QUEENSLAND COURTS

CORONERS COURT OF QUEENSLAND

FINDINGS OF INQUEST

CITATION:	**Inquest into the deaths of Christine Nan Leonardi and Samuel John Leonardi**
TITLE OF COURT:	Coroners Court
JURISDICTION:	Brisbane
FILE NOS:	2013/3357; 2013/3396
DELIVERED ON:	11 October 2017
DELIVERED AT:	Brisbane
HEARING DATES:	23 May 2017; 11 – 14 July 2017; 19 July 2017
FINDINGS OF:	Mr John Hutton
CATCHWORDS:	Coroners: Inquest: motor vehicle collision; Franna AT-20 crane; pick and carry crane; mobile articulated steering crane; loss of control; lateral instability; speed restrictions; road restrictions; medium rigid licence; work health and safety high risk work licence; mobile crane code of practice; operator's manual

REPRESENTATION:

Counsel Assisting:	Mr Peter De Waard (Coroners Court of Queensland)
Counsel representing Terex Australia Pty Ltd (Manufacturer of the Franna AT-20 Crane):	Anthony Harding (instructed by Colin Biggers and Paisley Lawyers)

Counsel representing Queensland Department of Transport and Main Roads (TMR):	Ben McMillan (instructed by TMR in-house legal)
Counsel representing the Queensland Office of Industrial Relations (OIR):	Cosmo Cater (Crown Law) (instructed by OIR)
Counsel representing the National Heavy Vehicle Regulator (NHVR):	Simon Formby (NHVR)
Counsel representing Loughlin Crane Hire (the driver's employer):	Amy Leonard (Norton Rose Fullbright Australia)
Counsel representing Rodger Hannemann (the driver of the crane):	David Jones (instructed by David Burns Lawyers)

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INTRODUCTION

1. Mrs Christine Leonardi was 37 years of age when she and her 6-year-old son, Samuel Leonardi, died as a result of being struck by a Franna AT-20 crane on a public road on 16 September 2013.

2. As part of my coronial investigation, I conducted enquiries with:

    a. Two expert mechanical engineers and forensic investigators, Dr Robert Casey (UniQuest Pty Ltd) and Dr Frank Grigg (Engineering Consulting Pty Ltd);

    b. The Queensland Police Service;

    c. Queensland Fire and Rescue Services;

    d. Terex Australia Pty Ltd (the manufacturer of the Franna AT-20 crane);

    e. The Crane Industry Council of Australia (the national 'peak crane industry body');

    f. Loughlin Crane Hire (the driver's employer);

    g. The Queensland Department of Transport and Main Roads;

    h. The New South Wales Department of Roads and Maritime Services;

    i. The Queensland Office of Industrial Relations; and

    j. The National Heavy Vehicle Regulator.

3. An inquest was held from 11 – 14 July and on 19 July 2017. A comprehensive brief of evidence was compiled and distributed to the parties.

4. I heard oral evidence from the following 12 witnesses:

    a. Mr Rodger Douglas Hannemann (the driver of the crane at the time of the incident);

    b. Mr Phillip Seibel (a driver of the crane two weeks prior to the incident);

    c. Mr Travis Edward Butler (the Loughlin Crane Hire work manager of the driver);

    d. Dr Robert Casey (Mechanical Engineer and automotive forensic investigator, UniQuest Pty Limited – an expert who provided a report in relation to this incident);

    e. Dr Frank William Grigg (Mechanical Engineer, Director of Forensic

Engineering Consulting Pty Ltd – an expert who provided a report in relation to this incident);

f. Mr Danny Black (General Manager of Terex Cranes, Terex Australia Pty Ltd);

g. Ms Nadine Dumont, (Principal Policy Advisor, Licensing, Queensland Department of Main Roads and Transport – in relation to the administration of the driver's licensing scheme for mobile articulated steering cranes);

h. Mr James Beck (former Director of Licensing and Advisory Services, Office of Industrial Relations – in relation to the Workplace Health and Safety Queensland work licensing scheme for articulated steering mobile cranes);

i. Mr Stuart Charles Davis (Principal Advisor, Construction Engineering, Office of Industrial Relations – in relation to Workplace Health and Safety Queensland Mobile Crane Code of Practice and Australian Standards);

j. Mr Brandon Hitch, Chief Executive Officer of the Crane Industry Council Australia;

k. Mr Mark Mitchell, Director Compliance and Heavy Vehicle Reform, Queensland Department of Transport and Main Roads – in relation to the interlink between TMR and NHVR); and

l. Mr Peter Caprioli, Executive Director of Network Access, National Heavy Vehicle Regulator.

5. These findings address the following issues, which were identified at a Pre-Inquest Conference on 23 May 2017:

a. The findings required by section 45 (2) of the *Coroners Act 2003;* namely the identity of the deceased persons, how, when and where they died, and what caused their deaths; and

b. Whether any recommendations can be made to reduce the likelihood of deaths occurring in similar circumstances or otherwise contribute to public health and safety or the administration of justice. Recommendations to be considered included, but were not limited to:

i. Whether the Franna AT-20 crane should be speed limited to, say 80km/h, on public roads;

ii. Whether the manufacturer of Franna AT-20 cranes should consider implementing engineered counter measures to decrease lateral instability on public roads;

iii. Whether the training and licensing assessment for Franna AT-

20 cranes should include a demonstrated ability to drive the crane safely on public roads; and

iv. Whether the Franna AT-20 crane Operators Manual and the *Mobile Crane – Code of Practice 2006* should contain guidance about how to avoid and react to lateral instability on public roads.

6. During the inquest, the scope of the recommendations being considered were expanded to include all mobile articulated steering cranes, not just Franna AT-20 cranes, because it became obvious that the same issues applied.

FINDINGS REQUIRED BY S. 45

7. Pursuant to s. 45(2) of the *Coroners Act 2003* (Qld), I find:

Christine Nan Leonardi

a. *Identity of the deceased* – The deceased person is Christine Nan Leonardi.

b. *How she died* – As per the circumstances outlined below.

c. *Place of death* – Christine Nan Leonardi died at Ruthven Street (near the driveway of 1127), Top Camp, Toowoomba, in the state of Queensland.

d. *Date of death* – Christine Nan Leonardi died on 16 September 2013.

e. *Cause of death* – The medical cause of Christine Nan Leonardi's death was massive soft tissue and bony injury, due to a motor vehicle collision with a Franna AT-20 crane.

Samuel John Leonardi

a. *Identity of the deceased* – The deceased person is Samuel John Leonardi.

b. *How he died* – As per the circumstances outlined below.

c. *Place of death* – Samuel John Leonardi died at the Mater Children's Private Hospital, 501 Stanley Street, South Brisbane, in the state of Queensland.

d. *Date of death* – Samuel John Leonardi died on 18 September 2013.

e. *Cause of death* – The medical cause of Samuel John Leonardi's death was multiple injuries (surgically treated), due to a motor vehicle collision with a Franna AT-20 crane.

RECOMMENDATIONS

8. Section 46 of the *Coroners Act 2003* (Qld) provides that a coroner may comment on anything connected with a death that relates to public health or safety, the administration of justice, or ways to prevent deaths from happening in similar circumstances in the future.

