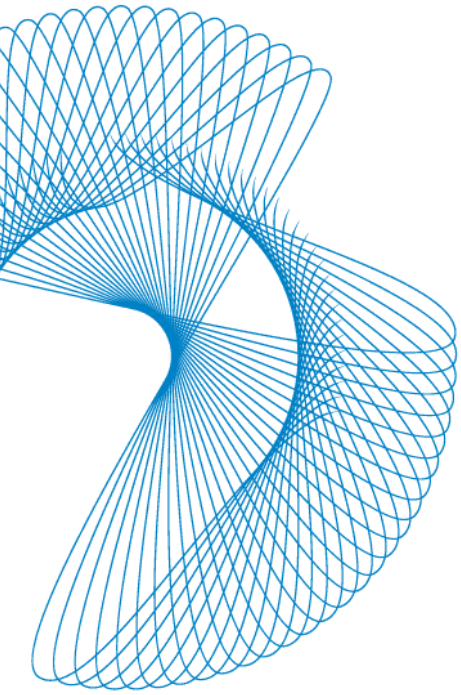
MARITIME NEW ZEALAND



Safety Investigation

Paihia High–Speed Passenger Boats

27 June 2009

Maritime New Zealand

Maritime New Zealand (MNZ) is a Crown Entity appointed under section 429 of the Maritime Transport Act 1994, with the responsibility to promote maritime safety, security and the protection of the marine environment.

Section 431 of the Maritime Transport Act sets out MNZ's functions. One of those functions is to investigate and review maritime transport accidents and incidents.

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Introduction

1. At approximately 1510 hours on 27 June 2009, a passenger on board the 18m high-speed passenger vessel ***Excitor*** suffered a lower back compression fracture.

2. She was participating in a 90 minute boat trip in the Bay of Islands, travelling from Paihia to Piercy Island, otherwise known as 'The Hole in the Rock', then back to Paihia. She received a serious harm injury to her vertebrae when she landed heavily on her seat after she was momentarily lifted into the air due to the motion of the vessel. She was treated in hospital for a number of days before returning home to begin recuperation.

3. Boat trips of this type involving fast, commercial vessels are reasonably popular in the Bay of Islands. However, these vessels are particularly susceptible to relatively high levels of shock and vibration when transiting choppy or disturbed waters in the vicinity of Bird Rock and in the more open waters areas approaching the outermost section of the trip. This is when the risk of spinal and other injuries is increased.

4. Maritime New Zealand (MNZ) is aware of seven other accidents that have resulted in lower back compression injuries on board the two high-speed vessels that have been operating out of Paihia since 1999. Three of these accidents occurred in 2009, and resulted in four passengers receiving injuries.

5. The risk of this type of injury can be reduced by the skill of the skipper, the design of the vessel, and putting in place procedures – such as the exclusion of individuals particularly at risk for medical reasons.

6. As a result of this most recent accident, an investigation was launched to look into the disproportionate amount of accidents resulting in injuries, which have occurred in the two high speed passenger vessels operating out of Paihia.

Analysis

7. Information has been gathered from:

- a report (number 11/2009) by the Marine Accident Investigation Branch (MAIB) in the United Kingdom, regarding the injury on board Celtic Pioneer in the Bristol Channel on 26 August 2008
- a STResearch paper 'High-speed Craft; Motion, Ergonomics and Injury 2008'
- the High-speed Craft Human Factors Engineering Design Guide
- Maritime Management Services and Survey Nelson Ltd.
- vessel operators
- archived MNZ accident reports.

Design

8. The two vessels currently operating in the Bay of Islands are ***Mack Attack*** and ***Excitor***.

9. ***Excitor***:

- was built 2002
- is 18m long
- carries up to 60 passengers
- is intended to be used for high-speed rides.

10. This vessel is required to meet Maritime Rule Part(s) 40A.10–40A.63 and 40A.70. These are standard requirements for all passenger vessel construction and equipment. There are no particular construction requirements under existing maritime rules for high-speed vessels of this size and configuration.

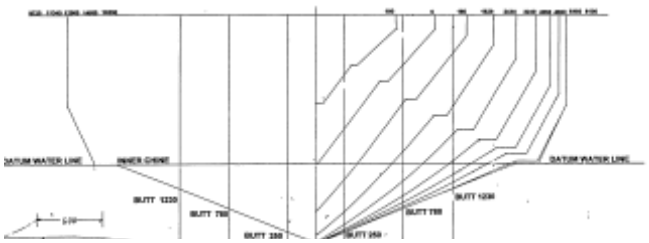

Figure 1 Bow section of ***Excitor***

11. This vessel is a moderate to deep V mono hull with a single chine. This type of hull is designed for high-speed. In moderate or larger sea conditions this could result in the vessel appearing to handle the larger waves easily, but as a result the vertical motion of the bow would be pronounced which can lead to rapid deceleration when passengers are seated in the most forward areas.

12. ***Mack Attack***:

- was built in 1996
- is 11.4m long
- is capable of high-speed
- carries up to 32 passengers.

