Bike Path Lighting Layout Guidelines

Plans Supporting Council's Sustainable Paths and Safety Strategies

Example Site: Upfield Path Fawkner

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Background

The world's climate has become far more unpredictable in the last years and it seems that electrical power infrastructure will become less reliable, requiring back-up services to meet the needs of government and industry to maintain safe and productive working environments.

SolarOne Marketing Pty Ltd has been created to develop and market new lighting products that meet the needs of sustainable lighting for public and industrial pathways.

SolarOne has taken the approach that corners should not be cut and risks should not be taken if customer's needs are to be met and SolarOne's reputation is to be built.

To this end during 2007, 2008, 2009 and 2010, SolarOne conducted extensive studies to determine the best products that meet Australian conditions and completed trials to define and satisfy user need as well as to thoroughly test our technology.

The result has been an outstanding level of user acceptance of our installations of solar lighting on shared pathways in off-road, wetland and coastal boardwalks and other areas that are not connected to the power grid, and that may be classified as non-vital and sub-network.

This document is still being developed as we learn more about council needs however so far it meets the approval of all of the reviewing councils and bicycle user groups.

Due to uncertainties in the delivery of grid connected power, recent requests have shifted our focus to include the critical lighting needs of organizations seeking suitable lighting to provide back-up during power outages to ensure duty of care for both the public and employees.

In keeping with the expectations of sustainable lighting, the SolarOne products require minimum maintenance over their life of more than 10 years, and installation causes little disruption to existing infrastructure with no cabling and virtually no intrusions into carriage and pathway space.

From a community educational point of view SolarOne installations act as highly visible and practical examples of harnessing free, clean energy and will show others how solar electricity may be used for the benefit of a community.

The SolarOne lights are:

- **State of the art technology**
  - No pollution
  - Long life (10-15 years)
  - Rapid charge
  - Unlimited discharge cycles (Over 50,000 before noticeable diminished light output)
    - No chemicals
    - Electromechanical "Ultracapacitor"
      - Every discharge full power
  - Extreme temperature tolerance
  - Used for secure delineation guide - lighting, not point-of-light
    - non-vital/sub lighting, an adjunct to current vital lighting
- **Sustainable**
  - Free power as they derive energy from the sun
  - Virtually no maintenance (Sealed lighting unit easily replaced in a few minutes with special tool)
- **Safe to use**
  - Ideal for security applications
  - No protrusions (Flush-with-ground mounted)
- **Environmentally friendly**
  - No CO2 emissions
  - Low level light emission
  - Will not upset delicate eco-system
  - Completely recyclable
  - Do not require batteries
  - No toxic waste
- **Simple to install**
  - No cabling
  - No trenching
  - No need to check subterranean obstacle (Dial before Dig)
  - Quick to supply and install (new or retro fit)
  - Inexpensive to install
    - Same as laying a brick or a tile
    - No special equipment or adhesives required
      No special trade skills required
- **Secure**
  - Cannot be removed without specialist tools
  - Clear high strength polycarbonate cover
  - Aluminum alloy casing
  - 2 year manufacturer's warranty

Selection Criteria:

Bicycle path lights should be:

- Suitably visible to cyclists and pedestrian using the paths
- Safe, in that they do not obstruct or jeopardize traffic passage
- Aesthetically appealing, they are low light emitting and designed to be non-intrusively ground-flush fitting
- Non-intrusive, with respect to the local environment (must not upset local fauna)
- Low cost, being that they require no other fuel than the sun's rays
- Inexpensive to install, being self contained requiring no cabling or secondary service
- Of a minimal maintenance overhead, being "set and forget" with a 10-15 life span
- Easy to install requiring minimal concreting or paving skills
- Secure, being set in the ground with cement or resin (they must be virtually immovable by non-specialists).

S1 R/W S (Red/White Steady)

Features:

- bi-directional Light Emitting Diodes (LEDs)
- ground-flush mounted
- dual colored
- charge time is approximately 4 hours in full sun and 8 hours during overcast days or slightly shaded
- light emission is steady
- visible up to 500 plus meters

Fig. 1. a - b

3*2 rows of LED (White/Red)

How Used

The S1 R/W S is used in opposing pairs (one on either side of the path) with the red light facing the oncoming rider on the left-hand-side of the path and the opposite white light visible on the right-hand-side.

For Eco-paths the S1 W S white lights delineate paths for pedestrians without flood lighting sensitive areas and possibly upsetting circadian bio-rhythms.

S1 A S Amber Steady

Features:

- mono-directional LED
- ground-flush mounted
- single colored
- charge time is approximately 4 hours in full sun and 8 hours during overcast days or slightly shaded
- light emission is steady
- visible up to 500 plus meters

Fig. 2. a - b

3*1 row of LED (Amber)

How Used

The S1 A is used in to indicate to those riders or pedestrians that they are approaching a crossing with a road or either a pedestrian or bike path.

The S1 A S should face the oncoming traffic and placed approximately 1.5 meters apart.