9. I recommend that:

a. The National Heavy Vehicle Regulator:

i. Urgently amend the *National Class 1 Special Purpose Vehicle Notice* to:

1. impose a speed restriction of 60km/h on all mobile articulated steering cranes (until such time as electronic stability control systems are developed and fitted); and

2. restrict access to mobile articulated steering cranes on roads and motorways where it is assessed that a speed restriction of 60km/h will be unsafe for other motorists.

ii. Propose an amendment to the *Heavy Vehicle National Law* to ensure that internal speed limiters are set to 60km/h on all mobile articulated steering cranes (or 80km/h when fitted with electronic stability control); and

iii. Conduct independent testing of each make and model mobile articulated steering crane to determine whether there are any inherent lateral stability issues that need to be addressed in terms of the design of the vehicles.

b. The National Transport Commission:

i. Amend the national licensing scheme so that before a driver is authorised to drive a mobile articulated steering crane on a public road, they must undergo a:

1. Practical assessment on a public road in a mobile articulated crane; and

2. Theoretical assessment addressing the unique handling

characteristics of mobile articulated cranes and emergency procedures in the event of a loss of control.

c. All State and Territory road regulators:

i. Support an urgent amendment by the National Heavy Vehicle Regulator to the *National Class 1 Special Purpose Vehicle Notice* to:

1. impose a speed restriction of 60km/h on all mobile articulated steering cranes (until such time as electronic stability control systems are developed and fitted); and

2. restrict access to mobile articulated steering cranes on roads and motorways where it is assessed that a speed restriction of 60km/h will be unsafe for other motorists.

ii. Support a proposed amendment to the *Heavy Vehicle National Law* to ensure that internal speed limiters are set to 60km/h on all mobile articulated steering cranes (or 80km/h when fitted with electronic stability control); and

iii. Support an amendment by the National Transport Commission to the national licensing scheme so that before a driver is authorised to drive a mobile articulated steering crane on a public road, they must undergo a:

1. Practical assessment on a public road in a mobile articulated crane; and

2. Theoretical assessment addressing the unique handling characteristics of a mobile articulated crane and emergency procedures in the event of a loss of control; and

i. (As the Northern Territory and Western Australia are not parties to the National Heavy Vehicle Regulator scheme, they should separately impose regulations that mirror 9.(b) above).

d. Safe Work Australia:

i. Amend the national workplace licensing scheme, so that before a person is authorised to drive a mobile articulated steering crane on a private or public road in the course of their employment, they must undergo a:

1. Practical assessment on a road in a mobile articulated crane; and

2. Theoretical assessment addressing the unique handling characteristics of a mobile articulated crane and emergency procedures in the event of a loss of control.

e. All State and Territory work health and safety regulators:

i. Support an amendment by Safe Work Australia to the national workplace licensing scheme, so that before a person is allowed to drive a mobile articulated steering crane on a private or public road in the course of their employment, they must undergo a:

1. Practical assessment on a road in a mobile articulated crane; and

2. Theoretical assessment addressing the unique handling characteristics of a mobile articulated crane and emergency procedures in the event of a loss of control; and

ii. Amend relevant mobile crane Codes of Practice to include guidance about the unique handling characteristics of mobile articulated steering cranes and emergency procedures in the event of a loss of control.

f. Terex Australia Pty Ltd:

i. Develop electronic stability control systems that can be fitted or retrofitted to all mobile articulated steering cranes;

ii. Amend the Owners Manuals for all mobile articulated cranes to provide guidance to drivers in relation to the crane's unique handling characteristics and emergency procedures in the event of a loss of control; and

iii. Issue a Safety Bulletin containing guidance to drivers about the unique handling characteristics of mobile articulated steering cranes and emergency procedures in the event of a loss of control.

EVIDENCE, DISCUSSION AND GENERAL CIRCUMSTANCES OF DEATH

Background

1. Mrs Christine Leonardi was 37 years of age when she and her 6-year-old son, Samuel Leonardi, died as a result of being struck by a Franna AT-20 crane on a public road on Monday 16 September 2013.

2. Mrs Leonardi died at the scene, whilst Samuel died in the early hours of 18 September 2013 at the Mater Children's Hospital in Brisbane. Mrs Leonardi's two other children aged 9 and 11 were also in the vehicle at the time of the collision. They were critically injured, but survived.

3. The collision occurred at about 8:23am, whilst Mrs Leonardi was driving her three children to school.

4. The collision took place on Ruthven Street (which is part of the New England Highway), just south of the intersection with Nelson St on the outskirts of Toowoomba.

5. Mrs Leonardi was driving a Ford dual cab and heading in a northbound direction. Mr Rodger Hannemann was driving a brand new Franna AT-20 crane and heading southbound, in the opposite direction.

Autopsy results

Christine Nan Leonardi

6. An external autopsy (including a whole of body CT scan) was performed by a forensic pathologist on Mrs Leonardi's body on 18 September 2013. The autopsy report was issued on 18 September 2013 and updated on 24 October 2013 after toxicology results were obtained.

7. The toxicology certificate of analysis issued on 21 October 2013 confirmed that there were no alcohol or drugs in Mrs Leonardi's system.

8. The forensic pathologist noted that:

    a. There were multiple left and right rib fractures with a fracture of the sternum with a flail chest;

    b. The rib fractures were compound into the thoracic cavity and there were bilateral haemothoraces;

    c. There was laceration of the lungs;

    d. There was a displaced fracture of the thoracic vertebral spine at the level of T3/T4;

    e. There was an extensive fracture of the right and left pelvis with associated haematoma and a compound fracture of the right pelvis through the skin of the right iliac region; and

    f. There was a compound fracture of the right mid radius and ulna with extensive soft tissue injury, resulting in an almost severed distal forearm.

9. The forensic pathologist was of the opinion that the medical cause of Mrs Leonardi's death was due to massive soft tissue and bony injury sustained in a motor vehicle accident.

10. I accept the forensic pathologist's opinion.

Samuel John Leonardi

11. An external autopsy (including a whole of body CT scan) was performed on Samuel's body by a forensic pathologist on 20 September 2013. The autopsy report was issued on 26 September 2013.

12. The forensic pathologist noted that there were multiple injuries, including:

    a. Traumatic brain injury;

    b. Multiple fractures of the femur and left tibia;

    c. Multiple bruises; and

    d. Abrasions of the entire torso, head and extremities.

13. The forensic pathologist was of the opinion that the medical cause of Samuel's death was multiple injuries (surgically treated), due to, or as a consequence of a motor vehicle collision (passenger).

14. I accept the forensic pathologist's opinion.

Circumstances of the collision

15. At the scene, the driver of the Franna AT-20 crane, Mr Roger Hannemann, provided a brief explanation of events to his work Manager, Mr Travis Butler, and to police. However, he declined to participate in a police record of interview or to provide a police witness statement.

16. Just prior to the inquest, Mr Hannemann provided a statement, through his solicitor, dated 7 July 2017. He also provided oral evidence at the inquest.

17. There were several witnesses travelling on Ruthven Street in both directions at the time of the incident, who provided detailed police witness statements.

18. From the witness statements, physical evidence at the scene, and oral evidence at the inquest, I have concluded that the sequence of events was as follows:

    a. Mr Hannemann was following two other work vehicles (a truck and a ute) down Ruthven Street in a convoy.

    b. When Mr Hannemann approached the start of the downhill section of Ruthven Street, he was travelling at a speed of between 80 and 90km/h. The sign-posted speed limit was 80km/h.

    c. The distance from the start of the downhill section of Ruthven Street to the impact point with Mrs Leonardi's vehicle was about 800m.

d. Mr Hannemann took his foot off the accelerator at the top of the hill. He did this because he was about to travel downhill and he did not wish to over-rev the crane.

e. As he took his foot off the accelerator, the front of the crane gave a kick to the left. He applied the brakes softly. The crane then pulled to the right.

f. At first, the crane was moving side to side by a couple of inches, this escalated to a point where the crane was swerving side to side more significantly (i.e. 'fishtailing') down the hill. The down hill gradient was moderate, at about 8%.

g. Mr Hannemann again applied the brakes softly in an attempt to stop the crane from swerving. When this failed to stabilise the crane, he accelerated.

h. It is estimated that the speed of the crane downhill was between 80 – 95km/h, but most likely at the higher end of this estimate. (The crane could not have been travelling faster than this because the engine brake engages at 95km/h).

i. The reason Mr Hannemann accelerated was because he thought that this would provide more hydraulic pressure and that this would assist him to better steer the crane. He also believed, through prior experience, that accelerating would pull the crane out of the fishtailing motion because the crane was front wheel drive. (Mr Hannemann had about seven years prior experience driving mobile articulated steering cranes).

