TRANZ RAIL

Engineering Services

REVIEW OF STROBE LIGHT TRIALS AT RAILWAY LEVEL CROSSINGS

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1. INTRODUCTION

In about 1995 Tranz Rail (TRL) took a renewed interest in investigating alternative methods of providing effective flashing lights at level crossings fitted with alarm systems. The incandescent lights that had been traditionally used had limitations on effectiveness, in particular brightness and angular visibility in the horizontal plane. A number of people had written into TRL suggesting the use of rotating beacon lights and strobe lights, so it was decided to trial these as supplementary lights working in conjunction with the standard flashing lights. At the time, the development of LED flashing lights for railway applications was in its infancy.

Recent advances in the design of LED railway flashing lights meant that it is now possible to economically provide a very effective warning light with a considerably improved horizontal light beam spread and also greater overall conspicuity during all daylight conditions. Thus the initially perceived advantage identified for the use of strobe light as a supplementary warning device with the standard incandescent flashing lights has now been superseded by improvements in standard flashing light technology.

2. TRIALS OF SUPPLEMENTARY LIGHTS

In 1997 two level crossings were selected in the Wairarapa in liaison with the local Road Safety Council Officer and trial supplementary lights installed on the mast above the standard set of flashing lights either side of the railway line as follows;

- Pembroke St, Carterton – red strobe lights
- Norfork Rd, Waingawa - red rotating beacons

These two level crossings were considered to have incandescent flashing lights with less than satisfactory light output. (Note that LED units were subsequently installed at a later date to address this problem).

A site survey was carried out at each level crossing on the 3 April 1998 where a number of motorists were stopped and interviewed. The results of the survey indicated that;

- A large portion of local road users noticed the strobe light or rotating beacon before looking at the standard railway flashing lights. In some cases the strobe lights drew attention to the fact that the flashing lights were operating.
- Strobe lights or rotating beacons should be installed on more crossings (it must be noted that there had been considerable publicity in the local press which would have contributed to positive support)
- Rotating beacons had no advantage over strobe lights (both were equally effective)

However at the time of the Wairarapa trial, no objective study over a period of time was carried out to determine whether the addition of strobe lights resulted in increased compliance when the alarms were operating.

Tranz Rail considered the results of the feedback together with experience gained from other trial installations with strobe lights (see section 3 below).

Rotating beacons were known to have variable reliability due to past experience with use as "Wanted Winkers" at selected stations which, when operating, summonsed locomotive engineers to talk on a train control telephone. They were also prone to periodic theft.

Key findings were;

- Strobe lights used were found to be somewhat less reliable than standard flashing lights. This was a concern to TRL especially in cases where motorists tended to rely on them exclusively and ignore the primary flashing lights which are designed to provide the principle warning to motorists with a high level of integrity.
- A high output strobe light had to be used to provide reasonable effectiveness in daylight conditions. However they were found to be relatively ineffective in bright daylight conditions, especially when they were viewed against a sky background.
- There was a risk that some motorists could confuse the operation of the strobe lights as indicating the scene of an accident rather than a railway level crossing.

3. OTHER TRIAL STROBE LIGHT INSTALLATIONS

3.1 Problem Level Crossings

Strobe lights have been installed at some other level crossings with a history of problems to provide enhanced warning to motorists as follows;

- McKays Crossing on SH 1 between Paekakariki and Paraparaumu – they were found to be relatively ineffective during bright daylight conditions and thus were removed and reused elsewhere. Two sets of flashing lights in each direction are provided for approaching motorists on SH 1 so the crossing are deemed to be well covered with warning lights.
- Otahianga Road between Paraparaumu and Waikanae (now fitted with LED' flashing lights which have overcome the identified sun-strike problem)
- Victoria St, Waipawa (now fitted with LED flashing lights).

