The Mega-Project as Crux of Integrated Planning: Insights from Munich's Central Corridor

Chris A. Hale
ARTICLE

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CHRIS HALE

Abstract

This paper discusses the role of large-scale integrated master-planned projects. The Central Corridor project in Munich, Germany is used as a case study. Munich’s Central Corridor urban redevelopment is now reaching its mature phases, with many of the individual ‘transit-oriented development’ style precincts in this 8 km east–west axis now either completed or under construction. The blend of mass transit infrastructure, mixed-use development, and the delivery of urban design and public realm upgrades represents an example in which many of the ‘theories’ of transit-oriented development have actually been effectively delivered. In this sense, Munich offers an example of translating ‘goals and rhetoric’ into implemented outcomes. Findings from Munich’s approach to planning, infrastructure and major projects are broadened into recommendations for other cities.

Introduction

Munich’s current planning and development efforts at the ‘Central Corridor’ are an important lesson on a global scale. This is because the planning approach has clearly identified that sustainable transport outcomes are necessary if strategically valuable brownfields sites in inner and middle suburbs are to be developed to their full potential.

With transport, housing, environmental and other urban pressures building in many locations, various cities have sought different paths toward meeting these challenges in a sustainable manner. Some cities adopt an ‘incremental’ posture toward growth and change—looking to address metropolitan evolution through small-scale planning, through approaches to real-estate development that focus mainly on individual buildings and sites, and on making transport infrastructure improvements according to what the prevailing political will allows at any given time. In this approach, only limited attention is given to analysis, and to explaining planning through written documentation. Land use and real-estate development are largely treated separately from transport planning and infrastructure expansion.

Chris Hale, University of Queensland, Centre for Transport Strategy, c/o Civil Engineering Office, University of Queensland 4072, Australia. Email: c.hale2@uq.edu.au
Other locations pursue a more ‘rational and strategic’ approach to metropolitan evolution. In its best examples, this approach is founded on strong analytical readings of the city as it exists and as it may evolve and change into the future. Demographic analysis and housing market needs are strong in the mix of background analysis. Published output on planning frameworks tends to be extensive. Land use and transport tend to be very closely integrated, and the professional split between ‘land-use planning’ and ‘transport planning’, so onerous in many locations, has been overcome in these more enlightened cities.

Between 2006 and 2009, the University of Queensland embarked on a research programme to source and understand different approaches to integrated land use and transport planning. Of particular interest were the approaches taken in locations experiencing population growth. During this research process, the hypothesis that two largely divergent planning approaches were being pursued in different places throughout the western world was essentially confirmed. This paper reviews planning, projects and developments in the Central Rail Corridor area of Munich—which was identified as a leading location from among the cities and projects adopted as case study locations for the University of Queensland (UQ) Centre for Transport Strategy (CTS) transit-oriented development (TOD) research.

The Munich outcomes were considered important for a number of reasons. Firstly, it is clear from the broader planning context, culture and documentation in Munich, as well as the observed approach to development and planning activities, that non-sustainable ex-urban development of a car-dependent nature has by and large been ruled out in Munich into the future. Munich has clearly concentrated its efforts on development that falls within its preferred ‘compact, urban and green’ archetype.

Secondly, Munich has a strong track record in achieving outstanding mode share splits from a transport sustainability point of view. This was seen by the researcher to be a result of an integrated land use/transport approach as well as excellent transit service and infrastructure. While Munich’s use of advanced transport analytical tools is commendable, and its commitment to quality infrastructure is also impressive, these are not wholly responsible for the strength of actual results. It seems that it is only through recognizing the ‘truly integrated’ nature of urbanism and planning in Munich that we can fully account for the city’s strength on a range of strategic questions, transport included.

Thirdly, planners in Munich are clearly comfortable with the use of transport mode share targets. Unlike many other locations pursuing a ‘predict and provide’ approach based on 1960s-style ‘black box’ modelling techniques, Munich planners seem quite content to set mode share targets for individual precincts and neighbourhoods, and to deliver the transport infrastructure, public realm improvements, and transit level-of-service needed to support the achievement of those goals.

And finally, having established a robust framework of planning documents and directions, Munich has been able to deliver in housing, real-estate development and infrastructure terms through the dedicated pursuit of a multi-precinct mega-project that meets pre-agreed strategic planning objectives. This was seen by the researcher to be a key difference between Munich and other locations encountered.
during recent research. Many cities *espouse* a similar rhetoric to Munich in terms of a desire for better transport-related environmental outcomes and a more integrated land use/transport mix. Few are actually achieving these outcomes to the same extent, however. It is the researcher’s contention that Munich’s institutional and industry competencies allow it to deliver large-scale projects that make a substantial impact in delivering sustainable locations and the sustainable metropolis. Other cities without these competencies in mega-project conceptualization and delivery seem to be left hoping that, in planning and development terms, a large number of small projects will be able to contribute ‘a whole that is greater than the sum of its parts’. Rarely does this seem to occur.