j. Mr Hannemann believes he had nearly regained control of the crane but that he then hit a bump in the road about half way to three quarters of the way down the hill. Mr Hannemann felt a noticeable jolt. However, it is unlikely that the crane had in fact stabilised at any point down the hill and only a very minor undulation in the road was identified in the vicinity near the dip in the road before the road goes uphill on a gradient of around 1.8%. This minor undulation did not cause a significant disturbance to other vehicles passing by.

k. Mr Hannemann was rapidly turning the steering wheel from side to side in an attempt to bring the crane under control. He stated that he went from having absolutely no control to very limited control of the crane. He likened this experience to him being a passenger and the crane driving him. It is, however, highly unlikely that the circumstances of the incident could have at any stage generated the level of force required for the steering wheel to turn without Mr Hannemann physically turning it.

l. The crane crossed into the oncoming lane of traffic, narrowly avoiding oncoming cars, and then back to the edge of its lane.

m. Mr Hannemann stated that he then steered the crane hard left, in an

attempt to 'ditch it'. However, the physical evidence at the scene was inconsistent with an attempt by Mr Hannemann to ditch the vehicle, due to the large turning arch.

n. As the crane veered onto the verge, the crane was almost bent into an 'L' shape.

o. The crane then ceased fishtailing and suddenly shot across the road at a sharp angle into the oncoming lane. Again, this sharp turning motion would have been caused by Mr Hannemann physically turning the steering wheel in that direction.

p. The crane collided with Mrs Leonardi's vehicle.

q. Mrs Leonardi attempted to avoid the crane by positioning her vehicle as far as possible to the left side of her lane but the collision could not be avoided.

r. The crane continued on after the collision over a 1.5m embankment, knocking down fences and trees and coming to rest in a paddock around 60m from the point of impact.

s. The crane came to rest close to a power pole and a home.

19. The crane had minor damage and Mr Hannemann sustained minor injuries.

20. The damage to Mrs Leonardi's vehicle was so extensive that the make and model of her vehicle were unrecognisable.

21. The steel tethering chain connected to the front boom of the crane cut through the driver's side of Mrs Leonardi's vehicle in a motion similar to a potato peeler.

22. Mrs Leonardi died immediately upon impact and her son, Samuel, who was sitting behind her in the vehicle, died two days later in hospital. Mrs Leonardi's two children seated on the non-driver's side of the vehicle were injured but they survived.

Causes of the incident

23. This incident was the subject of a thorough and professional police investigation conducted by the Toowoomba Forensic Crash Unit. The police report was dated 28 August 2014.

24. At my direction, police obtained two expert reports from Dr Robert Casey of UniQuest Pty Limited (report dated 3 June 2014) and Dr Frank Grigg of Forensic Engineering Consulting Pty Ltd (report dated 11 August 2014). Dr Casey and Dr Grigg are experienced mechanical engineers and forensic investigators and they provided oral evidence at the inquest.

25. Dr Casey and Dr Grigg inspected both vehicles and the scene on 30

December 2013. They also both conducted test drives of the crane over a short distance at a slow speed in the holding yard.

26. As a result of their examination, Dr Casey and Dr Grigg agreed that the incident was caused by:

    a. The speed the crane was travelling; and

    b. The driver's responses to the loss of control (i.e. accelerating instead of softly braking, and over-steering).

27. Dr Casey and Dr Grigg also drew the following conclusions:

    a. ***It was not possible for the crane to steer itself:***

        i. Although Mr Hannemann genuinely believed that the crane had steered itself at times leading up to the incident, and then into the path of Mrs Leonardi's vehicle, both Dr Casey and Dr Grigg agreed that this was highly unlikely. The hydraulic cylinders prevent the crane from moving without driver input (i.e. against the direction it is steered). The magnitude of forces that would be needed to force the vehicle against the action of the hydraulic cylinders would be tonnes. The circumstances of this incident would not have generated that level of force.

    b. ***The crane was in good mechanical condition***:

        i. The crane was essentially a brand new vehicle. Mr Hannemann's employer, Loughlin Crane Hire, only took delivery of the crane two weeks prior to the incident on 30 August 2013.

        ii. Sergeant Bradley Deickman conducted a mechanical inspection of the crane on 25 September 2013. He concluded that there were no mechanical breakages or defects, which could have contributed to the incident. Both Dr Casey and Dr Grigg reached the same conclusion after their examinations.

        iii. During the inquest, consideration was given to the possibility that the deflated passenger rear inner tube could have occurred prior to the impact and contributed to the incident. This was because the deflated tube was on the opposite side to the impact forces. Mr Phillip Seibel's evidence was also relevant. He came forward to police after the Pre-Inquest Conference and he provided oral evidence during the inquest. Mr Seibel stated that he had driven the same crane two weeks prior to the incident and had experienced some minor handling difficulties, which he attributed to the same deflated tyre.

            Further enquiries revealed that when Mr Seibel identified the deflated tyre two weeks earlier, Loughlin Crane Hire had

replaced it. All tyre pressures had also been checked a couple of days prior to the incident by an external tyre servicing company as part of their routine service schedule.

Dr Casey and Dr Griggs were of the opinion that the tube was most likely deflated post impact (possibly as a result of the crane driving over the embankment at speed). This is because the puncture was due to the valve assembly being damaged and ripped from the inner tube, which would have caused rapid deflation to the tyre. There were no marks on the tube or tyre indicative of the wheel running flat for an extended period.

iv. During the inquest, consideration was also given to whether there had been a fault with the crane's steer cylinders and orbital steer valve prior to the incident, which could have caused steering difficulties. Mr Hannemann and Mr Butler had become aware after the incident that the insurance repairers replaced these components but it was not known why.

I made further enquiries with the repairer after the inquest. The repairer provided a report, which showed that all steering components were tested for possible cracking and no cracking was found. No further fault testing was carried out. However, after consultation with an independent Engineer, it was decided by the repairer that due to the nature of the incident and the possible forces transferred to these components, they should be replaced. (It would appear that the repairer was under the mistaken belief that the crane had been involved in a roll over).

During the inquest, Dr Casey stated that he had visually inspected the steer cylinders and he did not find any sort of breakage, leakage, defect, bend or anything of that nature. He steered the crane during a test drive in the holding yard and did not have any concerns with the steering. He also steered it lock to lock several times, whilst sitting stationary and he did not notice any loud noises or grinding noises. Dr Griggs stated that he did not notice anything remarkable when he test- drove the crane. Dr Casey and Dr Griggs were not of the opinion from their examinations that the steer cylinders or orbital steer valve were defective.

c. ***The road conditions were adequate:***

i. The road was well sealed and in good condition.

ii. There were white lines clearly marking the centre and outside lanes of the dual carriageway.

iii. There was a gentle right hand bend in the crane's direction of travel but the road was straight for the last 400 – 500m before impact.

iv. The road surface was slightly damp due to light rain the evening before and into the morning. However, a Department of Main Roads and Transport engineer testing conducted friction supply testing on the road whilst it was still wet and concluded that the friction supply level was within the acceptable range.

d. ***Visibility was adequate:***

i. There was mist in the air, but visibility was good.

e. ***No driver fatigue or influence of drugs or alcohol:***

i. Mr Hannemann had been on rest days the previous weekend and had only commenced his shift on the day of the incident at 7:00am.

ii. The incident occurred during Mr Hannemann's first job for the shift – to load several poles for Ergon and travel via the incident location to Hodgson Vale and unload them.

iii. At the scene, Mr Hannemann provided a specimen of breath for alcohol testing, as directed by police, and returned a zero reading. He later voluntarily supplied police with a specimen of blood and no alcohol or drugs were detected in his system.

f. **Mrs Leonardi appeared to be driving satisfactorily:**

i. There was nothing untoward about Mrs Leonardi's driving and she did not appear to be exceeding the speed limit.

