



Transit Oriented Development in Copenhagen, Denmark: from the Finger Plan to Ørestad

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ABSTRACT

Ørestad is Copenhagen's linear new town being built over a 30 year period around stations on an elevated, driverless mini-metro line. Copenhagen Metro's construction was to be financed by the sale to developers of publicly-owned land along the route. The Øresund Bridge from Malmö in Sweden also facilitates substantial international commuting by rail and road to Ørestad. This paper briefly assesses Copenhagen's 60 year record of transit-oriented development since its internationally renowned 1947 Finger Plan. It focuses principally on analysing Ørestad's progress since the late 1990s in creating transit-oriented development of jobs, housing and retail, education and leisure facilities. The paper finally examines how Ørestad is contributing to Copenhagen's economic growth and relieving pressure on Copenhagen's Central Business District.

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1. Introduction: The origins of Transit Oriented Development

Transit Oriented Development (TOD) is a term which encapsulates the process of focussing the development of housing, employment, activity sites and public services around existing or new railway stations served by frequent, high quality and efficient intra-urban rail services (Cervero, 1998; Curtis et al., 2009). TOD is designed to create a relatively high density, compact and mixed urban form (Loo et al., 2010). In the United States, TOD is now a very important part of a broader smart growth approach to urban development including new urbanism, urban infill, urban growth boundaries, historic preservation, affordable housing and inclusionary zoning (Goetz, 2012).

TOD itself is not just a recent phenomenon. Adams (1970), Kellett (1969), Ward (1964) and Warner (1962) recognised a close association between the development of streetcar (electric tram), underground and commuter railway routes and a star-shaped urban form in the late 19th and early 20th centuries in a period which predated private car ownership. Whilst transit development enabled suburbanisation to occur, real estate development also required mortgage banking to finance house sales (Knowles, 2006a).

Early examples of TOD from the mid to late 19th century, financed at least in part by land value capture, include the Manchester, Altrincham and South Junction Railway in the UK and New York's subway in USA. The former was designed to encourage the development of commuter housing for better paid workers employed in Manchester's fast expanding Central Business District

(CBD). The latter used a 5 cent uniform fare to encourage people living in overcrowded lower Manhattan to move out to purposely developed suburbs in upper Manhattan, the Bronx, Brooklyn and Queens. Similarly, streetcar suburbs developed around electrified tram routes in American cities like Boston and European cities like Copenhagen in Denmark and Leeds in the UK, in the first two cases using the incentive of low flat fares to neutralise the cost of distance (Jensen, 1984; Ward, 1964). In the 1920s and 30s, London's Metropolitan Railway marketed a vision of Metroland, later commemorated by Poet Laureate John Betjeman, as a semi-rural idyll to promote the sale of commuter housing and the development of a captive market of rail passengers as it progressively extended its commuter rail routes into the surrounding countryside (Guest, 1978, pp. 215–236).

2. Planning of Transit Oriented Development

After the Second World War, until at least the 1970s, many European towns and cities experienced rapid physical expansion, population growth in the extended urban area from natural population increase, rural to urban migration and immigration, but inner city population decline due to slum clearance of worn out 19th century industrial workers' housing. This lower density suburban expansion was facilitated by rapidly increasing private car ownership. TOD is much more difficult to deliver when a substantial proportion of the population has the choice of using their own car. Britain, like North America, continued to pursue largely market-oriented suburban development and urban planning was mainly reactive (Fullerton and Knowles, 1991). Moon (1990) noted the clustering of high density urban land uses around transit

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stations in North America especially where floor space ratios had been relaxed. However, in the Scandinavian capitals of Copenhagen, Oslo and Stockholm, and in the French capital of Paris, planners were able to channel suburban development into satellite suburbs along transit served corridors (Fullerton and Knowles, 1991).

In some large Asian cities, including Hong Kong, Singapore and Tokyo, TOD has been very successful and has delivered compact and very high density urban development focussed around rail transit stations (Cervero, 1998; Cervero and Murakami, 2009; Loo et al., 2010; Majoor, 2008; Murakami, 2011). Hong Kong's rail-property development model uses the capture of increased land values from transit development to finance railway investment and operating costs. Rail transit is profitable despite low fares as TOD property income exceeds fare revenue (Cervero and Murakami, 2009). In Hong Kong, TOD is helped by all land being government owned and individuals and private sector companies can only buy 50 year leases which give exclusive property development rights. The Government awards land grants for TOD to the partly privately owned railway company. In these Asian mega cities very high usage of cheap rail transit helps to lower the demand for private car ownership and use. Hong Kong's car ownership remains very low at about 70 cars per 1000 people despite a per capita GDP of US\$36,500 in 2006 similar to most developed countries where car ownership is 6–10 times higher (Loo and Lam, 2007).

3. Research objectives

This paper briefly assesses Copenhagen's 60 year record of transit-oriented development since its 1947 Finger Plan. It focuses principally on analysing Ørestad's progress since the late 1990s in creating transit-oriented development of jobs, housing and retail, education and leisure facilities. It assesses whether there has been modal shift from cars to public transport. The paper finally examines how Ørestad is contributing to Copenhagen's economic growth and international competitiveness by relieving pressure on Copenhagen's Central Business District.

4. Copenhagen's 1947 Finger Plan

Copenhagen led the way after World War 2 with planned TOD when planners from the Danish Town Planning Institute produced its world famous Finger Plan (*Egnsplan*) in 1947 (Fig. 1) (Egnsplankontoret, 1947). This early and outstanding example of planned TOD designated five fingers, or corridors, of urban development along existing or planned suburban railway lines which would be electrified to provide rapid rail transit services to Copenhagen's CBD (Fullerton and Knowles, 1991). Every station would be the focal point for high density housing and contain local shopping facilities. Each planned suburb would be linked to the next one and onto Copenhagen's CBD 'like beads on a string'. New land was reserved for industrial purposes where the fingers connected with the developed urban zone. As private car ownership was still very low (about 30 per 1000 people in 1950), Finger Plan suburbs served by rail transit were the most accessible locations for new housing at a time of rapid urban expansion. Although the Finger Plan was advisory, it succeeded in co-ordinating the development of housing land in 29 municipalities, mainly in Copenhagen County, at a time when the City of Copenhagen was short of land and unable to extend its boundaries further. Another distinctive feature was the proposed retention of 'Green Wedges' of farmland and recreational land between each Finger, already identified in Copenhagen's Green Area Plan from 1936 (Jensen, 1984). A ring road was planned to link larger centres at the base of each finger and provide

