulsion plant and its associated machinery, that "everything is fine, everything is in perfect shape." [2]

At 1310, the Chief Engineer proceeded to the Engine Control Room (ECR), where he spent a few minutes reviewing the day's time sheets. He was also intending to review the day's work order, but there were none submitted that day.[3] From there, he reviewed the day's engine logbook entries. According to these entries, there were no plant abnormalities either.[4]

The Marine Engineer reported for his shift on the Andrew J. Barberi, in the ECR, at 1320 and relieved his counterpart. He was told #1 Generator and #1 Boiler were currently online.[5] Once having completed his watch turnover, the Marine Engineer proceeded out to the propulsion plant to make his initial afternoon round of the plant and propulsion spaces, checking generators, oil levels, and temperatures, looking for problems of any kind.[6]

By this time, the 2 other engine room watchstanders, the Oilers, had assumed their watch duties. Both of them were called in on overtime for that shift cycle, as the regular scheduled Oilers for that day had called in sick. Upon accepting their watch, the 2 Oilers left the ECR to make rounds of the plant, as well as the forward and after propulsion spaces. In his testimony,

[2] Covella Interview, Page 6, Line 3
[3] Covella Interview, Page 6, Line 5
[4] Andrew J. Barberi Engine Logbook page of 10-15-03
[5] Gherardi Interview, Page 5, Line 17
[6] Gherardi Interview, Page 6, Line 5

one Oiler explained that during his round, “Everything was normal, it was a routine trip as always, like everyday.”[7]

Between 1330 and 1520, the Andrew J. Barberi maintained its normal itinerary to Manhattan and back without event. The plant was in it’s normal configuration that day, with all 4 main engines, and both forward and after Voith-Schneider propulsion systems running propelling the vessel. During the transit the engines were running at full speed, and the propulsion drives were at 100 percent pitch, giving maximum thrust ahead. During these trips, the engine room watch-standing personnel were making their normal, routine plant rounds, with no plant abnormalities reported. At 1520, during the return trip from Manhattan to the Staten Island terminal, the ferry allided with Maintenance Pier B-1.

At the time of the impact, all 4 engineering watchstanding personnel were in the ECR, with the Chief Engineer sitting on a settee, and the Marine Engineer standing in front of the electrical board. The following day during the Chief Engineer’s interview testimony, he stated that it felt like they had gone aground, “like the boat was shaking.”[8] According to the Marine Engineer’s testimony, it was a “violent crash”, his first impression being that they had run aground.[9]

The Marine Engineer reported that prior to striking the dock, there were no engine alarms, warnings, or calls from the wheelhouse to indicate imminent danger of any kind. “It was a very normal watch.”[10]

Following the allision, the Chief Engineer stated he jumped up off of the settee, and upon approaching the propulsion monitoring station at the control board, noticed from his console speed and pitch indicators that both the main engine speeds and pitch of the 2 Voith-Schneider propulsion drives were still at full ahead. In his testimony, he wondered why “nobody is giving

[7] Koutsoulias Interview, Page 5, Line 4
[8] Covella Interview, Page 7, Line 10
[9] Gherardi Interview, Page 6, Line 22
[10] Gherardi Interview, Page 10, Line 4

me a bell to take the controls, why are we still going full speed?"[11] There was no engine order telegraph command, or Cowbell alarm sounded[12] from the wheelhouse indicating that propulsion control should be taken over in the ECR. At this point, the Chief could feel a "rumbling" under the vessel as the propellers churned water in place with the ferry lodged against the dock. He thought to himself that they were either "going aground" or had possibly "run over a little boat" at this point, not knowing what had actually transpired outside.[13]

Realizing something had gone wrong, the Chief Engineer attempted to call both wheelhouses on the sound powered phone to ascertain what had happened. No one answered the phone in either wheelhouse.[14]

After having tried unsuccessfully to contact the wheelhouse by sound powered phone, the Chief Engineer sent his engineering watchstanders to various locations outside of the engineroom to check the vessel for damage and/or flooding, as well as to check both end propulsion units for damage. One Oiler first went to the New York end propulsion space to check that unit. He proceeded down the ladderway to that space, and seeing that all was in good order there, he continued back toward the Staten Island end propulsion unit. However, upon reaching the main deck area where the doorway down to that unit was located, he could see that it was impassable due to the debris, which had collapsed onto the doorway. At that point, he returned to the engine control room to inform the Chief Engineer of his findings. Both the Marine Engineer as well as the other Oiler left the engine control room with the first Oiler to check for any signs of damage outside of the engine space. Both of them, upon exiting the engine room spaces into the main deck area and seeing what had happened, returned back to the engine control room.