28. At the request of Terex Australia Pty Ltd, I also obtained Mr Hannemann's mobile phone records. Mr Hannemann's mobile phone records confirmed that he was not on his phone at the time of the incident. There was no evidence that Mr Hannemann was distracted by his phone or for any other reason. I do not accept Terex's submission that the incident was contributed by Mr Hannemann becoming distracted for some unknown reason. I do accept that he was most likely travelling too fast for the conditions and/or that he reacted inappropriately to an emergent situation.

History of similar incidents in Queensland

29. Historical accident data was obtained from the Queensland Police Service in relation to incidents involving a loss of control of Franna AT-20 cranes (and its predecessor, the AT-15) on Queensland public roads.

30. Between 2007 and 2016, there were 23-recorded incidents, including the incident the subject of this inquest, where a Franna AT-20 or AT-15 crane had lost control on a Queensland road.

31. The common threads in the sample data were as follows:

a. All incidents involved a loss of steering control (e.g. over-steering);

b. Common terminology by drivers and witnesses used to describe the loss of control were: “wobble”, “fishtailing” and “swerving”;

c. Most incidents were in the course of employment;

d. Where there was an estimated speed, most drivers were travelling at a speed of 70km/h or more;

e. Where there was an estimated speed and the sign posted speed limit was known, most drivers were driving below the sign posted speed limit;

f. Most drivers were experienced at driving mobile articulated steering cranes on public roads;

g. Most drivers were not affected by alcohol or drugs;

h. Most roads were straight, sealed, level, and dry;

i. Most incidents occurred in daylight conditions and with good visibility; and

j. Many incidents involved the crane driving over an undulation such as: a bump, a pothole, off the shoulder of the road, a bridge crossing.

32. Most incidents were single vehicle incidents and resulted in injuries or death. Whilst most incidents did not result in the death of the driver or others, they could have easily done so. Examples of outcomes included the crane:

a. Tipping over;

b. Colliding with other vehicles, including trucks;

c. Narrowly avoiding an oncoming fuel tanker;

d. Driving through guard rails over highway median strips;

e. Crossing onto oncoming lanes;

f. Jackknifing across the road,

g. Hitting the side of a bridge; and

h. Landing in a creek.

33. Both Terex Australia Pty Ltd and the National Heavy Vehicle Regulator have submitted that this sample data is unreliable and that I cannot draw any meaningful conclusions from it. I acknowledge that the data has limitations. For example, not all of the drivers provided statements to the

police and none of the drivers, except for in this case, were cross-examined in an inquest.

34. I also acknowledge that drivers are not always honest about their speed and that sometimes honestly held perceptions may not reflect reality. However, all of the drivers and witnesses in the sample data were unrelated to each other, yet the same themes regarding speed and wobbling continued to come up.

35. Much was also made of the fact that the sample data was not necessarily representational of the entire pool of mobile articulated cranes in use on the roads. Whilst the sample data does not provide overall statistics, I am of the view that the 23 incidents do provide a useful snapshot of what is most likely a much larger issue. This is not 'illegitimate circular reasoning', as submitted by Terex. The basis for this view is that:

    a. As at 6 April 2017, there were 637 Franna AT-20 cranes registered in Queensland, yet there have been 1,467 Franna AT-20 cranes sold in Australia;

    b. Franna AT-20 cranes were introduced to the market in 2000. But the accident data only covers from 2007 onwards;

    c. The data only covers a 9 year period out of 39 years that mobile articulated cranes have been on the market;

    d. Franna AT-20 cranes only make up around a third of the mobile articulated steering cranes on the market;

    e. The data only covers incidents reported to the police; and

    f. The data only covers incidents in Queensland.

36. The National Heavy Vehicle Regulator has questioned why we focused on the AT-20 model for the purposes of the inquest. We focused on this model because it was the same model as the crane involved in the incident, which was the subject of the inquest. Also, the names of all of the other models over the years were unknown to us until further information was provided by Terex in response to a request for information just prior to the commencement of the inquest.

37. I note that the National Heavy Vehicle Regulator has expressed a willingness to conduct further research in relation to historical accidents nationwide. I support this measure. However, I am quite concerned about the approach that the National Heavy Vehicle Regulator seems to intend on taking with this exercise.

38. Firstly, the National Heavy Vehicle Regulator has indicated that they wish to delay taking action until better quality information is obtained. In my experience, the nature of road accidents is such that there will never be high quality information, no matter how much further research is undertaken. It is incumbent upon decision makers not to delay important

public safety regulation such as the imposition of speed and road restrictions on mobile articulated steering cranes in pursuit of perfect data. The trends are already clear enough from the sample data, and in any event, they need go no further than the deaths of Mrs Leonardi and Samuel Leonardi.

39. Secondly, the National Heavy Vehicle Regulator seems to be of the view that if it cannot be statistically demonstrated that mobile articulated steering cranes have historically caused more fatalities on the roads compared to other heavy vehicles, the National Heavy Vehicle Regulator will not take action to limit their speed. I cannot see the point of comparing mobile articulated steering cranes to other heavy vehicles. They are different. And so what if other heavy vehicles have caused more fatalities on the roads than mobile articulated cranes? This may mean that more action should be taken to identify ways to make other heavy vehicles safer. It shouldn't mean that no action is taken to make mobile articulated steering cranes safer. (My reasoning as to why I am recommending a 60km/h speed limit for all mobile articulated steering cranes is outlined further below).

Why it is difficult to re-gain control of a mobile articulated steering crane after a loss of control at speed

40. Mobile articulated steering cranes have several features, which make them different to trucks, buses, cars, and even other cranes.

41. Their unique characteristics make it difficult to re-gain control in the event of a loss of control at speed. This incident and the majority of incidents in the sample data demonstrate that even experienced drivers can experience difficulties. The unique characteristics of mobile articulated cranes are as follows.

Frame steering results in the driver rapidly rotating in the direction of steering

42. Trucks, buses and cars have 'Ackerman steering', meaning they are steered by turning the front wheels. The body of these vehicles do not rotate, only the front wheels. Therefore, the driver stays with the body of the vehicle when the vehicle turns.

43. Whereas, mobile articulated cranes have 'frame steering'. They steer by bending the crane in the middle, which in effect turns the front wheels in relation to the rear wheels. A driver of a mobile articulated crane does not steer with the front wheels. The driver is physically and rapidly rotated with the front half of the cabin in the direction of steering. This leads to a different sensation by the crane driver.

Hydraulic cylinders and lack of feedback leads to 'twitchy' steering

44. Mobile articulated cranes use hydraulic cylinders to push the two halves of the vehicle's body apart to generate steering.

45. There is little feedback in the steering wheel and the response from the hydraulic system makes the steering change sharply when the steering wheel is rotated rapidly (i.e. it is ‘twitchy’).

46. The lack of feedback in the steering wheel means that the steering wheel can be turned very quickly with little effort. This can lead to over-steering (i.e. where the driver’s steering over-corrects and turns too far).

Front wheels do not naturally straighten up

47. The front wheels of trucks, buses and cars have castors. This means that they tend to act like the castor wheels on a shopping trolley. When the steering wheel is released after a turn is completed, the castor effect tends to bring the wheels back into a straight line.

48. Whereas, in mobile articulated steering cranes, when the steering wheel is released, the steering does not tend to naturally straighten up. This means that the driver must always remain very attentive and active with their steering.

Extraordinarily harsh suspension

49. The suspension on mobile articulated steering cranes is extraordinarily harsh. This means every bump and undulation in the road is felt by the driver.

50. An air suspended seat is also fitted to Terex manufactured mobile articulated cranes, which means that the driver bounces up and down a reasonable amount relative to the vehicle as result of road roughness.

51. The harsh suspension comes about because when the crane is being used as a crane, it needs to lift up a heavy load at the front. The entire load must be supported by its front suspension.

52. Mobile articulated cranes are specifically intended to drive around work sites with the load suspended at its front. This stands in strong contrast to other mobile cranes, which cannot travel while suspending a load. Other mobile cranes use extendable legs to deal with the large lifted loads and use dedicated road suspension when travelling along roads.

