



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 27, 2006

In reply refer to: M-06-5 through -9

Admiral Thomas H. Collins
Commandant
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On March 6, 2004, the small passenger pontoon vessel M/V *Lady D*, a 36-foot-long by 8-foot-wide enclosed water taxi, was carrying 23 passengers and 2 crewmen en route from Fort McHenry National Monument to Fells Point, Inner Harbor, Maryland, when it encountered a rapidly developing storm with high winds. As the wind and wave intensity increased, the vessel capsized. Most of the water taxi's occupants were able to escape from the vessel, and all but 3 occupants of the *Lady D* were rescued within an hour of the capsizing. The bodies of the remaining victims were recovered from the waterway on March 14 and 15. As a result of this accident, 5 passengers died; 4 passengers suffered serious injuries; and 12 people sustained minor injuries.

The National Transportation Safety Board determined that the probable cause of the capsizing of the pontoon-style small passenger vessel *Lady D* was its lack of intact stability, which was insufficient to withstand the strong winds and waves that the boat encountered.¹ The lack of intact stability was caused by overloading, which resulted from a combination of the following:

- The *Lady D* was erroneously granted sister status by the U.S. Coast Guard to a pontoon vessel with different design characteristics;
- The Coast Guard certificated the *Lady D* to carry too many people as a result of an inappropriate stability test on the vessel to which it was granted sister status; and
- The Coast Guard's regulatory stability test standards on which the *Lady D*'s passenger allowance was based use an out-of-date average passenger weight.

The *Lady D* was the third in a series of four pontoon-style small passenger vessels built over a 10-year period. The 1992 stability proof test on the first pontoon vessel in the

¹ For additional information, read National Transportation Safety Board, *Capsizing of U.S. Small Passenger Vessel Lady D, Northwest Harbor, Baltimore, Maryland, March 6, 2004*, Marine Accident Report NTSB/MAR-06/01 (Washington, D.C., 2006)

series, the *Fells Point Princess* (later renamed the *Patricia P*), was not conducted in accordance with the pontoon simplified stability test (PSST) protocol as it should have been, but rather with the simplified stability test (SST) protocol for monohull vessels. Based on the inappropriate use of the SST on the *Fells Point Princess*, that pontoon vessel was certificated to carry 25 persons based on the 140-pound average weight standard specified in Coast Guard regulations. The next three vessels in the series had the same general size and arrangement as the *Fells Point Princess*. The Coast Guard granted sister status to these boats because of their similarities and did not subject them to their own stability tests. Consequently, all four vessels were certificated for the same passenger load (25 persons). Subsequent to the capsizing of the *Lady D*, the Coast Guard and the Safety Board determined that the vessels should not have been considered sister vessels, and that they should have been certificated for substantially fewer passengers.

During the early phase of its investigation of this accident, the Safety Board discovered from interviews and hospital records that the average weight of the persons on board the *Lady D* was 168.4 pounds, much heavier than the 140 pounds specified in the Coast Guard's stability test criteria. After determining the detrimental effects of the total passenger load on the *Lady D*'s stability, the Board issued Safety Recommendation M-04-4 asking that the Coast Guard take measures to minimize the possibility that occupant load carried on a pontoon passenger vessel would exceed the stability proof test weight. In its letter to the Coast Guard, the Safety Board suggested that the average weight used to calculate maximum occupant capacity should be increased. The Board cited the per-person weight criterion of 174 pounds per person used by the Federal Aviation Administration for aircraft loading. The Board suggested that as an alternative measure, the cumulative weight of persons permitted could be limited to the allowable load calculated in a vessel's PSST. This alternative measure could be accomplished in various ways, including summing the actual weights of people as they boarded the vessel, or by placing a load reference line on the vessel's pontoons to indicate the occupant load.

The Coast Guard concurred, in part, with the recommendation, and provided the Safety Board with an early draft of its multiphase action plan addressing pontoon passenger vessel stability. The Coast Guard chartered a workgroup to analyze the passenger weight issue and to assess the potential impact of regulatory changes in pontoon vessel stability calculations. The Coast Guard subsequently announced in the October 27, 2005, *Federal Register* that it was contracting for a study to determine the potential impact on the marine industry of increasing the passenger weight and size standards used when assessing the intact stability of all domestic passenger vessels, including pontoon vessels.