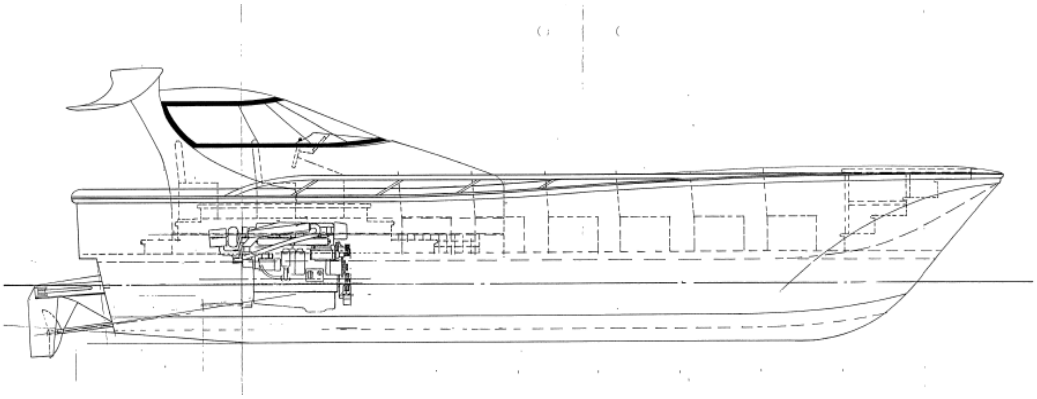

Figure 2 ***Mack Attack***

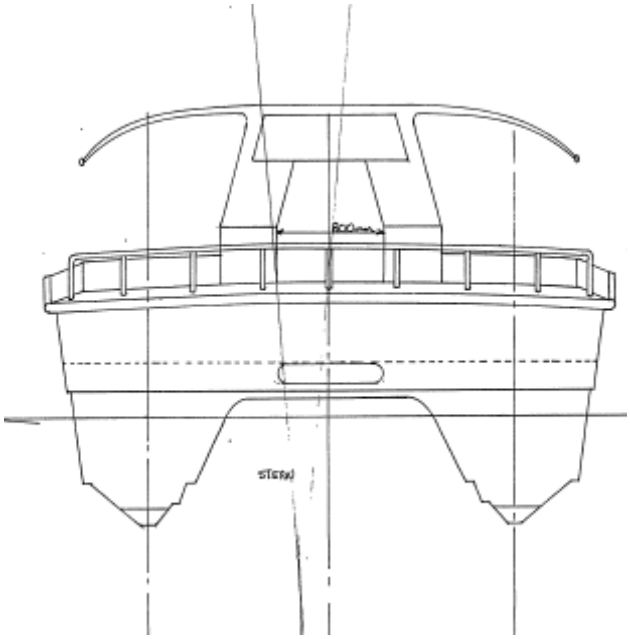

Figure 3 Forward view of ***Mack Attack***

13. This vessel is a catamaran design. Vessels of this type of design are likely to operate in similar conditions as the mono-hull up to a point. The maximum point is reached earlier and a reduction in speed and/or course is likely to be needed earlier for comfort and safety of those on board the catamaran.

14. The geometry of the hull has a large effect on the ride comfort and impact exposure. Larger craft have a more comfortable ride, although this is also normally related to an increase in weight that enhances ride comfort. For a mono-hull, the dead-rise angle is also critical to reducing impacts – the steeper the angle the better the ride, whereas the shallower the angle (i.e., a flat bottomed boat) the harsher the ride. Catamarans and multihull designs can also enhance ride comfort, although there are often operational requirements that limit the use of these designs.

15. The high-speed craft rule would not specifically apply to ***Mack Attack*** as this craft entered service before 1 February 2001. Maritime Rule Part 21 Appendix 6 clause 2.1, 1.2, 1.2.2 and 1.2.3, requires the owner to have a safety policy that establishes safeguards against all indentified risks and that continually improves safety management, thus ensuring the prevention of human injury. The Owners of this vessel do not have the advanced systems that the Owners of ***Excitor*** have, particularly with regard to complying with additional rules due to the size and build date.

16. However, if the Owners of either vessels were aware of back injuries occurring on the vessel or other similar craft they should have reviewed their SSM system and the fitness for purpose of the ship and made improvements which they (and their SSM company) considered appropriate. If more injuries occur, again further reviews and further improvements are required. Improvements could include fitting better seats or changing the way in which the vessel is operated, i.e., by slowing down.

17. Both hull designs suffer from attempting to compromise between ride safety and cost. Passengers on both vessels are experiencing rapid deceleration at times.

Injuries

18. The type of injury suffered typically occurs in the lumbar spine as a result of an axial load[1] being applied with a degree of forward flexion, and is commonly referred to as a 'wedge' compression fracture.

19. Spinal wedge compression fractures are common among people who have fallen from a height, been involved in a head on car crash, experienced a violent helicopter landing or have ejected from a military airplane.

20. The constant pitching and rolling of a boat in a seaway destabilises the upper body, and the resulting shocks due to wave slamming allow this mechanism of injury to be easily mimicked during fast boat rides. (This issue is addressed in the recommendations section).

21. Shocks and vibrations resulting from the impacts between a boat's hull and the sea are transmitted through its deck and seats to the passengers and crew. The size of the shocks experienced by people on board a boat are significantly magnified when their bottoms leave the seats and then land as the boat rises up towards them.

22. The human spine is at its strongest in the standing posture, when it assumes a natural S shape and can readily support the weight of the trunk and head as well as additional loads applied along its axis. An evenly distributed gap is maintained between the vertebrae by its discs, and maximum support is offered by the trunk and abdominal muscles. The spine is weaker in the seated position, when it assumes a slumped posture, and many of the muscles supporting the trunk cannot function effectively.

23. During axial loading the body's centre of gravity moves forward, increasing the risk of the spine bending forward (forward flexion). It is the combination of the flexion of the spine and the axial forces applied that causes contact between the vertebrae and results in fractures due to the wedging effect.

[1] An axial load is a load applied compressively through the longitudinal axis of the spine.

24. If a twist or bend is introduced to the lower back region the risk of this type of injury is further increased. Research indicates that the introduction of a twist can reduce the mechanical strength of the vertebra/intervertebral disc unit by about one third.