S1 CE R/W

Features:

- bi-directional LED
- ground-flush mounted
- dual single colored
- charge time is approximately 4 hours in full sun and 8 hours during overcast days or slightly shaded
- light emission is steady
- visible up to 600 plus meters

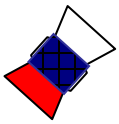

Fig 3. a -b

3*2 rows of LED (White/Red/Amber)

How Used

The S1 CE R/W (Bidirectional Red/White are used with the S1 R/W S when they are not to be mounted in the ground. For example one side of the pathway may be a hazard such as a wall, sand, fencing, etc., requiring the same lighting but having to use different fittings due to the different available fixing surface.

The YH-YF should have the Red LEDs facing the oncoming traffic and should be the same distance apart as the S1 R/W S if used in conjunction.

GF "Ground Flasher"

Features:

- multi-directional diffuser
- ground-flush mounted
- single colored
- charge time is approximately 4 hours in full sun and 8 hours during overcast days or slightly shaded
- light emission is steady
- visible up to 100 meters

Fig 4. a –b

1 * Diffuse LED (White/Red/Amber/Blue/Green)

How Used

The Ground Flashers are multidirectional lights with low level output designed to be used at fairly close proximity (1-5 meters) and in clusters of strips or groups. They are visible up to 100 meters.

One usage is to divide shared pathways by placing them in a strip along the centre of the pathway (see Fig. 18.) and, as such, clearly defining the path's centre so that pedestrians can be guided to the left allowing bikes to pass with less risk to either party. They may also be used to emphasize painted signage that is invisible at night.

S1 H **- Hazard Lighting**

Features:

- bi-directional LEDs
- ground-flush mounted
- single light colored
- charge time is approximately 4 hours in full sun and 8 hours during overcast days or slightly shaded
- light emission is steady
- visible up to 600 plus meters

Fig 5. a -b

3 * LED. Bollard, etc. mountable (Red/Amber/Green/White/Blue)

How Used

S1 H are mono-directional LED lights used to indicate a hazard or risk. They may be a steady light or flash as required and are visible from over 600 meters.

After lengthy discussion with SolarOne, Council and VicRoads it was decided that trials should follow convention and mimic the motor roadway signage as often as possible. Thus, as with motor vehicle carriageways, the red lights are on the left hand side, possibly indicating the tail lights of the vehicles in front, with the opposite side white lights being oncoming headlights.

To the path should resemble a low level lit airport “landing strip”. (See Fig. 7.)

To indicate caution it should be noted the amber lights are the most commonly used traffic light colors and thus they are used to indicate area where caution should be observed such as crossings, etc. (See Fig. 15.)

Where pedestrians and bicycles must share a common path, as there is no conventionally accepted standard, we have opted to use the small white pin head lights (GF) that are visible from all directions and thus clearly define the paths centre such that pedestrians can be guided to the left allowing bikes to pass with less risk. The effect will be a strip of ground lights clearly delineating the pathways left and right hand sides. (See Fig. 18.)

Where there is a requirement for moderate caution we use the Amber flashing lights a standard commensurate with road signage and industrial signage. Similarly should an extreme caution situation be present we use bidirectional red LEDS.

In the current projects we use the delineating red/white, amber steady, amber flashing and the center lane pin heads.

Standards Australia

As it appears from our extensive research that the SolarOne lighting design seems to be acceptable to cyclists and pedestrians, SolarOne is now preparing the application for the specifications to be presented to Standards Australia as a suitable standard for sustainable lighting of pathways. Currently no such variation to the standard exists under AS1158 for P Category applications for similar technology and lighting layout and design.

These Bicycle Path Lighting Standards show clearly the best combinations of lights for the various conditions met on bicycle and pedestrian paths, at low light levels or night times.

Bicycle paths comprise a number of common topographical and design characteristics with locale specific variations. In this document we have restricted the selection to accommodate most of the user needs conditions, these are outlined below.

A. Straights

Lights are placed at intervals of approximately 40 meters where there is clear visibility on flat straight pathways.

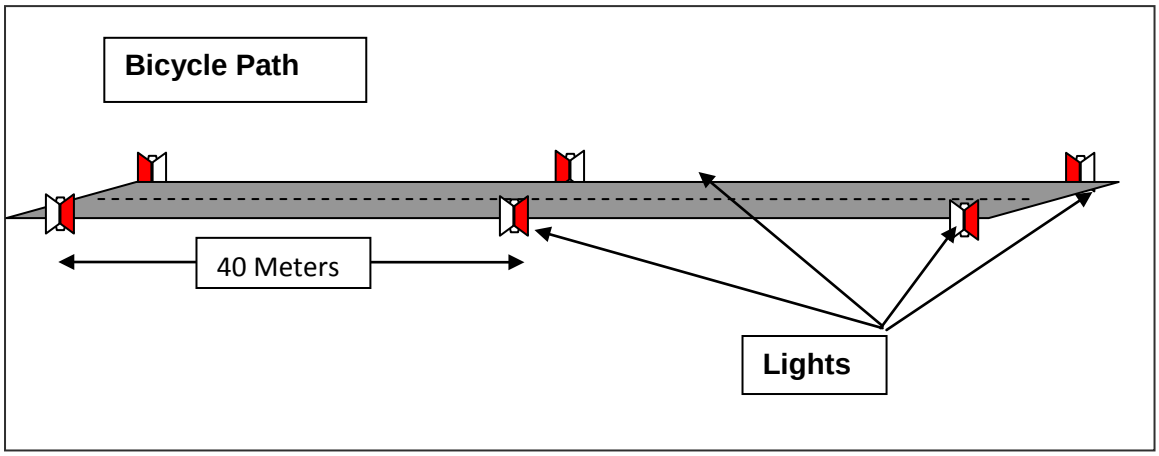

Fig. 6.