The Safety Board agrees that the passenger weight standard should be revised in the stability criteria for all domestic passenger vessels and has classified Safety Recommendation M-04-4 "Closed—Superseded" in its final report on the capsizing of the *Lady D*. The 140-pound weight standard is used in the PSST (46 *Code of Federal Regulations* [CFR] 178.340), the SST (46 CFR 178.330) for monohull small passenger vessels on protected routes, and in Subchapter S stability calculations for passenger heel (46 CFR 171.050). Updating these standards will result in a more realistic assessment of the number of passengers a vessel can safely carry. Considering that a statistically representative average passenger weight is subject

to change, the Coast Guard should also identify how best to address a weight standard that may change in the future.

Updating the passenger weight standard will be a positive step toward ensuring that a vessel is certificated for the number of passengers it can safely carry. However, even if the number of passengers permitted is based on an increased average weight standard, the problem remains that a vessel can become overloaded if many of the passengers on board are heavier than the standard. Masters therefore need an easy way of identifying whether the passenger load they are intending to carry will compromise the stability of their vessels. If a mark were painted on the hull that corresponded to the waterline when the vessel was carrying maximum approved load, the vessel operator could easily determine whether the vessel was overloaded simply by observing the vessel's draft in relation to that mark. The Coast Guard should identify a simple and reliable method for operators to determine that the maximum safe load for a small passenger vessel is not exceeded.

In this accident, as the *Lady D* proceeded across Baltimore Harbor and the master changed course to make for safe haven, the full strength of the storm struck the vessel on the port beam. The wind gusts and waves rocked the vessel so much that the *Lady D* could not resist the heeling forces and capsized. Recognizing that the wind and waves were factors in the capsizing, the Safety Board contracted for a study to evaluate the intact static and dynamic stability of the *Lady D*.

Calculations performed to evaluate the ability of the *Lady D* to withstand a 40-knot beam wind showed that with a load of 25 persons weighing an average of 168.4 pounds, the vessel had adequate righting moment to resist the static force of a 40-knot wind acting directly on the side of the vessel. In the static analysis, the vessel heeled about 6° and had slightly less than 2 inches of freeboard, but it remained upright. The results of the computer simulation to evaluate the dynamic effects of wind and waves on the *Lady D* were dramatically different. The environmental model used in the simulation assumed 1.25-foot waves at a peak period of 3.0 seconds and a 25-knot steady wind gusting to 42 knots on the beam. The dynamic simulation was repeated 20 times to establish a statistical baseline, and the vessel capsized within 1 minute in every case.

The Coast Guard's original PSST did not include a wind heel condition, as does the monohull SST. Coast Guard officials indicated that they thought an exception to the wind heel conditions had been made for pontoon vessels because early vessels, as designed, did not carry canopies or deckhouses. Under those circumstances, passenger heel, rather than wind heel, was the more critical stability test. The Coast Guard has since recognized the evolution in design and configuration of pontoon passenger vessels and addressed the impact of wind heel by issuing Policy Letter 04-10 to all Officers-In-Charge, Marine Inspection (OCMIs). The policy letter includes a job aid with a revised PSST protocol that includes an additional calculation that evaluates wind heel as a potential limiting condition on vessel stability.

The Safety Board recognizes that the job aid developed by the Coast Guard should be easier for inspectors to use than previous references. The applicability instructions in the job aid should preclude a Coast Guard inspector using the wrong test protocol when conducting a stability proof test. However, the guidance for the job aid still directs Coast Guard inspectors

to use the 140-pound per-person weight standard for passengers on protected waters in its calculation formulas, based on criteria in 46 CFR 178.340. The Safety Board has noted that this weight standard is out-of-date and does not reflect the weight of average Americans today.

