FURTHER COMMENTS FROM P.J.McKAY TO
PARLIAMENT OF VICTORIA ROAD SAFETY COMMITTEE
ROAD/RAIL LEVEL CROSSING SAFETY
28 April 2008

1. Reasons for Additional Comments:
   These additional comments are given:
   - to expand or clarify my responses to questions from Committee members at the public hearing on Monday 14 April 2008.
   - to provide additional information arising from these.
   - to pass on additional comments from other people.

2. Australian Standard for Visibility
   a) The RISSB (Railway Industry Safety and Standards Board) has prepared this standard for issue under the Australian Standards banner: **Australian Standard AS 7531.2-2007 "Railway Rolling Stock – Lighting and Rolling Stock Visibility – Part 2: Freight Rolling Stock"** has been designed to cover many of the issues that the Committee is investigating.
   b) For example, Section 4 "Visibility Lights", Section 6 "Flashing Beacons", Section 11 "Reflective Delineators" and Section 15 "Maintenance".
   c) Unfortunately, this appears to be a 'work in progress' which may have been issued early to ensure certain immediate issues were dealt with, while leaving other areas entirely unspecified So Sections 4 & 6 are empty – they are just headings at this stage.
   d) The Committee will be interested in the following:
   11.1 Reflective delineators shall be fitted to vertical surfaces on each side of all freight rolling stock (Mandatory).
   11.2 Reflective delineators shall be mounted between 800mm and 2000mm above rail (Recommended).
   11.3 Each reflective delineator shall have a minimum area of 0.025 square meters (Mandatory).
   11.4 At least two delineators per side shall be fitted, with one mounted near each end of the vehicle (Mandatory).
   11.5 Additional delineators should be fitted every 2.5 to 5 metres between the end-mounted delineators (Recommended).
   11.6 Class 1A reflective material compliant with AS/NZS 1906.1 shall be used (Mandatory).
   11.7 The colour of reflective delineators shall be white or yellow (Recommended).
   15.2 Reflective delineators shall be inspected and maintained to preserve their fitment and reflectance properties (Mandatory).
   e) The Committee is advised to seek more information directly from the RISSB, who may care to put you in touch with any Victorian representative on the RISSB committee responsible for this standard.

3. AS 7531.2 in Application:
   a) Inspection of rolling stock in the North Melbourne area on Tuesday 15 April revealed that most wagons at one stage complied with Section 11 requirements, but virtually none currently complied with Section 15 – reflective delineators were missing in part or whole on most wagons and all were dirty enough to be virtually useless.
   b) A lot of the dirt appeared to be metallic brake dust which had formed a very strong bond to the reflective surface. So the simple 'wipe with a wet rag' mentioned at the public hearings would not be practical unless it was done regularly from Day One.

4. Visibility of Trains Approaching Passively Protected Crossings:
   a) Trains are more visible when they provide a strong contrast to their surroundings.
      - Trains are generally more visible if painted in lighter colours.
      - A stronger contrast is provided by striped paintwork, which minimizes 'blending in'.
      - In nature, most things are horizontal or vertical. So putting stripes on a diagonal provides even greater 'presence'. (The lower half of the ends of Comeng motor carriages used to have green & yellow diagonal stripes).
      - At night, trains are more visible if they have reflective strips on the sides (see above).
      - Where possible, the reflective strips should either be positioned on a diagonal or create a diagonal reflection.
   b) Train Lights at the Head End:
      - At night, locomotive or motor carriage headlights usually provide sufficient warning of an approaching train.
      - For additional presence on approach, flashing beacons/rotating lights could be added to the top front of locomotives or motor carriages.
      - These flashing beacons should not be amber, since most people would associate these with slow-moving or stationary work vehicles. The colour should be unique to trains (perhaps. purple or green) or two colours (eg. purple & amber).
      - To really grab motorists' attention, the twin red/blue lights of emergency vehicles could be used. On the move, this would not conflict with the principle of reservation for emergency purposes – lives are indeed at risk. However if a train stopped, red/blue lights could be a distraction to motorists, taking their attention away from the roadway and perhaps making them blasé about its use and future recognition.