Rider's View of Straight

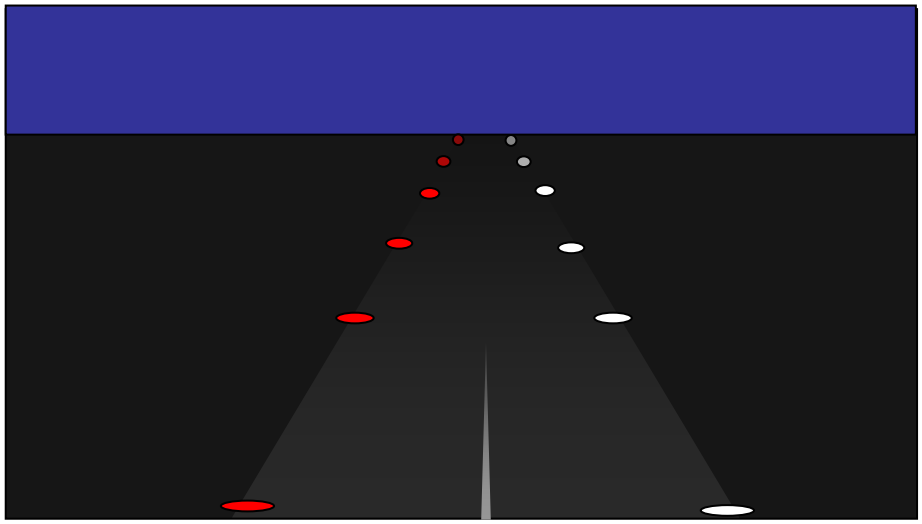

Fig. 7.

"Landing Strip" View - Straight lighting clearly visible for well over 200 meters

B. Gradual Curves (Greater than 135 degrees)

As the straight approaches a gradual curve the distance between the lights is reduced in decrements of 20 and then 10 meters units and, once the curve has been traversed, the distance increments by 10 meters and then 20 meters to the standard distance for the straights, being 40 meters. Should the path twist in the opposite direction its path is followed with lights at the 10 meter separation distance or closer if appropriate.

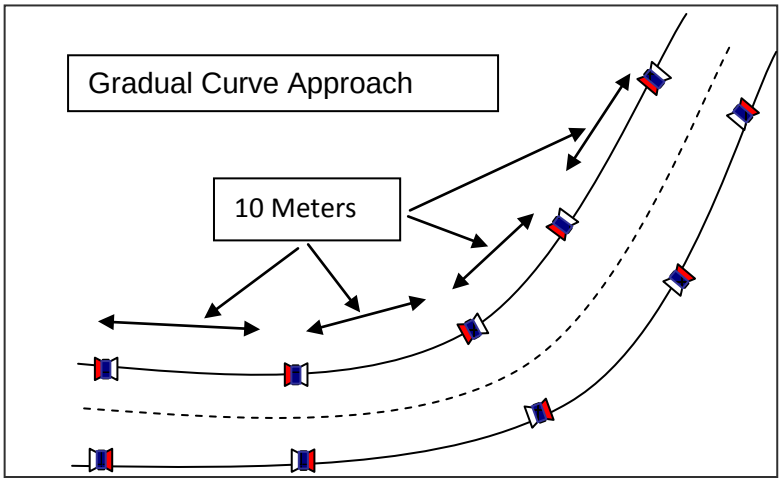

Fig. 8.

Rider's View of Curve

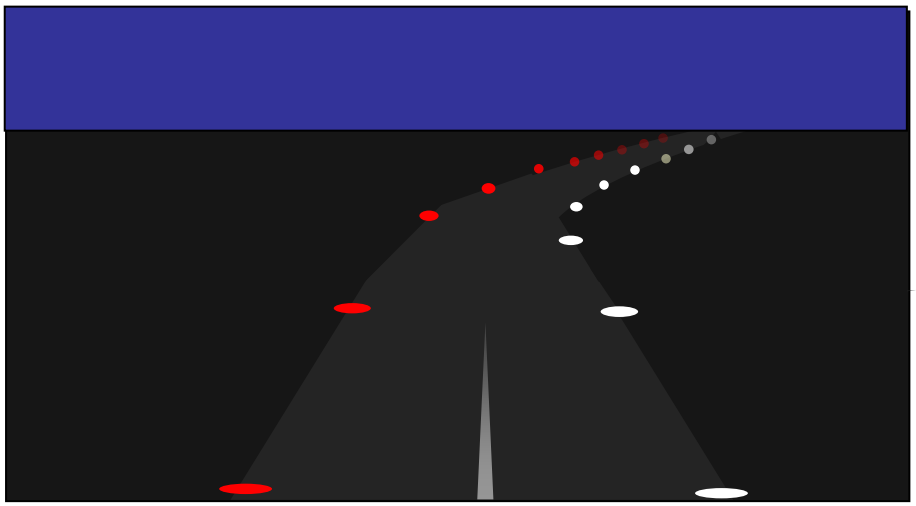

Fig. 9.