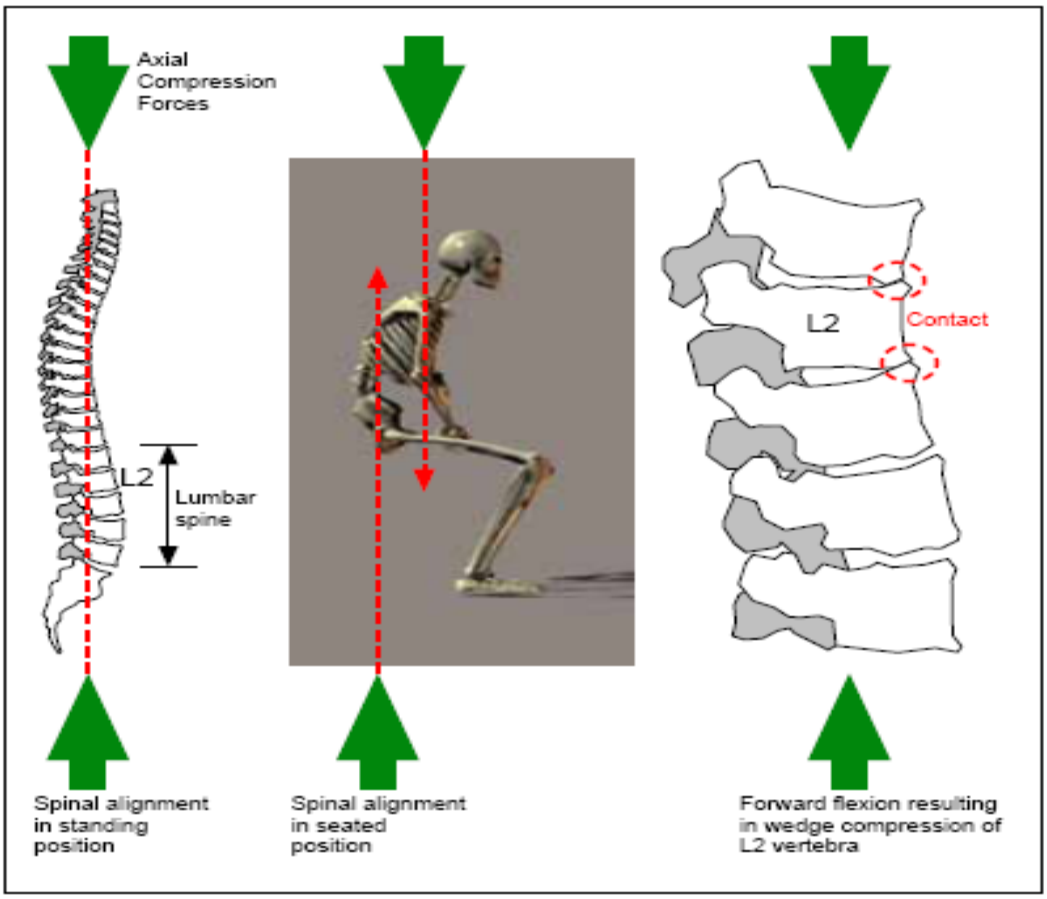

Figure 4 Spinal alignments

Courtesy of STResearch

Similar Accidents

25. MNZ is aware of seven other accidents that have resulted in lower back compression injuries on board one of the two current high-speed vessels operating out of Paihia in the Bay of Islands. There have been four compression fractures on three separate accidents in 2009 alone.

26. Two other accidents occurred in 1999 on ***Excitor I*** which was owned by a difference company and no longer operates commercially in Paihia. Not all the accidents were fully investigated. Documentation that was available from MNZ/MSA files is listed below in chronological order.

Report No. 98 1994, January 1999, Piercy Island area

"5.1 The Skipper is an experienced Skipper with good knowledge of the area. His training on fast boats was thoroughly done by the owner, but needs to be refined and firmly structured, e.g., three trips in calm conditions with the Owner/Senior Skipper, then three trips in marginal conditions with the Senior Skipper and maybe two trips without passengers in adverse but safe weather conditions. The SSM Company commented;

"Thus without the loading of passengers in adverse conditions the craft could be at greater risk from being broached, or heeled dramatically be (sic) the wind".

The training regime shall be discussed between the Owner and the SSM Company. The resulting regime shall be incorporated into the SSM manual for the vessel. The Maritime Safety Authority shall be notified of the changes made.

5.2 At the end of last year, the Owner/Senior Skipper left employment with the Fast Boat Company, taking with him many years of experience. This resulted in an urgent need for selecting and training a qualified and responsible Skipper. This could happen again and provision for this situation has to be made in a more formal and rigid manner.

*5.3 The seating in **Excitor** should be reviewed by the Owner, his Skippers and the SSM Company. Improvement was made in the early days of operation when additional foam was introduced in the bottom part of the seating. The continued injuries to passengers indicate that further modifications to the seats should be considered.*

5.4 The introduction of lap belts on all seats should be considered. This will also assist the Skippers in reinforcing the passengers to keep seated. A proposal should be made by the Owner/Senior Skipper to MSA to this effect.

5.5 The introduction to the passengers should be more detailed and should focus their attention specifically on the adventure and the risks involved with the trip.

5.6 The need and use of protective clothing should be explained in plain English to ensure it understood and passengers should be made aware of what to expect."

Report No. 99 2067, April 1999, Bird Rock area

"5.1 The Management of the Fast Boat Company to issue written safety instructions in each appropriate language to cover all possible passengers. The written instructions must be signed by each passenger to indicate that they have understood the instructions given and the risks involved in the trip.

*5.2 The seating on high-speed vessels, such as **Excitor**, should be reviewed externally, by a person with expertise in ergonomics. The Management of the Fast Boat Company to arrange this review and report the results back to the Maritime Safety Authority within one month, i.e., by 30 June 1999."* Records show that this document was not received by MSA at the time. This was not followed up at the time which is now 10 years ago.

Report No. 03 3143, March 2003, Tapeka Point area

27. Reported to MNZ but no formal investigation carried out.

Report No. 08 4954, November 2008, Bird Rock area

28. Reported to MNZ but no formal investigation carried out.

Report No. 09 4976, January 2009, Bird Rock area

29. Reported to MNZ.

The operation was inspected by an MNZ maritime safety inspector, who recommended that company management reviewed seat belts, seats, and passenger suitability, and tighten up their operating procedures.

Unreported to MNZ, April 2009, Bird Rock area

30. Current investigation ***Mack Attack*** – June 2009, Bird Rock area. There is anecdotal information which suggests other unreported accidents on this vessel.

31. It would appear that during the December 2008 or January 2009 accident investigations that the previous accidents of a similar nature were not identified.

32. With the benefit of a full analysis having been undertaken, it can be seen that the seating and seat belt issues have been known to the operators and MNZ for some time.

33. Due to the lack of full investigations of some of the previous accidents, data is not available with regard to seating positions of those injured.