3.2 Alarms Operating Indication for Train Drivers

A small number of single strobe lights have been installed at specific level crossing installations as an "alarms operating" indication for locomotive engineers. Strobe lights in this category are mainly provided at installations fitted with grade crossing predictor control systems where it is necessary to indicate the "alarms operating" condition for trains starting from stop on the crossing approach.

A new LED flashing sidelight unit has now been developed that can provide an effective "alarms operating" indication and it is expected that this unit will eventually replace the strobe lights currently provided for this purpose.

4. ADVANCES IN THE DEVELOPMENT OF LED FLASHING LIGHTS

The first type of LED flashing light unit used by TRL (the Aurora model made by GRS) was selectively installed nationwide from about 1997. It did not incorporate any special optical lens system but demonstrated that these units offered an overall improvement in conspicuity on the standard incandescent light head, especially those in poor condition. The light output on the centre beam axis was not necessarily better than an incandescent head in good order.

An LED flashing light unit is able to provide a more uniform light pattern compared to an incandescent flashing light unit (which derives its light from a single point source). LED's also

have the advantage of fast turn-on and turn-off times compared to an incandescent light bulb and this feature (similar to a strobe light) helps to provide greater conspicuity.

Subsequent trials of the Safetran type of LED flashing light showed it to have an improved horizontal spread from the centre light axis compared to the Aurora LED unit. The Safetran unit incorporates a prismatic lens system for each LED.

Discussions with Vega Industries Ltd, Porirua (a navigation light manufacturer with an international reputation) commenced in 1999 with a view to producing a LED railway flashing light head with advanced lens optics to;

- give good wide angular vision
- provide a quantum increase in performance on any other LED light unit available on the market at the time,
- provide similar conspicuity to that which was available from a strobe light or rotating beacon
- provide a high reliability unit.

The result was the Vega model VLB 40 flashing light unit that provides the following;

- Light intensity on the centre light axis exceeding the best results obtainable for an incandescent flashing light unit in good order.
- Met TRL requirements for a wide angle viewing with an effective horizontal spread of the order $\pm$45 degrees from the light beam centre axis being achieved. The angle of divergence either side of the light beam centre axis to achieve half the maximum light intensity was about 25 degrees.
- Has built in dual redundancy (two electronics systems each feed half the LED array) to ensure high reliability.

The Vega light unit is now TRL's preferred flashing light unit with more than 200 installed nationwide. The issued guide lines for the prioritizing of alarm installations for the use of these light units is as follows;

- Recommendations from reports of alleged incorrect alarm operation that may implicate the effectiveness of the existing flashing lights
- Wide angle and curved road approaches (where coverage needs to be improved)
- Rising and setting sun problems regularly encountered
- Special cases (eg. background clutter, complex road intersections).

5. REASONS FOR THE DISCONTINUANCE OF STROBE LIGHTS

- Advances in the design of LED Flashing light heads have overtaken the original need for strobe lights.
- They were found to be relatively ineffective in bright daylight conditions, especially when they were viewed against a light sky background.
- They were found to be less reliable than standard flashing lights.
- Strobe lights necessitate special circuit modifications at a level crossing alarm installation as they are power hungry and can not be driven off the standard flashing light and bell circuits. (The LED light units can be directly substituted for existing incandescent flashing lights without any significant modification required at the level crossing installation).
- There is no substantive evidence that the addition of strobe lights has any significant effect on road user compliance at level crossings (i.e. more likely to stop when the lights are flashing) when flashing light heads with good light output are installed.
- Strobe lights currently do not form part of the standards of level crossing protection agreed between Tranz Rail and the Land Transport Safety Authority (other than for trial use).
- The meaning of alternating flashing lights is specified in statutes. In the Road Code, stand-alone flashing lights indicate a crash site where motorists are required to slow down and take

extra care. There is no legal responsibility to stop for a strobe light (hence the reason that Tranz Rail has classed them as supplementary warning devices only)

- Strobe lights have not proven to be of any particular advantage in cases of “sun strike” (the new Vega LED units effectively mitigate this problem).
- They may be prone to theft

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