Delineated pathway outlined with lights - clearly visible for well over 200 meters

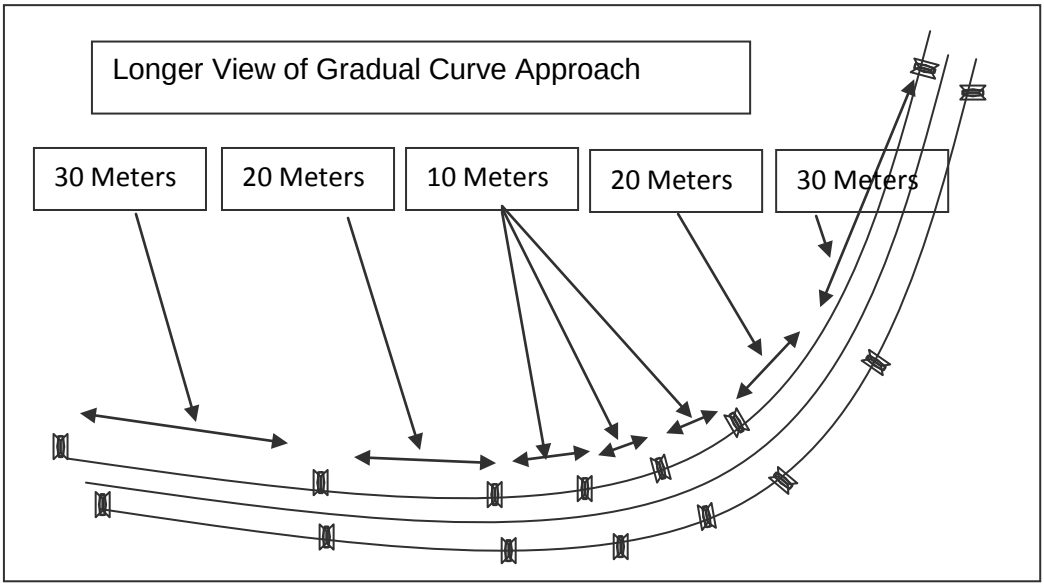

Fig. 10.

C. Sharp Curves (Less than 135 degrees).

The approach to sharp curves is much the same as for gradual curves, however as the curves tightens, the distance between the lights may be reduced to 5 meters or less.

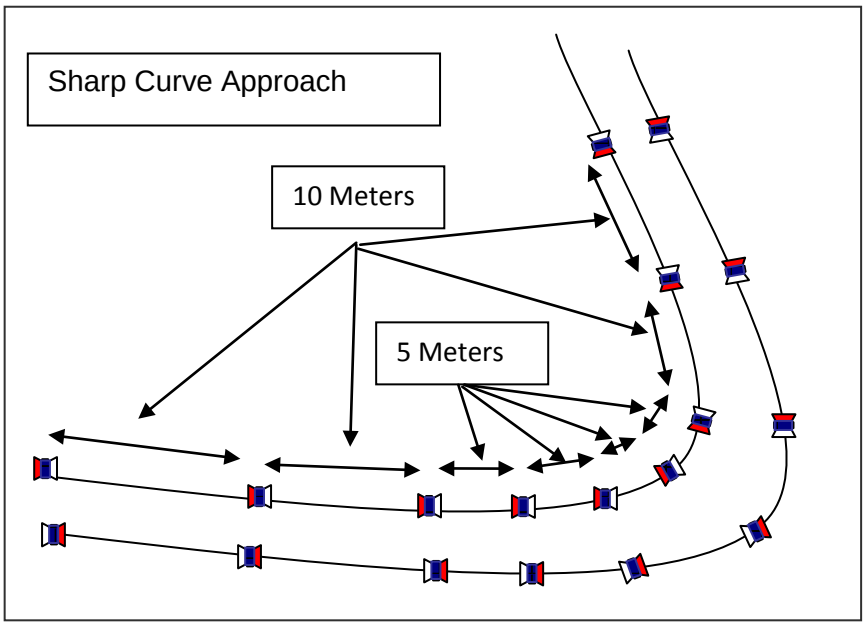

Fig. 11.

D. Hills and Dips

Paths approaching hills or dip that render the path ahead “out of view” have lights placed at the peak and dip of the topographical variance.

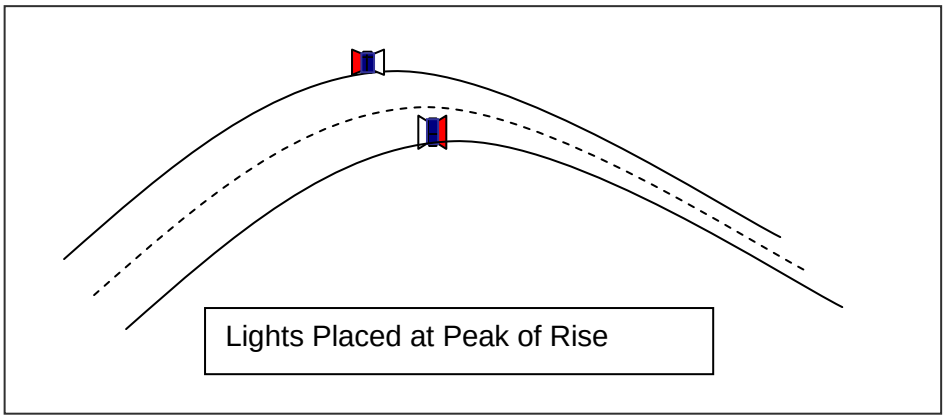

Fig. 12.

