5. Discussion

Existing situation

The selected case study streets have very different characteristics among them and for that reason it is difficult to establish a pattern representing all streets.

The unchanged streets have different kinds of problems and could be considered problematic in relation to several aspects, as shown by the out-of-balance of some indicators. It is therefore concluded that these streets have many problems that give an impression of lack of sustainability.

The main building use in these streets is the residential use and a very poor presence of other kinds of uses such as retail, business, etc. was observed. This results on a small number of people in the streets, evident in almost every unchanged street on study. It was identified that the pedestrians on the street are located nearby to some specific points, such as buildings with commercial areas, public services and at some public transport stops. In the street Rua do Monte dos Burgos, a lack of space for pedestrians is evident, consisting of very narrow footways in one of the sections. On the other hand, at Av. Fernão Magalhães the footways are considerably wide but poorly paved, hence providing unsatisfactory conditions for pedestrians walk.

A dominant feature along these streets is the large number of inactive frontages.

Greenery is present in almost every street with a large variety both on its percentage and significance. Usually it only appears in some streets on the public space, as is the case of the street Av Fernando Magalhães and the two reconstructed streets Rua do Campo Alegre and Rua da Restauração. The presence of greenery is generally considered as good indicator of sustainability in a street, however by night it may represent a problem because often it is incompatible with the street lighting.
The number of pedestrian crossings is relatively low in two of the unchanged streets, namely Rua do Monte dos Burgos and Av. Fernão Magalhães and these are usually non-signalised marked pedestrian crossings. Signalised pedestrians crossings only occur at signalised junctions.

More than fifty per cent of the public space of the street is allocated for the carriageway, so the current allocation of the public space of the street favours motorised users rather than residents and pedestrians.

Even for the streets where there is enough space for pedestrians and residents, that does not necessarily mean that they will use it, since these streets usually have higher volumes of traffic and consequently higher air pollutant concentrations and noise. Thus in these cases, it is for environmental reasons that the pedestrian usage is limited.

The two cases of reconstructed streets have been implicitly designed under a sustainable perspective.

For the case of the Rua da Restauração, the space segregation introduced has increased the area allocated for different functions other than traffic. The presence of green was enhanced and improved. However, this factor did not have much influence in the sustainability of this street, since the previously existing greenery prevailed dominant.

The shift of the tram line to a separate lane (channel) has reduced its influence in the delays of the other vehicles circulating simultaneously, with evident benefits in terms of air pollution reduction and energy consumption. This is particularly relevant considering the very high gradient of this street.

The changes in the urban architecture of the street have clearly increased its aesthetics and the users’ impression towards the street, hence improving its sustainability.

The low number of accidents before and especially after reconstruction indicates that this street is on its way to sustainability.

Concerning the other reconstructed case study street, Rua do Campo Alegre, the most important change was the implementation of a bus lane with several sustainable measures associated such as new bus stops, improvements in the footways as well as an increase in the street greenery.
In both of these two reconstruction cases, a decrease in the number of parking bays was observed, which is a new problem for car users that must be solved with car parks.

All case study streets in Porto are well integrated in the public transport network, with the exception being the Rua da Restauração, which has a limited number of bus and tram routes. At the moment, trams are mostly used by tourists.

### Short and long term effects

The small amount of information related to long-term effects has narrowed the range of conclusions on this issue. Regarding the plans it was possible to observe several changes in land use such as the construction of new buildings and also verify that some of them already existed thirty years ago. Another important conclusion derived from that observation is the great influence imposed by the construction of the collector road VCI (Via de Cintura Interna) on the other streets especially on the case study streets currently at analysis.

In relation to long-term effects, it should also be mentioned that over thirty years ago, trams used to circulate in almost all case study streets; during this thirty year period, this mode of transport was abandoned and replaced by trolley cars and then by buses. Nowadays, the vision towards an increase of mobility and sustainability includes the return of trams, as they have become to be considered an important transport mode.

As for performance indicators, there is not any information available and therefore nothing to comment on.

The reconstructed street cases are of two different types. Whereas for the Rua do Campo Alegre, the main change affected only one aspect of the street, a new bus corridor, for the Rua da Restauração the reconstruction involved the whole public space of the street. In this case, the changes comprised an area much larger than the street itself. The creation of separate public transport lanes (bus and tram) has favoured the
users of public transport (that may include residents) while other general traffic users are negatively affected.

Both of these reconstruction cases have occurred very recently, so even the short-term effects could not be assessed, especially in relation to patterns of use in agreement with that we have assumed that the uses of the buildings are the same before and after the reconstructions.

The major changes occurred for the following aspects:

- Increase of greenery
- Reduction in parking bays
- Reduction of carriageway lanes
- New cross-sections, footways, parking bays, greenery, carriageway
- New surface materials for the different allocated public spaces

The number of injuries and deaths in traffic accidents has decreased after reconstruction but that is a general trend in the entire City of Porto.

**Decision making and Design Processes**

There is no tradition on reconstructions of a specific kind of streets such as arterial streets.

Some arterial streets have been reconstructed especially in cases where the street is part of a major reconstruction area such as the street Rua da Restauração. For that reason, almost all arterial streets do not have a specific reconstruction project focused uniquely on the street itself and usually are not the only element to be treated. The City Council Authorities defend that if any changes are to be made in one particular street, those changes will have a strong impact on the others. This is even more pertinent for streets such as arterial since these are important channels for flow traffic.
What makes the decision-making task and the design processes different in these cases is the time and financial funding available for the reconstructions. For example, the reconstruction made at Rua da Restauração followed a different process from that of the Rua do Campo Alegre because the intervention programme, the needs and the available funding were different as well as the scale and scope of both projects.

The reconstruction on Rua da Restauração was integrated on a large group of different urban reconstructions proposed and managed by an independent entity called “Porto 2001, SA”. Conversely the reconstruction of the Rua do Campo Alegre was made directly by the City Council and involved exclusively the creation of a bus corridor along several streets and the implementation of associated facilities.

The decision to reconstruct urban streets is always made by the City Council of Porto. The different stakeholders of the street usually play an important role during the elaboration of the design of the reconstruction.

The City Council authorities select different teams of Architects and Engineers to be responsible for the design of the street reconstructions. Rather than providing an array of alternatives, the design process is conducted in an interactive environment where all the main stakeholders of the street and the design team(s) work together. The final design project is therefore a refinement of the initial solution.

Implicitly almost all design reconstruction projects are sustainable, because the changes observed after reconstruction enhance the quality of the street, usually favour the use of sustainable modes of transport and promote the reduction of space for private cars, while improving the aesthetics of the street.