[11] Covella Interview, Page 7, Line 12

[12] An alarm bell, mounted in the Engine Control Room, with a mechanical linkage to the wheelhouse, that the master uses to signal the Engine Control Room personnel to standby to take local control of the propulsion system.

The sound powered phone rang in the engine control room. When the Chief Engineer picked up the receiver, there was no one on the other end. Even though there was no one on the line, he determined that the call was being made from a wheelhouse by the fact that the phone system incorporates a distinctive ring tone from the bridge.[15]

In the time that the watchstanders were out of the engine room, the Chief Engineer could see dust and debris starting to fall down into the engine room from above. It was also during this time while his watchstanders were out of the engine room that the Chief Engineer noticed that someone on the bridge was slowing down the engines and taking pitch off of the propulsion drives.[16] He wasn't sure who was performing this action due to the fact that he didn't have phone contact with the wheelhouse.

The Chief Engineer then instructed the Marine Engineer to remain in the engine room to monitor the propulsion plant while he made his way to the wheelhouse to meet with the Captain to see what was going on. The Chief Engineer exited the engineering spaces on his way to the Hurricane deck. He at first attempted to get to the wheelhouse by going up the Staten Island end ladderway. Upon seeing the damage to the ladderway and surrounding area, he instead went up the New York end ladderway. Once arriving on the Hurricane deck, he went directly to the Staten Island end wheelhouse, where he encountered the Captain. The Captain immediately asked for the Chief's assistance in transferring propulsion control from the Staten Island wheelhouse to the New York end wheelhouse saying, "Richie Smith has lost it, he couldn't focus—he was pacing in a daze."[17] In order to transfer propulsion control from wheelhouse to wheelhouse, 2 people are required to accomplish this task, one in each wheelhouse. Upon telling the Chief Engineer of Smiths' condition, the Captain left for the New

[13] Covella Interview, Page 7, Line 19
[14] Covella Interview, Page 7, Line 22
[15] Covella Interview, Page 8, Line 18
[16] Covella Interview, Page 8, Line 21

York end wheelhouse to receive propulsion control. Upon arriving in the New York end wheelhouse, the Captain signaled the Chief Engineer to "send" the propulsion control command to him. This is accomplished by pushing a button in the "sending" wheelhouse. The Chief Engineer performed this function, and the Captain pushed his "accept" button in the New York end wheelhouse to complete the transfer.[18] The Captain now had control of the propulsion system in the New York end wheelhouse, and he began maneuvering the vessel back to slip 5, using both forward and after propulsion drive systems. As the Chief Engineer waited for the signal from the Captain to transfer propulsion control, Port Captain John Mauldin radioed the vessel. The Chief Engineer responded to the Port Captain's radio call from shore, informing him of the severity of what had happened, and that more than the 2 ambulances that the Chief Engineer could now seen arriving on the dock would be needed.[19]

Once he completed in assisting the Captain in transferring propulsion control, the Chief Engineer noticed Captain Smith pacing outside of the Staten Island end wheelhouse. He opened the wheelhouse door to the open deck, and approached Smith, asking, "what happened, how the hell did this happen?" Captain Smitb put his head down and said, "I passed out."[20]

After having spoken with Captain Smith, and having assisted Captain Gansas in the propulsion transfer, the Chief Engineer returned to the engine room.