E. Approach to Butted Road

To identify the proximity of a road terminating at or near the path and feeding pedestrians onto or across the bicycle pathway, S1 A S Amber lights are used facing the roadway adjoining pathways entry points. The lights should be spaced 1.5 meters apart and numbers used selected to cover the width of the entry path placed centrally as well as at either side.

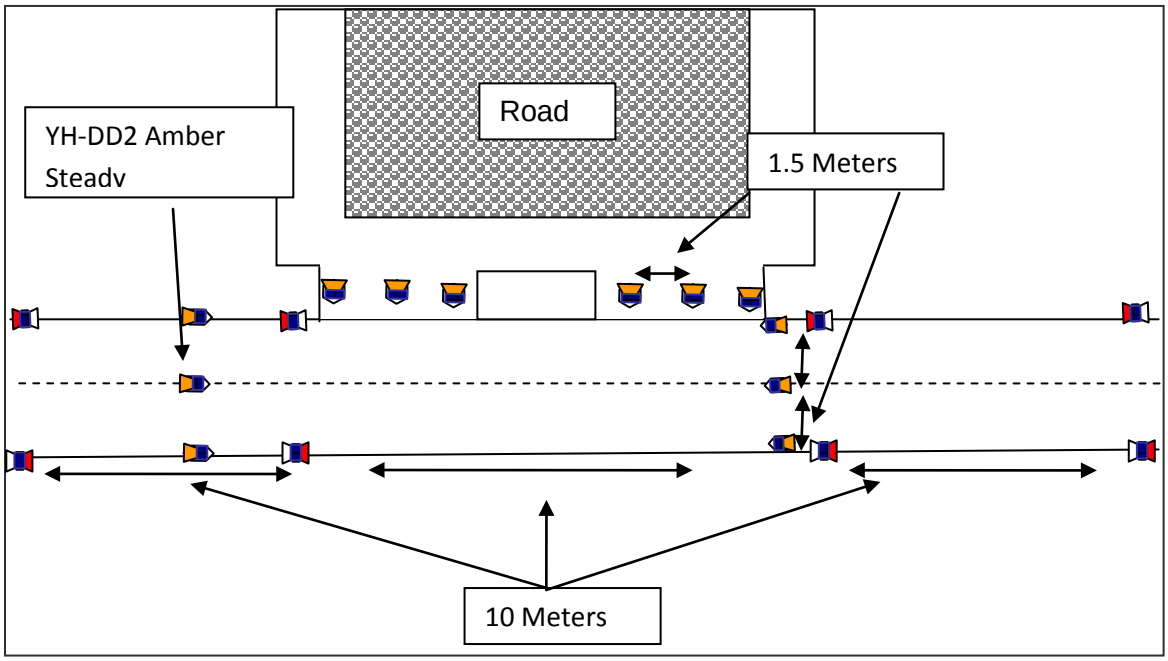

Fig. 13.

F. Approach to Cross Roads

To identify the proximity of a road crossing a bicycle pathway, S1 A S steady Amber lights are used facing the pathway entry points. The lights should be spaced 1.5 meters apart and numbers used selected to cover the width of the entry path placed centrally as well as at either side. Generally sets of three lights.