The need to impose a 60km/h speed restriction

53. A key question for this inquest was to determine the safest speed for mobile articulated steering cranes on public roads.

54. The current situation in Queensland is that mobile articulated cranes have a regulated speed restriction imposed on them of 90km/h. In New South Wales and the Australian Capital Territory, the speed restriction is 80km/h and in all other States there appears to be no speed restriction.

55. The reason for the lower speed restriction in New South Wales is that there is a recognition by the Transport Roads and Maritime Services in their *Vehicle Standards Information Sheet No 30*, (last updated on 13 September 2012) that vehicles with a hydraulic steering system on public roads *usually lose sensitivity when driven at high speeds*. The default speed restriction is set at 45km/h. An exemption can be granted if independent handling and performance testing by the manufacturer can demonstrate that the vehicle can be safely driven to its maximum speed. In 2003, Terex retained an independent company to test the Franna AT-20 crane and a successful application was made to allow all Franna cranes to be driven at speeds of up to 82km/h (which was later reduced to 80km/h).

56. From 2014, Terex Australia Pty Ltd set the internal speed limiters in Franna AT-22 cranes to 80km/h for vehicles delivered to New South Wales only. For deliveries to all other States and Territories, the internal speed limiter is set at 90km/h. Additionally, the engine brakes are set at 5km/h above the internal speed limiters.

57. The recent application by the Queensland Department of Transport and Main Roads to the National Heavy Vehicle Regulator to impose speed restrictions of 80km/h on mobile articulated steering cranes and the decision by the National Heavy Vehicle Regulator to await the outcome of this inquest is acknowledged.

58. In my view, the continued inconsistency in approach between jurisdictions and by Terex is unsatisfactory. The question then becomes what is the appropriate speed restriction, if any?

59. Dr Casey recommended that all mobile articulated steering cranes be speed restricted to:

    a. 60km/h; or

    b. 80km/h providing that systems are fitted to the cranes to assist with stability control and that drivers are educated on what to do if instability occurs.

60. Dr Casey acknowledged that there are currently no commercially available electronic stability control systems for mobile articulated steering cranes.

61. The basis for Dr Casey's recommendation (of 60km/h in the current state of affairs) was that:

    a. The historical accident data for the Franna AT-20 crane had a strong thread of commonality in terms of the circumstances and terminology used such as 'wobbling' and 'snaking', which indicated to him that there was lateral instability. He had investigated all manner of car accidents and truck accidents. The descriptors "lost my brakes", "skidded", "went around a corner, and couldn't control it" were very common in other vehicle incidents but not "wobble". This indicated to him that this was an issue unique to mobile articulated steering cranes;

    b. Most of the incidents in the sample data that related to instability tended to be at speeds above 60km/h and it seemed to Dr Casey that a speed reduction to 60km/h would have prevented them. 60km/h would not avoid all instances of instability but it would give the driver an ability to regain control;

    c. In Dr Casey's experience, it is widely accepted that speed is always detrimental to a vehicle's stability. In simple terms, as speed increases, the forces that are generated by some vibration can also increase. Furthermore, the time that the driver has to properly respond decreases.

    d. It was acknowledged by Dr Casey that the sample data did not provide statistical evidence of the number of incidences, and that there were a number of drivers who may never have experienced lateral instability. However, it was Dr Casey's view that even if lateral instability does not occur very frequently, that does not necessarily mean there is no problem that requires addressing. A correlation was drawn with vehicle recall notices. It is common for recall notices to be issued in the interests of public safety, even though the actual number of vehicles that experience the problem is small.

62. Dr Griggs recommended that mobile articulated steering cranes be speed restricted to 82km/h.

63. The basis of Dr Grigg's recommendation was:

    a. That it was not unreasonable to restrict the speed of the mobile articulated steering cranes to the limits of what they have been tested to. In 2003, the Franna AT-20 crane was tested up to 82km/h for a lane change, which Dr Griggs considered to be the beginning of a slalom manouevre (this testing will be discussed further below);

    b. Not all of the incidents in the sample data would have been avoided at a speed of 60km/h;

    c. A speed limit of below 80km/h can create a hazard in traffic situations; and

d. There does not appear to be a substantial risk of loss of control because there are lots of mobile articulated steering cranes out there, which have been driven by drivers for a number of years uneventfully.

64. Terex Australia Pty Ltd holds 95% of the market in Australia for mobile articulated steering cranes. It is their view that their cranes can be safely driven up to 95km/h. The basis for their view is:

a. The 2003 testing by Commercial Vehicle Design Services Pty Ltd. That testing compared the performance of a Franna AT-20 crane to a laden Isuzu truck at a raceway in Ormeau, Queensland. Three tests were conducted:

i. Slalom testing at 45km/h around cones spaced 30m apart, and at 60km/h and 65km/h around cones spaced 40m apart;

ii. A high speed lane change at 85km/h on a lane 4m wide with a 50m cross over interval between the alternate lanes; and

iii. A braking test at 40km/h, 60kmh and 82km/h in accordance with Australian Design Rule 35/01.

The assessor, Mr Kit Beakley, concluded that the Franna AT-20 crane displayed no adverse operating characteristics at speeds up to 82km/h and that it safely equaled the performance of the Isuzu truck;

b. Terex's experience over many years has been that their vehicles have been operated safely at speed. They have manufactured 4,300 mobile articulated steering cranes over the past 39 years. They estimate that the mobile cranes travel on average 10,000km per year per vehicle on public roads, which they claim equates to 500 million km of road travel;

c. No demonstrated safety reason exists for a speed restriction. As with any vehicle, accidents can happen when drivers become distracted, drive too fast for the conditions, or react inappropriately to emergent situations. Lateral stability occurs in circumstances of 'abnormal operation of the vehicle' and does not occur when 'operated competently';

d. That every new crane manufactured by Terex undergoes the following two separate road tests on public roads:

1. A pre-paint road test (including a road test whilst driven by a Terex employee to the subcontractor painters and back); and

2. A final inspection road test by a Terex employee.

In total, these tests equate to in excess of two hours. Over the years, Terex has driven its cranes to various subcontractor painters located

in Clontarf and Virginia, some distance from their Eagle Farm facility. On each of these road tests, there have been no issues reported as to the crane's inability to be driven safely on public roads; and

e. On 12 May 2017 in the lead up to the inquest, the current model Franna AT-22 crane was driven by a Terex employee a few times down Ruthven Street where the incident that led to Mrs Leonardi's and Samuel's deaths occurred. This testing was recorded on a series of videos provided to me. Extracts were played during the inquest. Terex is of the view that the testing validated the ease at which a Franna crane can travel on that stretch of road. They submit that the testing showed that the crane operated safely when driven at speeds up to 90km/h (where it was signposted that it was legal to travel at this speed).