In this sense, the following paper reviews Munich’s current integrated mega-project in the Central Corridor to identify some of the contributing factors that have allowed this scale of ‘compact, urban and green’ development outcome to be delivered. As cities around the world seek to meet major growth challenges, it may just be possible that the ability to plan and deliver on a much larger scale could be a key ingredient for meeting sustainability objectives. Supplying new housing and commercial space options in locations that are well-served with transport and social infrastructure through well-conceived and executed mega-projects may lie at the crux of the sustainability hopes and metropolitan planning needs of so many cities in Europe and beyond.

**TOD and Large-scale Integrated Development: Theoretical Discussions, and Emerging Analytical Techniques**

If we allow one eye to be cast across Europe, the discussion of TOD becomes much more interesting and fruitful than any conversation defined entirely by the worthwhile, but largely US-centric, body of existing literature.

The US-centred body of knowledge discusses TOD as an emergent but largely unproven or even problematic planning concept, as does the small body of Australian sources (for example, Curtis, 2008). Notable publications such as Dittmar and Ohland (2004), Hess and Lombardi (2004), Swenson and Dock (2004) and of course the Transit Co-operative Research Program (2004), have come predominantly from the USA—but these must be understood as a counter-trend to the dominant currents of urban development and planning that emerged in the latter 20th century in the USA, and to a degree also in ‘New World’ cities throughout Canada, Australia and New Zealand (Hamnett & Freestone, 2000; Beauregard, 2006; Flint, 2006; Curtis, 2008).

Fortunately, the dominance of private automobile-oriented planning, property development and infrastructure provision in the New World should not be seen as universal or eternal—and it is generally understood that the move toward TOD approaches is an attempt to productively incorporate essentially ‘European’ approaches to these issues. Robert Cervero’s milestone studies of comparative transport and land-use planning were outlined in *The Transit Metropolis—A Global Enquiry* (Cervero, 1998), and this important text provides examples of various urban evolutionary processes that have been more public-transit based when compared with ‘typical’ car-centric US cities. Not coincidentally, the
exemplar cities covered by Cervero (including Munich) are generally in the top league of economic and cultural performance. The widely acknowledged analysis from Newman and Kenworthy (1999) also concurrently established a discussion of land use and transit across a selection of major international cities—beginning to clarify the distinctions between sustainability performance in Europe and Asia versus that in the New World, while perhaps becoming overly focused on the question of density. We are also thankful for vigorous discussions of ‘universal’ sustainable transit planning principles (such as Bratzel, 1999; Vuchic, 2006; Banister, 2002; Lyons, 2004; and now Mees, 2010) that allow us to move beyond the inherent (and sometimes sub-conscious) transit scepticism of most North American and Australasian discourse.

Meanwhile, in design terms, the work of European design practitioner-theorists such as Jan Gehl (2006) might be seen as more or less mainstream to the TOD concept (without being overtly within the body of ‘TOD literature’). Gehl’s analyses of urban places recommend the assembling and integrating of activities at transit-served, pedestrian-friendly, and largely car-free precincts (Gehl, 2006, pp. 81–112). These views are highly relevant and informative for TOD precinct design, and add much needed variety, contrast and style to the developing body of literature. Equally, Jacobs (1961) holds down an important position in the international design and planning canon—identifying and clearly explaining certain TOD principles during the 1960s, well before the concept had firmly established itself. These sources and more were reviewed to initially formulate a broad formative set of ‘TOD principles’ (some of which remained to be applied in this paper). After the literature review, a process of survey and interview-based enquiry with local, then international experts was delivered to refine these principles—before their application to an analysis task covering major TOD projects in Australia, the USA and Europe (including the Munich precincts described here). It is this iterative long-term process of refinement, soon to be released in Hale (2010), that led to the confident application of the TOD principles selected for the purpose of this paper.

Equally, recent discussion in Planning Practice and Research has been lively, informative and influential—with Haywood and Hebbert (2008) pointing out the importance and centrality of rail stations in particular, while also covering the need for ‘… institutional design involving multiple agencies and interests …’ (Haywood & Hebbert, 2008, p. 283). Curtis (2008) explained the peculiarities of New World TOD attempts and the problematically ingrained non-integration of land use and transit investment in Australian cities (which carries more or less equally for North America). Peek and Louw (2008) reminded us that European cities continue to tally-up success stories in large-scale TOD. This may at least partially be due to a more conscious and successful resolution of what they term the ‘bivalent character’ of both place and node in TOD precincts. This challenge appears to have been relatively successfully resolved in Munich overall, through what your current author refers to as a dynamic process of ‘double-leveraging’ of critical mass in both transit infrastructure investment and real estate development. All of these issues will be reprised below, and re-observed around the dynamic and gargantuan scale of Munich’s Central Corridor project suite.
Central Corridor: Urban Context

Configured in an east–west orientation on the western approaches to Munich’s central railway station (Hauptbahnhof), the Central Rail Corridor district (Zentrale Bahnflächen) reflects large-scale redevelopment opportunity in the inner urban and inner suburban areas of this most vibrant of European cities.

