

TRANSIT-ORIENTED MIXED COMMUNITIES: SOCIAL SUSTAINABILITY LESSONS FROM CASE STUDIES OF GERMANY AND SPAIN

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Abstract

This research focuses on the role of transit-oriented mixed communities in contemporary cities as a socially sustainable variant of the widely recognised concept of TOD. The review of literature has suggested that introducing social diversity and mixed incomes in transit-focussed development generates additional benefits for the residents. Through the comparative analysis of case studies in Madrid and Freiburg, this paper reports on the outcomes of mixed use policies in terms of residential socio-economic mix and travel behaviour, showing how different planning approaches and urban design models can be utilised to achieve the same objectives: socially sustainable communities embodying the principles of equity and balance, with environmentally sustainable travel patterns. Reflecting on these empirically measured outcomes, drawn from quantitative data, interviews with residents, planners and municipal leaders, as well as household questionnaire surveys, the authors address the issue of defining policy 'success'.

1. Introduction and key concepts

Transit-oriented mixed communities bring together the environmentally rooted principles of Transit Oriented Development or TOD (Cervero, 1997) with inclusionary planning. The approach incorporates two prominent elements of social sustainability; social equity – embracing social justice aspects of inclusion and accessibility (Bramley et al, 2009; Kearns, 2003) and sustainability of community – defined as the “ability of society itself, or its manifestation as local community, to sustain and reproduce itself at an acceptable level of functioning” (Dempsey *et al*, 2012: 94). By seeking a more representative demographic mix, planners have sought to address issues of residential self-selection and demographic concentration that have been associated with many TOD schemes (Bohte *et al*, 2010). Although the exact nature of each development scheme will reflect the different interests and pressures exerted by municipal leaders, planners, developers and local community, a number of common features may be identified. These include compact built form through building density, a diverse socioeconomic profile of residents achieved through a range of housing types, tenures and prices - with particular attention given to first-time or young buyers, public facilities including retail and communal amenities within each neighbourhood, a high-quality urban design playing a key role in building community and placemaking, a high-quality pedestrian environment as well as an overall propensity towards public transport ridership achieved by focussing the development towards a high quality suburban transport network.

But to what extent do realised social and environmental outcomes of these schemes match the original objectives, and how can success or failure be defined? The two questions form the basis of this paper. By means of an international comparative study of case study projects in Germany and Spain, varying from the neighbourhood to district scale

interventions, it is possible to analyse the empirical results and local variations of transit-oriented mixed communities in different countries. Despite a difference in scale, layout and position in relation to urban structure, the selected case studies share similar qualities in built form and demography. The Spanish approach is exemplified by the Madrid region, illustrating its historically strongly transit-focussed developments (Valenzuela, 1973) and the more recent 'post-suburban' forms of TOD, which have produced a diversification of land uses and housing types in former suburban dormitory towns. The Madrilenian case study selected for this paper is an expression of the latter type, being representative of the current development trends in the capital of Spain. Similarly, the southern German city of Freiburg began to focus new development strongly towards a reconstituted urban tram network since the 1970s (Buehler & Pucher, 2011). Both cities have used a range of delivery methods including institutional consortia, compulsory purchase orders, public agencies, independent cooperatives and collaborative build organisations to deliver significant proportions of new housing, some of which is subsidised and affordable.

2. Literature review

The TOD concept was introduced at the beginning of the 1990s by Peter Calthorpe and has recently been defined by the California Department of Transportation, as a "*moderate to higher-density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding the auto*" (Parker et al., 2002: 3). TOD shares some similarities with New Urbanism but focuses more on transportation and reduction of car dependency. Moreover, it does not necessarily promote a neotraditionalist architectural style, although "*mixed-use formats based on traditional towns and villages have been embraced*" (Bohl, 2002: 117). The creation of TOD may be hindered by "*a lack of inter-jurisdictional cooperation, auto-oriented design that favors park and ride lot over ridership generating uses, and community opposition*" (Mathur and Ferrel, 2009: 1). For this reason, "*transit agencies, municipalities and developers*" are promoting around the US "*partnership arrangement that support transit initiatives*" (Bohl, 2002: 117). The legal basis for the implementation of TOD has been explored by a TCRP report about "Zoning and Real Estate Implications of Transit-Oriented Development" (TCRP, 1999).

