

ITS specification  
Lane control unit supply and  
installation  
(ITS-04-01)

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Private Bag 6995  
Wellington 6141

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# Document management plan

## 1) Purpose

The purpose of this document is to specify the general requirements for the supply and installation of Lane Control Units.

## 2) Document information

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Document author	Jamie French	(09) 300 9000
	Tom Harris	<a href="mailto:Tom.Harris@opus.co.nz">Tom.Harris@opus.co.nz</a> (09) 355 9542
	Bruce Walton	<a href="mailto:Bruce.Walton@beca.com">Bruce.Walton@beca.com</a> (09) 336 9465
	Paul Addy	<a href="mailto:Paul.Addy@beca.com">Paul.Addy@beca.com</a> (09) 308 0833
	James Shi	<a href="mailto:James.Shi@nzta.govt.nz">James.Shi@nzta.govt.nz</a>
Document owner	Russell Pinchen/Kevan Fleckney	

## 3) Key words

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Final R1	All	Provisional	BW & JS	14/2/2012

Superseded

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# 1.0 Lane control system

## 1.1 Scope

This section sets out the requirements for the supply, testing, installation and commissioning of the Lane Control System (LCS).

Each LCS Field Installation (LFI) shall provide specific, localised lane availability status and advisory or regulatory speed information to motorists, using multiple display devices, and shall comprise the following elements:

- a. Lane Control Units (LCU), capable of displaying a limited set of lane use and speed advisory messages complemented by amber flashers;
- b. Overhead gantry sign support structure, which positions the LCU's centrally above the motorway lanes as specified in the NZ Transport Agency's (NZTA) *ITS specification: Support structures and foundations* (ITS-01-05);
- c. Ancillary control and communications equipment.

The Lane Control Units (LCU) shall each be capable of displaying a fixed limited message set of speed indications and graphic lane control symbols.

Lane Control Systems require either advisory speed LCU's or mandatory speed LCU's.

Requirements for any civil work required are specified in NZTA's *ITS specification: Civil and motorway site works requirements* (ITS-01-04).

## 1.2 Advisory speed lane control units

Advisory Speed Lane Control Units shall:

- a. Display speed indications at 10 km/h increments from 10 to 100 inclusive using a standard 5 x 7 pixel matrix;
- b. Each character shall have a minimum height of 450 mm;
- c. Display move left and right arrows, divert left and right arrows and a lane closed ("X") symbol;
- d. Aspects shall be amber with the exception of the lane closed "X", which shall be displayed in red;
- e. Utilise proportional spacing to separate each character displayed;
- f. Have 150mm diameter amber flashers located at each corner of each LCU display;
- g. Have a 100mm wide bezel surrounding the flashers.

Note that preference is given to utilisation of the same or similar hardware for Advisory Speed LSU's as that already installed.

## 1.3 Mandatory speed lane control units

Mandatory Speed Lane Control Units shall:

- a. Comply with the above requirements for Advisory Speed LCU's;
- b. Have a red roundel, comprising of LED elements which can be turned on or off independently of any other displays. This roundel shall surround the speed display and shall be of a size and width to emulate the proportions of a standard static mandatory speed sign;

- c. Have a 100mm wide bezel surrounding the flashers and the roundel.

## 2.0 Lane control units

### 2.1 General

For all LCU applications, LED display technology is the de-facto standard for all LCU displays. This technology provides good visibility under most viewing conditions and has low maintenance requirements. Other technologies may be considered subject to specific approval from the NZTA's National Office Network Operations Network Demand staff.

Lane Control Units shall employ light emitting technology, not requiring external or supplementary illumination.

Each unit shall display messages comprising any combination of text, numerals and free-format graphics. In general the signs will operate in either a text mode, or in graphics mode. In text mode, the signs shall display text, numerals and standard punctuation marks. In graphics mode, the signs shall be able to display graphics only. Signs shall be of the continuous matrix type.

### 2.2 Lane control unit requirements

#### 2.2.1 Symbol display

All symbols shall be developed in accordance with MOTSAM and are subject to the approval of the Engineer.

Aspects shall be white, or white/yellow with the exception of the lane closed "X", which shall be displayed in red.

The display shall be updated in a manner that appears instantaneous.

An amber flasher shall be located at each corners of each LCU display (size to match existing LCU's at diameter of 150mm). The flash frequency shall be synchronised by a central control system e.g. DYNAC.

#### 2.2.2 Text display

Each LCU shall be capable of displaying numerals using a standard 5 x 7 pixel matrix. Each character shall be a minimum of 450mm high. LCU signs shall utilise proportional spacing to separate each character displayed.

Each LCU sign shall be capable of displaying messages comprising any combination of text and numerals, including a limited graphics capability incorporating arrows.

A means of flashing complete messages and individual characters or groups of characters within a message shall be provided.

The time taken to display an alphanumeric message generated at the local controller shall not exceed 0.5 seconds.

Default and fail-safe messages shall be employed. Default and fail-safe messages shall be configurable at the central control computer(s).

A blank fail-safe message shall be displayed in the event of a power failure, display character module failure, communications failure or the failure of any other significant component of the control system.