Accident area

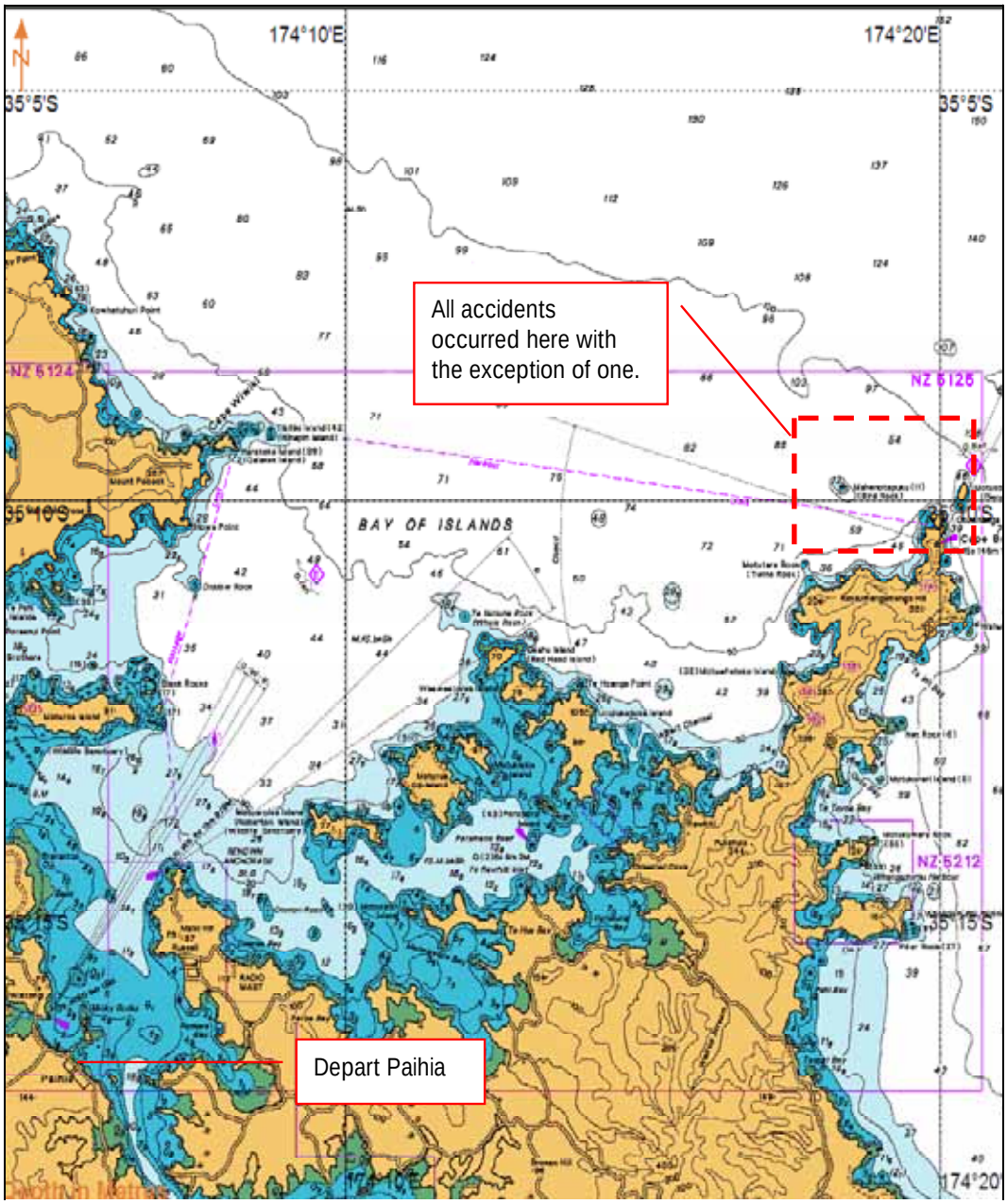

Figure 5 Chart of Bay of Islands

34. The trip starts at Paihia and heads out to 'the Hole in the Rock' which is located in Piercy Island. The island is on the extreme right of the red dotted box in figure 5.

35. There are a number of channels between the various islands on the voyage out to Piercy Island. This allows the skipper to operate in the much calmer areas before heading out to the more open waters past Bird Rock. The skipper can assess the weather conditions and stay within the confines for more of the trip.

36. There is a portion of the trip that must be undertaken in relatively open waters as the vessel passes south of Bird Rock heading for Piercy Island. It is in this area that all the injuries have occurred, with the exception of one.

37. In this area the oceanic swells are present and the prevailing north to north-east winds blow and create the windborne swell and chop.

38. The constant pitching and rolling of the vessel as it manoeuvres through the calmer enclosed waters can destabilise the upper body. After the vessel enters the more exposed areas near Bird Rock the movement can change, and shocks due to wave slamming can cause injuries to occur.

Seating and seat design

39. Figures 6 to 15 below are examples of commercially available seats. (Courtesy of High-speed Craft Human Factors Engineering Design Guide.)

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

40. Both vessels have lap belts fitted. These can help to reduce the distance that the passenger leaves their seat. They are designed to arrest the vertical movement, not the forward movement like a vehicle seat belt does. They are fitted with a plastic 'click together' type of buckle and are not self tightening, so rely on either the passenger themselves ensuring it is sufficiently secure or the vessel crew doing so.

41. The injuries have been caused by the passengers leaving their seats as the vessel drops away and then striking the seat as their bottom is still heading down and the seat is moving back up. A four point harness or a self-tensioning belt system could assist in keeping the passenger 'at one' with their seat in most motions.

42. Recently, extra padding has been added to the seat bottoms in an attempt to reduce the impact as the passenger meets the returning seat. However, this can lead to increased risk of injury, because the individual will still be moving downwards, compressing the cushion, while the boat has landed and is travelling upwards. This results in an increased impact as the boat seat and occupant are travelling in opposite directions at the point of impact.

43. If the seat bottoms are of a firmer and more form fitting and the passenger is held into the seat the risk of injury is reduced. The key point in seat padding is to keep the passenger moving in the same direction as the seat, if they are moving in opposite directions then higher impacts can be expected.

Handles

44. Handle position can be critical for the continuing safe posture of the passenger's back. By being too low it may provide no support to stop the individual from being thrown forward as the boat impacts with the water. By being too narrow it provides little lateral support to the individual when the boat impacts with the water or during cornering.

45. This again contributes to increased lumbar instability.

46. Both vessels in Paihia have differing handle setups that vary in their ability to provide the seated stability required for the passengers.