5. Visibility of Trains already on Passively Protected Crossings:
   a) Again, trains are more visible when they provide a strong contrast to their surroundings. So all the same comments in section 4(a) above still apply.
   b) The Committee raised the question of lighting the sides of freight trains at night.
      - This would be relatively easy to do on locomotives, but it would be an enormous task for the many government & private Victorian & interstate freight wagons, each having its own different longitudinal profile and other characteristics. Strict uniformity of lighting every type of wagon would not be necessary, but there should be sufficient commonality so that when a motorists sees this light, the brain says "TRAIN!".
      - There are many performance & reliability criteria such lighting would have to meet. The following are expected to be very difficult to achieve:
        - very bright but robust lamps; able to withstand dirt & abrasion from the dust & grit raised by moving trains; waterproof; vandalproof.
        - extremely reliable wagon-to-wagon electrical connectors that could withstand many rough couplings & uncouplings.
        - A high government & corporate tolerance of failure (eg. when the inevitable happens and an electrical cable temporarily becomes a towrope). There is unlikely to be a practical fallback position with damaged cables, so trains with no sidelighting will still have to be permitted to run, but such failures should be recorded against the performance criteria of individuals & organizations to prevent carelessness or constant acceptance of no sidelighting.
      - If each wagon had a 'stand-alone' solar/battery lighting system, certain problems would be overcome bit other ones would be created (eg. keeping solar cells clean & undamaged).
      - The reliablity & maintainability of a wagon sidelighting system would be very low, generating high costs for little gain, with the possible exception of small dedicated trains which are never coupled/uncoupled. In my judgement, wagon sidelighting is not worth further investigating at this time.

c) The Committee also raised the question of **visibility of unloaded flat-top wagons**:

- Flat-tops are about one metre high, which is below the eye height of many tall vehicles (eg. 4WDs) and all trucks.
- Flat-tops have side members ~150-200mm high, which may present to the eye as very thin, except in the vicinity of a bogie.
- Newer style '3-pack' and '5-pack' wagons have been skeletonised to reduce their weight and they have extremely thin side members (~50-60mm), which would not be very visible even with a clean reflective delineator on it.
- So increasing contrast alone does not seem to hold any promise of increasing conspicuity. It seems that the problem is two-fold requiring a two-pronged solution: what is needed is increased area of reflectivity at an increased height.
- The only way to get permanent increased height is to locate a reflector between flat-top wagons on an arm which attaches to the end of a wagon or to the coupling gear. This will be in danger during loading & unloading operations, and the larger the reflector, the more likely it will be hit and damaged.
- Movable reflectors which are kept out of harm's way during loading & unloading & running of loaded flat-tops may hold more promise. Some ways to do this are:
- Reflectors on arms which are located under floor level of '3-pack' and '5-pack' flat-tops, which are rotated up through the "floor" (there is no floor – only a central beam & side frames) when the wagons are to be run unloaded.
- Reflectors on arms which are attached to side members of conventional flat-tops with floors and which are rotated up for unloaded running. These may have to be located in the vicinity of the bogie only - although freight wagons are narrower than passenger carriages, they often have a cross-sectional profile &/or length which gives them less clearance on curves, and anything attached to the outside in the middle or at the ends may strike convex or concave platforms respectively. Any such devices would need a full clearance check.
- Reflectors on a bar or pole which is totally removable. The pole would sit in a hole in the floor or in a bracket on the side member. These could be located wherever there are holes or brackets. The disadvantages are that removable items are more easily lost, damaged and soiled, and they would need a system of storage and management.

6. <u>Use of Protection Devices which are not Fail-Safe:</u>

a) The Committee asked my opinion of installing active protection devices which are not fail-safe at passively protected crossings, and I gave the reply that I did not object to this since it would give a generally higher level of protection than the current passive protection, but a thorough public education campaign would have to accompany this.

b) I would now like to qualify this in case I have misled you. I was thinking more of the advance warning on approach to a level crossing rather than the protection at the level crossing itself when answering Mr. Mulder's question.

c) Non-fail-safe Protection at a Level Crossing:

- For over half a century, the active protection of boom barriers & flashing lights have been fail-safe, and people have a very high degree of confidence that "no lights means no trains".
- If non-fail-safe protection systems were introduced at level crossings, the momentum of history and their personal experience would lull people into a false sense of confidence that any new system would say the same thing to them (ie. "no lights means no trains") with at least the same, if not better, degree of safety.
- To change this, the motoring public would need to be not just educated – it would have to be almost battered into them, perhaps to the point of them having to prove that they understand it in a test. The education must aim at prevention, not cure. If you say they will be fined if they do the wrong thing, it will be too late – if they have done the wrong thing, they will probably be dead.