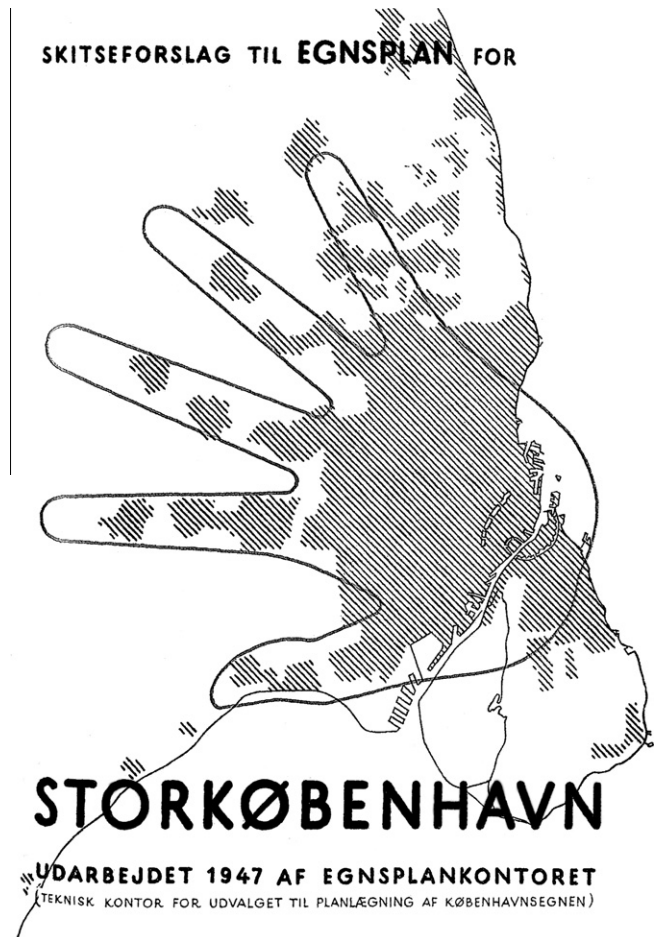


Fig. 1. Copenhagen's 1947 Finger Plan. Source: Egnsplankontoret (1947).

alternative industrial locations to those long established in Copenhagen harbour and the inner city.

Copenhagen's Finger Plan quickly led to well pronounced TOD with a linear urban development pattern. This contrasts strongly with more concentric patterns of urban development in both free-market and 'Green Belt' encircled cities (Fullerton and Knowles, 1991). The Finger Plan deliberately discouraged further urban development along the scenically attractive coastal corridor northwards to Helsingør by not designating this corridor for expansion and by not extending the electrified, suburban 'S' train route beyond its existing terminus at Klampenborg (Fullerton and Knowles, 1991). This corridor was in any case already well-served by frequent trains on the national rail line to Helsingør which connected with rail ferries to Sweden. By the early 1960s most of the Finger Plan's housing land had been developed so the two southernmost fingers were extended in the 1963 First Step Plan westwards in the direction of Roskilde and south-westwards along the coast towards Køge. Although Hansen (1960) found a strong relationship between transport development and population and employment growth in Copenhagen's western Finger Plan suburbs in the 1950s, the development of 'S' train lines did not always keep pace with housing development especially in the Køge Bay finger (Fig. 2). Also, fast rising living standards led to unexpected increases in car ownership to about 82 cars per 1000 people in 1960 and 200 in 1970 and competition for 'S' train services which originally had a captive market. Motorway construction encouraged the development of lower density detached houses in areas poorly served by public transport and threatened the integrity of some of the Green Wedges (Fullerton and Knowles, 1991).

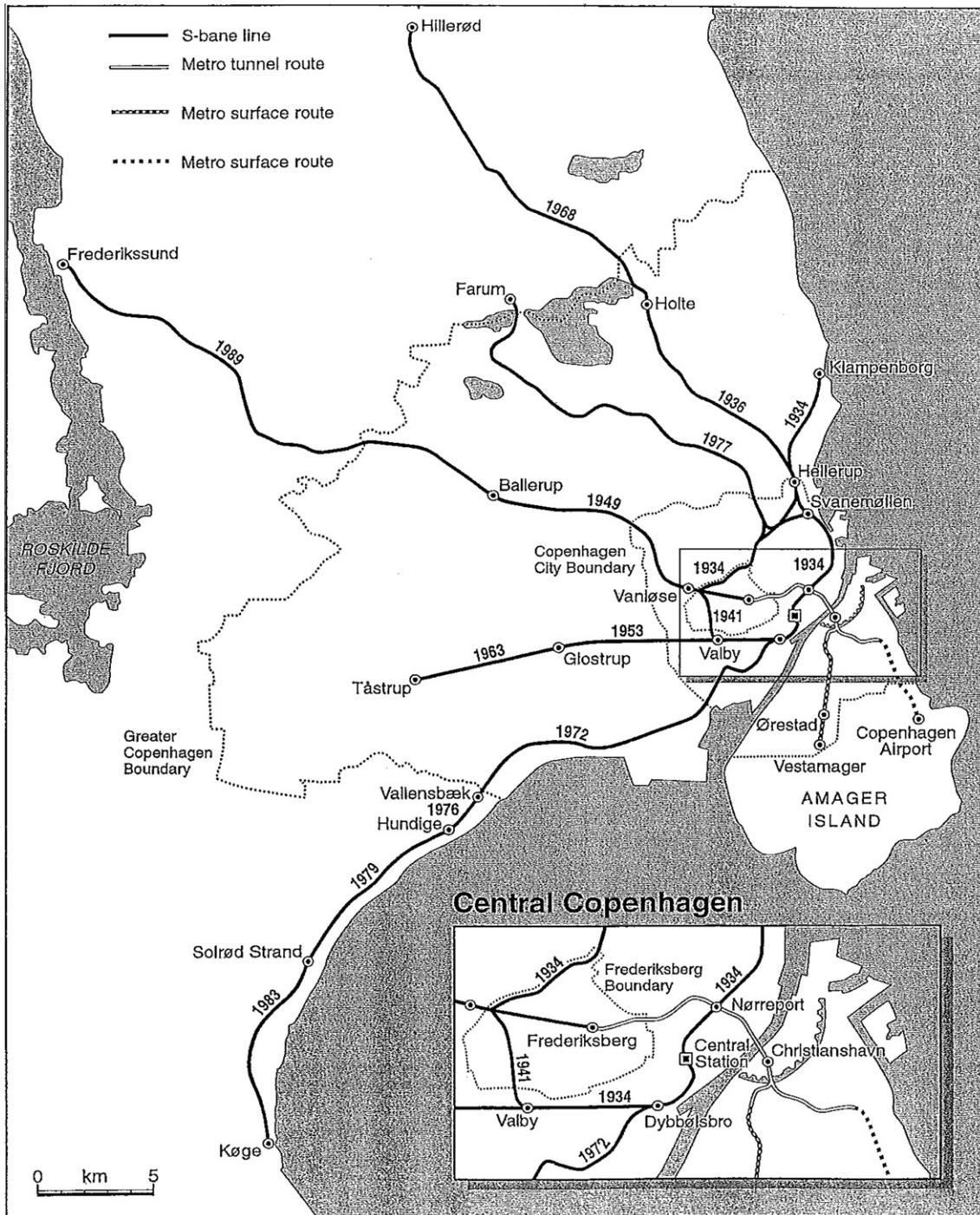


Fig. 2. Development of Copenhagen's 'S' train and Metro networks.