Figure 16 An example of what happens when the seat handles are too low
Courtesy of STResearch

Figure 17 An example of what happens when the seat handles are too low
Courtesy of STResearch

Figure 18 Example of a more supportive wide and high hand rail grip
Courtesy of STResearch

Excitor

47. The seating on these high-speed vessels is a crucial part of the overall design. Seating is as important as the hull design as it will directly interact with the passenger and can reduce the injury rate dramatically.

48. ***Excitor*** has a number of different seating designs. The vessel has a number of 'extreme' seats that are situated at the most forward part of the passenger area. These are a 'jockey' style where passengers need to sit astride the seat and grip the seat pod between their legs and use their knees to absorb the shocks, in a similar manner to a jockey riding a horse.

49. This seating style is similar to those used on a large number of high-speed vessels operating in the United Kingdom. They are considered preferable when operating in more extreme weather conditions. A degree of skill, strength and agility is required to maintain the desired seating position. Careful passenger vetting is required to ensure passengers understand the loading that takes place whilst seated, particularly in the more forward area.

Figure 19 Extreme seats on ***Excitor***

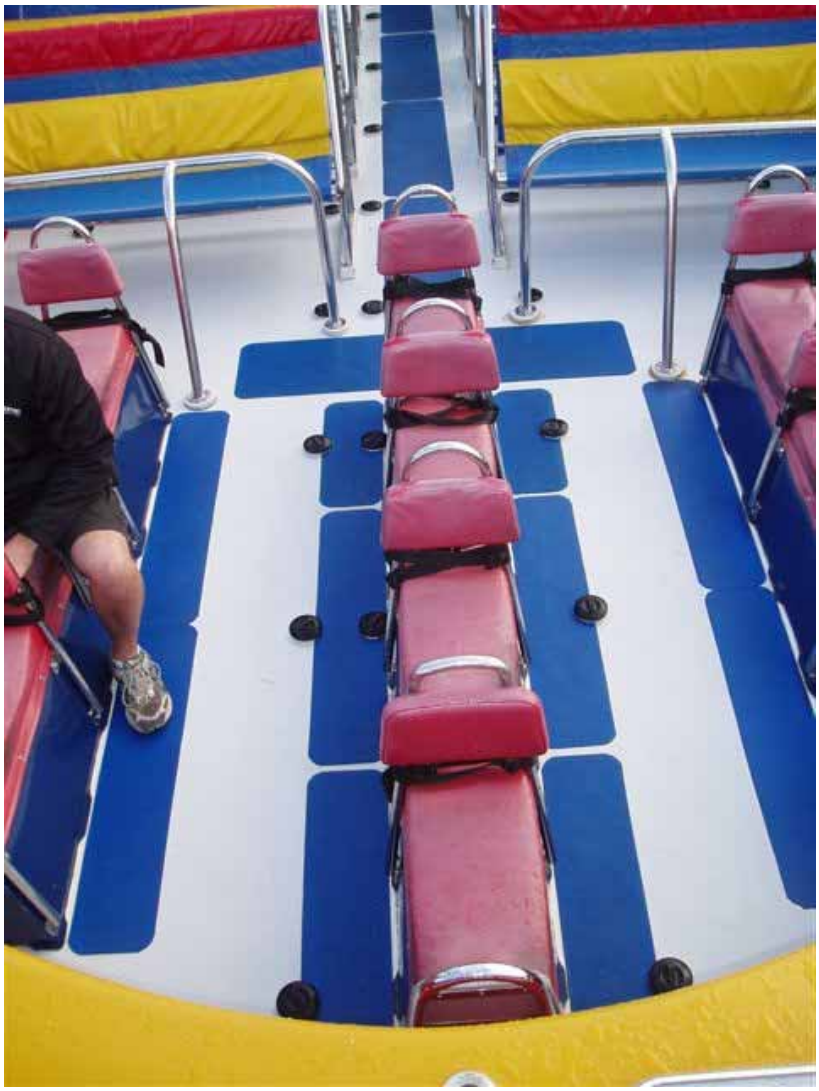

Figure 20 Extreme seats as seen from the front of the boat

50. The seat cushion padding of this type of seat is 70mm thick with the lumbar padding being 40mm thick. Note the narrow hand rail available to passengers seated here; this could contribute to a lack of lateral support where a wide hand grip is seen as best practise.

51. Other designs on board ***Excitor*** are a bench seat type. There are slight variations in design and padding but all are essentially very similar. They do, however allow for wide hand placement.

Figure 21 Bench seat on ***Excitor***

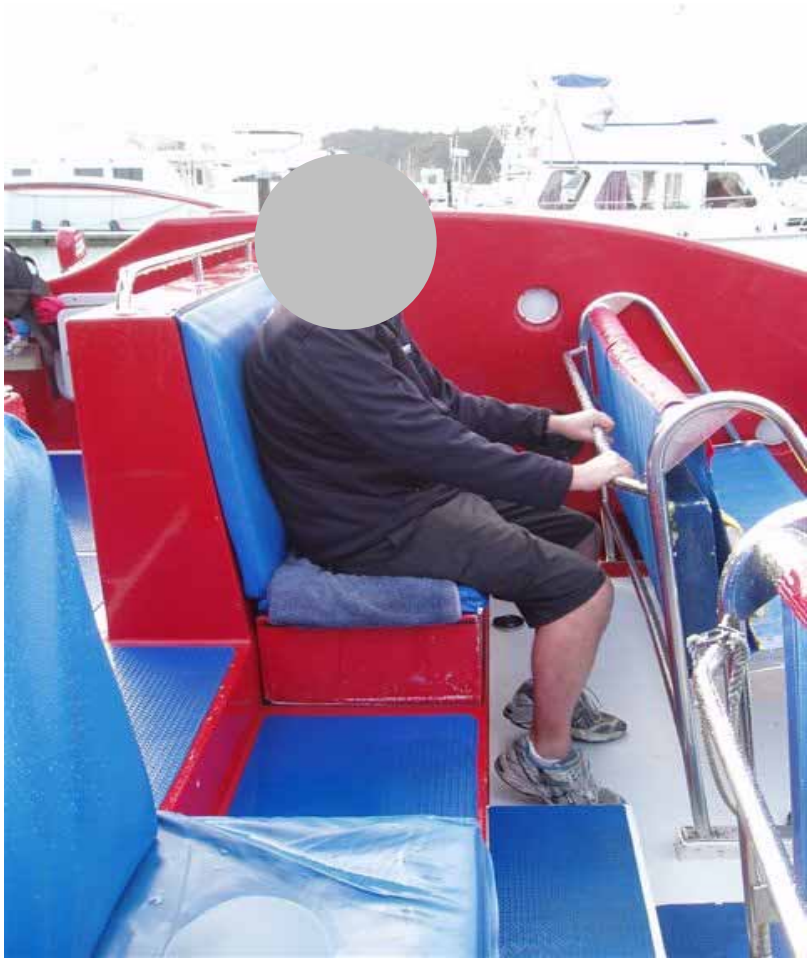

Figure 22 Alternative bench seat on ***Excitor*** showing that low forearm angle which allows for greater lumbar instability compared to a higher forearm angle

