Innovative transport services in areas with weak and peculiar public transport demand

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A growing demand for mobility and the deficiencies in the transport system have transformed urban centres in "unliveable" places. A prevalent use of private cars produces high levels of pollution, casualties and road congestion. The promotion of public transport is considered an effective strategy to make mobility more sustainable for people. When a public transport system serves areas with a weak transportation demand, as it happens in territories with dispersed settlements (urban outskirts, rural areas, mountains, …), the resort to unconventional forms of public transport, such as dial and ride bus services, is necessary (Figure 1).

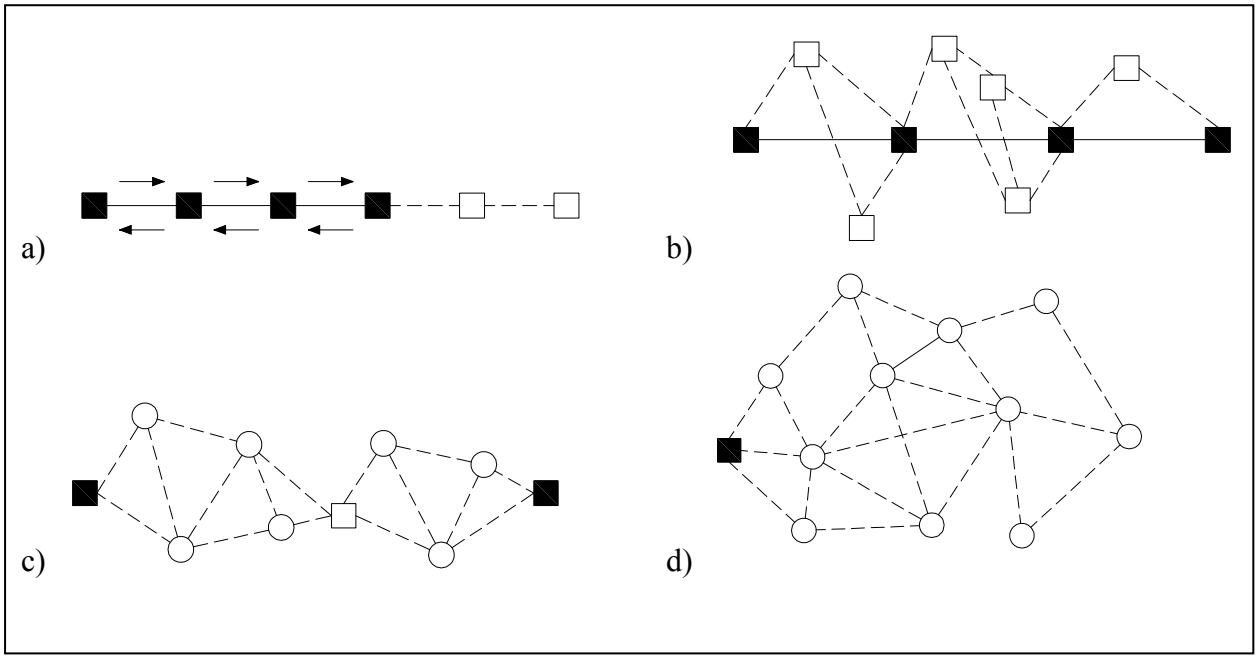

Figure 1: a) conventionally scheduled bus service integrated with a dial and ride service; b) conventionally scheduled bus service along a main corridor integrated with dial and ride side detours; c) dial and ride bus service with fixed stops along a predefined corridor; d) dial and ride bus service with fixed stops in a predefined area.

The scheme of such a system is based on the following principles (Figure 2):

- Users book their trip through call centres, internet, ITS systems, etc;
- Operators plan schedules and fleet operations;
- Drivers receive updated schedules both in on line and off line mode.

Figure 2: Dial and ride service scheme.

This study propose a methodology to identify areas with weak transportation demand, where flexible and integrated public transport system, such as dial and ride bus services, can be successfully introduced.
To reach this goal, a method to identify weak transportation demand areas, called MIADD was developed and validated comparing the results with a well acknowledged approach such as Classic Multi-Criteria Analysis. The method proposed is based on a multiplicative mathematical model (Figure 3) featuring three groups indicators, describing territory, population and mobility condition, like township area (S), population density (D), car use index (IGP), ect. This indicators take in to account the eventual need for an integrated public transport system. The data used were obtained from various sources like ISTAT, ACI, etc.

$$IDD = \underbrace{(ID \cdot Disp. \cdot IGP)}_{\text{Basic weak demand index}} \cdot \underbrace{R \cdot VP \cdot D \cdot AR \cdot TO \cdot UL \cdot TI \cdot S \cdot A \cdot Q \cdot CA \cdot IMS \cdot IGT \cdot VI \cdot DS \cdot M}_{\text{Factors}}$$

Figure 3: multiplicative mathematical model (MIADD).