5. 1973 and 1989 Regional Plans

Greater Copenhagen's Capital Regional Authority existed between 1972 and 1989 and provided opportunities for strategic regional and transport planning. The 1973 Regional Plan continued the Finger Plan's principles of TOD and was legally enforceable. It included terminal towns such as Høje Taastrup, large park and ride facilities and proposed ring roads between the radial corridors (Vuk, 2005). However, these changes coincided with reduced demand for urban expansion as Greater Copenhagen's population stopped growing and national political priority for development was given to other Danish regions and cities.

The 1989 Regional Plan followed Finger Plan principles of TOD by allowing industrial and service facilities to be constructed only within 1 km of stations on the radial railway corridors. This reduced the amount of commuter traffic into Copenhagen's CBD (Vuk, 2005).

Starting in the late 1980s, the national railway lines were electrified from Copenhagen northwards to Helsingør and westwards to Roskilde as a precursor to the new line from Copenhagen to Copenhagen Airport and across the proposed Øresund Fixed Link to Malmö in Sweden, which opened in 2000. Electrification of the Helsingør line provided better access to jobs in central Copenhagen and beyond for communities along this coastal route. This was

particularly important for Helsingør's residents following the closure of its shipyards and the anticipated loss of ferry traffic and employment when the Øresund Fixed Link opened between Copenhagen and Malmö. The Helsingør corridor was included alongside the Finger Plan corridors in Copenhagen's 2003 Traffic Plan (Greater Copenhagen Authority, 2004).

6. Ørestad New Town: Copenhagen's new development Finger

In the 1990s Denmark's economic development was refocused on Copenhagen. Most of Copenhagen's wealthier families had long since moved to the suburbs beyond the city boundary and its tax base was near to collapse. For Denmark to stay internationally competitive, the three major political parties (Social Democrats, Liberals and Conservatives) agreed that big initiatives and investments were needed to strengthen the national capital. This required a controversial change in Copenhagen's spatial planning policies from a social democratic welfare-oriented perspective to a neo-liberal entrepreneurial agenda (Andersen and Jørgensen, 1995; Majoor, 2008).

Four mega projects were approved:

1. Redevelopment of Copenhagen Harbourfront.
2. Ørestad New Town, Metro and Development Corporation.
3. Øresund Fixed Road and Rail Link to Malmö and southern Sweden.
4. Cultural Capital of Europe 1996.

Two of the four mega projects involved major investment in new public transport systems, the Metro and the Øresund Fixed Link. This investment is supported by research findings which show that international competitiveness is enhanced by investment in modern integrated public transport systems (Docherty et al., 2009).

Ørestad New Town is an important example of TOD. It forms a new 'finger' of planned urban development for Copenhagen half a century after the five original corridors designated in the 1947 Finger Plan. Ørestad's site on the western side of the island of Amager, south of Copenhagen, is on land reclaimed from the sea in the 1930s and 1940s and is publicly owned by the city (55%) and the Danish Government (45%). It is 5 km long but only 600 m wide so its total land area is only 310 ha in size and it borders directly onto protected nature reserves (Fig. 3).

Ørestad was designed to be built under the direction of a joint public-public state and city owned Ørestad Development Corporation (*Ørestadsselskabet*) (ODC) using cheap government backed 30 year loans (City of Copenhagen, 2003; Majoor, 2008). In 2007 ODC was divided into a Metro Corporation (*Metroselskabet*) tasked with developing the Metro network and a City and Harbour Development Corporation (*Udviklingsselskabet By & Havn*) (CPH) tasked with land development in Ørestad and redevelopment of various sites in Copenhagen harbour (Book et al., 2010). Although Andersen and Jørgensen (1995), Majoor (2008) and others show that this process of entrepreneurial development in Ørestad represented a radical shift from established Danish principles of participatory planning, it mirrored the top-down planning of new towns and dockland redevelopment schemes in other countries. This might be justified by the large capital investments required to develop individual sites which could only be provided by large private companies, financial institutions or public organisations.

The 1993 Copenhagen Municipal Plan required the Ørestad Development Corporation to hold an international competition to scope Ørestad's development. The 1995 Master Plan focuses urban development around stations on a new driverless light rail mini-metro system. Ørestad was planned from the outset to be a sus-

tainable development with the Metro at its core together with good bicycle lanes and a deliberately low and expensive car parking provision designed to minimise the use of private car transport.

"The location of the railway and its distinctive visual presence, together with the very frequent train service, signal that public transport is regarded as the most important form of transport in Ørestad."

(City of Copenhagen, 2003, p. 60).

Like the Docklands Light Railway in London, Metro's light rail tracks are deliberately elevated throughout Ørestad to reduce the barrier effect on mobility at ground level and to present an iconic impact on the urban landscape. Place marketing is often enhanced through the development of iconic buildings and transport infrastructure (Book et al., 2010).

Ørestad residents pay significantly higher parking fees than the rest of Copenhagen (BY&HAVN, 2010c). Car parking is mainly in multi-storey car parks shared by residents and businesses so that Ørestad's landscape is not visually dominated by parked cars (BY&HAVN, 2010b). The cost and shortage of car parking has however deterred some companies, including Topdanmark property, from investing in Ørestad (BY&HAVN, 2009b).