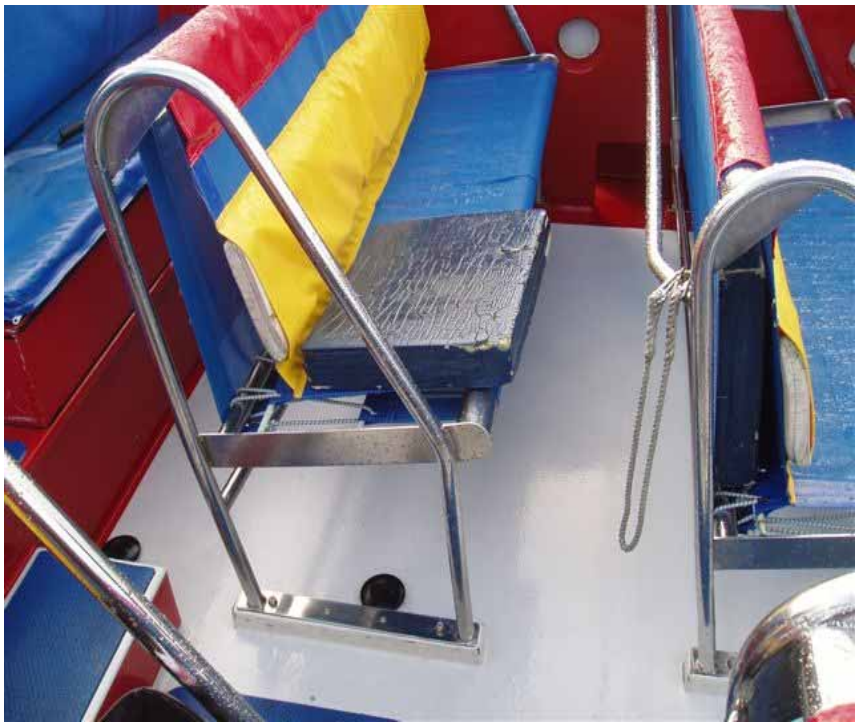

Figure 23 Bench seat on ***Excitor***

52. Figures 23 and 24 show the different styles of bench seats currently used on board ***Excitor***. Figure 24 shows the moveable seat cushion used for short people and children.

53. Bench seats offer little opportunity for passengers to use their legs to absorb shocks while underway. They are, however, simple to use and are generally better suited for high-speed vessel trips on smoother water.

Figure 24 Showing wear on padding in its stored position.

54. The condition of the seat cushions is an important part of the overall operation of the seat. Figure 25 shows that the cushion cover has been allowed to degrade. This will allow water ingress to the cushion, as well as allowing the foam material to protrude which can further accelerate degradation.

Mack Attack

55. The other vessel operating out of Paihia is ***Mack Attack***.

56. This vessel has one single design style throughout, which is a single ‘bucket’ seat for each passenger.

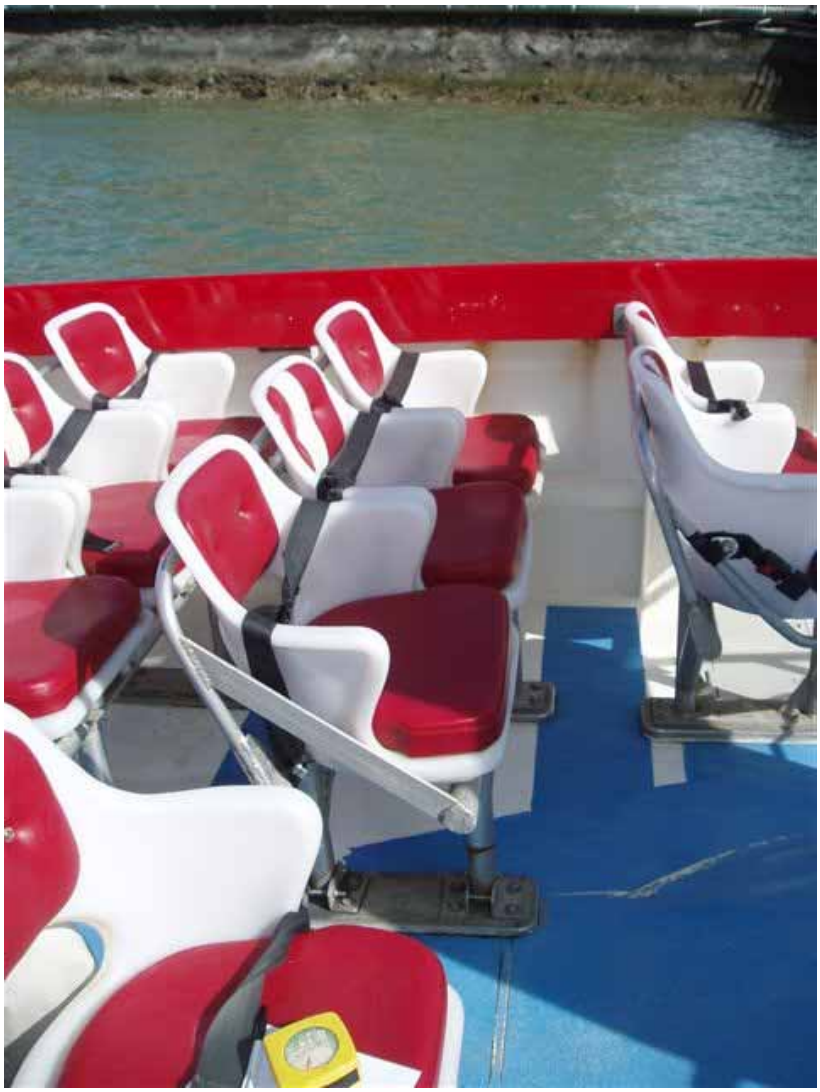

Figure 25 Bucket style seating of ***Mack Attack***. The seat padding is 60mm thick and the lumbar padding is 20mm thick

Figure 26 Front seats of ***Mack Attack***

57. This vessel has four seats at the extreme forward end of the passenger deck. These are shown in Figure 27 above. Note that the inside passenger has no readily available hand rail for their use. This reduces the ability of the passenger to support themselves during periods of vertical movement.