- Even allowing for a proper public education that certain devices are only advisory, giving warning 99% of the time and protection 0% of the time, the high reliability demanded of non-fail-safe systems will have a dark flip-side - unfortunately, over a period of time, unless people have been present at a crossing during a warning failure, the very reliability will gradually lull them into a false confidence of "no lights means no trains", and when these lights are the last line of defence, this attitude can be fatal.
- Therefore, I believe that any active protection which is the last line of defence, that is, located at the level crossing itself, must be fail-safe.
- However I believe that there is still a case for non-fail-safe active protection which is not in the last line of defence, ie. advance warning signs.

d) Non-fail-safe Advance Warning Signs:

- If an advance warning sign saying something like "LOOK FOR TRAINS" had one or two flashing amber beacons mounted above it, and these beacons were activated by trains, and this sign/beacon was located at a reasonable distance (but not too far) from the crossing, people would treat it as strongly advisory and watch out for trains.
- If the lights had failed, motorists would still treat the sign as advisory but give it less credence.
- However because of the distance to the crossing, whether the flashing beacons are working or not, they are likely to consider their final approach to the crossing as a new event and so rely on the protection provided at the crossing for their final warning, even if this is only the passive protection of signs.
- So there is balance to be struck:
  - If the advance warming sign was too close to the level crossing, people would tend to treat the beacons as full fail-safe flashing lights, especially if coloured red.
  - If the sign was too far from the crossing, people would tend to forget about its warning by the time they reached the crossing.
  - Therefore the sign must be close enough to the crossing so people will not forget it and far enough from the crossing so that people will treat it as advisory of something ahead, not their final warning. Amber coloured beacons would reinforce the idea of a warning to watch for a train rather than an indicator of the presence of a train.
- The case that we must avoid is the "a little knowledge is a dangerous thing" case, where someone knows that the beacons are train-activated and makes the conclusion that "no lights means no trains" and proceeds from the advance warning sign to & over the crossing without taking any other precautions. This "Russian Roulette" approach to driving safety would have to a strong part of the education.

e) Engineering Solutions may give False Confidence:

- When I was a young engineer on a bridge reconstruction job, the amenities room was at ground level and the worksite was down in a cutting. The workmen had to clamber down an embankment to get to the worksite while carrying their tools, but fortunately, there had been no accidents. A safety officer suggested that a path & steps be cut into the embankment and all agreed that this would be safer. Injuries then rose to three per week because the men had too much confidence in the new "safer" path. They no longer took the care that they did when they knew there was a higher risk. Engineering had improved infrastructure safety by X, but attitude to operations on that improved infrastructure had reduced safety by 2X.
- The same could easily apply to non-fail-safe level crossing solutions. It may be better to have a slightly greater infrastructure risk at the crossing itself (ie. passive signs instead of non-fail-safe active warnings) and aim at attitude improvement through active (though non-fail-safe) advance warnings.

7. <u>Expert Advice:</u>

The Committee asked about sources of expert advice. I would recommend the following:

a) RTSA (Railway Technical Society of Australasia - under the umbrella of the Institution of Engineers Australia) which was formed to disseminate railway technical knowledge. It focuses on the civil (track) and mechanical (rolling stock) engineering areas, and not so

much on the electrical (signals & traction power) engineering areas. RTSA also nominates the Victorian representatives on the committees drafting railway standards for the Australian Standards Association.
Contact: Martin Baggott, Chairman of Victorian Chapter RTSA, contact thru GHD (Gutteridge Haskins Davey) on 8687 8000.

b) Institute of Railway Technology in the Mechanical Engineering Department at Monash University, which is really the former Melbourne Research Laboratory of BHP transferred to Monash. Their worldwide network of railway engineering contacts in all fields is unsurpassed.
Contact: Ravi Ravitharan thru 9905 1986.

c) Consultant Worley Parsons Rail for matters concerning modifications to rolling stock.
Contact: Warren Williams thru 9676 3500.

d) For analysis of any matters of railway signaling (including level crossing active protection systems), the acknowledged guru in these matters is former PTC signals engineer Paul Niehoff, now working at consultant SKM (Sinclair Knight Merz).
Contact: Paul Neihoff thru 9248 3100.

e) APESMA (Association of Professional Engineers, Scientists & Managers of Australia) is not primarily a technical organization, although it does conduct technical seminars. However with members numbering in the tens of thousands, it can reach large numbers of practicing engineers very quickly, canvassing their views and calling for contributions to any matters where they might have expertise.
Contact: Sharelle Herrington on 9695 8971.

8. Additional Comments from Other People

Other people, knowing that I have made a submission to the Committee, have offered me the following comments to place before the Committee:
The use of the large “RAILWAY” and right-pointing chevron signs (ie. width marker signs) on the left side of the road and “CROSSING” and left-pointing chevron signs on the right side of the road is too rare. The general opinion is that these should be used much more often at level crossings, whether these have active or passive protection, for the following reasons:

- These are very large and harder to ignore than one sign on one side of the road.
- These convey their message in both a graphic & written form, so the presence of a level crossing is easily and quickly recognized.
- These show at a glance the exact alignment of the road over the railway, allowing the driver to more safely divert his attention from the road to the railway in order to scan for trains.

I hope the Committee finds the above useful.

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