Largely created through the rationalization of underutilized or non-economic rail corridor lands (see Figure 1), the redevelopment project addresses what were previously dull and industrialized city-scapes. These locations are now transforming into a variety of other far more intensive and active uses (see Figures 2, 3, 4, 5). The precincts in the corridor are well-positioned because of proximity and direct access to the downtown area of Munich (see Figure 6) and the important regional transport hub at the nearby Hauptbahnhof. The various precincts mostly offer strong access to existing amenities in their surrounding areas, beyond the rail corridor itself, such as parklands or established neighbourhoods. The development clusters also benefit from strong access to existing and soon-to-be upgraded sustainable transport infrastructure—offering high frequencies and strong service levels. The famous Nymphenburg Palace grounds are a substantial pre-existing amenity for the Nymphenburg-South precinct and other locations. Overall, however, rail infrastructure continues to exert substantial domination over the urban landscape. As the corridor approaches the Hauptbahnhof in an easterly heading, surrounding areas become increasingly urbanized as the transit right-of-way is eventually surrounded by long-established 19th-century inner suburbs like Maxvortadt, Neuhausen and Schwantalerhöhe.

New Development Interventions: Precincts Summary

The property development components of this multi-precinct project are extensive and varied (see Figure 7). The primary precincts include: Arnulfpark, an office/residential district; Laim, primarily offices; Nymphenburg-Süd, which balances residential and office development; and Pasing, which is a mixed-use renewal-style centre.

Overall Scope and Dimensions

Strategic planning documents have called for a total housing provision for some 16,000+ residents in the Central Corridor area, with office and retail space for around 19,000+ jobs (City of Munich, 2005b, p. 48). This positions the overall ambitions of the Central Corridor project among the most noteworthy of any urban planning and development exercise currently underway worldwide.

At Pasing (see Figure 8), according to some estimates (City of Munich, 2008a), total floor space of some 165,000 sqm is planned, under construction or recently completed. Of this, some 92,000 sqm is commercial space, while projected residential floor space accounts for around 72,000 sqm (based on local planner’s assumptions of 80 sqm per two-person dwelling, and 40 sqm office floorspace per job). This represents space for the equivalent of approximately 1,800 residents and 2,300 jobs, respectively—and positions Pasing as a location working toward a
reasonably even balance of commercial and residential usage. Pasing has a strong pre-existing neighbourhood character, and development for this area at the western ‘far end’ of the project corridor is clearly intended to imbed itself sympathetically into the established urban fabric.
At Nymphenburg South (City of Munich, 2008a) (see Figure 9), total floor space of around 150,000 sqm is planned, under construction or recently completed. Of this, about 96,000 sqm is residential space, while projected...
FIGURE 5. Residential construction in the Arnulfpark area, summer 2009.  
Source: Author, 2009.

FIGURE 6. Marienplatz Station in central Munich. New residents and workers in the Central Corridor have the opportunity of quick and direct one-seat ride access by rail to central Munich.  
Source: Author, June 2008.
FIGURE 7. Central Corridor projects—an overview. Source: Courtesy of the City of Munich, Referat für Stadtplanung und Bauordnung.
commercial floor space accounts for 42,000 sqm (although developer Vivico is suggesting 60,000 sqm on its website). This represents the equivalent of 2,400 residents and 1,050+ jobs, respectively—positioning the precinct as a slightly residential-heavy location. Situated to the north of Laim station, adjacent to the Nymphenburg Palace gardens, and with a strong emphasis on public green space and recreational opportunity, Nymphenburg South appears to be an inheritor to the early 20th-century European ‘garden city’ planning tradition.

At Laim (City of Munich, 2008a) (see Figure 10), a total of some 88,000 sqm commercial floor space is planned, under construction or recently completed—which provides space to accommodate the equivalent of around 2,200 jobs. Situated to the south of Laim S-Bahn station, the Laim precinct is being positioned as a predominantly office/commercial destination, while its counterpart precinct on the north side of the rail corridor (Nymphenburg South) is more residentially oriented.