CREW INFORMATION

Chief Engineer

The Barberi's Chief Engineer, 61 years old, held a USCG Chief Engineer's license with Unlimited Horsepower endorsements for Motor and Gas Turbine plants. He started working for

[17] Covella Interview, Page 11, Line 1
[18] Covella Interview, Page 11, Line 11
[19] Covella Interview, Page 11, Line 13

the New York City Department of Transportation Ferry Service in May of 1988. He first sailed in the capacity of Marine Oiler for a period of about 11 months. He then was promoted to the position of Marine Engineer. He maintained this position for approximately 2 years, at which time he was promoted to Chief Engineer via the ferry services's rapid referral civil service program. He has sailed as Chief Engineer for the City's ferry service since this time on various vessels in their fleet, including numerous times on the Andrew J. Barberi.

Marine Engineer

The assistant engineer on watch in the engine room at the time of the accident, with a title of Marine Engineer, had worked for the New York City ferry service for 12 years. He held a Third Assistant Engineer's USCG Unlimited Horsepower license for motor vessels. The first 2 years of his employment with the ferry service he served in the capacity of Marine Oiler. Following his 2-year stint as Marine Oiler, he was promoted to Marine Engineer, a position that he has held for the past 10 years. During this time, he has worked on all the ferry service's fleet vessels.

VESSEL INFORMATION

The NYCDOT Ferry Service fleet is comprised of 3 classes of ferryboats: the Kennedy, Barberi, and Austen classes. Additional ferries of a fourth class are currently under construction at Marinette Marine Corporation, Marinette, Wisconsin. The start of delivery of the fourth class is anticipated to begin during 2004. The vessel involved in this accident, the *Andrew J. Barberi,* is a member of the Barberi class of vessel.

Equitable Shipyards, Inc., in New Orleans, Louisiana, built the Andrew J. Barberi in 1981. It was the first vessel constructed in its class. Its design capacity is 6,000 passengers. It is a

[20] Covella Interview, Page 12, Line 1

welded steel, double-ended vessel. It has a displacement of 2721 long tons, is 310 feet in length, 70 feet in breadth, and has a design draft of 12’ 6”.

VESSEL DESCRIPTION

Hull

The hull is all welded construction, transversely framed on 30-inch centers, and subdivided by watertight bulkheads to provide end ballast tanks, voids, propulsion gear rooms, and machinery spaces. The hull is symmetrical about the midships transverse section; frame numbers are designated such that Frame 0 is located at midships.

There are 10 watertight compartments. The engine room, containing the bulk of all main and auxiliary machinery, is located amidships between frame 12 NY end (NYE) and frame 12 of the Staten Island end (SIE). The 4 main engines and auxiliary equipment are located in this space. Also installed in this same space are the engine control room (ECR), auxiliary boilers, and the auxiliary power generators.

Next to these spaces are voids between frames 12 and 20 on both ends. On the NYE, this void contains the crew locker rooms, sewage treatment plant, and CO2 bottle room. On the SIE, this void contains diesel oil storage and service tanks. At both ends between frames 20 and 31 are voids as well. In the NYE this void is a potable water tank. Between frames 31 and 40, there are void spaces as well at both ends.

The next compartment on both ends, from frames 39 to 52, form the propulsion gear spaces. These spaces contain the pumps, controls, and reduction gears to drive the cycloidal propellers.

The spaces from frames 52 to both ends form ballast tanks; below the ballast tanks at each end there is a fixed, plated steel skeg which protects the cycloidal propeller from impacts with debris as well as improves directional stability and provides structural support for when the vessel is drydocked.

Between frames 12 and 40 at each end is a shaft tunnel, containing 2 propulsion line shafts and 12 line shaft bearings.[21]

Superstructure

There are 3 decks for passenger use and one open deck restricted to use by the crew. Embarkation is at 2 levels, main deck and upper embarkation level, suited to the terminal facilities. Ramps are provided between bridge deck and upper embarkation levels, and stairs are provided between the upper embarkation level and saloon deck, and between the saloon deck and main deck.

The enclosed portion of the main deck seats 1630 passengers and has an open boarding area at each end protected by the upper embarkation level above. Seating is arranged with longitudinal seats on centerline and on the outboard sides, with the remaining space being occupied by groupings of transverse seats. Four large hinged doors open the cabin to the boarding space at each end. Enclosed stairwells forward and aft lead up to the saloon deck.

