

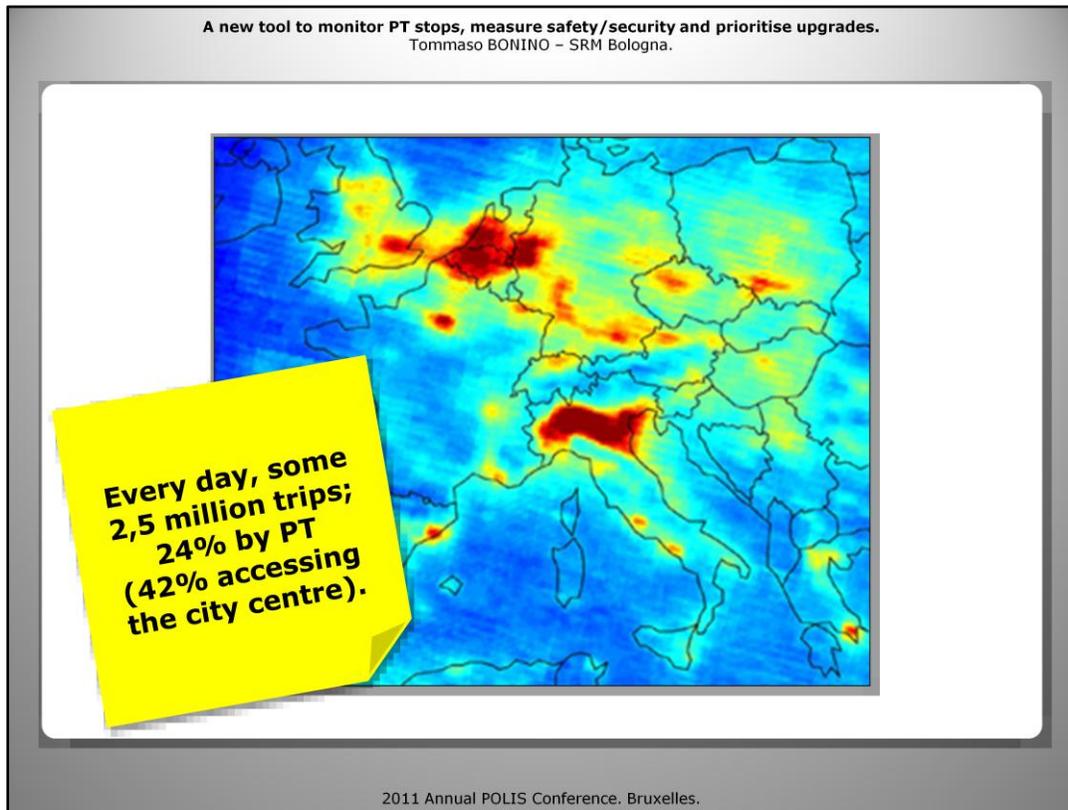
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**"A new tool to monitor PT stops, measure
safety/security and prioritise upgrades"**

Tommaso BONINO – SRM Bologna

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The Bologna province is home to almost one million inhabitants, with 375.000 living in the main town.

In this picture, the NO2 density allows you to understand where Bologna is: in the middle of the red area, between Milan and Venice, north of Florence.

Every day, some 2,5 million trips are made within the province; 24% by public transport (42% among those accessing the city centre). Over 60% of the provincial population, including those who use and could use transport, feel that they can travel by bus according to their needs.

SRM is the Bologna's Public Transport (PT) Authority, managing a 37,4 Mkm/year PT service, operated by about 1.000 buses, carrying 112 million passengers/year. The average satisfaction rate is a little over 7/10.

SRM, enacting local bodies' commitments, is responsible for organising, funding, planning and promoting public transport. SRM also owns infrastructures essential to public transport management (garages, depots, the trolleybus power line, shelters, ...).

From 2008, SRM ensures the safety of the whole bus stops network, which consists of almost 6.600 stops.

This presentation deals with an interesting work we developed during year 2010.



Safety on the road network is often exclusively related to private traffic, or to active movers.

Public transport (PT) users make virtuous mobility choices, but many times do bear risks while reaching bus stops and/or waiting for the bus.

Investments for individual car users are seen as necessary, even if they are very expensive.

On the other hand, investments on existing PT bus networks seem to be overwhelming: their small per user impact on costs and their usefulness are often not clear enough.

SRM decided to make a review of PT stops safety.