At Birketweg (City of Munich, 2008a), a total of around 240,000 sqm of residential construction is planned or underway—representing a large-scale new residential destination that will house around 6,000 residents on completion. Also, 240,000 sqm of commercial floor space is planned—which provides floor space to the equivalent of around 6,000 jobs in this longer-term development exercise. As one of the larger precincts under development, Hirschgarten/Birketweg will eventually provide an even split between commercial and residential floor space in a public realm-rich medium density setting that also clearly references the long-established European ‘garden city’ planning ideal. This precinct also features an emphasis on social infrastructure such as schools.
At Arnulfpark (City of Munich, 2008a) (see Figures 11, 12, 5), around 292,000 sqm of commercial space is projected, while residential floor space will eventually account for around 84,000 sqm. Some 4.3 hectares of public open space has been largely delivered, mainly in the form of a centrally-located park area. Arnulfpark, as the closest of the precincts to the central city of Munich, is clearly intended to be an office-oriented destination, although the overall precinct is very large and the residential components also quite considerable in absolute terms. Final development outcomes should offer provision of space for the equivalent of around 2,100 residents and 7,300 jobs. Even considering the well-executed public realm focus for the precinct, the overall image of Arnulfpark is much more ‘urban and compact’ compared with other precincts within the Central Corridor—which tend toward a more suburbanized atmosphere.

**Critical Analysis of Strategic Planning Outcomes**

**Metropolitan Policy Context**

Planning for the Central Corridor and its sub-precincts is a recognized strategic exercise within the city of Munich’s broader suite of planning policy frameworks, as well as its transport planning policies and documents (City of Munich, 2005b). Munich’s planning criteria and the catch phrase for new development approaches
is compact, urban, green—and the city holds the Central Corridor up as a key example of this philosophy. The Central Corridor demonstrates strong linkages from regional planning policy into localized delivery of identified housing and business accommodation needs. These ends are achieved through a multi-precinct fully master-planned development response, configured along a strategically vital transport corridor. This form of project appears to be highly necessary for cities genuinely attempting to deliver TOD and integrated development outcomes. The articulation of sustainability principles in Munich’s planning documents is directly reflected in precinct planning and in outcomes on the ground throughout the Central Corridor—and the researcher interprets Munich as currently being a more effective deliverer on sustainable planning rhetoric than many other major cities internationally.

The following critical analysis mobilizes a selection of important ‘TOD principles’, developed through the UQ TOD research programme, to analyse and review key elements of the Central Corridor project. These principles were derived from a multi-phase research effort that included literature review, informant interviews and surveys, and refinement through application to real-world TOD projects. Extensive discussion of the Central Corridor was pursued with City of Munich planners.
TOD Principle: Built Form Should Effectively Balance Density and Scale with Intimacy and the Creation of People-friendly Locations

The headline density for development throughout the Central Rail Corridor district redevelopments is calculated on available figures at somewhere between 0.4 and

Figure 11. Arnulfpark—new offices. Source: Author, August 2009.

Figure 12. Recently completed housing quarter at Arnulfpark. Source: Author, June 2008.
2.0 floor area to land area ratio (FAR), depending on location, and whether density is calculated on an overall corridor basis or on a precinct-by-precinct basis. This calculation primarily utilizes information from the City of Munich (2008a). This is perhaps a surprisingly low figure, given the outsider’s impression of ‘European density’ and the reasonably high-intensity image of some of the individual precincts (like Arnulfpark) (see Figure 11). Some of the lower ‘overall’ figures (such as the 0.41 FAR calculated for Pasing) include allocations to streets, parks, civic uses and other public realm, however. On the other hand, the highest intensity development-only calculation comes out at 2.0 for parts of the Arnulfpark precinct—and again, this is a figure that might be considered ‘low’ by many New World TOD analysts.

Between four and six storeys is typical of the height of development within the Central Corridor precincts. Although some individual buildings (an 11-storey business tower at Laim, for example) may be somewhat taller than the usual range, there is little scope in Munich for true ‘skyscraper’ heights beyond historic norms. This is partially due to acceptance by the community and its representatives of the need to preserve historic viewsheds.

Munich’s version of density and scale is of particular interest. While heights and densities seem limited compared with North American or Australian urban TOD approaches (for example), the use of broader-scale planning and development at medium heights and densities allows for an effective balance between human scale and overall compactness of development in the researcher’s view. The total quantum of new development is very significant, but the vast majority of the precincts will remain in the medium or low/medium density category—while being very effectively serviced with new and substantial public realm investments. Overall, the combination of development intensity and offsetting public realm is seen by the analyst to be a very effective and nuanced outcome delivered by the Central Corridor planning process.

**TOD Principle: Mixed-use Zoning is Essential for TOD**

In Munich, mixed-use is now encouraged as a principle for the development of centres that were previously seen primarily as either business or residential locations. In Munich, limited attention seems to be given to the ‘zoning’ concept so familiar and common in the American planning vocabulary. A range of strategic challenges in Munich have led to a strong focus on a limited number of major planning and redevelopment opportunities throughout the entire metropolitan region (City of Munich, 2005b, esp. ch. 5), and in this context more emphasis appears to have been given to master-planning and design competition processes. These were intended to produce strategically desirable development configurations, land uses, and a robust mix of uses that meet pre-identified housing and other urban needs.