A unique feature of Ørestad in contemporary Europe is that the cost of constructing Phases 1 and 2 Copenhagen's Metro, including the trans-CBD underground section, was intended to be financed by capturing increased land value by selling building sites along its route in Ørestad and earmarking future revenues from Metro ticket sales to pay back the cost of the 30 year Government construction loan (Book et al., 2010). However this funding model proved to be insufficient as Metro's overall construction problems increased costs which more than doubled from an estimated 5.2 billion Danish Kroner¹ in 1996 to 12.3 billion Danish Kroner in 2005 whilst the forecast of 69 million passengers a year by 2010 was too high, only reaching 52.45 million (Majoor, 2008; Skousen, 2011). This financial shortfall is being paid for by Danish taxpayers and is part of Flyvbjerg's thesis about the inaccuracy of megaproject forecasting (Flyvbjerg et al., 2003). However, the cost of constructing the Ørestad section of Metro has been partly covered by land value capture. Ørestad's land development costs were also much higher than expected so the amortization period has been extended to 2038 to cover increased debts (Majoor, 2008).

Ørestad's second unique feature is its strategic international location on the rail and motorway route linking Copenhagen to Copenhagen Airport and Malmö in southern Sweden via the Øresund Fixed Link, which opened in 2000 (Fig. 3) (Knowles, 2006b; Knowles and Matthiessen, 2009).

Ørestad is subdivided into four distinct urban districts: 1. Ørestad North (*Nord*); 2. Amager Common (*Fælled*) District; 3. Ørestad City; 4. Ørestad South (*Syd*) (Fig. 4).

6.1. Ørestad North

Ørestad North, served by two Metro stations (Islands Brygge and DR Byen & Universitetet), is the nearest part of Ørestad to the CBD, which is less than 1 kilometre away. Some argue that its close proximity makes Ørestad North part of Copenhagen's CBD and unsurprisingly it is the first part of Ørestad to be completed with eight sites totalling 290,500 m² developed between 2002 and 2007 whilst the final two sites were opened in 2010 (Table 1) (BY&HAVN, 2010a; Ørestad, 2006).

Ørestad North's successful mixed-use development relies heavily on investment by public sector organisations and is focussed on

¹ The Danish Krone is pegged to the Euro at the exchange rate of 0.13425 Euro = 1DKK (7.449DKK=1 Euro) (12th August 2011).

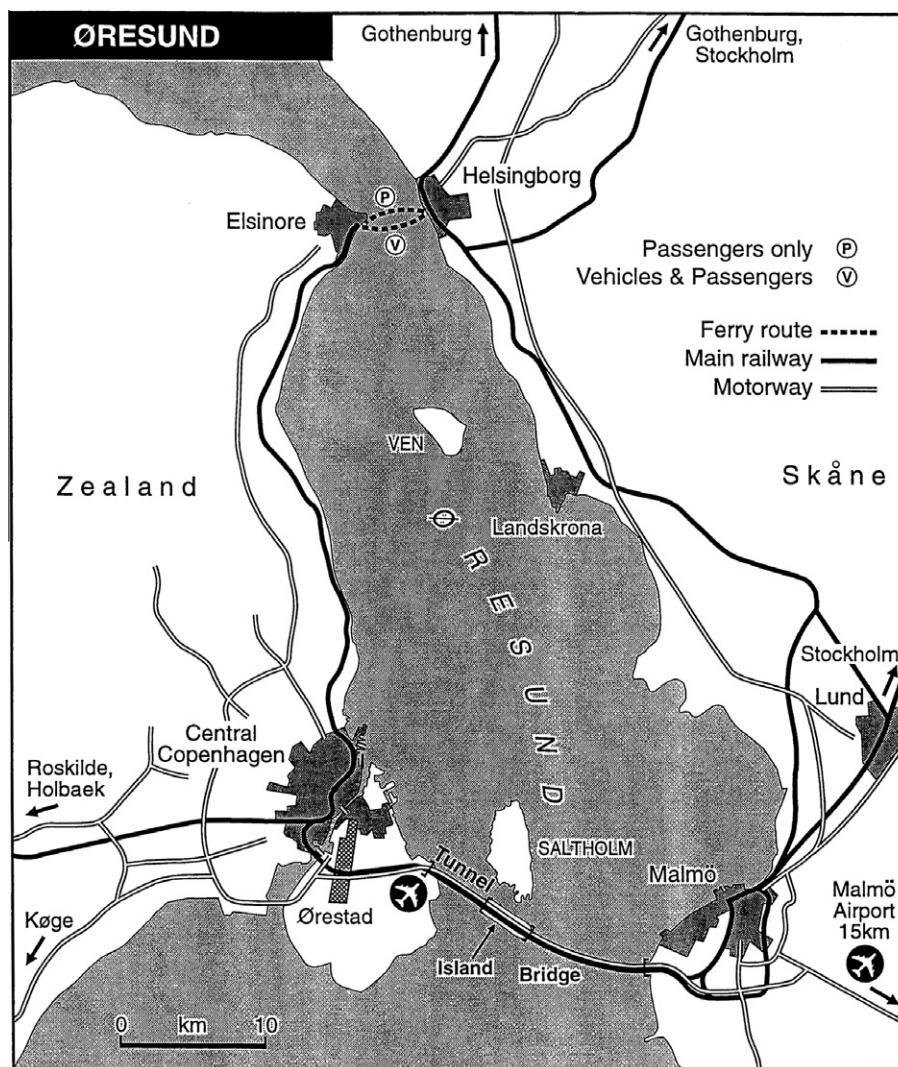


Fig. 3. Øresund: Copenhagen and Ørestad's rail and motorway links via the Øresund Bridge with Malmö and Sweden.

Copenhagen University's Humanities Faculty and on a world-ranked Media City (DR Byen) anchored by the Danish Broadcasting Corporation (DR) and a new IT University (City of Copenhagen, 2003; Ørestad, 2001). These partners have created Crossroads Copenhagen to provide an international network for culture, media and communication technology. Media City also contains multi-media facilities and a 1600 seat concert hall which opened in 2009 (DR Byen, 2002). Between 2005 and 2007, DR and its 3000 employees were relocated from 10 separate but cramped sites in Copenhagen's CBD.

Copenhagen University's expansion at its Ørestad North site relieves pressure on its historic campus sites in the CBD. Its current numbers of 17,000 students and 800 staff in Ørestad North will increase when computer science, theology and law studies move into new buildings being built to replace the site's original pre-Ørestad University buildings by 2013 (BY&HAVN, 2010b). The adjacent IT University has 1500 students and 400 staff. This area has developed into Copenhagen's research and development centre of global importance for culture, media and communication technologies. There is also a shared use sports centre and two office developments including a relocation of the architects firm Arkitema's headquarters from its previous Copenhagen harbour location in Søndre Frihavn. Ørestad North also contains 507 student residences and 506 dwellings which are a mixture of family dwellings, social housing units and apartments. Most students live in other

parts of Copenhagen or Frederiksberg and commute by Metro, Metro and train, Metro and bus or by bicycle.