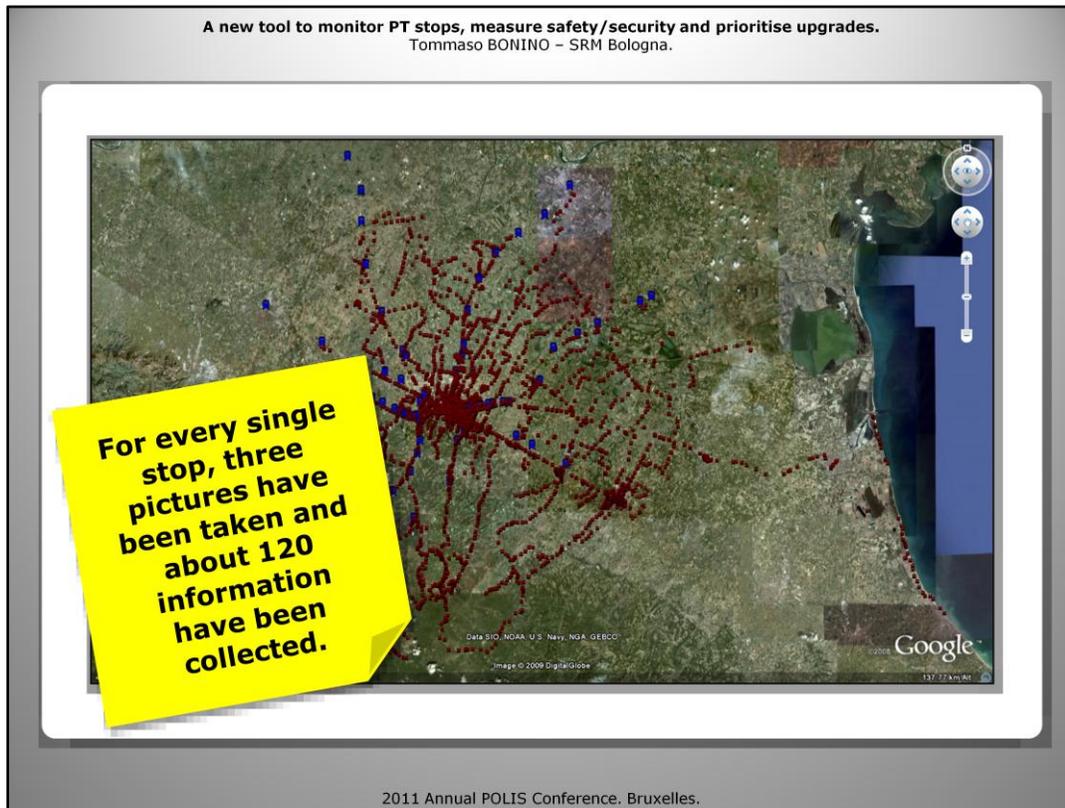
A lot of stops exist since more than 30 years: during decades PT network, number of users and road characteristics have changed a lot and some stops are now less safe than years ago, when firstly empowered.

And, over years, monitoring and controls over PT stops were performed only against users claims.

As a matter of fact, during the years, the bigger part of the available economic resources has been used to renew the bus fleet. This led to good results, but infrastructures haven't had similar growth and updating.

Another element which influenced the (not) evolution of bus stops deals with frequent changes within the subject in charge of their safety: until the '90s bus stops' safety was in charge of local offices of the Transportation Ministry, then it was delegated to Regions, in 1998 Regions delegated the issue to Provinces and Municipalities, (eight different local bodies in the Bologna basin). Finally, in 2008, SRM has been delegated by local bodies the responsibility on bus stops' safety.

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SRM felt the need to have a specific tool – absolutely a brand new commitment – in order to define a list of priority in managing the stops maintenance, also on the basis of what declared by the regulation about service quality (ISOs 13816 and 15140): it's recommended to use the ratio of customers - as much as possible - to express the results of evaluations, thus allowing priorities to stress on actions leading to quality improvement.

During 2010 SRM provided to carry out a survey of all PT stops.

