

# SOLUTIONS TO INCREASE THE SAFETY OF VULNERABLE ROAD USERS



# FLIR and SWARCO have joined forces to offer solutions to increase the safety of intersections – in particular the safety of vulnerable road users (VRU).

Based on FLIR's pedestrian and bicycle detection applications and SWARCO's traffic light controllers, integrated solutions have been created to improve the safety and efficiency at signalized and

unsignalized intersections and crossings. Detection of vulnerable road users allows for the dynamic control of traffic signals and warning lights.

THE FOLLOWING JOINT SOLUTIONS DEVELOPED BY FLIR AND SWARCO ARE DESCRIBED BY HIGHLIGHTING THE RESPECTIVE:

- Use case or problem
- Components of the solution
- Benefits for the road users

## Touch-free pedestrian and bicyclist crossings

Push-buttons are touched by hundreds of hands a day, making them a hot-bed for germs and viruses. In order to decrease the spread of viruses, the use of push-buttons and other detection buttons needs to be reconsidered, and where possible, replaced by a safe and efficient touch-free system.

The FLIR TrafiOne uses a thermal imaging sensor to detect pedestrians and cyclists based on their temperature signatures. These sensors don't need street lighting to work and as a result, they provide uninterrupted, 24-hour detection of pedestrians and bicyclists.

Protecting vulnerable road users is important!

50% of all accidents occur in an urban environment.

33% of all accidental fatalities involve pedestrians or cyclists.





## Triggering flashing beacons

The vehicle speed at a collision will depend on the reaction time of a driver and the ability to brake. Many factors influence this reaction time; distraction, bad weather conditions, bad visibility, intoxication etc.

Bad visibility can also be due to the fact that an object – car, truck or parked bus – is blocking the view for the driver or pedestrian. When a driver actually (gets to) sees the pedestrian, it is probably already too late.

Warning lights can help drivers and motorists recognize crossing pedestrians and help reduce speed in time. However, the traditional, continuously flashing warning signals have a small impact because motorists do not receive any real stimulus to change driving behaviour. Research has shown that warning lights that are dimmed and start flashing when activated by a pedestrian or cyclist are far more effective (in thus drawing the attention to the crossing, enhancing the awareness of the vehicle driver which results in faster reaction times and reduced speeds).

Pedestrian detection can activate warning lights such as flashing beacons or in-road LED studs dynamically and improve the safety at pedestrian and bicycle crossings in all weather conditions.

The FLIR TrafIQ and FLIR ThermiCam2 can be used to detect the presence of pedestrians in a pre-defined area of detection on the crossing or on the curb side and will keep the detection output activated as long as one or more pedestrians are crossing or approaching. Warning signals are activated upon detecting pedestrians and are flashing to draw the attention of motorists to the crossing area.

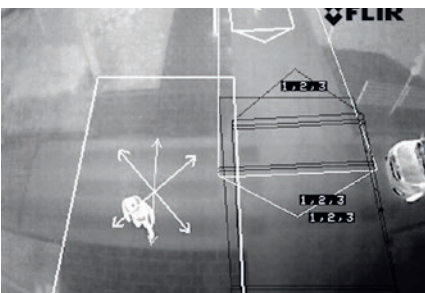


## Dynamic clearance time

At signalized intersections, the green man signal allows pedestrians to start crossing the road safely. When it switches to red, a clearance time is given for pedestrians to get to the other side of the road. During the clearance time, all traffic signals are in red phase to keep vehicles waiting, preventing possible collisions. Elderly and less mobile people may require more time to cross than the standard clearance time programmed in the traffic signal controller. On the other hand, the standard clearance time can also introduce unnecessary delays when there are no pedestrians on the crossing anymore.

Pedestrian detection and dynamic control of the clearance time allow a safer environment to cross while optimizing the vehicle traffic flow.

FLIR TrafiOne or FLIR ThermiCam2 can be used to detect the presence of pedestrians in a predefined area of detection on the crossing and will keep the detection output activated as long as one or more pedestrians are crossing. The SWARCO ACTROS traffic signal controller can adjust the clearance time according to the presence of pedestrians.