A Coast Guard study team conducted an analysis to determine whether the PSST was still appropriate for modern pontoon vessels, which might have superstructures that add weight and make the vessel more susceptible to the effects of wind. The analysis was a parametric review comparing stability standards in Federal regulations (the PSST in Subchapter T and criteria in Subchapter S) with those of industry, including the American Boat and Yacht Council and the International Organization for Standardization (ISO). The study team found that some pontoon vessel designs that could meet the static stability criteria in Subchapters S and T would have difficulty meeting the ISO stability standard for wind and waves. In the case of the *Lady D*, the study team determined that it would not have met the full load submergence criteria in the certificate of inspection (COI) condition (25 persons at 140 pounds each) or the accident condition (25 persons at 168 pounds each). In each condition, the full load submergence exceeded 50 percent. Based on its analyses, the study team recommended implementing a maximum wind speed under which pontoon vessels could operate in protected waters and revising the average passenger weight standards.

The study team's findings were consistent with the results of the Safety Board's evaluation, which shows that existing Coast Guard intact stability standards for pontoon passenger vessels (the PSST in Subchapter T, "Small Passenger Vessels," and/or the alternative criteria in Subchapter S, "Subdivision and Stability") do not adequately account for the dynamic loading from wind and waves on a pontoon vessel operating on an unrestricted protected route. The Coast Guard therefore should revise the stability criteria for small passenger pontoon vessels for all passenger loading conditions to minimize the potential for capsizing in wind and waves.

Coast Guard Policy Letter 04-10 specifies that a pontoon vessel owner can provide design calculations to the Marine Safety Center (MSC) showing that the vessel meets the applicable stability criteria of 46 CFR Subchapter S in each condition of loading as an alternative to the PSST. In the case of the *Lady D*, the MSC would have approved the Subchapter S calculations for the carriage of 25 persons. Yet, the MSC's February 2005 analysis of this accident indicated that the dynamic factors affecting the *Lady D*'s stability were not precisely known, and, consequently, it could not reliably assess the stability required to survive the actual conditions because of the complexity of the calculations and the wide range of introduced error. To prevent the possibility that a pontoon vessel might be certificated for an inappropriate load, the Coast Guard needs to develop interim pontoon passenger vessel stability guidance based on static and dynamic intact stability considerations until such time as regulatory revisions are made as recommended above.

Although the CFR defines protected waters as sheltered waters presenting no special hazards, the definition includes no wind or wave restrictions. OCMI's will often include "Under reasonable operating conditions" as an operating restriction on COI's issued by the Coast Guard. This caveat gives no objective operational guidance to vessel operators for assessing the ability of a vessel to safely operate in wind and waves. The Safety Board

therefore concluded that a Coast Guard endorsement on a vessel's COI restricting a pontoon passenger vessel to limiting weather conditions would provide definitive operational guidance to a vessel's operator.

In summary, the National Transportation Safety Board makes the following safety recommendations to the U.S. Coast Guard:

Revise regulations to require that passenger capacity for domestic passenger vessels be calculated based on a statistically representative average passenger weight standard that is periodically updated. (M-06-5)

Identify a method for determining the maximum safe load condition of a small passenger vessel at the time of loading, such as a mark on the side of the hull, and require that the vessel owners implement that method. (M-06-6)

Revise the stability criteria for small passenger pontoon vessels for all passenger loading conditions to minimize the potential for capsizing in wind and waves. (M-06-7)

Until such time as you revise the passenger weight standard as requested in Safety Recommendation M-06-5 and the stability criteria used to evaluate small passenger pontoon vessel safety as requested in Safety Recommendation M-06-7, develop interim pontoon passenger vessel stability guidance based on static and dynamic intact stability considerations. (M-06-8)

Establish limiting environmental conditions such as weather in which pontoon vessels may safely operate, and list those limiting conditions on the vessel's certificate of inspection. (M-06-9)

We urge you to take action on the safety recommendations in this letter. The Safety Board would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendations. Please refer to Safety Recommendations M-06-5 through -9 in your reply. If you need additional information, you may call (202) 314-6177.

Acting Chairman ROSENKER and Members ENGLEMAN CONNERS, HERSMAN, and HIGGINS concurred with these recommendations.

[Original Signed]

By: Mark V. Rosenker
Acting Chairman