TODs can be developed on vacant land as brand-new projects, although the concept may be also applied to suburban retrofit. This is the case for *MetroWest* in Virginia (United States), where a former detached housing estate has been transformed into a transit-oriented development with different housing types and a mixed-use centre, next to the train station, mostly devoted to non-residential uses (Dunham-Jones and Williamson, 2011:23; Rein, 2006). Dittmar and Ohland have collected a set of TOD case studies selected as best practices in the US, including the famous Rosslyn-Ballston corridor in Arlington County (Dittmar and Ohland, 2003). In Europe, recent policies for the development and regeneration of cities have considered public transport as a major issue. Peter Hall (Hall, 2014) has underlined the importance of integrating transport, planning and development in a holistic approach through the examples of Lille, Montpellier and Strasbourg in France; Ypenburg, near the Hague in the Netherlands, connected with an integrated tram and rail network (RandstadRail); Ørestad (Copenhagen), defined as a "New Town in linear Town" (Hall, 2014:236).

The idea of transit-oriented mixed communities combines the benefits of TOD with the location of mixed-income housing near transit. The Center for Transit-Oriented Development (CTOD) has endorsed this development approach and suggests that further benefits can include "*truly affordable housing; stabil[e] transit ridership; broadens access to opportunity; relieves gentrification pressures*" (CTOD, 2009: 3).

Finally, the CTOD has identified 11 possible strategies for the delivery of mixed-income TODs. These include: *incentives for proactive station-area planning and zoning; public-private partnerships; target existing funding to preserve and create affordable housing along transportation corridors; inclusionary housing; modify low income housing tax credits to offer greater incentives for locating near transit; infill development or redevelopment in transit zones; facilitate use of value capture to fund affordable housing; land acquisition/land*

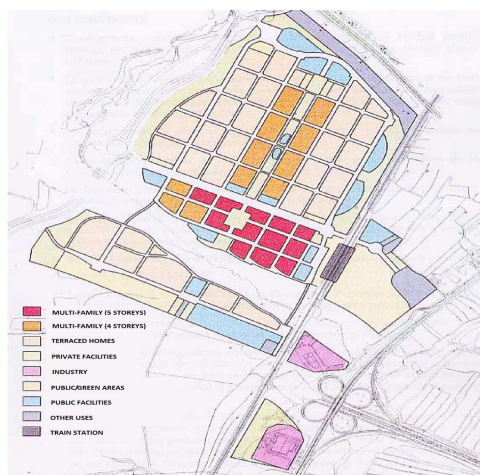
banking funds; incentive-based zoning; tax-increment financing; reduced parking requirements (CTOD, 2009).

Recently, evidence has begun to emerge on the processes of residential self-selection that occur because of the lifestyle appeal of particular physical qualities of a residential environment, including access to transport modes (Handy *et al*, 2006). Residential self-selection may influence travel behaviour in turn, where residents holding particular attitudes, values and demographic traits are drawn to particular environments that are oriented towards particular travel modes – for example a high quality urban realm for walking or particular public transport modes (Mokhtarian & Cao, 2008). In this way, travel preferences can be considered as a dominant aspect of wider lifestyle choice with residential self-selection as the outcome. Yet the exact importance of self-selection processes in determining travel behaviour remains unclear. Bohte *et al* (2010:133) report that significant levels of mismatch or ‘dissonance’ (Schwanen & Mokhtarian, 2005) can exist between residential location, different travel-generating activities, and travel preferences. The mismatch indicates that residents do not always travel in the manner that they would wish, and ultimately travel preferences are one of a number of factors that need to be balanced in determining residential location. Residential self-selection may pose social challenges to developments that strive to embrace broader sustainability principles.

3. Madrid Case Study: Polvoranca

The tradition of linking suburban development with local rail networks has been established in Madrid from the 19th century. At that time, the Madrilenian historic tramway routes were already connecting the city center with its outskirts, demonstrating their importance in Arturo Soria’s project of Ciudad Lineal (Valenzuela, 1973). Simultaneously, a first outline of the currently existing suburban rail network was traced connecting Madrid with its surrounding towns and a series of second-home developments. In the last two decades, the tradition of developing residential settlements around train stations has been rediscovered and placed in the context of regional policies, favouring the deconcentration and diversification of nonresidential (universities, shopping areas, hospitals, technologic parks...) and residential uses in suburbia. With regard to housing, public administration has been promoting mixed-housing and mixed-income developments including a significant presence of subsidised housing, in order to encourage social integration and cohesion. Some of these public-led residential developments were structured around suburban train stations and can be considered as the Madrilenian autochthonous version of the TOD pattern. The selected case study, Polvoranca, in the municipality of Leganés, is representative of the evolution of a former working-class dormitory town located South of Madrid into a mixed-use post-suburban centre, favoured by the aforementioned public policies for land-use diversification. This process can be associated with a socioeconomic upgrade of local residents (Adelfio, 2014).