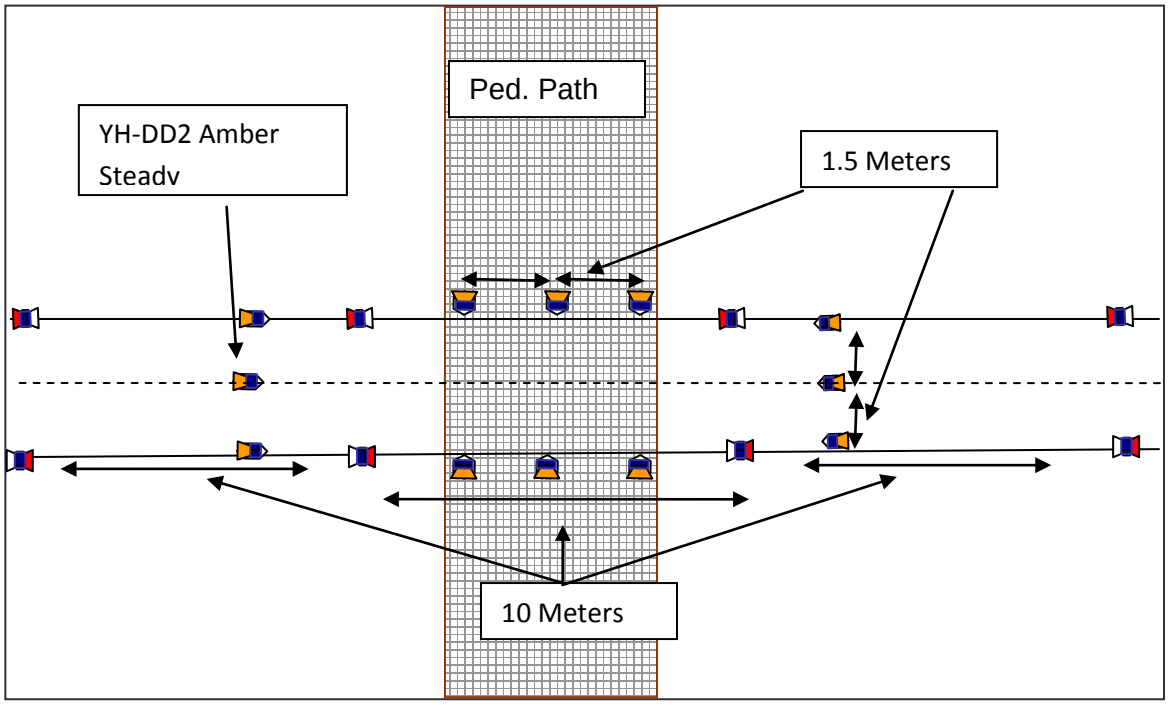

Fig. 14.

Rider's View of Path Crossing

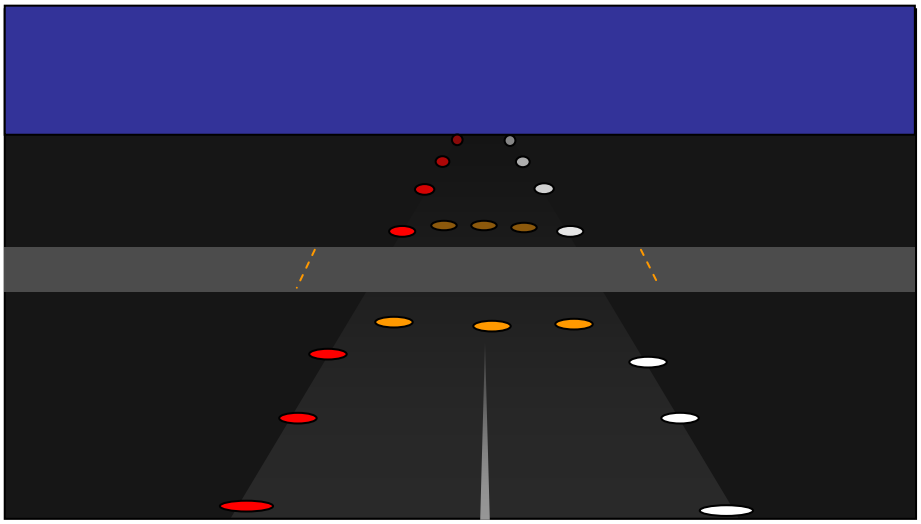

Fig. 15.

Pathway Crossing - clearly visible for over 500 meters

G. Approach to Butted Pathway

To identify the proximity of a pedestrian pathway abutting, crossing or converging with the bike paths, S1 A S Amber lights are used facing the pedestrian pathway at intersecting pathways entry points and also facing the bicyclists. The lights should be spaced 1.5 meters apart and numbers used selected to cover the width of the entry and evenly spaced.

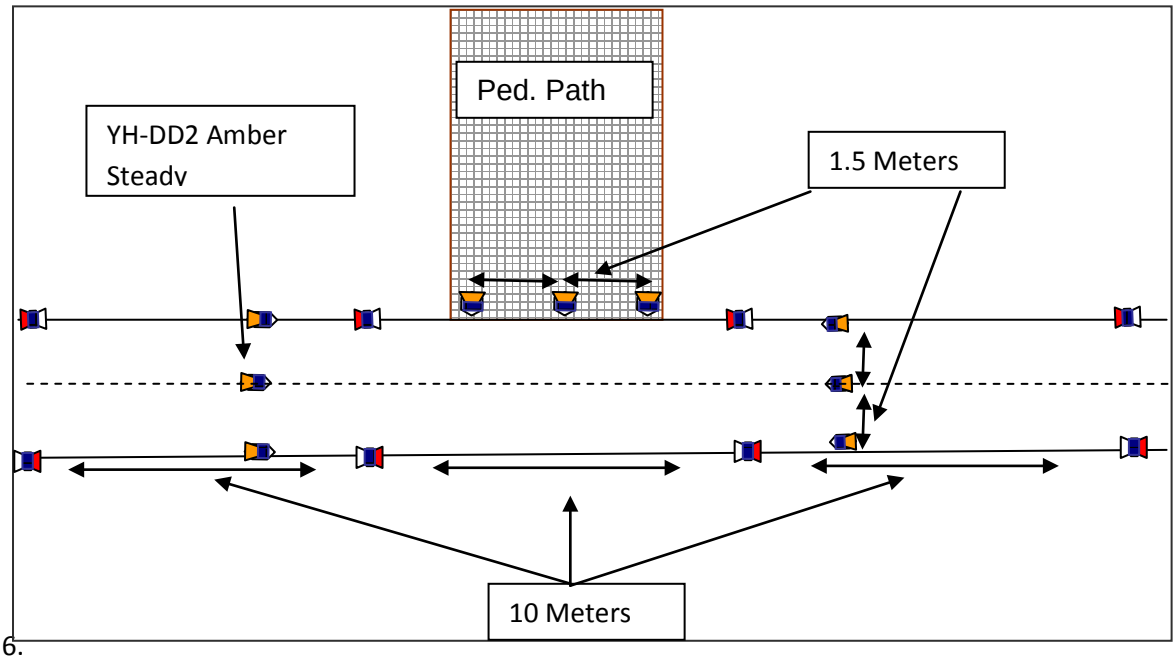

Fig. 16.