6.2. Amager Common District

City Park includes existing wetlands to be "conserved managed and integrated in the new town" (City of Copenhagen, 2003, p. 70) and the man-made green wedge alongside Ørestad. Urban developments within Amager Common District near the Sundby Metro station are Amager Psychiatric Hospital, and the Solstriben housing development within the narrow strip to the east of the Metro line (Table 2) (Ørestad, 2006). The small Ørestad Friskole (Free School) and a daycare centre are located further north. With only six completed developments totalling 65,800 m² of floor space, this is the least developed part of Ørestad. Extensive housing development to the west of the Metro line has intentionally been designated by the Development Corporation BY&HAVN as the last section of Ørestad to be developed.

6.3. Ørestad City

Ørestad City is served by two Metro stations, a regional railway station and a motorway. Regional trains and the motorway connect Copenhagen and Ørestad with Copenhagen Airport and on to

Four districts

Ørestad Nord

Ørestad Nord is the most developed part of Ørestad. The district is a mixed town including residence halls, apartment buildings and DR Byen, the IT University and the University of Copenhagen, Amager. The large institutions have turned the town into an international research and development centre for culture, media and communication technologies.

The Amager Fælled District

Only the eastern part of the Amager Fælled District has been developed. This is the location of Amager Hospital, the residential area of Solstrøben, Ørestad Friskole, and the day-care centre of Småland. The western part of this area will be the last developed section of Ørestad.

Ørestad City

Ørestad City has already been inhabited by families moving into apartment buildings and by a number of businesses. The natural focal points of the district are Kay Fiskers Plads at Ørestad Metro and the Regional Train Station as well as the city park with its many surrounding dwellings. Ørestad City is also the location of the large shopping centre of Field's. Immediately west of the district, one of Europe's best golf courses is being laid out.

Ørestad Syd

Ørestad Syd will become a dense and varied urban community including businesses, residential areas, shops, schools and other public services. Ørestad Syd will be the most populated district of Ørestad. Some 10,000 people will move into this district, which will also become the professional basis for another 15,000. To the west and the south, Ørestad Syd borders on the Kalvebod Fælled District. Some of the sites of Ørestad Syd have already been sold and the first constructions will emerge in 2007/08.

➔ www.orestad.dk

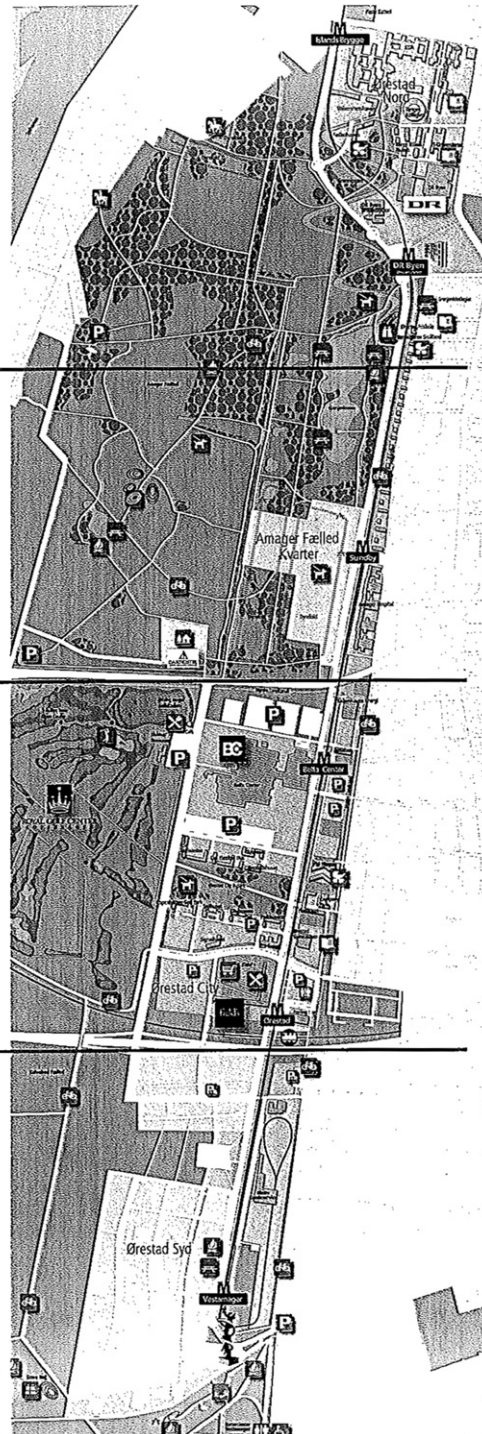


Fig. 4. Ørestad's Four Urban Districts: Ørestad North, Amager Common, Ørestad City and Ørestad South. Source: BY&HAVN (2009a).

Malmö in southern Sweden via the Øresund Fixed Link (Fig 3) (Knowles, 2006b; Knowles and Matthiessen, 2009). The Bella Center Metro station to the north of Ørestad City serves the pre-existing Bella Center convention and conference venue and the 814 room Bella Sky Comwell hotel, which opened in September 2010, to the west of the Metro line and the new residential development to the east (BY&HAVN, 2011).

The Ørestad Metro and regional railway stations and the motorway serve a high density commercial district directly accessible from both Copenhagen and Malmö (Fig. 3). In Ørestad City much higher densities of development can be achieved as, unlike in the

historic CBD, 8+ storey buildings and higher densities are permitted as ODC (now By og Havn) has been allowed by City of Copenhagen Planning Department to plan and regulate land development (Book et al., 2010; Ørestad, 2001). However early development was very slow due to low demand from the private office sector which preferred waterfront sites in Copenhagen's harbour and Ørestad City acquired a reputation as a deserted city. The Swedish pharmaceutical company Ferring relocated from Malmö, Copenhagen and Kiel in 2002 to a 20 storey office tower at the crossroads location next to Ørestad's Metro and regional stations and motorway but for several years remained isolated from other

Table 1
Ørestad North's Development 2010. Source of data: BY&HAVN (2010a).