Figure: Polvoranca Masterplan



Source: ARPEGIO (translation by the author)

The masterplan was adopted in 1999, the land management being in the hands of ARPEGIO, a public agency of the regional government (Comunidad de Madrid) which acquired the land by means of Compulsory Purchase Orders. Looking for consensus, “the regional government signed a series of agreements in order to give back more than 70% of land to the original land owners after expropriating and urbanising it” (De Blas 2004: 114).

Table 1: Key Features of Polvoranca

| Category | Parameter | Data |
|--------------------------------------|--|--|
| <i>Design & Planning</i> | Development Concept | Sustainable urban extension, built around a suburban train station. |
| | Total Area | 131.83 Ha. |
| | Number of Dwellings | 3,600 (1,200 houses; 2,400 subsidised flats) |
| | Gross Density | 27.3 dwellings/Ha. |
| | Layout | Grid with internal shared-surface streets, two mixed-use commercial streets and public main square |
| | Amenities | Grocery stores, pharmacies, day-care centre for the elderly, community centre, nurseries and primary schools, sports facilities, post office, bars and restaurants. Maximum distance to public facilities is 500 m, established in the masterplan. |
| <i>Community Characteristics</i> | Total Population | 9.880 in 2014 |
| | Average Household size | 2.9 (Leganés: 2.6; Madrid - municipality: 2.4) in 2011 |
| | % aged 6-18 years old | 19 in 2014 |
| | % aged 65 years + | 3.6 in 2014 |
| | Mean age of residents | 30 (Leganés: 41; Madrid - municipality: 42.8) in 2011 |
| | % People in employment | 50% in 2011 (excludes students, children, retired, unemployed); Leganés: 41% |
| <i>Transport & Accessibility</i> | Public Transport Provision | Train: suburban train station, providing direct and reliable service to Leganés and Madrid. Bus service, less frequent than train |
| | Train ridership (% of residents) | 30% of total residents; 50% of residents aged 15-64 |
| | % Residents travelling to work by car / public transport | 52%/ 32% in 2011. |

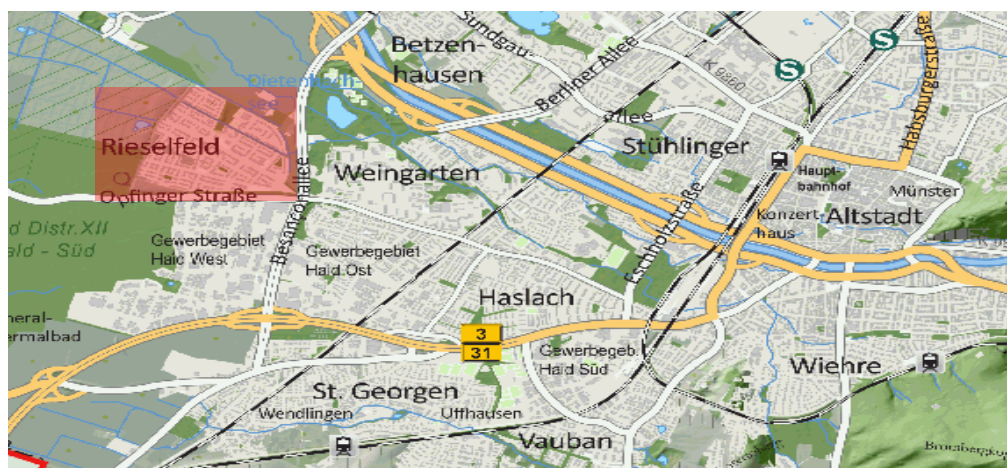
Social sustainability is addressed through the inclusion of different features. The provision of subsidised flats has fostered the settlement of young families and first-time buyers (more than 50% of residents are aged between 25 and 49) along with terraced-home owner-occupiers. An interviewee from residents’ association has pointed out that “*young families with children feel integrated into the neighbourhood*”. Urban design was supposed to favour social interaction through a pedestrian-friendly environment (including: two commercial streets, a mixed-use square, shared-surface residential streets, high internal street connectivity with an average block perimeter of 289 m and public facilities at walkable distance). The objective is only partially achieved since “*there are no offices. Life begins once you are back from work*” when the “*families gather round the square*” (Interviewee: president of residents’ association).