H. Shared Pathways and/or Twisting Paths

To clearly indicate that pathways are shared by both pedestrians and cyclists the small Ground Flashers (GF) may be used. They are spaced at intervals of approximately 1.5 meters or less and may be grouped to form motifs such as arrows or pointers to indicate divergence, etc., much the same as day-lit white lines are used.

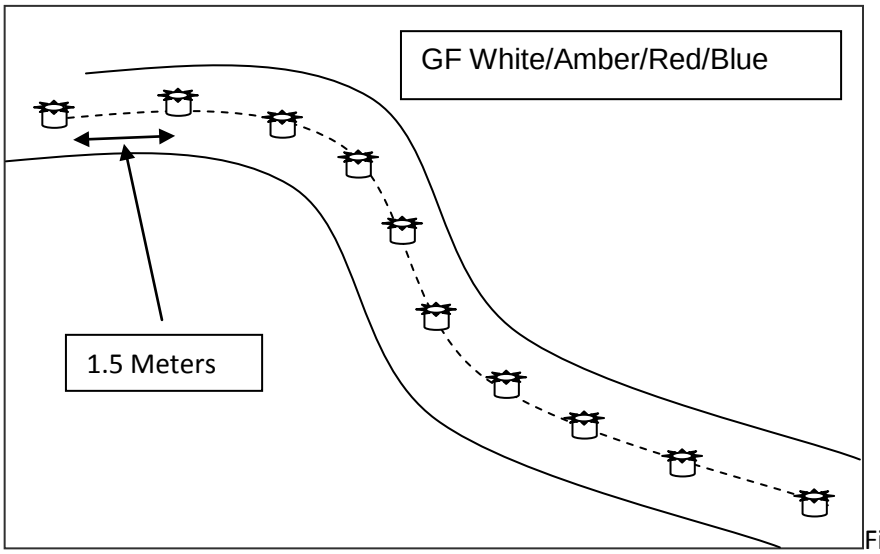

Fig. 17.

Rider's View of Approaching Curve/Corner

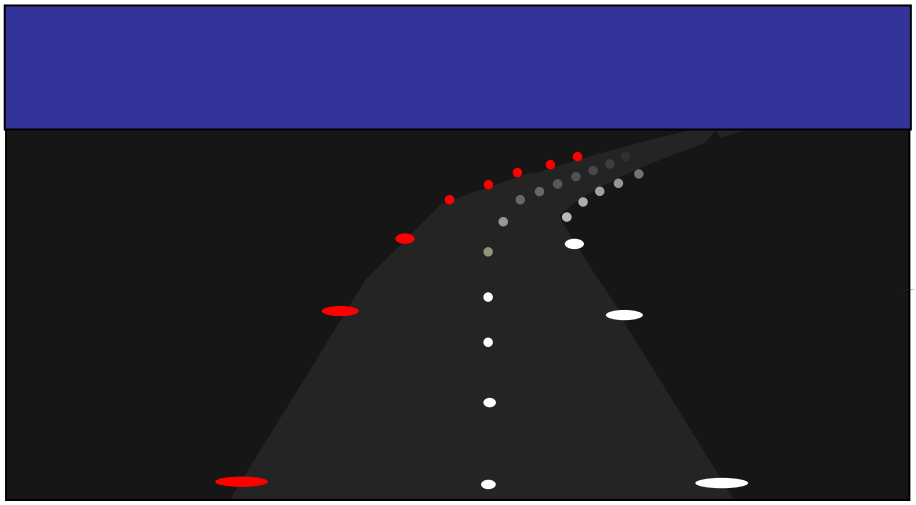

Fig. 18.

I. Hazards (Temporary and Permanent)

Some hazards are permanent while others may be temporary. Either way, the S1 R/A or the S1 H A lights may be used to indicate the presence of hazards and may be fixed by being bolted to the offending hazard or mounted, in the case of a wall or extended protrusion. The S1 H A are mono-directional and the S1 R S are bidirectional and in most cases either one will suit.