Land uses in the Central Corridor tend to be horizontally rather than vertically mixed. A critical analysis might suggest that retail and hospitality amenity may have fallen out of the mix somewhat within the residential precincts of the Central Corridor. While this may be a ‘problem’ from a TOD-theory standpoint, it may well be that new residents in these locations prefer a more residential, quieter, and less active atmosphere in their home surrounds.
Munich is very effectively matching its housing, population distribution and urban lifestyle challenges with its rail transit infrastructure and service planning. A proposed ‘second trunk’ infrastructure project is being planned to compliment the busy five-line S-Bahn route that passes through the Central Corridor (City of Munich, 2005a). Already the city’s busiest commuter rail axis, the capacity demands on the east–west trunk are encouraging a move to provide a separate extra line at significant cost. Linking this important rail investment initiative to new urban development outcomes essentially in the same corridor represents a logical integration of concurrent growth in both land use and transit intensity. The author refers to this type of mutually supportive change as the ‘double-leveraging’ of development intensity and transit investment. While many other cities around the world emphasize these goals in rhetorical terms, in Munich we observe that integration is not only discussed but effectively implemented and coordinated. The Central Corridor project also links reasonably well with pre-existing light rail lines.

The large-scale of new development underway in the Central Corridor is said by planners at the City of Munich to be only possible because of a heavy emphasis on the sustainable modes (public transport, walking and cycling). In other words, a scenario of car-dependent travel outcomes as a result of the planned increases in the housing and commercial development stock would have been simply unmanageable—due to the sheer scale of the project’s development impacts. Local planners are clear on the sustainable transport emphasis—in regional planning documents, in the language of planning reference materials for the Central Corridor, and in their own explanations of the project and its philosophy.

Positioned on Munich’s core east–west rail axis (see Figure 13 for broader overview), which passes through the city’s central rail station and into the downtown retail district, the Central Corridor was probably an obvious candidate for carrying new development due to its pre-existing transit infrastructure and locational strengths. Local road options, on the other hand, were seen as limited, and this added further accentuation to the sustainable modes in precinct planning exercises. The sustainable transport focus articulates itself through specific proposals for new transit facilities and stations in the corridor, and through the delivery of trunk infrastructure upgrades (City of Munich, 2005a). It also includes revisiting tram and bus connections and service levels. Perhaps most tellingly, it also articulates itself through precinct design outcomes that clearly de-emphasize the car and provide for excellent walking and cycling connections to rail (see Figure 3).

**TOD Principle: Planned New Development must be Linked-to, and Supportive-of, Transport Outcomes**

**TOD Principle: Effective Multi-modal Connectivity is Vital**

A notable upcoming initiative for improving Munich’s multi-modal connectivity will be the introduction of a suite of ‘connection assurance’ measures that dramatically reduce the likelihood of failure to connect between modes (bus and rail services, for example). This will be largely based on the installation of real-time connection information instruments in buses (City of Munich, 2006a,
FIGURE 13. Munich S-Bahn and U-Bahn heavy rail networks. The Central Corridor is located between Hackerbrücke and Pasing stations.

Source: Courtesy of MVV (2009).
In this example we see that not only individual modes, but the relationship between different modes and operating paradigms are under active consideration within the overall scope of transport measures that address the Central Corridor.

**TOD Principle: Convenient Transit Service Levels are Needed throughout the Day and Week**

The generic ‘red S-Bahn’ type follows a similar formula around Germany—and generally operates on 15-minute headways throughout the day, rising during peaks but with service levels dropping late evenings and on weekends. Munich’s transport planning documents (City of Munich, 2006a) indicate that one of the primary options for boosting public transport ridership is the so-called ‘taktverdichtung’ frequency-improvement strategy (perhaps best translated as ‘speeding the beat’). It is clear from planning documents that increasing frequencies and service levels on key S-Bahn corridors will occur as population pressures and travel demand in Munich and the Central Corridor climb. In the Central Corridor a strategy of *taktverdichtung* toward 10-minute standard headways is currently underway (City of Munich, 2006a, p. 34). Generally, however, existing service levels are convenient and provide good coverage throughout the day and week—and this should be seen as a key element in an effective TOD-style development effort in which new residents and workers will be enticed into transit usage rather than reliance on private vehicles.