65. I am of the view that Dr Casey's recommendation of a 60km/h speed restriction should be adopted because:

a. Speed was a primary cause of the inability of Mr Hannemann to regain control of the mobile articulated steering crane, which led to Mrs Leonardi's and Samuel's death;

b. Most of the loss of control incidents in the sample data, where the speed limit was estimated, were at speeds above 60km/h. This indicates that speed was also a primary factor in those incidents and that a reduction in speed to 60km/h is likely to substantially reduce the number of future accidents;

c. Whilst the number of mobile articulated steering cranes losing control on public roads might not be high, relative to other vehicles or the number of mobile cranes on the road, the repercussions in the event of an accident are significant. The circumstances and causes of the incident leading to the deaths of Mrs Leonardi and Samuel are a timely reminder of this. These cranes are up to 40 tonne in weight, driving at high speeds. They can easily cause mass casualties in the event that they cross multi lane highways, collide with other vehicles, pedestrians, and infrastructure such as power lines and homes);

d. The unique characteristics of mobile articulated steering cranes mean that in the event that a crane loses control, even the most experienced drivers can have difficulty regaining control. The cranes are simply not primarily designed for road travel at high speeds like other road vehicles;

e. Common sense dictates that a speed restriction of 60km/h will decrease the chances of the crane losing stability in the first place, or at least decreasing the escalation of lateral instability. In the event that the crane still loses control, a speed restriction will reduce the reaction time needed by the driver to respond to the emergent situation;

f. Additional training and driver education and guidance will assist but you will never be able to eliminate the human element from accidents. Humans will make mistakes, but the price should never be serious injury or death. A regulatory and engineering control such as a speed restriction (and an internal speed limiter) is needed;

g. The 2003 testing of the Franna AT-20 crane was limited because of its limited scope and parameters. For example:

i. A Franna AT-20 crane was tested, not all mobile articulated steering cranes found on public roads. Although it is acknowledged that Terex have submitted that they have also tested other models;

ii. The testing was only conducted at 65km/h in a slalom manouevre, 85km/h in a lane change, and 82km/h for braking. The crane was not tested at its maximum rated travel speed of 90km/h, nor at its maximum achievable speed of 95km/h;

iii. The testing was conducted in ideal conditions, which do not necessarily replicate the reality on public roads. The testing was on a flat, smooth, dry, bitumen road in perfect weather conditions, and without traffic; and

iv. An experienced driver was used, who was anticipating the manouevres.

h. The pre-paint tests and final inspection road tests conducted by Terex are not specifically designed to test the effect that various speeds and conditions have on the lateral stability of the crane, or on the ability of a driver to respond;

i. A few successful runs by a Terex employee down Ruthven Street in a Franna AT-22 crane is of limited weight. Yes, it proves that on those occasions, there were no difficulties with the handling of the crane and no loss of control at a speed of up to 90km/h. However, as Dr Casey explained, this also shows that there will always be an element of random stochastic behavior in accidents. In other words, you can conduct a test, seemingly over the same conditions and it may occur sometimes, and may not occur at other times. This did not mean it will, and cannot, occur. The loss of control, and inability to regain control, of Mr Hannemann's crane down the same stretch of road is proof of this; and

j. I acknowledge that companies such as Loughlin Crane Hire, which are primarily 'taxi crane' businesses, will be financially impacted. This is because they have built their businesses around a high volume of small crane jobs within a relatively

small radius from their depot. They rely on the dual-purpose nature of mobile cranes to be able to drive the cranes from job to job.

A restriction of speed will mean that the cranes will be restricted from certain motorways and roads. This will result in a requirement to transport the cranes by truck if an alternative route cannot be found. Extra cost is caused by the need for extra labour, time, and potentially machines and traffic control to load and unload vehicles on public roads. But this is no different to the existing towing requirements for other types of cranes in the industry.

Over longer distances, some companies, such as Loughlin Crane Hire, are already towing mobile articulated steering cranes anyway because it is more economical (i.e. it is quicker and there is less tyre wear on the cranes).

Increasing demand for tow trucks and tow truck drivers may even increase employment.

In any event, additional costs caused by a change to speed limits will apply to all crane businesses in the same situations, equally. Therefore, all taxi crane businesses will face increased costs and this should therefore be able to be passed on to consumers without any competitive disadvantage. In my view, this is a small price to pay for safer roads.

The commercial impact on industry should never be given more weight over human lives. The aim should always be to conduct business as safely as possible.

The need to impose road restrictions

66. The Queensland Department of Transport and Main Roads has explained that there is no speed threshold that is used to prohibit certain classes of vehicles from entering motorways. The challenge is about risk management in ensuring that road users are safe.

67. It is the Department's view that differential speeds cause more incidents on multi-lane motorways where there is a mix of traffic changing lanes more frequently and could be confronted with a very slow moving vehicle.

68. The Queensland Department of Transport Main Roads currently manages slow moving or vulnerable vehicles on motorways by erecting restricted road access signs at motorway entrances. These signs currently prohibit pedestrians, cyclists, moped riders, tractors and animal riders. Section 97 of the *Transport Operations (Road Use Management – Road Rules) Regulation 2009* (Queensland Road Rules) provides that it is an offence if a driver drives on a road to which a road access sign applies if the vehicle they are driving is indicated on the sign. Section 125 of the Queensland Road Rules further provides that it is an offence for a driver

to unreasonably obstruct other vehicles by driving abnormally slowly when there is no reason. The example provided in the rule is a driver driving at a speed of 20km/h on a length of road to which a speed limit of 80km/h applies when there is no reason for the driver to drive at that speed on the length of road.

69. In my view, in the event that a 60km/h speed restriction is imposed on all mobile articulated steering cranes, those vehicles should also be restricted from being driven on high-speed roads such as motorways, where it is assessed that a speed restriction of 60km/h will be unsafe for other motorists.

70. I agree with the Queensland Department of Transport and Main Roads' submission that for consistency and regulatory efficiency, this restriction should be included in the proposed amendments to the Notice by the National Heavy Vehicle Regulator in consultation with State and Territory regulators, rather than by local jurisdictions amending their road rules to restrict access to designated high-speed roads.

The need for further lateral stability testing

71. When reviewing this incident, Dr Casey obtained the raw data of the lateral acceleration plots for the 2003 slalom testing of the Franna AT-20 crane.

72. He noted that the nature of the tests was such that cones were set up and the crane was driven through these cones in a slalom type manoeuvre. The lateral accelerations were then measured. He compared the 'smoothed' graphs, which were reproduced in the 2003 report presented to New South Wales Transport Roads and Maritime Services, with the 'raw data' plot, which was not.

73. Dr Casey noted that the lateral acceleration plot for the raw data had a feature that may be associated with a 'natural vibratory response' of the crane. It appeared to him that the amplitude of the secondary signal could be problematic.

74. Dr Casey initially put forward two possibilities as to why the crane in the incident may have initially oscillated back and forth by two inches or so. One could be a 'natural vibratory response', which by definition requires some aspect of the crane to vibrate. This can come about because of expansion and contraction in the hydraulic system that actuates the steering. That is, the hydraulic hoses can expand and contract and this then means that hydraulic fluid is moving in and out of them. The same hydraulic fluid leads to the hydraulic cylinders that control the steering and therefore the steering itself would oscillate back and forth in response. Secondly, the tyres on the crane can also slew laterally.

75. I also acknowledge that there is a third possibility raised by Terex, which Dr Casey accepted, and that is that small movements by Mr Hannemann of the steering wheel could have caused the crane to change direction due to the sensitivity of the frame steering system.

76. Dr Casey is of the view that a comprehensive engineering investigation of the crane's lateral stability is warranted. I note that the National Heavy Vehicle Regulator has expressed a willingness to conduct this further testing. In my view, this should be encouraged.

77. However, such testing should not be used as a reason to delay or avoid the speed restrictions recommended above. Enough is already known to justify speed restrictions. The purpose this further testing would be to determine whether vehicle design improvements are required.

The need to develop electronic stability control systems

78. At present, there are no engineered counter measures installed within mobile articulated steering cranes that would typically be found in other road vehicles.

79. Dr Casey is of the view that the best way to increase safety in mobile articulated steering cranes is to prevent instability from occurring in the first place. He is of the opinion that it ought to be possible to adapt at least one of the commercially available counter-measures that deal with vehicle instability. For example:

    a. An 'Electronic Stability Control' that has been widely adopted in passenger vehicles and trucks for some time. This device detects when a vehicle is skidding and applies the brakes on just some of the wheels to counter the skidding; or

    b. Systems that allow for the transfer of hydraulic fluid from one side of the steering system to the other.

80. Terex Australia Pty Ltd is of the view that no demonstrated safety reason exists for engineered counter-measures and that such a measure is not realistic or workable.

81. Terex has also submitted that for an adapted electronic stability control system to have made a material impact on the outcome of the incident the subject of this inquest, it would need to be able to detect the onset of lateral instability, which they submit has not been established to have occurred.

82. Terex has advised that they are not in a position to develop an adapted electronic stability control system on their own. They can only do so by way of a partnership or joint venture with a specialist supplier.