The saloon deck is completely enclosed and has seating accommodations for 1258 passengers. Seating is arranged similar to the main deck. Enclosed stairs lead from the saloon deck to the upper embarkation levels; ramps lead from the upper embarkation levels to the bridge deck.

The bridge deck is divided by 2 longitudinal bulkheads to provide a convertible promenade area to the port and starboard of the enclosed center. This deck has longitudinal seating on the centerline and on the outboard side of the interior longitudinal bulkheads. The bridge deck seats 784 passengers.

[21] Information supplied by NYCDOT Engineering Staff

The wheelhouses and stack are located on the Hurricane deck. The stacks provide space for the engine casing and passenger space ventilation fans.[22]

MAIN PROPULSION MACHINERY

The *Andrew J. Barberi* is equipped with 2 Voith-Schneider cycloidal propeller systems, one at each end, rated at 3500 horsepower each. The cycloidal propellers can provide virtually equal thrust through a 360-degree circle: for this reason, the cycloidal propellers are used to accomplish both propulsion and steering of the vessel. The Voith-Schneider propeller is a unique propulsion system allowing quick and precise direction and speed control of the vessel. Fig. 1 is a photo of the Voith-Schneider propeller on the *Andrew J. Barberi's*. The vessel's control system is such that the magnitude and direction of thrust of each propeller is separately and manually controlled: each of the 2 wheelhouses can control both propellers. An automatic control system maintains the speed of the main engines at approximately 750 RPM when the vessel is underway and prevents any of the manual commands to the cycloidal propellers from overloading the engines. The propellers themselves turn at approximately 55-60 RPM when the engines are running at full speed, as the reduction ratio of the gearing between the main engines and the propellers is 13.7:1.

Each main engine is coupled to a cycloidal propeller through a torsionally flexible coupling, a disk coupling, a hydraulic coupling, a length of line shafting, and a length of line shafting supported by angularly flexible couplings. Two main engines drive the NY end propeller, while the other two main engines drive the Staten Island end propeller. Draining a hydraulic coupling permits declutching its associated engine thereby driving its associated cycloidal propeller using

[22] Information supplied by NYCDOT Engineering Staff

a single engine when required. The propellers each have an internal combining and reducing gear/right angle gear, as the axis of the propeller rotor is vertical.[23]

Fig. 1- Andrew J. Barberi Voith-Schneider propeller

Both forward and aft propulsion systems can be controlled from either of 3 stations; the engine control room; either of the 2 wheelhouses. To gain control, it must initially be transferred from the engine control room to either of the 2 wheelhouses. From this point on, control can be transferred back and forth between the 2 end wheelhouses.

To accomplish the transfer of control from one station to the other takes 2 individuals, one in the sending station, and one person in the receiving station. The person in the sending station

[23] NYCDOT Engineering data

presses a transfer button. He notifies the individual in the receiving station that this task has been accomplished, at which time the person receiving control presses an “accept” button in his station to complete the transfer operation. Both direction control wheels for both propulsion units must be at zero pitch to perform this transfer of control. Figures 2 is a photo of the engine control room propulsion control station, and figure 3 is a photo of a wheelhouse control station located on each bridge.

Figure 2- Engine Control Room Propulsion control station

Figure 3- Wheelhouse Propulsion control station

Main Engines

The 4, 16-cylinder main engines are manufactured by General Motors EMD (Electromotive Division). They are rated at 1750 brake horsepower each. Their maximum rated speed is 800 RPM, however their normal operating speed is 725-750 RPM. They are 2 cycle engines, incorporating roots blowers , started with air motors.

POST-ACCIDENT EQUIPMENT TESTING

Several post-accident tests were performed on various pieces of equipment and machinery of the Andrew J. Barberi. In each of the tests, all Engineering Group Party members were present and participated in the testing process.