The MIADD approach has been applied to the Palermo province area in order to identify weak transportation demand districts with their priority ranking, where unconventional public transport system may be applied successfully (Figure 4). Using a GIS software the district composed by the townships of Bolognetta, Misilmeri and Villabate was studied in detail, planning both economically and operationally a dial and ride bus service. To identify the main service routes, an origin-destination matrix was derived from the official statistics on mobility (ISTAT) for the district of interest (Figure 5).

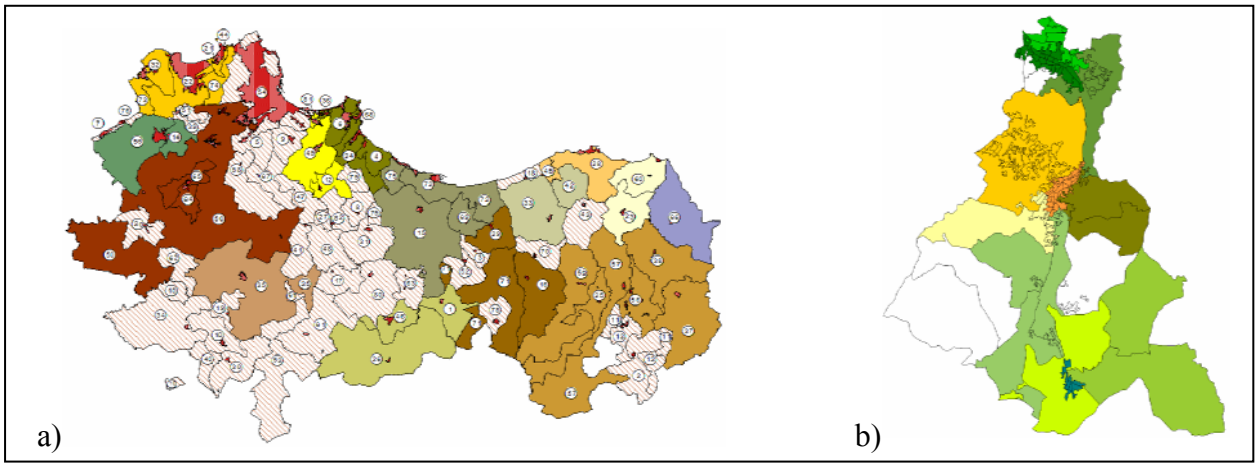

Figure 4: a) homogeneous transportation demand districts in the Palermo province area; b) the homogeneous transportation demand district of Bolognetta, Misilmeri and Villabate.

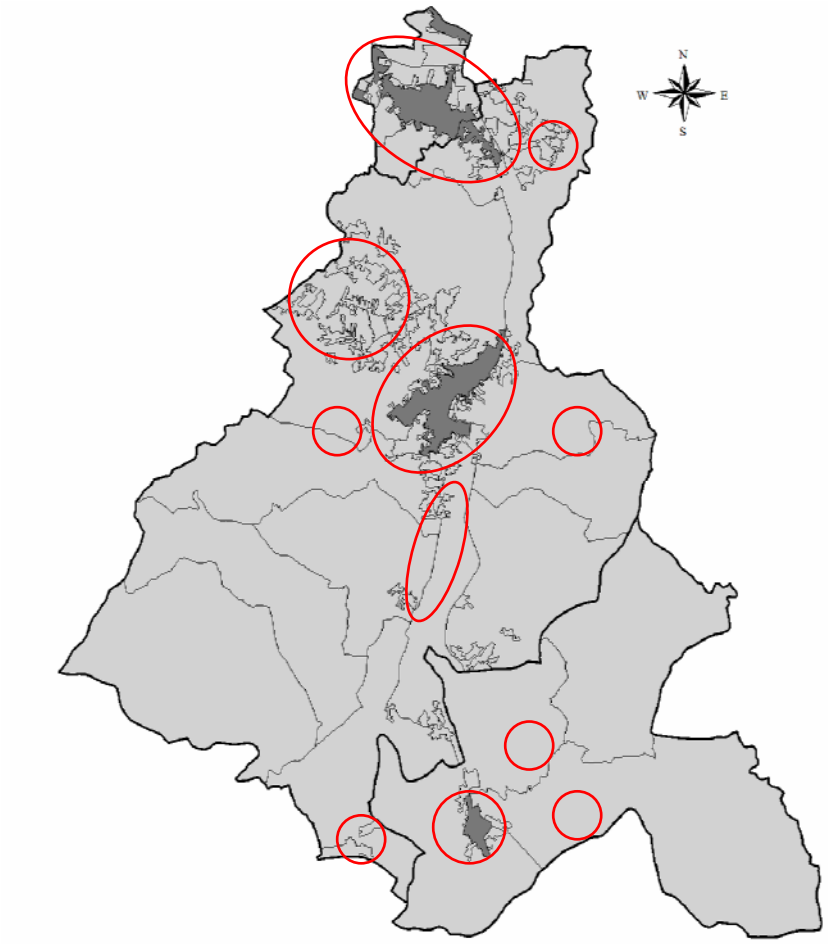

Figure 5: settlement pattern analysis of the district of Bolognetta, Misilmeri and Villabate.