Site	Size (m ²)	Date	Use
1. University of Copenhagen	40,000	August 2002	Humanities Faculty: 5000 students
2. DR Byen	136,000	November 2005	Multimedia and Concert Hall ^a
8. IT University	30,000	September 2004	IT University; 3000 students
9. Karen Blixen Parken	20,700	April 2004	Housing: 212 family dwellings
11. Tietgenkollegiet (Hall)	25,000	September 2006	University residence: 400 dwellings
12. Bikuben Kollegiet (Hall)	6800	September 2006	University residence; 107 dwellings
19. Fælledhaven	13,000	December 2005	114 Social housing units
20. Universitetshaven	19,000	August 2006/7	170 Apartments
32. Metropolen	9500	October 2010	7 Storey office building and shops
50. Mikado House-Arkitema	18,000	April 2010	Relocated HQ, offices and cafe
Ørestad North	Total: 318,000		

^a Opened January 2009.

Table 2
Amager Common's Development 2010. Sources of data: BY&HAVN (2009a, 2010a).

Site	Size (m ²)	Date	Use
6. Amager Hospital	17,000	November 2001	Psychiatric Hospital: 110 patients
14. Solstriben	15,000	August 2004	91 Apartments and 55 houses
15. Horisonten (Phase 1)	26,000	April 2007	180 Apartments
23. Småland day care centre	700	April 2004	44 Children
36. Ørestad Friskole	1800	January 2006	Private independent school
53. Danica	5300	October 2009	Office complex
Amager Common	Total: 65,800		
15. Horisonten (Phase 2)	7600	Proposal	Apartments
? west of Metro line	c190,000	Conceptual	Housing
Amager Common	Planned: c197,600		

development (BY&HAVN, 2009a). The area lacked street life and local shops and amenities reinforced by the controversial decision to build an American-style out of town indoor shopping centre, called Fields, with blank walls on the most accessible site next to the motorway and to the Metro and rail stations (Majoor, 2008). Fields obtained a Government exemption from a moratorium on out of town shopping centres justified by the need to stimulate development in Ørestad (Book et al., 2010). This was despite Fields encouraging an increased dependency on car use (car 67%; metro 18%, train 3%, bus 3%, bicycle 3% and walking 3%) which is contrary to Ørestad's sustainable development goals. The non-car modes should increase as Ørestad's employment and population grows.

By 2010 however Ørestad City was becoming a successful mixed development with over 500,000 m² of developed sites in use or under construction including many offices, a mixture of housing types and several local shops, and a further 195,000 m² planned (Table 3). To the west of the Metro line is Fields, Scandinavia's largest indoor shopping mall, high rise office development, housing and a local park (Ørestad, 2002). A new golf course will be developed in the green wedge to the west (Ørestad, 2006). To the east of the Metro station are Ferring, pension fund KLP Ejendomme, Ørestad's new Gymnasium (Senior High School), a multi-storey car park and new dwellings (Table 3). The Gymnasium is the most popular secondary school in Copenhagen and most students commute there by Metro or rail. Nearly 2000 apartments and houses have now been built in Ørestad City with a socially mixed community of owner occupied, private rented, social and senior citizens' dwellings.

6.4. Ørestad South

Ørestad South is served by Vestamager and Ørestad Metro stations and is designed to become a densely populated mixed community including homes for 10,000 people and jobs for 15,000 (Ørestad, 2006). Almost one third of Ørestad South's development

is completed including Rambøll engineering, Telia communications, a Crowne Plaza hotel, the temporary headquarters of DI (Danish Confederation of Industry), the Metro depot, 755 dwellings and a further 334 apartments to be completed in 2012 (Table 4). Future development has space allocated for office complexes, hundreds of new dwellings, a school, shops, public services as well as a local park and a sports arena and hotel. The sites for the 20 storey Copenhagen Towers/World Trade Center Copenhagen complex and the Ørestad Business Center are both located in the northern part of Ørestad South near to Ørestad Metro and rail stations and motorway (Ørestad, 2008).

6.5. Ørestad's Development Targets

Ørestad's physical development is ahead of its 30 year 1995–2025 schedule. By 2007, 53% of its development land had been sold, mainly to private developers (Port and City Development Corporation, 2007). By September 2009 land sales agreements had been concluded with companies and institutions for 57 sites in Ørestad and most of Ørestad North and Ørestad City had been developed (BY&HAVN, 2009a). By 2010, 59% of Ørestad's development (over 1.1 million m² out of Ørestad's total of 1.86 million m²) had been completed or was under construction (Table 5) (BY&HAVN, 2010a).

Ørestad New Town was designed to provide 60–80,000 jobs, 20,000 education places and dwellings for 20,000 people in the 30 years to 2025. At the half way point in 2010 Ørestad was well behind its jobs target, partly because of the 2008 global economic recession and competing development sites on Copenhagen's regenerated waterfront and in Malmö. 10,000 jobs had been established by 2006/7 and 12,000 by 2010 (BY&HAVN, 2010b; Ørestad, 2006). The jobs target relies heavily on securing private sector investment to build Ørestad Downtown, Ørestad Business Center and Phase 2 of Copenhagen Towers. In contrast, Ørestad has

Table 3
Ørestad City's Development 2010. Source of data: BY&HAVN (2010a).

Site	Size (m ²)	Date	Use
3. Fields Shopping Mall	178,000	March 2004	150 Shops, restaurants and leisure
4. Ferring pharmaceuticals	15,000	January 2002	20 Storey office tower: relocated
4a Neroport	10,500	October 2009	Skandia and Bombardier offices
7. KLP Ejendomme	29,000	September 2003	8 Storey office complex
10. Company Park	5300	May 2002	4 Storey office complex
16. Ørestad Gymnasium	12,400	August 2007	Senior High School: 800 students
17. Parkhusene	15,100	July 2005	120 apartments and Netto store
18. VM husene	25,400	2005	212 Apartments and day care (48)
21. Københavns Energi	13,500	January 2005	Relocated: 550 employees
22. Porthuset	14,100	July 2007	165 Apartments and shops
24. Brohuset	12,000	October 2007	123 Social housing units
25. Sejlhuset	12,000	March 2008	128 Social housing units and day care for 60
26. Signallhuset	8300	August 2006	288 Young housing units
27. City Husene	12,800	April 2007	125 Apartments
28. Copenhagen Golfpark	16,000	March 2007	149 Apartments
29. Bella Hus	5900	March 2007	63 Dwellings and clothing store
30. Det Flexible Hus	12,000	July 2007	124 Dwellings
31. Ørestadshuset	12,600	September 2007	127 Apartments
33. School	10,000	End 2011	Primary and Junior High School
34. AAB	9000	Building 2010	88 Pensioner social housing units
37. Golfpark and Fairway City	29,900	December 2007	Apartments and offices
38. CERACO	10,000	Building 2011	Office complex
39. KLP Ejendomme	26,100	August 2008	Office complex
40a CABINN Metro Hotel	12,000	July 2009	710 Room hotel
47. VM BJERGET	10,200	July 2008	80 Dwellings, 480 car park and shop
56. Winghouse	11,500	May 2010	Offices
Ørestad City	Total: 528,600		
35. KLP Ejendomme	50,000	Proposal	Office complex
40. Ørestad DownTown	100,000	Planning	Commercial
55. Nordkranen/4D	26,000	Proposal	Commercial and housing
Ørestad City	Planned: 176,000		

Table 4
Ørestad South's Development 2010. Source of data: BY&HAVN (2010a).