New York End Wheelhouse Communications Equipment

The first equipment tested in the NYE wheelhouse was the Engine Order Telegraph (EOT). Both thrust and steering telegraphs were tested, and both were found to be working satisfactorily. The procedure used to test was to station one group member in the wheelhouse and one in the engine control room. Orders were given via the telegraph system from the wheelhouse to the engine room. A VHF radio was used to communicate between stations for verification that the orders were being received at both stations properly.

We next tested the NYE sound-powered phone system (SPP). In this test, we phoned from the test station to the engine room, as well as the SIE wheelhouse. Calls made to the engine room performed satisfactorily, while calls made to the SIE wheelhouse would ring in the SIE wheelhouse, but there was no audio circuit between these 2 stations.

The Public Address (PA) system was tested, and performed satisfactorily. When tested, it could be heard loud and clear throughout the vessel.

The NYE ship's whistle tested satisfactorily, testing both methods of sounding the whistle. One method is to depress a console pushbutton, which in turn opens a solenoid admitting air to sound the whistle. The second method of sounding the whistle is to manually pull an overhead pull cable in the wheelhouse, which is mechanically linked to the valve at the whistle itself, thereby sounding it.

Last to be tested in the NYE wheelhouse was the “Cowbell system”. The system consists essentially of a pull lever in both end wheelhouses connected directly to a cable leading to the engine control room. In the engine control room, this cable was fastened to a set of 2 actual cowbells. When the lever is pulled in either wheelhouse, these bells would ring in the engine control room. Hearing the ringing of these bells, the engine room watch personnel are to immediately stand by to take over control of the propulsion system upon the subsequent ringing down of an engine order telegraph command.

In summation, all of the communications equipment tested in the NYE wheelhouse performed satisfactorily.

Staten Island End Wheelhouse Communications Equipment

Testing of the SIE wheelhouse PA system, Cowbell signaling system, and that end’s whistle all worked satisfactorily, as they had in the NYE wheelhouse.

During testing of the SIE wheelhouse SPP system, we encountered some system deficiencies. Outside of this wheelhouse, an engineering group member was placed in the NYE wheelhouse, as well as the engine control room. All calls initiated from the SIE wheelhouse, regardless of location being called, had no audio circuit to them. The ringer would ring at the selected call destination, however there was no audio connection. All calls made from the engine room or the NYE wheelhouse to the SIE wheelhouse encountered the exact same results- the phones would ring but you could not talk between the 2 locations.

Testing of the SIE Engine Order Telegraph (EOT) also brought to light evidence of less than satisfactory results. To perform this testing, a group member was positioned both in the SIE wheelhouse, as well as the engine control room. These 2 stations were also in contact via a handheld radio. When an EOT command was ordered from the SIE wheelhouse EOT, a ringing

of the EOT was noted in the engine room, but there was no EOT needle movement coinciding with the ringing to indicate what speed change had been ordered. When an EOT command was given from the engine room, the same results were noted in the SIE wheelhouse, that being a ringing indication of an incoming EOT command could be heard, but there was no needle movement indicating what command was being sent. This test was performed in both directions for each speed from stop to full astern, and from stop to full ahead, with the same results. It should be further noted that although testing of this equipment was performed, the vessel was not using it at the time of the accident, as they were operating in bridge control of the propulsion systems, thus there was no need to use the engine order telegraph.

Propulsion System Functional Tests

The Engineering Group performed operational response and station transfer tests on both the Staten Island and New York end propulsion systems.

These tests were performed without main engine rotational drive being applied to the unit's gearboxes, as the impact of the main engine and propulsion system vibration upon the upper deck structural integrity was a concern at the time of testing. This was due to a lack of shoring support being in place on the Main Deck during the period of testing. It was determined that the intent of the testing was to prove effective functional operation and response of the propulsion units themselves, and not of the driving medium.

To effect these tests, the hydraulic drive pumps were started and the system was brought up to operating pressure. Group members were positioned at the wheelhouse controls as well as at the propulsion systems physical location.

Control was transferred from the engine control room to each of the 2 wheelhouses, and the group members in the wheelhouses varied both the thrust and steering from zero to 100 percent in both directions. Radio contact between wheelhouse and propulsion units group members was maintained at all times during the tests.