83. Terex advised that in around June 2015, they made enquiries with several manufacturers of specialised brake control systems about the possibility of adapting an electronic stability control system to its cranes. They were not currently able to offer a commercially available system to Terex. The development lead-time was believed to be in the order of two to four years, with a high-level project development cost of in excess of $1M.

84. Mr Black estimated that it would cost around $15,000 per unit for

electronic stability control to be retrofitted to existing cranes. To put this in context, a Franna AT-20 crane costs around $405,000 and a MAC 25 costs around $460,000. Mr Black agreed that $15,000 per unit would be better spent on developing and fitting electronic stability control than the $5,000 per unit to fit a monitoring device to cranes. This is because electronic stability control is more of a preventative measure. (There will be further discussion below about monitoring devices).

85. I am unable to make a finding as to whether an adapted electronic stability control system would have mitigated or prevented the incident that led to the death of Mrs Leonardi and Samuel because there are too many unknowns. However, I am of the view that further pursuit by Terex Australia Pty Ltd of an electronic stability control device that can be retrofitted to their mobile articulated cranes is a worthwhile endeavor. Such a device may well mitigate prevent serious incidents in the future.

86. The imposition by regulators of a speed restriction of 60km/h on these vehicles until they can be fitted with such a device may provide more incentive and demand for such a product.

87. I agree with Loughlin Crane Hire's submission that in the event that electronic stability control devices are developed and can be retrofitted in the future, that further consideration should be given to whether this will be voluntary or mandatory, and who will bear the cost of fitment.

The need to change the transport and work health and safety licensing schemes

88. At the time of the incident, Mr Hannemann held a Heavy Rigid driver's licence with the Queensland Department of Main Roads and Transport and a High Risk Work licence with Workplace Health and Safety Queensland. This enabled him to lawfully drive a heavy mobile articulated crane on public roads and on worksites.

89. Mr Hannemann had around 7 years prior experience and he had received some induction training with Loughlin Crane Hire. Yet, through his experience, he was under the mistaken belief that it was reasonable to accelerate in the event that a 20-tonne mobile articulated crane lost control on the road, rather than to brake softly. There was also some anecdotal evidence that this may be a common misconception within the mobile crane industry. Mr Hannemann also oversteered the crane, in circumstances where he should have maintained slight movements of the steering wheel. It is not my intention to be critical of Mr Hannemann in what would have been a difficult situation. Rather, what this case (and the sample data) demonstrates, in my view, is that experience counts for nothing, if the correct lessons are not taught.

The licensing scheme for public roads

90. The driver's licensing requirements for a driver to operate a mobile articulated steering crane on a public road in each State and Territory has now been standardised under a 'National Driver Licensing Scheme'. The

National Transport Commission publishes national guidelines. Changes to the national guidelines can only be made with the agreement of the national Registration and Licensing Taskforce, which comprises of senior representatives and advisors from Australian licensing jurisdictions, as well as representatives (in a non-advisory capacity) from New Zealand.

91. The terminology may differ between Australian jurisdictions but the substance is the same. In Queensland, a mobile articulated steering crane is classified as a 'Medium Rigid vehicle'. This is the same category as buses and trucks (of more than 8 tonne and not more than two axles). This means that under state legislation, a person only requires a 'Medium Rigid heavy vehicle driver licence' to drive a mobile articulated steering crane on a public road. Drivers seeking to obtain a Medium Rigid licence are not required to nominate what type of heavy vehicle they intend to drive upon attaining the licence.

92. Of concern, is that in order to obtain a licence to drive a mobile articulated steering crane on a public road:

    a. A person must undertake training with a private trainer accredited by the Queensland Department of Transport and Main Roads or a period of supervision with a person who holds an open Medium Rigid licence. Yet, those trainers and supervisors are not required to have actually ever driven a mobile articulated steering crane. Nor is it necessary for the training or supervision to be conducted in a mobile articulated steering crane;

    b. There is no requirement for a person obtaining a Medium Rigid licence for the purposes of driving a mobile articulated steering crane on public roads, to undertake the training or supervision in a mobile articulated steering crane;

    c. There are no guidelines as to how a person should be trained to competently and safely drive a mobile articulated steering crane on a public road;

    d. In the written licensing test, there are no specific questions about mobile articulated steering cranes. There are no questions about their unique handling characteristics and no questions about emergency procedures in the event that a mobile articulated steering crane loses control; and

    e. In the practical licensing test, there is no requirement, or ability, to do the test in a mobile articulated steering crane. The test must be conducted in either a truck or a bus.

93. The Queensland Department of Transport and Main Roads acknowledges that the evidence presented at the inquest supports a proposition that further training and assessment of mobile articulated crane drivers may be beneficial. However, they submit that:

    a. They do not conduct driver training for any type of vehicle. They

merely assess a person's capability to drive a vehicle in normal conditions. Further, their driving examiners do not currently have expertise in the handling characteristics of particular special purpose vehicles or safe driving procedures for those vehicles and, as such, they are not able to adequately conduct on-road driver capability assessments for mobile articulated steering cranes;

b. Given the relatively small number of mobile articulated steering cranes registered in Australia, as a proportion of all heavy vehicles, it is impractical and undesirable to impose additional training and assessment requirements under the National Driver Licensing Scheme;

c. This is better addressed through an extension and improvement to the workplace-licensing scheme, rather than through the introduction of a special class or category of driver licence for mobile articulated steering cranes;

d. Their preference is to avoid an undesirable duplication of regulation by working with other government departments and industry to find the most pragmatic and efficient response to provide training and assessment associated with driver licensing, including by leveraging existing training and assessment mechanisms across government and industry where possible; and

e. Addressing this through the workplace-licensing scheme makes sense because it is unlikely that mobile articulated cranes would ever be driven on a public road other than in a workplace context.

94. Whilst I understand the reasoning behind the Queensland Department of Transport and Main Roads' submissions, I am firmly of the view that State and Territory road regulators should not be relying on other departments to tell them that drivers are capable of safely driving mobile articulated steering cranes on public roads. Road safety is the primary responsibility of road regulators. Even with co-operation between the departments, the road regulators cannot practically control the content, quality, or continuation of training and assessment by work health and safety regulators. Therefore, they must do it themselves. If this results in a duplication of effort between road regulators and work health and safety regulators, so be it. This is better than the current regulatory gap that exists, and this will be a safeguard against gaps appearing again in the future.

95. I am therefore of the view that the National Transport Commission should:

a. Amend the national licensing scheme so that before a driver is authorised to drive a mobile articulated steering crane on a public road, they must undergo a:

i. Practical assessment on a public road in a mobile articulated crane; and

ii. Theoretical assessment addressing the unique handling characteristics of a mobile articulated crane and emergency procedures in the event of a loss of control.

96. All State and Territory road regulators should support the National Transport Commission with the amendments above.

97. It does not matter to me how the recommendations above are achieved, whether it be through a new licensing class, or through an endorsement to the existing Medium Rigid class. What matters is that my recommendations are achieved at a national level as soon as possible.

98. I note that Loughlin Crane Hire has submitted that any new regime provide for recognition of prior competency and learning for drivers who have significant experience driving mobile articulated steering cranes over a number of years. I have no objection to such recognition, so long as there remains a minimum level of training and assessment for all drivers regardless of experience. This is because this incident and the sample data have highlighted that experience does not necessarily mean that the correct lessons have been learnt.

The licensing scheme for worksites

99. To drive a mobile articulated steering crane on a worksite in Queensland, a driver must hold a 'High Risk Work Licence' with Workplace Health and Safety Queensland.

100. The High Risk Work licensing scheme is part of a standardised national licensing scheme administered by Safe Work Australia, and adopted by most States and Territories.

101. In Queensland, the current unit of competency for a High Risk Work Licence for a non-slewing mobile crane greater than 3 tonne capacity is 'TLILIC3006A'. The licence identifier is 'CN'. The content is developed by 'Australian Industry Standards', which is an independent government-funded Skills Services Organisation established under the Commonwealth government's reforms of vocational education and training.