**TOD Principle: Major New TOD Initiatives Work Best when Positioned Effectively within a Comprehensive Metropolitan/Regional Transit Network**

Munich possesses one of the world’s most comprehensive and well-integrated rail networks for a mid-sized city (Jacob’s Consultancy, 2006) (see Figure 13). At the urban scale, central Munich and its inner and middle suburbs are extremely well supported by their U-Bahn system, which links with the S-Bahn at strategic points, while differentiating itself through shorter station spacings and a more grid-style network configuration. At the metropolitan level, the S-Bahn provides an extremely comprehensive and effective commuter rail style system based on two primary network elements—a central east–west core (translating more or less to the development zone under discussion), and a familiar radial-style network pattern heading off into surrounding suburbs. On a regional basis, trains are also available at the Hauptbahnhof to points throughout Bavaria—but connections are especially effective to nearby cities like Augsburg, Ingolstadt, Landshut and Rosenheim. Inter-city high-speed services offer the ability to travel to major cities like Stuttgart and Vienna within 2 or 4 hours, respectively. The Hauptbahnhof offers convenient transfers from the local and metropolitan public transport systems into longer-distance services. Overall, the Central Corridor is ‘highly advantaged’ as a development location because its position and transit context facilitates a wide variety of convenient transit-based journeys—in the highly-effective urban and metropolitan Munich systems, and to destinations beyond.
According to the 2006 Transport Development Plan (City of Munich, 2006b, p. 34), commitments of relevance to the Central Corridor project from current funding included the following:

- Lifting the performance of the main central rail corridor.
- Strengthening of the S4 and S8 lines with improved signalling.
- Delivery of 10-minute headways during peak periods on the westerly stretches of the S2, S4 and S8.
- Delivery of new rolling stock and improvements to customer service.

It seems that capital investments in transit are being directed into the Central Corridor at the same time as real-estate development unfolds—and this should be noteworthy to other locations pursuing TOD-style initiatives. Although Munich appears to be achieving this integration of development and transit investment, it is surprising how seldom this outcome occurs in other locations internationally.

**TOD Principle: A Customer-service Orientation is Vital in Making Transit Attractive to New Residents and Workers**

The City of Munich (2005a, pp. 10–21) *Public Transport Plan* for Munich outlines the full range of issues and ‘quality standards’ that the system should deliver. These include achieving customer-friendly outcomes in the following:

- Walkable access to transit.
- Frequency of service (a 10-minute standard headway benchmark is identified, with 20 minutes seen as a minimum desirable level).
- Hours of operation (20 hours per day as a benchmark minimum).
- Average daily vehicle loadings (30% over the average workday, 50% in normal operating times and a surprisingly comfortable benchmark of 65% passenger loading against maximum vehicle capacity during peak periods).
- Vehicle standards (cleanliness and accessibility standards are stipulated).
- Service personnel (it is stipulated that staff should be willing and able to explain relevant tariffs, interchange options and the main transit routes).
- Specifications are given for the standard of facilities that should be provided according to patronage levels at a particular stop or station.
- Five minutes is stipulated as a maximum desirable wait time for intermodal changes.
- Timing of late-night inter-service connections is targeted for particular attention, so that passengers are able to reach their destinations reliably.
- Traffic signal prioritization for buses and trams.
- Communication with passengers.

This suite of measures in combination represent a serious framework for customer-oriented transit service that should ensure new residents of the central corridor are
provided with a level of service from transit that is attractive and competitive with private-vehicle alternatives.

**TOD Principle: Transit must be Competitive with the Car as a Travel Choice**

Munich’s mode shares for all trips reveal that more journeys throughout the metropolitan region are taken by private vehicle than any other mode, but overall travel outcomes represent a much ‘healthier’ or balanced share for sustainable modes including public transport than is the case for many cities in the developed world (see Tables 1 and 2). For example, current projects see Munich maintaining at least a 31% city-wide mode share to public transit through to 2015 (City of Munich, 2006a, p. 29). It is probably fair to suggest that for many work-related commutes to the pedestrianized inner city, or to key business locations in the middle suburbs, public transport offers a more attractive option than the car in Munich. The areas within Munich’s ring motorway system seem to have been planned and developed in an ongoing manner in order to emphasize public transport, walking and cycling.

It has also been noted (City of Munich, 2006a, p. 4) that Munich is a leading performer in public transport outcomes among its peer German cities. This high level of performance appears to be an outcome of an institutional framework for public transport that sees the ‘winning’ of new customers as a guiding objective. Planning in Munich is very rigorous in identifying and describing the ‘contest’

<table>
<thead>
<tr>
<th>Location (associated central corridor development precinct)</th>
<th>Car mode share (%)</th>
<th>Public transit (%)</th>
<th>Walking (%)</th>
<th>Cycling (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxvorstadt (Arnulfpark precinct)</td>
<td>15</td>
<td>22</td>
<td>45</td>
<td>17–18</td>
</tr>
<tr>
<td>Neuhausen-Nymphenburg (Nymphenburg South and Birketweg/Hirschgarten precincts)</td>
<td>33</td>
<td>22</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Laim (Laim precinct)</td>
<td>30</td>
<td>25–27</td>
<td>30–32</td>
<td>12</td>
</tr>
<tr>
<td>Pasing-Obermenzing (Pasing precinct)</td>
<td>50</td>
<td>20</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: All data are indicative only.
Source: City of Munich (2004, p. 12).