The goals of the review SRM launched and implemented are:

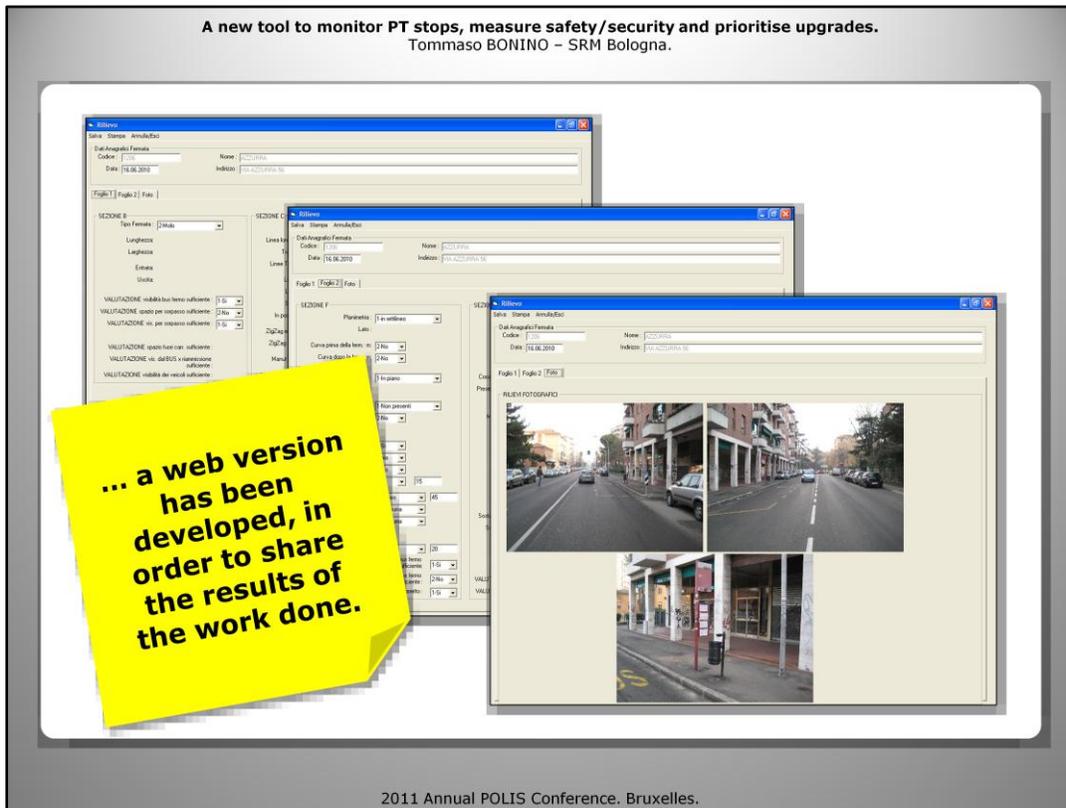
- to give herself priorities in intervention,
- to give satisfaction to users regarding the overall service quality,
- hopefully, to increase the PT modal share, too.

For every single stop, three pictures have been taken and about 120 information have been collected (concerning geometric features as users' waiting area conditions, user's accessibility, road characteristics, GPS location, ...). A data-base has been filled with all data.

In the meanwhile, SRM built an algorithm defining the Safety Level of each bus stop, borrowing the approach from the concept of 'risk' as the combination of 'probability' and 'damage'.

On the basis of all collected data and of external factors (as: number of users per day at the bus stop, vehicular traffic, traffic speed, number of buses per day, and of the statistic data of car accidents occurred next to stops in the last eight years) the algorithm can now assign a mark from 1 (worst) to 10 (best) to each bus stop.

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By the application of the algorithm to all the bus stops, SRM gets the Safety Level for each of them.

It is important to highlight one more thing: the choice to base the definition of safety on the concept of risk – and not only on geometric features – could lead to some bus stops apparently not matching what is required by the Italian law (the Road Code), but having, given the conditions of the environment, a Safety Level high enough to be considered safe, better: to be considered not requiring priority actions.

From the operational point of view, this algorithm was developed under Visual Basic and on Microsoft Access data-base.

Also a web version has been developed.