### 2.2.3 Optical performance

The LCU displays shall be clearly legible from any distance between 75m and 300m under normal motorway operating conditions, and from any part of the approaching lanes, including the hard shoulder.

The optical performance of all signs shall conform with BS EN 12966-1, Visual Performance as detailed in section 4.2 of the NZTA's *Fixed variable message sign design guide* (SP/M/026).

### 2.2.4 Viewing angle

The LED elements for LCU's shall have a minimum of 15 degrees viewing angle.

The LED's shall be grouped to form a symmetrical, circular shaped pixel in the display matrix. The luminous intensity of the pixel shall not decrease by more than 50% when viewed at a minimum angle of 15° (7.5° 1/2 angle) centred about the optical axis and perpendicular to the surface of the display. The luminance for different pixels shall not vary by more than +/- 20% of the mean output of all the pixels.

### 2.2.5 LED's

The Contractor shall supply evidence that LED's supplied as part of any LCU meet the quality, life expectancy, candela ratings and batch requirements outlined in this document and any referenced external standard.

The Contractor shall also supply details of the current rating of the proposed LED's to be used and what actual current they will be driven at to meet the candela requirements of the NZTA for the LCU.

LED's used in the LCU shall all be sourced from the same batch / bin to mitigate minor variations in colour.

The decrease in luminous intensity of any LED pixel under 24 hour continuous operation shall not exceed 30% after one year and 40% after five years.

No LED or group of LED's shall be "overdriven" or supplied additional current such that the stated LED life expectancy is compromised, to achieve the candela ratings required under BS EN 12966-1.

LED's selected shall be highly reliable for the intended application; with a target continuous operating period of five years, the Mean Time Between Failures (MTBF) of a single LED display element shall not be less than 150,000 hours; (a display element is defined as failed when less than 75% of the LED in the display element are operational or when the display element has failed to achieve 75% of the intended output intensity).

The LED pixels shall be waterproofed to protect the LED;

All soldering of LED's required to form pixels will be of a type that minimises the exposure of the LED's to sudden excess heat and creates a reliable, tested set of connections, (wave soldering combined with component PCB preheating) and meet viewing angle performance levels.

### 2.2.6 Display intensity

Each LCU shall include no less than two integral light sensors (facing forward and to the rear) to measure the ambient external light conditions from all directions and automatically adjusts the intensity of the LCU displays to a minimum of four different levels.

The light sensor system shall ensure that the luminance output of the LCU's is maintained in accordance with the ambient and background light conditions, including direct sunlight and darkness.

The controller shall ensure that the intensity of the sign display is unaffected by short fluctuations in ambient light conditions by averaging light sensor readings over a suitable, (60s ± 30s), and configurable period of time.

The LCU's shall prove conformance to the minimum luminance under external illumination prescribed in BS EN 12966-1.

## 2.2.7 Display colour

The text and arrow graphic pixels shall display an amber colour using LED's having a nominal wavelength of 590nm.

The lane closed ("X") symbol and red roundel pixels shall display a red colour using LED's having a nominal wavelength of 630nm.

The colour of LED's shall be uniform across the sign;

When measured with the test module fully dimmed on axis and at the horizontal and vertical half angle positions, the colour coordinates shall be within the limits given below (from CIE 1931 Colour Domain).

Table 2-1 : Display colour

		1	2	3	4
Yellow	X	0.618	0.612	0.564	0.560
	Y	0.382	0.382	0.426	0.440
Red	X	0.618	0.612	0.564	0.560
	Y	0.382	0.382	0.426	0.440

## 2.2.8 Display maintenance access

Display elements and control equipment shall be readily accessible and removable for maintenance. Removal of display modules shall be undertaken by the loosening of easily accessible screw fixings, or other suitable fastening arrangement, and disconnection of power and control connectors only.

The display elements shall be designed in modules to facilitate maintenance and replacement. Failure of operation of a single display element (pixel) shall not require on-site replacement of more than one display module. Failure of a single pixel shall not affect the operation of any other pixels.

Pixels and/or Pixel mounting blocks shall be modular and easy to swap / replace without requiring any soldering or any other form of heat based bonding to other electrical components as part of the process.

During replacement of faulty driver boards or light emitting modules the sign shall remain operational.

## 2.3 Lane control unit enclosure and mounting

### 2.3.1 General

The LCU enclosure shall be a black non-reflective corrosion resistant enclosure that shall contain all display elements and driver electronic equipment. Individual LCU control electronic equipment may be housed in a separate enclosure mounted inside the LCU gantry truss.

The LCU and individual LCU control enclosures shall be constructed to present a clean, neat appearance.

All LCU's and individual LCU controllers shall be fully serviceable from the rear of the enclosure. Sign and individual controller design for replacement, repair, or maintenance activities, shall ensure there is no risk of any element of the sign, enclosure, maintenance materials or tools falling on to the carriageway below.

The equipment housed within the LCU and individual LCU controller enclosures shall be protected from moisture, rain, snow, sun radiation, dust, dirt and salt corrosion. The enclosure shall provide a minimum IP65 ingress protection as defined in AS 1939 -1990.