Table 2. Indicative prevailing and/or projected transport mode shares (%) at TOD projects under analysis by UQ 2007–2009

<table>
<thead>
<tr>
<th>Project</th>
<th>Public transit use (%)</th>
<th>Walking and cycling (%)</th>
<th>Total sustainable mode shares (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munich, Bavaria (Nymphenburg South)</td>
<td>22</td>
<td>45</td>
<td>67</td>
</tr>
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<td>Berkeley, CA, USA</td>
<td>20</td>
<td>41</td>
<td>61</td>
</tr>
<tr>
<td>Albion, QLD, Australia</td>
<td>8</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>Beacon, NY, USA</td>
<td>6.5</td>
<td>3.6</td>
<td>10</td>
</tr>
</tbody>
</table>
between private vehicles and public transport for individual journey choices. As a high-income society with high levels of car ownership and strong automobile infrastructure, Munich’s planners are consciously focused on making public transport options as attractive as possible, in order to maintain sustainability and viability of the transport system and quality of life (City of Munich, 2006a, p. 14).

The area around the Arnulfpark project precinct, being closest to central Munich, currently carries a diminutive 15% figure for travel by private vehicle (see Table 1). The figures above indicate a familiar phenomenon of growth in car mode share as we progress further from the central city. But notably, even the suburbanized Pasing area still carries a bare majority (an even 50%) of travel by car. These figures reinforce the impression of Munich as a strong mode-share performer both overall and in individual locations if we assume sustainable mode shares to be an important objective. The outcomes at Central Corridor development locations are likely to match those of their surrounding urban settings, and in doing so the Central Corridor performs substantially better than other TOD projects and locations encountered during the UQ Centre for Transport Strategy TOD research programme in the USA, Australia and Europe.

The sustainable mode shares aimed-for, and attained in, the Central Corridor, when cross-checked against performance of selected TOD projects in the US and Australia (as above, see Table 2), led the researchers to the conclusion that ‘genuine TOD’ outcomes can only be claimed if a project achieves majority shares to the sustainable modes. This deduction should prove important for ongoing debates surrounding the nature of TOD.

FIGURE 14. Bikes parked at Pasing station. Munich sees high modes shares to bicycling, but access facilities are currently somewhat under-developed in Central Corridor locations.

Source: Author, June 2008.
**TOD Principle: Arrivals to Mass Transit (i.e. Rail) should be Encouraged by Other Sustainable Modes (Walking, Cycling, Feeder Buses) as Much as Possible**

Munich’s public transport network is planned on the important premise of **comprehensive coverage**. City Planners designate indicative passenger catchments for various modes, and then ensure that almost all urbanized areas in the city are within the walkable catchment of one mode or another. It is suggested in planning documents (City of Munich, 2005a, p. 11) that 80% of the population is currently within the walking catchment of either S-Bahn, U-Bahn, tram or bus services, with the heavy rail modes said to offer a larger walking catchment.

The Park & Ride concept as articulated in Munich is much more targeted and strategic than is the case in Australian or American cities, where parking at most suburban rail stations seems to be expected. Munich has a limited number of strategically-located major P&R facilities, but parking is simply not provided at most railway stations. Overall, access to rail by sustainable modes is assumed, but is also directly encouraged through effective infrastructure support and planning frameworks. On the other hand, a current problem with bike parking under-supply was observed at a number of Central Corridor stations (see Figures 14).

**Summary and Conclusions**

In the discussion that follows, we return to the question of how Munich’s Central Corridor exercise might assist in defining the ambitions and requirements of effective mega-project TOD planning in meeting the urban sustainability needs of cities in Europe, the New World and beyond.

**Property Development: Large-scale Ambition and Delivery**

In housing around 16,000 residents, and providing space for some 19,000+ jobs across 170 hectares of development land, the Central Corridor is not short on development ambition, nor the **critical mass** of development that can underpin more viable transit infrastructure and service levels. At the same time, new residents and office workers are being offered an urban environment that is user-friendly from a sustainable-transport standpoint. While the magnitude of overall development is indeed impressive, the design approach and the treatment of scale and density seems to be reasonably nuanced—and intensive new development is never far from public realm and open space in the Central Corridor.

Planners in other cities might look to this willingness to plan on such a broad canvass for the opportunities it opens-up in terms of balancing intensive new development with the provision of public realm and parkland amenities.