Site	Size (m ²)	Date	Use
5. Telia	1900	1999	Telecommunications
13. Keops Development	9000	Building 2010	Commercial complex
44. Lake City (Stage 1)	c12,000	Early 2011	36 House and 83 apartments
45. 8-Tallet	59,000	Jun 2010	476 Dwellings and child care
46. Stævnen	20,000	March 2009/11 ^a	Commercial and 160 apartments
48. Copenhagen Towers	c29,200	November 2009	Phase 1: hotel, DI and offices
51. SEB Pension/Rambøll	40,000	August 2010	Relocated HQ offices
57. Sheltered apartments	11,500	Early 2012	114 Sheltered apartments
58 Residence (Hall)	5100	Mid 2012	120 Students and young
Ørestad South	Total: c187,700		
40. Ørestad Business Center	105,000	Planning	Commercial
41. Arkaden	16,500	Building rights	180 Apartments
42. Site 3.1	20,000	Building rights	Dwellings and commercial
43. Frikvartnet	23,000	Proposal	Housing and commercial
44. Lake City (Stage 2)	c12,000	Planning	211 dwellings
48. Copenhagen Towers (2)	c100,000 ^b	Planning	Offices, restaurants and shops
49. Klasi Holistic House	17,300	Proposal	Wellness centre and hotel
52. Hannemannsparken	84,500	Concept	Housing and commercial
54. School	8000	Proposal	Primary and Junior High School
Ørestad South	Planned: c386,300		

^a Phase 2: early 2011.

^b Phase 2: 3 integrated 20 storey towers and 7–9 storey blocks.

already nearly fulfilled its target of education places in universities and schools and will exceed them by 2013.

The housing target was always planned to be mainly achieved in the 2010/25 period with the release of sites in Ørestad South and Amager Common. Therefore the resident population of 6839 at the beginning of 2011 is on or even ahead of target and consists largely of families with children (BY&HAVN, 2011). One third of Ørestad is allocated for parks, green areas, lakes and artificial canals whilst large scale leisure space, 'peace and tranquillity' are next door to the west and south in Amager and Kalvebod's nature

reserves within West Amager's green wedge (Ørestad, 2006). This helps Ørestad to attract disproportionately more young people to live there, mainly high income families with high educational attainment and young children (Ørestad, 2010).

7. Ørestad's transport links, activity sites and modal switch

Ørestad is marketed by its Development Corporation By & Havn as an extension of Copenhagen's CBD "less than 10 min away from

Table 5
Ørestad's Development 2009. Sources of data: BY&HAVN (2009a, 2010a).

Site	Developed floor space (m ²)	Planned floor space (m ²)
Ørestad North	318,000	Completed
Amager Common	65,800	c197,600 ^a
Ørestad City	528,600	176,000
Ørestad South	c187,700	c386,300
Total	1100,100	759,900

^a West area + Phase 2 Horisonten residential development.

historic Copenhagen" (Ørestad, 2006) just as in the UK, Canary Wharf is marketed as an extension of the City of London and Salford Quays is marketed as an extension of Manchester's CBD. Ørestad is also marketed as the geographic centre and pivotal point of the 14,000 km² Øresund Region with excellent international accessibility both from close proximity to Copenhagen Airport (10 min from Scandinavia's main airport) and Malmö in Sweden (29 min by train or car via the Øresund Bridge) (Fig. 3) (BY&HAVN, 2008; Ørestad, 2001).

Ørestad is designed to be highly accessible by public transport and bicycles. Car parking within Ørestad is restricted both for residents and visitors and is largely confined to multi-storey car parks. Residential parking permits in Ørestad City and Ørestad South are 975 Danish Kroner per month (ØrestadsParkering, 2006).

Metro Line 1 opened in 2002 linking Ørestad with an underground route through Copenhagen's CBD (Fig. 2). It was extended in 2003 out through Frederiksberg on a converted 'S' train line to Vanløse. Metro Line 2 serves east Amager and was extended to Copenhagen Airport in 2007 (Vuk, 2005). Copenhagen Airport attracts most Line 2 extension passengers and intermediate stations have attracted few passengers. Both Metro lines operate a 4 min frequency service and interconnect with high frequency A-line city buses. Initial effects of Metro in 2002–2003, when only its first phase was in use and initial operating problems were being resolved, showed 10% of trips by Metro, 35% by bus and train and 55% by car, compared with 65% by car before Metro opened (Vuk, 2005). By 2009 Metro usage on the two Metro lines had grown to 50 million passengers a year, more than half the total on the whole suburban 'S' train network (90.9 million) serving the 5 Finger Plan corridors. Daily Metro traffic to Ørestad's six stations grew by 55% from 16,995 in January to June 2007 to 26,399 in January to June 2010 (Metroselskabet, 2010). Nørreport, is the origin for about 40% of all Metro passengers to Ørestad's six stations, where they interconnect with 'S' train, rail services and buses in Copenhagen's most heavily used station (Table 6) (Metroselskabet, 2010). Kongens Nytorv and Christianshavn in the city centre are the next most important origins and destinations for Ørestad's Metro traffic.

Table 6
Ørestad's Metro main daily origin–destination traffic. Source of data: Metroselskabet (2010).

Metro Station	Top origin Station	2nd Origin Station	3rd Origin Station
Islands Brygge	Nørreport 1975	Kongens Nytorv 1376	Christianshavn 703
Universitetet	Nørreport 1781	Christianshavn 585	Frederiksberg 289
Sundby Bella Center	Nørreport 472 1421	Kongens Nytorv 199 367	Christianshavn 195 308
Ørestad	Nørreport 2349	Christianshavn 1066	Kongens Nytorv 858
Vest Amager	Nørreport 1816	Ørestad 1294	Kongens Nytorv 443

Ørestad station provides an interchange between Metro and the main railway services linking Copenhagen, Airport, and Malmö in Sweden via the Øresund Bridge and makes Ørestad City the most accessible site in the new town (Fig. 3).