Figure 27 Hand position on ***Mack Attack***

58. Figure 28 shows poor positioning of passenger hands with regard to the forearm angle. This low angle does not allow the passenger to set a solid stance when riding over waves. The angle is further reduced when the passenger lifts off their seat when the vessel drops away. It does, however, appear to provide support for the hands to be wide enough for better posture.

59. In summary, both vessels have a one size fits all seating arrangement. Seating styles do differ and with passenger placement the risk of injury could be reduced when body type, strength and experience are taken into account.

Skipper Control

60. The skipper has a direct influence over the vessel's motion by their use of the steering and throttle to control the vessel. Throttle response is the principal mechanism influencing the vessel's performance and therefore shock exposure. The ability of the skipper to use the throttle to reduce shock exposure, i.e., reduce power before reaching the top of a wave, may be taught, and is enhanced with training.

61. The skipper must have the ability to ‘read’ the waves as the vessel is approaching them. In both high-speed passenger vessels in Paihia, the design is such that the skipper is ‘driving’ the vessel from almost right aft, with all the passengers seated forward of his position. He could get a very false sense of movement compared to the passengers seated more forward.

62. The operators of ***Excitor*** have a training program in place for their skippers and have a sign-off phase to confirm they are ready to operate the vessel.

Manning

High-speed vessel endorsement

63. A high-speed vessel is defined in Maritime Rule Part 31B as a vessel to which Section 2 of Maritime Rule Part 40A applies.

64. Section 2 of Maritime Rule Part 40A .66 states that, amongst other things, the vessel must enter service on or after February 2001. I believe ***Excitor*** meets these requirements.

65. Under Maritime Rule 32.33 a certificate of competency with a high speed vessel endorsement may be made by the Director for vessels that are 20-35m in length, or carrying more than 50 passengers and operating at 20 knots or more.

66. If the vessel meets the above then the master of this vessel must hold a high-speed vessel endorsement from the Director of MNZ.

67. Maritime Rule Part 31B.11 (High-speed vessels) states that the owner and master must hold the endorsement as set out in Part 32 above.

68. The master must also have a type rating issued by the owner for up to 2 years if they have completed type training as per Part 31B.11(3) and (4), as approved by the Director of MNZ.

69. What this essentially means is that the owner must have an approved training regime for each skipper. Upon completion of this the skipper may apply to MNZ for a high-speed vessel endorsement. Further assessment will be needed to ascertain whether the systems used by Fullers comply.

    There is no evidence that this process has been followed for ***Excitor***. It appears that both MNZ and the SSM companies did not identify this requirement.

Minimum safe crewing assessment

70. Section 2 of Maritime Rule Part 31B.6(2)(b) requires a vessel carrying 50 or more passengers in the inshore limits to hold a minimum safe crewing document issued by the Director of MNZ.

71. Advisory Circular 31B.5 ‘Passenger Vessel Minimum Safe Crewing Assessment’ tables give an indication of proposed safe manning levels.

72. For a vessel carrying 50–99 passengers that is considered a high-speed vessel, the master must hold a New Zealand Offshore Watch-keeper endorsed Inshore Launch Master. The deckhand must hold an Advanced Deck Hand certificate, in accordance with the associated flow chart in the advisory circular. The engineer must hold an Marine Engineer Class 5 and can be the deckhand.

73. Manning ***Excitor*** at the time of the last injury was a Master ILM and one deckhand.

74. In November 2003 the owners of ***Excitor*** submitted a proposal to MNZ (called the Maritime Safety Authority at the time) regarding a minimum safe crewing document.

75. The proposal outlined what the owners considered a safe manning level for the vessel. There was no mention of high-speed vessel requirements as listed in the maritime rules. The proposal did note that the vessel

> *"fits into the role of adventure tourism. The vessel offers high-speed adventure rides…"*

76. The file held by MNZ shows that this proposal was reviewed by a number of staff at MNZ. There is no evidence that the high-speed issue was looked at.

77. The owners were issued a Minimum Safe Crewing Certificate in December 2003. This states that manning must be a Local Launch Masters Certificate (LLO) for 0–24 passengers and an LLO and crew for 24–60 passengers.

78. The certificate also notes under the heading 'Additional operational limitations':

- Masters and crew must have completed an in-house Fullers Bay of Islands training program tailored to this high-speed vessel.
- The training program must be audited by the SSM company.
- Master shall take into account Maritime Rules Part 91 (Navigational Safety Rules), 91.6.1(a), (b), (c) (Speed), and 91.7 (Wake).

79. There is no evidence showing that the SSM company has ever audited the training program as per bullet 2 above.

Operating procedures

80. The owners of ***Excitor*** have a robust operations system in place for the vessel. There appear to be good guidelines in place for the basic operation of the systems on board.

81. There are a number of sections dedicated to the safety of passengers. These are:

- passenger preparation
- passenger placement
- on board safety briefing
- alternative cruise guidelines
- open ocean
- speed limits and safety.

82. Following accidents in the recent past, there were changes made to the company's procedures, to reduce the risk of future accidents.

83. All the procedures have appeared to address the known issues of the operation. That is speed and extra padding on the seats. This appears to have been their knowledge level at the time, however research now shows that this is not enough to combat the ongoing seating issues.

84. I believe ***Excitor*** is required to comply with Maritime Rule Part 40A.70 (Additional requirements for high-speed craft of less than 20m).