The need to travel for residents has been reduced for basic shopping and amenities, which are well-used. Most of residents (approximately 85%¹) already purchases basic goods within *Polvoranca*. For other reasons, they “mostly use the train, then their cars and then local buses as their last option. You can reach the centre of Leganes in 3 minutes and the centre of Madrid in 25 minutes by train” (Interviewee: member of residents’ association). Travelling for work is necessary: according to 2011 Census statistics, only 7.5% of residents in employment are working at walkable distance (less than 10 minutes). Although the majority of residents commute to work by car (52%), more than 30% uses public transit. The use of car for work commuting is lower than other three suburban mixed-use developments in former suburban dormitory towns around Madrid². Moreover, considering that 50% of population is not in employment, we may suppose that public transit is also used for other reasons, as demonstrated by train ridership, measured through the number of outbound journeys from the local train station displayed as a percentage of residents (50% of those aged between 15 and 64). For all the aforementioned features, *Polvoranca* may be considered as a partially successful attempt to create a mixed-use transit-focused development, accurately planned and designed for the needs of daily life but probably not intended to be completely self-sufficient. The lack of offices is a characteristic of the majority of public-led mixed-use developments created during the last twenty years in the Madrid Region and must be considered as a necessary improvement for the future, to provide these places with real 24-hour vitality.

4. Freiburg Case Study: Rieselfeld

Spurred by the energy crises of the 1970s and more recent concerns over global climate change, the small city of Freiburg has recently been dubbed as Germany’s ‘Green Leader’ (Buehler & Pucher, 2011), having succeeded in doubling public transport patronage during the 1980s, expanded its cycle network by almost ten-fold over three decades since the 1970s and introduced a ‘five pillar’ transport vision for the city and surrounding region that placed the car firmly at the bottom of the transport hierarchy. The city’s population has doubled since the 1950s and continues to grow from a present figure of 215,000, owing largely to former students that remaining in the city after graduating from the city’s prestigious university. A long term housing shortage led to planners to create two new suburban development schemes in the early 1990s, at Vauban and Rieselfeld, on the city’s westerly fringe.

Figure 2: Location of Rieselfeld in Freiburg



¹ Estimated value extracted from a survey related to 300 residents living in 21 selected developments of the Madrid Region. The value of 85% is referred to 3 public led mixed-used developments of the last 20 years, including *Polvoranca*.

² *Loranca Garden City* in Fuenlabrada (55%); *Soto del Henares Eco-neighbourhood* in Torrejón de Ardoz (56%); *Pórtico del Sur* in Getafe (60%), all provided with metro or train stations, although Soto del Henares is still work-in-progress.

Rieselfeld was designed for a resident population of 10000, and with a high degree of autonomy in mind through a full range of services and amenities. The district is set out on a grid network, with a tramline forming a central axis through the development, which began operating services before the bulk of residents moved in. The grid layout of Rieselfeld means that substantial car-free blocks exist, and although the car parking ratio is relatively high at 1.5 spaces per home, a substantial proportion of residential parking has been allocated in subterranean car parks.

Table 2: Key Features of Rieselfeld

| Category | Parameter | Data |
|--------------------------------------|---|--|
| <i>Design & Planning</i> | Development Concept | Sustainable urban extension, built around a tram extension. |
| | Total Area | 70 Ha |
| | Number of Dwellings | 3,700 |
| | Gross Density | 53 dwellings/Ha. |
| | Layout | Grid with car-free superblocks |
| | Amenities | Full range of schools, library, police station, medical centre, grocery stores, restaurants, cafes, twice-weekly market. |
| <i>Community Characteristics</i> | Total Population | 9,384 (2012) |
| | Average Household size | 2.54 ((Freiburg - 1.84) |
| | % aged 6-18 years old | 21 (Freiburg – 10.2) |
| | % aged 65 years + | 6.1 (Freiburg – 16.3) |
| | % Receiving state support | 9 (Freiburg – 11.4%) |
| <i>Transport & Accessibility</i> | Public Transport Provision | Tram: all homes within 400m of tram, providing direct and reliable service to centre and to key destinations throughout city. Bus services serve suburbs and outlying villages |
| | % Household Car Ownership | 72% (Freiburg - 74%) |
| | % Journey to work by car / public transport | 26% (Freiburg - 17%) |