102. The training is delivered by Registered Training Organisations. These organisations are registered on a National Register and regulated under Commonwealth legislation.

103. The assessment is regulated by Workplace Health and Safety Queensland, under state legislation. An assessor must be accredited by Workplace Health and Safety and must also hold a current and relevant High Risk Work licence.

104. The assessment criteria is outlined in a 'National Assessment Instrument', issued by Safe Work Australia and approved for licensing purposes by all

State, Territory and Commonwealth work health and safety regulators.

105. Of concern is that the High Risk Work licensing scheme for mobile articulated steering cranes does not include any training or assessment of drivers about how to drive the vehicles safely on public roads. Although, I note Workplace Health and Safety Queensland's observation that the current course does carry components which could be expanded very easily to include such training.

106. For policy and resourcing reasons, the scope of the training has been limited to the operation of the cranes in 'crane' or 'plant mode' on worksites. Training and assessment in relation to the operation of the cranes on public roads is left to the Queensland Department of Transport and Main Roads.

107. From a practical and safety perspective, this artificial barrier is unsatisfactory. The 'workplace' does not begin and end at the worksite. These cranes are mobile (and are often referred to as 'taxi cranes' for good reason). They are often driven from worksite to worksite on public roads and clients are generally charged for all travel.

108. Further, section 8(1)(2)(a) of the *Work Health and Safety Act 2011* (Qld) provides that a workplace is:

    a. *A place where work is carried out for a business or undertaking and includes and place where a worker goes, or is likely to be, while at work*; and includes

    b. *A vehicle, vessel, aircraft or other mobile structure*.

109. Even within a worksite such as a farm (or a mining site, acknowledging that mine sites are administered by a different scheme), drivers of these cranes may be required to drive at speed on private roads. Similar safety issues apply to private roads, just as they do to public roads.

110. In my view, whilst the licensing schemes administered by Workplace Health and Safety Queensland and the Queensland Department of Transport and Main Roads are independent of each other (i.e. you can obtain one licence without the other), it is incumbent on both departments to fill the gaps in their training and assessment. This should be tackled in the first instance at a national level, given that they are both national licensing schemes.

111. In my view, Safe Work Australia should:

    a. Amend the national workplace licensing scheme, so that before a person is authorised to drive a mobile articulated steering crane on a private or public road in the course of their employment, they must undergo a:

        i. Practical assessment on a road in a mobile articulated crane; and

ii. Theoretical assessment addressing the unique handling characteristics of a mobile articulated crane and emergency procedures in the event of a loss of control.

112. Further, all State and Territory work health and safety regulators should support Safe Work Australia with the above changes.

113. I note Workplace Health and Safety Queensland's support for a change to the High Risk Work licensing scheme in respect of mobile articulated steering cranes and their advice that they will use every endeavor to work with Safe Work Australia and other regulators to implement changes.

The need to change the guidance in the *Mobile Crane Code of Practice*

114. In Queensland, the *Mobile Crane Code of Practice 2006* is an approved code of practice under section 274 of the *Work Health and Safety Act 2011* (the Act). An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the Act and the *Work Health and Safety Regulation 2011*. It is assumed that other State and Territory work health and safety regulators have similar codes.

115. The Code of Practice primarily deals with the safety of mobile cranes when used in the crane mode and includes minimal information relating to road travel. The information relating to road travel is limited to the issues of preparing the crane for road travel after lifting operations and licensing of operators to drive on roads. There is no guidance about the unique handling characteristics of mobile articulated steering cranes ways to avoid and react to a situation where a mobile articulated steering crane loses control or stability during road travel.

116. In my view, all State and Territory work health and safety regulators should amend their relevant Mobile Crane Codes of Practice to include guidance about the unique handling characteristics of mobile articulated steering cranes and emergency procedures in the event of a loss of control.

117. I note that Workplace Health and Safety Queensland supports such an amendment and has indicated that they will update the Code of Practice. I note their submission that information regarding the unique handling characteristics could be derived from input of crane experts, transport/mechanical engineering experts and the manufacturer. I also note their submission that advice regarding emergency procedures would need to be heavily qualified so as not to engender over-confidence and that all situations cannot be covered.

118. Mr Davis also stated that the relevant mobile crane Australian Standards are out of date and should be updated. In my view, this should occur through Standards Australia as per their usual processes.

The need to change the guidance in the Operators Manual

119. The Franna AT-20 crane Operators Manual contains about a page and a half of instructions for road travel. The instructions states:

    a. "Proceed to drive the crane as a normal heavy vehicle", with some specific guidance relating to the various modes.

120. The Operators Manuals of other mobile articulated steering cranes were not examined as part of the inquest, but it is assumed that they are similar in content.

121. Dr Casey and Dr Griggs agreed that there should be more information about the unique handling characteristics of the cranes and emergency procedures in the event of a loss of control / stability. Terex Australia Pty Ltd was initially reluctant to include such guidance but during the inquest, Mr Black agreed that it would be beneficial to do so.

122. In my view, all manufacturers of mobile articulated steering cranes should amend the Operators Manuals to include such guidance. Terex Australia Pty Ltd should also Issue a Safety Bulletin containing guidance to drivers about emergency procedures in the event of a loss of control.

Proposed installation of a monitoring device

123. Dr Griggs proposed that a 'bolt on' commercially available monitoring device be fitted to mobile articulated cranes, similar to devices currently used within the trucking industry. I liken these devices to the 'black boxes' fitted to aircraft. These monitoring devices can record information such as speed, braking, steering inputs, and even vehicle defects. A video recorder can also be installed showing the actions of the driver. Such a device may provide valuable information to investigators, in the event of an accident. It may also encourage drivers to drive the cranes responsibly.

124. There are a number of companies that offer these types of monitoring devices and they were estimated to cost around $5,000 per unit.

125. Terex Australia Pty Ltd is generally supportive of this concept and submits that a more suitable product would be a monitoring device or dash-cam, which would capture footage from the driver's point of view. Loughlin Crane Hire has also submitted that 'real-time' monitoring devices are available, which can assist businesses to monitor their drivers.

126. Mr Black suggested that such a system should be financed and administered by crane owners. However, it is unknown whether the majority of crane owners (and drivers) would support such an initiative.

127. During the inquest, I was amenable to making a recommendation that such devices be mandated. However, on reflection, I have reached the view that such devices are not really preventative measures. This is primarily about obtaining better data in the event of an accident. It does little to avoid or prevent accidents, even where there is real time

monitoring.

128. Humans will still make mistakes (purposely or unintentionally), regardless of whether such a device is fitted. We already know that some drivers have lost control of mobile articulated steering cranes on public roads and that people have died as a result. Assuming there was industry support for this device, it would take quite some time to implement, collect, and then review the data from a reasonable sample of accidents.

129. Whilst any initiative that results in better information should be encouraged, my concern is that this proposal is being held out as a reason to delay taking other action that would improve public safety now. In my view, resources would be better spent developing more of an engineering type control, which prevents a loss of control in the first place, such as an electronic stability system.

130. In the meantime, regulatory controls such as speed restrictions, road restrictions, a more appropriate licensing regime, and further guidance to drivers, are likely to be effective, and can be more readily implemented.

Proposed installation of an artificial ‘centre’ indicator to the steering

131. The National Heavy Vehicle Regulator has proposed that I make a recommendation that mobile articulated steering cranes be fitted with an artificial ‘centre’ or ‘straight’ indicator to the steering so that the driver can know by feel when the vehicle is driving straight.

132. Unfortunately, this proposal was not raised with the experts by the legal representative of the National Heavy Vehicle Regulator during the inquest, nor have the parties, such as Terex, had an opportunity to respond to this proposal. I am therefore not in a position to make such a recommendation but I encourage Terex to consider it.

133. I offer my condolences to family and friends of Christine and Samuel Leonardi.

134. I close the inquest.

John Hutton
Coroner
Brisbane

11 October 2017