Throughout all phases of thrust and steering testing, both end units performed satisfactorily. Both NY and SI end units were noted to have a response time from zero to 100 percent thrust of approximately 5 seconds in any direction, and a response time from full ahead to full astern of between 7 & 8 seconds. It was noted from original sea trial data that the vessel had the capability of coming to a complete stop from full ahead in approximately 420 feet, in an elapsed time of 43 seconds.[24] It should be noted that this sea trial data is more than 20 years old and based on defined conditions, thus today's stopping distance may be slightly different than it was at the time the data was collected.

The team also performed propulsion control transfer testing from the engine room to wheelhouse stations, as well as from NYE wheelhouse to SIE wheelhouse, and back. All transfer of propulsion controls from operating station to operating station were performed satisfactorily, without any problems. To effect a transfer from one wheelhouse to the other, first a "send" signal button on the console of the operating station (wheelhouse) which currently has control must be activated. After this signal has been sent, the operator in the wheelhouse receiving control of the propulsion must push a button located on the console to receive and have command of the propulsion controls.

PIER DAMAGE

Pier B-1, the pier that the *Andrew J. Barberi* struck, was approximately 1000 feet long and 50 feet wide. It was impacted on the southeast corner, and approximately 1500 square feet of the pier's surface collapsed into the harbor. There was little observed damage to the pier beyond the area of the collapsed portion, however, there was considerable debris underwater in the area where the pier was located previous to the accident. This debris included broken timber

[24] George C. Sharp, Inc., "Trial Report-Staten Island Ferry-ANDREW J. BARBERI", Page 9

piles, bracing, concrete, a bollard, and parts of the vessel. All of this damaged material must be removed before the pier's repair can occur.

Due to the degree of damage in way of the collapsed portion of the pier, complete replacement of that section of the pier was recommended. It would also be necessary for some additional removal of concrete decking to drive new pilings and to facilitate restoration of the concrete surface.

The estimated costs to repair the pier were $1,400,000.

VESSEL DAMAGE

For reference purposes in the following text, due to the fact that the *Andrew J. Barberi* is a non-conventional double-ended vessel, rather than refer to "bow and stern", we'll refer to them as the Staten Island end and the New York end. Also for reference, and as mentioned earlier in this report, the hull is symmetrical towards both ends about midships; frame numbers are designated such that Frame 0 is located at midships, extending out to frame 55 in either direction.

The Staten Island end (SIE) of the *Andrew J. Barberi* struck concrete pier B-1 at an oblique angle, approximately 12 feet outboard of port of the vessel's centerline. The direction of travel, and path of the damage, crossed the vessel's centerline at frame SIE 43, and continued on the starboard side for some 210 feet until it ended at the outboard side shell of the vessel at approximately New York end (NYE) frame number 25.

Most of the significant damages resulting from the allision occurred at the main deck level of the vessel, with minor tearing of this deck that opened into various voids, machinery spaces, and ballast tank spaces below the main deck. The leading edge of the main deck, starboard passenger cabin, at frame 54, appeared to have taken the brunt of the effects of the allision. This bulkhead was fully torn from the deck, from the starboard deck edge, full inboard through to

a point about 12 feet to the port of centerline. Continuing inboard from the deck edge, the collision site entered the main cabin passenger stairs and from frame 54 thru 44 the stairs were fully collapsed with all associated bulkheads, frames, structural support columns and saloon deck support frames ripped out and missing. There is a main centerline support column at frame 36 that is the furthest most forward support column for the deckhouse that remained intact that appears to have been the main supporting member for the forward house after all other midpoint columns had been destroyed.