In terms of residential social mix, Rieselfeld’s population is heavily oriented towards younger families, compared with the overall Freiburg average – a profile that reflects the city’s sustained housing demand among an expanding younger population of university graduates and migrants. Although its residential community appears heavily skewed, it is more balanced overall, compared with new housing schemes elsewhere in the city – notably at Vauban where less than 4% of the population is aged over 65 years old (Hamiduddin, 2014). Approximately 20% of housing is provided by the state or through cooperative groups, and a further 10% by means of collaborative group build or ‘Baugruppen’ produced housing. Rieselfeld has been designed as a ‘barrier-free’ neighbourhood accessible for elderly and mobility impaired residents, with all physical impediments to movement around the neighbourhood removed and all multi-home buildings fitted with a lift.

Analysis of travel behaviour (Hamiduddin, 2014 & 2015) shows a high level of localisation for access to essential needs and services, for example with 32% of residents walking to local shops in the neighbourhood for regular grocery shopping and a further 34% cycling to shops within the general locality. This pattern is consistent with the high level of retail provision at Rieselfeld, which includes two supermarkets – itself reflecting Freiburg’s policy of encouraging smaller, neighbourhood scale grocery stores through an 800sqm store size limit across the city. Planners have been rather less successful in their attempts to minimise work travel, and although in principle one job has been created per ten residents, the proportion of residents work within the neighbourhood is below 5%, indicating a spatial work-home imbalance.

Finally, the development approach has succeeded in producing sustainable patterns of travel behaviour generally. Although the ratio of household car ownership (72%) mirrors the overall city average (74%), only a quarter of residents regularly drive to work compared with one half of residents that cycle to work on a regular basis. Only 17% regularly use public transport to access work, reflecting Freiburg's relatively small and 'cycle-able' size. The decoupling of car ownership and car use is a city-wide phenomenon (Hamiduddin, 2014 & 2015), even in neighbourhoods such as Vauban where residents are required to purchase a parking space at a cost of Eur 18,000.

5. Concluding Discussion

Although the TOD concept embraces environmental sustainability goals by encouraging public transport alternatives to car use, social sustainability principles have often been sidelined, reflecting an historic vagueness surrounding the term that has only been recently sharpened by a new structure provided by social justice principles under the heading of 'social equity' as well as the ability for a community to regenerate itself lent by 'sustainability of community'. Residential self-selection may pose a challenge to the social sustainability of TOD, running contrary to the idea of inclusion, balance and social self-regeneration. In composite, the outcome is likely to be a neighbourhood unrepresentative of wider society and environmental sustainability in terms of travel patterns, bought at the expense of social integration. The two case studies presented here represent two different approaches to creating more demographically mixed, sociable and self-contained TOD schemes.

Despite the measures implemented to encourage socially representative residential profiles, a certain degree of demographic skewing remains evident in the two case studies presented, relating to the decision to concentrate public housing in the Madrid scheme, and the impact of Freiburg's housing shortage in creating demand among younger families in the Riesefeld case. Yet Riesefeld in particular has achieved both a modest success in creating a more representative demographic balance than other new TOD schemes in the city and, in particular, in marrying a relatively more socially 'balanced' resident community with environmentally sustainable patterns of travel. Yet, in both case studies employment remains the single greatest cause of essential travel and – sustainable or not – lifestyles remain 'distance intensive'. Elsewhere, other schemes have fared better in this respect – for example at the 2800 home Südstadt scheme in Tübingen, where a resident:job ratio of 0.3 has been created (Hamiduddin, 2015).

Although a universally acceptable definition of 'success' is unlikely to be possible, in line with the principles of sustainable mobility (Banister, 2008) and social sustainability (Dempsey *et al*, 2012) we propose that a successful transit-oriented mixed community would use policy instruments necessary to create a socially representative demographic mix while reducing the need to travel and, in particular, the need for automobile travel as far as possible.

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