85. Of particular importance is Part 40A.70(e) which states, "any possible hazard to persons aboard the ship resulting from a maximum likely acceleration or deceleration of the high speed craft is minimised".

Conclusions

86. In an attempt to draw some conclusions from all of the accidents, a number of questions were posed:

- Is the problem with skipper training and skill? (The same skipper has been involved in two of the three accidents in 2009.)
- Are operating procedures poor?
- If the vessels complied with the high-speed requirements in manning and construction would this make a difference to the number of back injuries?
- Are the vessel designs poor? (Including seating.)
- Should MNZ be concerned at the trend in accidents in this area?

87. Fullers have a training program for their Skippers. This should have ensured that their staff have the necessary skills and experience to keep the passengers safe. It appears that there was no gross deviation from the company operating procedures.

88. The procedures cover all aspects of the operation and have identified a number of areas of concern such as passenger assessment and placement and general speed and comfort.

89. Both vessels comply with the construction requirements of the maritime rules. There is nothing specific in the rules regarding high-speed craft of this type and size. However, the construction types and/or requirements of the build were not contributing factors in this instance. There are no specific design requirements for vessels of this type.

90. In Maritime Rule Part 21.13 (Entry to and conditions to be met in order for ship to remain in Safe Ship Management system), under Section (2)(a) it states the following:

> *"The owner is in possession of a certificate issued by a surveyor dated not more than 12 months prior to the date the ship entered the approved safe ship management system, which states:*
>
> *(i) the particulars of the ship; and*
>
> *(ii) the permitted operating limits assigned to that ship under rule 20.5(1); and*
>
> *(iii) the maximum number of passengers that may be carried; and*
>
> *(iv) that the ship is fit for its intended service and intended operating limits; and*
>
> *(v) any minimum freeboards assigned under Part 47; and*
>
> *(vi) any limitations on the use of the ship, including any restrictions on the carriage of cargo; and*
>
> *(vii) that the ship complies with the applicable maritime rules and marine protection rules; "*

91. The key item above is point four, "the vessel is fit for its intended service and intended operating limits". If all the serious vertebrae injuries and the area of operation where most of the accidents are occurring are taken into consideration then it is questionable if the vessel remains fit for this type of service and that a radical change in vessel design is required to ensure ongoing safety.

92. The layout of the vessel does not lend itself to the ongoing safety of passengers, particularly when the skipper is well aft and the passengers are at the extreme forward end. It is also arguable that the limits set for the vessel are a cause for concern, particularly when the accidents occur in the same general area almost every time.

93. With regard to the high-speed endorsement, this gives sign-off to the satisfaction of the Director of MNZ that the skipper has been through a training regime and has been competent to operate a high-speed craft. In this case it appears that this requirement has not been identified and no endorsement issued.

94. There is evidence of a training regime for skippers of ***Excitor***. It is undetermined whether this training regime would meet the criteria under Maritime Rule Part 32.33 and therefore is inconclusive as to whether the accidents would be less likely to happen if the endorsements had been issued.

95. It appears that the training program has not been specifically audited as per the requirements of the minimum safe crewing document.

96. Hull design is a factor. The catamaran hull would give an overall better ride in lesser wave conditions and would be forced to reduce speed earlier as the wave conditions worsened. The mono-hull would give a good high-speed ride in moderate and above wave conditions. The bow can easily push through or over the waves. This can, however, affect the skipper's ability to decide that the ride is becoming unsafe. This can be because the vessel appears to be travelling along in a satisfactory manner; it is not until such time as the bow slams into the next wave after passing through the previous one that a problem may occur.

97. MNZ should have investigated this issue fully. Or at least monitor this activity more closely, with regard to putting measures in place to ensure that passengers do not routinely continue to suffer compression injuries as they have in the recent past. MSA did not follow up to see if recommendations made in previous investigations had been completed.

98. MNZ is concerned at accident trends in this area. There was one injury in November 2008, two injuries in January 2009, one injury in April, and one injury in June 2009. All these accidents except one have occurred on the same vessel, that appears to be well operated, maintained and has robust procedures and training for all staff.

99. The key conclusions drawn after looking at the questions posed are that the seat designs and deck layouts are questionable, and that closer attention needs to be paid to the skipper training with regard to moderate to heavy weather operations and a tightening up of procedures particularly when operating in the open waters near Bird Rock.

100. The owners of both vessels need to be mindful of their responsibilities under the Health and Safety in Employment Act and the Maritime Transport Act. They have a clear duty to protect the passengers.

Recommendations

101. It is recommended that:

a) all skippers operating high-speed vessels undergo training for operations in moderate to heavy weather conditions and that they comply with the requirements set out in Maritime Rule Part 32.33 (High-speed vessels)

b) skippers need to be able to reduce speed very quickly if required. It is recommended that when necessary the Skippers maintain contact with the throttles to help reduce response times.

c) in the short term, changes are made to seat belts and seat cushion padding and hand rail heights, and that in the medium term they should progressively change seats to a more ergonomic design that will actively reduce the risk to passengers

d) the use of the more forward rows of passenger seating be further restricted, unless the weather is within tight weather window parameters

e) that operating procedures are changed to ensure that passengers are informed of the importance and use of the seatbelts with regard to them being tight at all times.

f) fixed weather windows are developed and adhered to, in order to reduce the risk of encountering larger waves in the Bird Rock area

g) the hull design and layout are critically assessed by the owner and SSM company and a suitably qualified person with knowledge of high speed passenger vessels as part of future strategic development. (Is the vessel still fit for its intended service?)

h) MNZ reviews the maritime rules with regard to seating requirements for high-speed vessels of this type and service

i) MNZ reviews the minimum safe crewing document issued to the operators of ***Excitor***

j) MNZ checks that the SSM Company is aware of the rules regarding high speed craft and the Safe Manning Certificate requirements.

k) MNZ inspects both operations to ensure compliance with the Maritime Transport Act, Health and Safety in Employment Act and relevant high-speed craft maritime rules.

l) MNZ actively monitors all the above recommendations to ensure they are implemented.

Comment

102. During the finalisation of this report, another incident has been reported to MNZ involving injury aboard the vessel ***Excitor***. This matter is being investigated by MNZ.

103. The owners of ***Excitor*** have voluntarily withdrawn the vessel from service pending an internal review of their operation.