This international accessibility is illustrated by evidence from the pharmaceutical company Ferring located in Ørestad City next to stations and the Øresund motorway (Dyhr, 2011). Nearly a third of Ferring's employees commute daily from Sweden. Three quarters of its Swedish employees travel to work by rail and one quarter by car over the Øresund Bridge. Just over half of its Danish employees travel to work by metro, rail or bus, 37% by car and 10% cycle (Table 7). A total modal share of nearly 60% by public transport and 7% by bicycle and just one third by car demonstrates that Ørestad's urban development is sustainable.

Rambøll, an international engineering, design and consultancy company, relocated its Headquarters and Danish operations in August 2010 from Copenhagen city centre (400 employees) and Virum (1200 employees) in north Copenhagen to a site next to Ørestad Metro station and close to the Øresund rail station and motorway. Mean travel distance increased by 28% from 17 to 23 km but 93% of employees live within walking distance or a 3 km bicycle ride of a train station and 18% can now travel by train from their home station to Ørestad station (Petersen, 2010). Rambøll's travel survey of 1107 employees in March 2010, prior to relocation, predicted a strong modal shift from car to public transport at their new Ørestad site (Table 8).

Car commuting was predicted to decline from two-thirds to 40% in summer and just over half in winter but actually declined to 49% in Rambøll's November 2010 survey. Car's modal share will decline further after Rambøll's agreement to pay employees' car parking charges of 600 Danish Kroner per month for the first 3 years in Ørestad expires (Agerlin, 2011). The City and Harbour Development Corporation (BY&HAVN) faces a dilemma; whilst Ørestad is a transit-oriented development, they collect the revenue from car parking charges.

The sustainability of Rambøll's Ørestad New Town site is shown by the large switch from car commuting to public transport, mainly by rail and metro, compared with their previous sites in Virum and the CBD. 39% commuted by public transport in November 2010 close to the prediction of 38% in summer and 42% in winter (Table 8). Cycling is weather sensitive with a predicted 20% cycling modal share in summer but just 5% in winter. In the November 2010 survey 12% cycled to work. Rambøll's Travel Plan (Rambøll Mobilitetsplan for Ørestad) is partly funded by the Danish Road Directorate (Vegdirektoratet) to encourage bicycle use with covered bike parks, dedicated bike routes, free laptop bags, helmet and breakfast for bicycle users and bike repair facilities at work (Agerlin, 2011). Denmark allows bicycle costs and public transport season ticket loans to be tax deductible but so are car commuting costs including bridge tolls. Fewer than 10 out of 1600 Rambøll's recently relocated employees commute from Sweden but this number is likely to grow because of the accessibility of its new Ørestad location.

An internet survey of commuting by Rambøll and Dansk Industri's employees in January and February 2011 confirmed that the number of public transport (metro, train and bus) commuters had grown since these organisations had relocated to Ørestad (Metroselskabet, 2011). 55% of Dansk Industri's employees now

Table 7
Ferring: Employees' Journey to Work by mode 2011. Source of data: Dyhr (2011).

	Employees	Public transport	Car	Bicycle
Denmark	291 (68.5%)	153 (52.6%)	108 (37.1%)	30 (10.3%)
Sweden	131 (31.5%)	99 (75.5%)	32 (24.5%)	0
Total	422	252 (59.7%)	140 (33.2%)	30 (7.1%)

Table 8

Rambøll: Employees' Journey to Work by mode 2010. Sources of data: Agerlin (2011) and Petersen (2010).

Main mode yesterday March ^a (%) (n = 1107)	Ørestad: predicted for summer (%)	Ørestad: predicted for winter (%)	Ørestad: November ^b (n = 1040) (%)
Car	66.7	40.6 (–26.1)	51.3 (–15.4)
Bicycle	15.8	20.2 (+4.4)	5.2 (–10.6)
Public Transport	15.5	37.8 (+22.3)	42.4 (+26.9)
Other	2.0	1.5 (–0.5)	1.1 (–0.9)

^a At Virum and CBD prior to relocation in Ørestad.^b Mild day so higher bicycle usage.

use public transport daily (38% previously) and 79% weekly (53% previously) and only 3% never (13%). 27% of Rambøll's employees now use public transport daily (9% previously), 45% weekly (17% previously) and 19% never (49% previously). Daily use of the adjacent Ørestad Metro station grew by 0.8 million between 2010 and 2011. The daily increase from 5289 to 6509 Metro passengers is mainly the result of Rambøll (701) and Dansk Industri (308) relocating to Ørestad. This shows the importance of developing large scale employment sites to Metro's usage and revenues with Metro fare income an important funding source for the repayment of the 30 year Government loans taken out in the 1990s to fund Metro's construction.

8. Effects of Ørestad's development on Copenhagen's CBD

International competitiveness is increased by investment in modern integrated public transport systems (Docherty et al., 2009). Ørestad has helped to improve Copenhagen's international competitiveness by expanding its CBD and developing highly accessible sites for office, media, retailing and leisure activities. The large investment in mass transport infrastructure in the central parts of Greater Copenhagen has increased its accessibility and encouraged commuting from a much wider area including 19,380 commuters a day from the Malmö area of southern Sweden, 55% of them by train (Øresundsbro Konsortiet, 2010). This investment helps to counteract the deconcentration forces of suburbanisation facilitated by private car ownership and use. Ørestad has also helped Copenhagen to expand its catchment area into southern Sweden especially by attracting major commuter flows from Malmö via the Øresund Fixed Link to thousands of new office jobs and university degree courses. Ørestad has also relieved pressure on Copenhagen's CBD by relocating major and expanding land uses such as the Danish Broadcasting Corporation, part of the University of Copenhagen and IT colleges and businesses such as Ferring, Rambøll, Københavns Energi and Arkitema. Ørestad's new residential districts are located in attractive natural environments and are very accessible with much shorter trip times and lengths to the CBD than most of the much more distant Finger suburbs.

9. Conclusion

Ørestad is an important and successful contemporary example of planned sustainable TOD. It builds on the principles of Copenhagen's renowned 1947 Finger Plan in creating transit-oriented development of jobs, housing and retail, education and leisure facilities. Whereas the Finger Plan was delivered in an era of low car ownership with little competition for rail transport commuting, Ørestad's development has to attract commuters, residents and shoppers to choose public transport or cycling when many of them have the option of using private cars. Ørestad has helped Copenhagen to increase its international competitiveness, attract substantial inward investment and create thousands of new jobs. Ørestad's location at an international crossroads on the Øresund Fixed Link railway and motorway routes, as well as its local acces-

sibility via Metro into Copenhagen, has also helped to expand Copenhagen's catchment area.

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