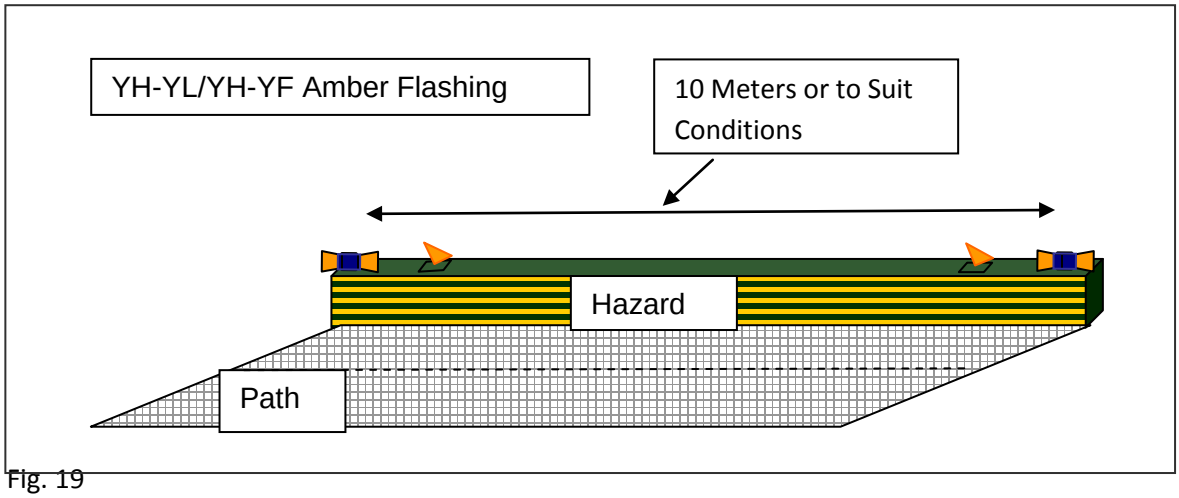

Fig. 19

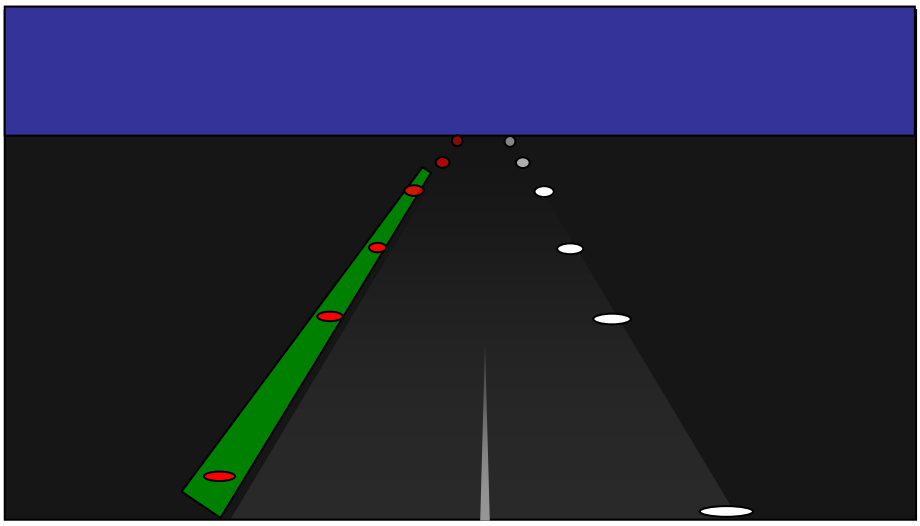

Fig. 20. Pathway with LHS Hazard - Lit with same lighting sequence however on raised hazard

Solarone

Lights Selections

Condition	Lights Selected	Colour(S)	Functionality (Type of Light Output)	Spacing (meters)
Straight	***S1 R/W S***	Red/White	Steady	10-20-30-40
Approach to:				
Corner Gradual		Red/White	Steady	20-10-X-10-20
Corner Sharp		Red/White	Steady	20-10-5
Road				
Cross	***S1 R/W SA***	Amber	Steady	1.5
Butted		Amber	Steady	1.5
Path				
Cross		Amber	Steady	1.5
Butted		Amber	Steady	1.5
Space		Amber		
Shared Pathway	***GF***	White/Red/Blue(?)	Steady/**Slow Flash**	1.5
Rises/Hills	***S1 R/W S***	Amber (Red/White)	Steady	As Required
Hazards				
Caution		Amber	**Flashing**	As Required
Extreme Caution		Red	Steady	
Dangerous		**Red**	**Flashing**	
Eco Paths	***S1 R/W S***	White/White	Steady	As Required
	S1 R/W S	Amber	Steady	As Required

Table 1.

Installation Assumptions

In completing this draft outline it has been assumed that;

1. Initially delineating lights (S1 R/W S R/W) will be spaced according to the paths characteristics with the straights every at a minimum of every 10 meters and turns and bends lit at reducing intervals to indicate the sharpness of the directional change. (See Fig 6 and Fig 18.)
2. Where bicycle paths either intersect with other roads tracks or paths, the S1 R/W S Amber will be placed in threes across both sides of the intersection of the approach bicycle path. (See Fig 14.)
3. YH-YF shall be used where there are hazards. (See Fig 19.)
4. Where there are shared pathways S1 R/W S shall be used to delineate and other intersectional lights, as may be appropriate, with the centre of the paths being defined using the GF White. (See Fig.18.)
5. Council may install the lights under the supervision of SolarOne.[1]
6. Each light will be identified and its location recorded using a suitable reference system, possibly GPS, for warranty and other commercial purposes.
7. Bollard lighting will be explored possibly using blinking blue.

[1] SolarOne can install the lights using an independent contractor.