## 2.3.2 Materials

The LCU enclosures shall be constructed from sheet metal (aluminium or mild steel) treated as necessary to provide the required protection and mechanical strength for the application and environment.

Materials used shall ensure deterioration due to atmospheric and/or local environmental conditions shall have no detrimental effect on the structural integrity or visual appearance (including colour fading or corrosion) of the finished enclosure for a period of not less than ten (10) years. Contact between untreated, dissimilar metals shall be avoided.

Protective screens shall have an impact resistance suitable for their purpose. Protective screens shall not deflect by more than 2mm at any point on the surface due to the effects of environmental conditions. Protective screens shall be coated to mitigate dirt adhesion, and shall remain effective, without any maintenance other than cleaning, for the design life of the equipment.

## 2.3.3 Doors

LCU and individual LCU controller enclosures shall have flush fitting doors with secured access. Locks of a type approved by the Engineer shall be used, and at least two keys shall be offered with each sign. All keys shall be keyed identically and shall match the existing LCU units.

## 2.3.4 Sign mounting

Installations shall be provided with a facility to adjust and align the optical axes, according to the local geometry. This adjustment mechanism shall employ a suitable arrangement for locking the sign in the desired position.

## 2.3.5 Construction requirements

All hardware supplied shall be:

- Industry standard, readily available from multiple suppliers;
- Modular;
- Flexible, allowing for enhancement of hardware and functions;
- Low maintenance, self diagnostic and easily serviceable; and
- Supplied new.

Materials shall be selected to prevent premature ageing. In particular, plastics shall be stabilised against the effects of UV radiation.

## 2.4 Control/data interface requirements

### 2.4.1 Sign control

The LCU shall comply with the NTCIP standard for device communications.

The LCU equipment shall respond to control commands issued at the local field controller. These commands will be initiated by the local field controller processing, or by central control computer(s) processing.

A control unit with an industry standard electrical interface shall be employed for each sign to enable control from the Traffic Operations Centre and to report the status of the sign to the central system.

## 2.4.2 Status feedback

A heartbeat signal originating at the central control computer(s) shall be used to confirm communications with the event response equipment. A default message shall be displayed in the event of a communications failure between the equipment and the central control computer(s).

The event response equipment shall incorporate an industry standard electrical interface to the local controller for purposes of control and status feedback. The control unit shall provide the following status information to the central system:

- Power failure;
- Communications failure;
- Display element failure;
- Incorrect message displayed;
- Message updated;
- External luminance level (lux); and
- Luminance setting.

## 2.4.3 Data transmission

The Contractor shall provide a means for data transmission between the central computer system and each sign, utilising an appropriate technology.

The performance of the data transmission shall not be adversely affected by other simultaneous operations of VMS, CCTV, FMS etc.

The Contractor shall provide all equipment, interface devices, cabinets, cabling, software and license agreements, as required, to establish error-free data transmission communications between each sign and the central computer system in accordance with this specification.

## 2.5 Electrical requirements

A UPS shall be provided to provide on-line power to each LCU field controller and any other components that are necessary to maintain communication with the Traffic Operations Centre.

The UPS shall be sized to maintain the systems for a period of one hour. The UPS shall be an on-line type and shall provide a no-break transfer to battery backed power in the event of mains power failure. The UPS shall utilise low maintenance, sealed gel type lead acid batteries.

A bypass switch shall be provided to enable the UPS to be either

- switched into circuit
- switched out of circuit or
- the mains disconnected to test the UPS.

Each sign shall be fitted with lightning and surge diversion equipment.

All internal and external wiring to the display units shall utilise cable connectors or card slot contacts to readily facilitate disassembly for maintenance purposes.

## 2.6 Testing requirements

The Contractor shall ensure that factory acceptance testing on all LCU signs includes tests for the following:

- Assessment of pixel output intensity levels;
- Assessment of colour uniformity;
- Demonstration of correct operation under varying external luminance conditions;
- Demonstration of door operation and weatherproofing;
- Demonstration of all pixels activated/deactivated in alternating mode using a checkerboard test pattern for 30 minutes minimum;
- Demonstration of operation with the sign control unit, including demonstration of the use of all software commands and application messages;
- Continuous soak test operation over 48 hours using a message display change every 15 minutes. Any pixel failures during this test will require satisfactory repeat of the complete test; and
- Sign response time for commands implemented at the sign control unit.

In addition to the tests defined above a representative communication link between the sign and its control unit, utilising the intended equipment for communication to be installed in the field shall be established to confirm correct operation in accordance with this specification.

All testing to include FAT, SAT and Commissioning shall conform to section 8 of Document SP/M026R2 in Appendix A.

## 2.7 Maintenance requirements

Each event response equipment shall be designed to facilitate planned and breakdown maintenance with the minimum of equipment and in the shortest time. All event response equipment shall be fully serviceable from the rear. Event response equipment design shall for all replacement, repair, or maintenance activities, shall ensure there is no risk of any element of the event response equipment, enclosure, maintenance materials or tools falling on to the carriageway below.

Event response equipment shall not require more than two field visits annually for routine maintenance.