## Push button enhancement

Pedestrian crossings in urban environments are used by both pedestrians and cyclists. Push buttons are not only inefficient but are also difficult to reach for cyclists. With pedestrian detection provided by the FLIR ThermiCam2 and FLIR TrafiOne, push button signals can

be enhanced. Cyclists are detected quickly and the SWARCO ACTROS traffic signal controller can react early and switch to green as quickly as possible. It also reacts to the arrival of pedestrians and can appropriately identify larger groups.



## Dynamic count down timers

A countdown timer is often used to indicate the amount of time left for pedestrians to cross the road. This is also referred to as the *invitation to cross period*. Although it is possible to detect if pedestrians are still crossing in order to dynamically change the clearance time, it is not possible to drop the countdown timers to zero when they are counting down and no pedestrians are on the crossing. Instead, by measuring how crowded the curb side is, the countdown timers can start at an optimal value. Pedestrian occupancy detection allows

for the traffic controller to set the count-down time dynamically.

The FLIR TrafiOne can be used to detect the volume of pedestrians in a predefined area at the curb side and will communicate the occupancy percentage to the SWARCO ACTROS traffic signal controller.

At low occupancy values, the countdown signals can start at a low value e.g. 9 seconds whereas at high occupancy values the countdown can start at 13 seconds or more.

## Pedestrian priority

Intersections near schools, business centres, shopping malls, sport stadiums etc. are not able to cope with changing pedestrian traffic flows as fixed signal schemes do not match the actual situation at different times of the day. Imagine a crosswalk near a sports stadium before an important football game compared to that same crosswalk on a regular day. Clearly, those are completely different traffic situations. It is beneficial to the safety to give priority to groups of people that want to cross without creating a conflict with the fixed schemes that might be better for the vehicle traffic flow when there is a single pedestrian.

By using pedestrian detection to manage the priority calls dynamically, both safety and efficiency can be greatly enhanced at these pedestrian crossings.

The FLIR TrafiOne can be used to detect the volume of pedestrians in a predefined

area at the curbside and will communicate the occupancy percentage to the SWARCO ACTROS traffic signal controller. At low occupancy values, the vehicle flow should not be interrupted immediately as it is less urgent to trigger the green phase for pedestrians. At high occupancy values, a priority call for green can be given to the traffic signal controller to let the pedestrians safety cross.



## Data Privacy

In the age of data protection and privacy, it is imperative that any sensor system set up within a city doesn't infringe on a person's privacy. FLIR thermal imaging

sensors are a perfect solution for this as it uses thermal detection, making a person's identity indiscernible.

# Pedestrian volume data collection

City planners responsible for installing new pedestrian or bike facilities like crosswalks, sidewalks or bike routes rely on real data to build their case. Data on the occupancy of pedestrians or other vulnerable road users for a given traffic environment is essential in making

decisions as to whether it makes sense to make the investment or not.

By logging the data generated by the FLIR TrafiOne in real time, a clear view on the pedestrian traffic can be given.



# Call cancellation

At signalized intersections, push buttons cause significant delays in vehicle traffic and interrupt the vehicle flow, as 70% of pedestrians that use the pushbutton start to cross before they get green, resulting in 3 x more CO<sub>2</sub> emission due to vehicles stopping unnecessarily.

With pedestrian detection, the green man signal requested by pushing the button can be cancelled when the pedestrian decides not to wait and can thus improve the vehicle traffic flow by 30% while at the same time still provides a safe way for pedestrians that wait for the green phase to cross.

The FLIR TrafiOne is used to detect the presence of pedestrians in a predefined area of detection at the curb side and keeps the detection output activated as long as a pedestrian is within the zone.

The SWARCO ACTROS traffic signal controller is then programmed to monitor the FLIR TrafiOne output and the push button.

PEDESTRIAN  
DETECTION  
CAN ACTIVATE  
WARNING  
LIGHTS AND  
IMPROVE  
SAFETY.



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FLIR Systems designs, develops, manufactures, markets, and distributes technologies that enhance perception and awareness. We bring innovative sensing solutions into daily life through our thermal imaging, visible-light imaging, video analytics, measurement and diagnostic, and advanced threat detection systems.

FLIR revolutionizes how traffic flows on roadways throughout the world by providing unique, field-proven solutions that help keep vehicles, pedestrians, and bicycles moving safely and efficiently. Find out more at

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FLIR Systems  
Hospitaalweg 1B  
B-8510 Marke, Belgium  
T. +32 56 37 22 00  
F. +32 56 37 21 96