**Land-use Planning—Astute Locational Choice Enhances New Development Opportunity and Meets Regional-level Needs**

Leveraging off the pre-existing transport infrastructure advantages of the Central Corridor, City of Munich strategic planners have identified this particular
redevelopment zone as among the prime urban land assets and development opportunities available to the city now, and over a longer time horizon.

Substantial community benefits are offered through providing significant new development with strong access to transit, green amenity and public realm, quality design and reasonably strong connections into more established locations. And these attributes should inform the selection criteria mobilized by other cities looking to deliver real outcomes in sustainable planning on a metropolitan scale. Planning processes and decisions in Munich are also notable because of the very strong analytical base on which they are grounded. Depth and breadth of analysis is provided in key areas such as demographics, housing markets and housing needs, urban land assets, and transport (see City of Munich 2007a; 2007b; 2007c; 2008b). This strong analytical base seems to allow for sure-footed decision-making and plan formulation—and, once again, other regions or cities would be wise to pay attention to the level of supporting research-based publication that assists Munich’s planners and planning stakeholders. Munich demonstrates that good planning techniques can lead to astute location selection at the metropolitan scale.

Transport: Consciously Leveraging the Relationship between Growth and Mass Transit

As the primary east–west rail corridor in Munich, the Central Corridor offers substantial opportunities for building patronage with targeted TOD-style development, but the corridor also faces pre-existing capacity constraints and already-heavy ridership levels. Integration of land use and transit is particularly effective here, however, in that population growth will occur around Central Corridor rail stations at precisely the time that substantial rail transit infrastructure investments and service upgrades are being made. Critical mass in development and transit is leveraging better outcomes in each.

Central Corridor transport outcomes will benefit significantly from the highly-effective transport planning and service provision that already exists throughout metropolitan Munich. The city of Munich has already established itself as a strong bicycle city, and has a comprehensive and popular mass transit system, supported by effective bus connections. Munich stands out as a major western city in which car travel is often less convenient than public transport options in urban areas in the researcher’s view, and as a city in which high targets for sustainable transport are included in major urban planning efforts. These are the same outcomes that other cities need to achieve if sustainability rhetoric is to become a lived reality.

Design: A Balance between Scale and Intimacy

The essential design challenge of the five-precinct Central Corridor project lies in the tension between the large-scale nature of the exercise on the one hand, and the need to create intimacy and identity on the other. Key design measures included integration with transit, a prominent role for the public realm, extensive greening and landscaping, and strong infrastructure for walking and cycling. The use of precinct-by-precinct design competitions was probably an example of enlightened
design practice. While at times some Central Corridor locations can seem slightly bland architecturally, there are also any number of sub-precincts in which design is lively and individualistic. The willingness to embrace precinct-level design competitions, and the so-called ‘architectural quality control’ function exercised by the City of Munich, stand out as design clues for other cities.

Broader Conclusions

In pursuing a major development and housing project with strong linkages to upgraded mass transit service, the City of Munich has clearly passed-over any opportunity to work with ‘small-scale, small-issue planning’. While other locations that were reviewed during the UQ research exercise in recent years were clearly struggling to deliver on their sustainability rhetoric, particularly in the realm of sustainable transit mode shares but also on many other counts, it seems that Munich’s mega-scale approach is able to deliver sustainable outcomes that are of metropolitan significance. It is also notable that the Central Corridor’s larger-scale approach also means that substantial inroads are being made into the considerable housing needs of this growing city. Increasingly, because of the challenges involved in meeting sustainability and other urban goals, it may be worth pondering whether other regions could be well-served in ‘getting more’ out of their existing brownfields urban land assets, just as Munich has done.

A highly important line of philosophy that has emerged from the Munich Central Corridor exercise is the idea that large-scale urban development in the inner and middle suburbs is only possible if catered to primarily by sustainable travel modes. This concept sees car-dependent travel outcomes as a limiting factor on the effective utilization of preferred sites for urban renewal. In short, if the Central Corridor had been planned to deliver high car mode share outcomes, the intensity of development we currently see would simply not have been possible due to the negative impacts generated by large increases in car movements and related infrastructure. Conversely, pursuing a sustainable transport outcome has allowed Munich to unlock the full potential of strategically important brownfields sites. Because well-positioned sites such as these are few in most major cities, the Munich approach is highly instructive in offering an example of enlightened planning that delivers both sustainability and optimization of development opportunity at the same time.

A future of urbanism based on efficient use of scarce urban land and transport assets, and a new willingness to use planning as a tool toward meeting higher-level metropolitan sustainability goals, may mean that the urban ‘mega-project’, once derided as an overblown planner’s dream, emerges again at the crux of integrated metropolitan planning in the 21st century.

References