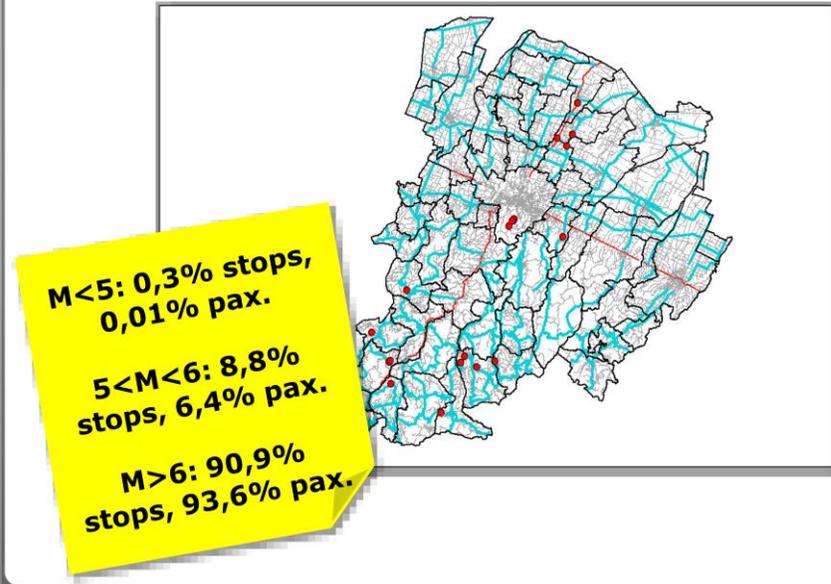
All these features are now included in a specific website, which is definitely available in everyday PT stops management (the average is two-three interventions/week in moving, upgrading, verifying PT stops in the whole provincial basin).

The Authority is committed in sharing information among decision-makers, public administrations and operators: a dedicated web page, easy and accessible, is available and continuously updated for stakeholders.

SRM collected also data not dealing with safety itself.

It's a thin line – of course – but information on lightning, presence of shelter, presence of urban functions, quality of materials, ... have also been collected. Responsibility for security close to PT stops is not SRM's, it is on local bodies. But this kind of work – we already said it is available – can help in

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Since the work has been finished, SRM analyzed the state of the art, in order to understand which was the global situation of bus stops' safety in the area of Bologna.

First of all, we calculated the number of bus stops with an insufficient Safety Level (represented by a mark lower than 6). The result was of 24 bus stops - SRM together with local bodies already got them right. We'll see some examples.

It is possible to summarize the global result with a few numbers.

We got 24 bus stops ranking under mark 5, representing 0,3% against the global number of stops and 0,01% in the global number of passengers traveling on the network.

We got 8,8% bus stops ranking under mark 6, but over mark 5, representing 6,4 % in the global number of passengers traveling on the network.

We got 90,9% bus stops ranking over mark 6, representing 93,6% in the global number of passengers traveling on the network.

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Finally, SRM produced a sort of catalogue of possible and standardized works in order to make a stop safer or to build a new safe and compliant stop. This catalogue can also be used by the algorithm to suggest the works, so to raise the mark to a chosen/given value.

The relationship created among geometric deficiencies, possible harmful events and the relative weight of each of them, offers a way to fix regulatory gaps in works to be done. SRM looks at the bus stop as modular object, to which various geometric elements can be related.

Geometric deficiencies are solved through a cyclical process, "pasting" to the bus stop the missing geometrical elements, one after the other (for example the creation of a waiting area, the improvement of accessibility, the improvement of road signs, ...), until a sufficient Safety Level.

The order in which geometrical elements are "pasted" depends on their influence on road accidents, as the process begins pasting those elements that are statistically the cause of more frequent and harmful accidents.

Then the Catalogue – the software itself, in which the Catalogue is integrated – gives as a return a list of measures to make a bus stop safer, even estimating costs in order to give also an economic indication.

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Now, I would like to introduce some examples of the work SRM already launched as a result of the recognition implemented.

This kind of work will be kept updated and will represent the strong headway in dealing with PT stops' safety.

In this case, an urban high-traffic street was provided with a bus stop, where service has high frequencies (192 passages per day) and high number of passengers (630/day).

There were, as you can see, problems for the bus in approaching the sidewalk and troubles for passengers to get on and off the bus because of irregularly parked cars. The solution has been implemented by extending the sidewalk, positively affecting the bus service and also parking.

The mark representing the Safety Level has grown from 5,5 to 7,0.

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**Mark from
5,5 to 7,0.**



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In this case, an urban high-traffic street was provided with a bus stop, where service has medium frequencies (77 passages per day) and medium number of passengers (95/day).

There was an unsafe waiting area for passengers because of the parking behind it. The solution has been implemented by moving the bus stop in the car lane and creating a sidewalk so that the waiting area and the park are now clearly separated.

The mark representing the Safety Level has grown from 5,5 to 7,0.

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In this (last) case, a suburban medium-traffic low-speed street was provided with a bus stop, where service has low frequencies (20 passages per day) and low number of passengers (5/day).

There was, as you can see, no waiting area for passengers and no accessibility to the stop.

The solution has been implemented by creating a comfortable waiting sidewalk.

The mark representing the Safety Level has grown from 5,5 to 6,5.



thanks for your attention,

tommaso.bonino@srbologna.it