The forward cabin bulkhead at frame 54, external to this bulkhead, from forward to aft on the deck edge, the forward most starboard deck edge cleat was found largely intact. However, the deck edge was ripped here forward of the cleat, resulting in a deck tear of some 15 inches longitudinally, and 10 inches transversely, that opened the ballast tank space below the main deck. Aft of this cleat was another tear that approximated the same dimensions of the forward tear; this aft one however opened the propulsion room below the deck. About 4 feet aft of this cleat in the area of the bunker station there were found to be numerous piping derangements leading also to the propulsion room that were flattened and bent over that all opened into the propulsion room. These pipes ranged from L/O fill connections, fire main connections, head tank, F/O fill lines, water tank fill line, and associated vent line for these tanks. Inboard of the bulkhead by about 12 feet, there was a ventilator trunk torn out and missing that opened the propulsion room below to the main deck, and aft of this vent trunk there was also a rectangular air duct found torn off and opening the same compartment as before. In total, there were 4 deck tears/openings into the propulsion room below.

The vessel was constructed with support columns installed longitudinally, positioned roughly midway between the vessel's centerline and outboard side shell, from fore to aft that were comprised mainly of steel pipe of about 10" in diameter. These columns were used to support the saloon deck and upper deckhouse of the ferry. Beginning at frame 54, there were several of

these columns that comprised the interior of the forward cabin bulkhead, and supported the forward part of the superstructure. The force of the initial impact with the pier sheared off all these columns and the bulkhead at the deck point where they were welded to the deck. Continuing aft from frame/bulkhead 54, the next frame that lent to superstructure support was a half frame 48 that also had its outboard attachment point and its inboard support column sheared off. Here also was found a tear in the deck in way of the pipe duct and ventilator ducting into the Voith room at the support column footing. Continuing aft from frame 48 were frames 44, 36, and 28, all sheared off at both their outboard attachment points and inboard supporting columns. At the foot of the sheared support column for frame 28 was a tear in the deck about 14 inches long, which opened the void space below the deck. The next frames aft, frame 20 and frame 12, were sheared off as all those forward of this location were. Located between these 2 frames, and on the outboard side of the passenger seats next to the exterior bulkhead, was a fuel oil tank vent pipe that was nearly sheared off. Due to the force applied to this pipe, the deck in this area was also torn for a distance of approximately 12 inches that opened the void space below this deck. Continuing aft from here, the next frame was frame 4, which was also sheared at both ends. At this point, we are passing the midships point of the vessel, that being frame 0, and the frame numbers will again increase in number as we continue on towards the NYE of the vessel. NYE Frames 4 and 12 were both found sheared off at both ends as all before but frame 20 was found with it's inboard support column intact, however its outboard attachment point sheared off as all other frames forward had been. Structural damage was evident thru frame 20, however the extent of visible damage appeared to be limited to the vicinity of frame 25 in that the cabin side shell was peeled back to this point with no further damage to main deck frames beyond this point on the NYE. There was evidence of only minor cosmetic damage to some seat flashing and cabin interior bulkhead panels aft of frame 25.

On the SIE, the extent of damage to the vessel from the starboard outboard deck rail to the centerline was complete destruction of all vertical structural members, bulkheads, seating areas, bulkhead trim, ceiling panels, lighting cables and fixtures and plumbing systems (including fire-main). This area began at the bow of the vessel from a point about 12 feet to port of the centerline and extended fully to the starboard deck edge and bounded by an area beginning with the bow rub-rail, and ending at approximately SIE frame 20. From this frame 20, and working further aft, the destroyed area began to taper away from the centerline and take a line that lead more toward the forward starboard corner of the machinery casing trunk. At this point the forward corner of the machinery casing was crushed including a lifejacket locker located here. The damage continued thru the mid-ship section and took a line leading toward NYE frame 20 with the inboard support column of this frame 20 being spared but the outboard attachment point sheared off. The final end of the bounds of the damage exited the vessel side shell at a point in the immediate vicinity of NYE frame 25.

The Voith-Schneider equipment propulsion machinery, located in the SIE main propulsion room below these passenger stairs, was devoid of any damages, since the concrete pier appeared to have passed along the outboard cabin bulkhead as the vessel passed on it's path thru the pier. Below the main deck level virtually no damages were noted, thus saving the propulsion equipment from any damage.

The total estimated costs to repair the *Andrew J. Barberi,* and return the vessel to service, are approximately $6,500,000.[25]

[25] Caddell Dry Dock & Repair Co., Inc., Brooklyn, NY, Work Order dated 4/21/04