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The Fourth Crisis in Urban Transportation

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THE FOURTH CRISIS

IN URBAN TRANSPORTATION

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I wonder what Frank Pick would think about it all. He would be bemused, surely, that nearly half a century after his death, here in London, transport has become a major issue -- often the issue -- of the day. Many of you, who travel widely, will know that this is not a unique London problem, though sometimes the media would cause you to think so. In city after city, across the world, it is the same story. Public opinion polls in major American cities, for instance, show that people there are more concerned about congestion than about anything else.

The reasons are not hard to find. One of the longest and strongest booms in the history of the capitalist economy has brought sudden increases in car ownership and car traffic. Major structural changes in the global economy have created new office jobs both in downtown areas and in suburban centres, which have sometimes mushroomed on green fields. Tourism has become a major source of urban income and of urban traffic demand. As a result, commuter and business traffic has burgeoned on central and inner-urban subway systems, and on suburban roads that were never built for these purposes or for these traffic volumes.

The result has been increasing strain. Traffic speeds, which had tended to rise or at least stabilize through improved traffic management techniques, have often shown sharp deterioration. The motorway and trunk road systems built in the 1950s and 1960s, in particular, have proved incapable of meeting

the demands placed on them in the 1980s. Traffic management seems to have reached some kind of limit, at least temporarily, and in many cities enforcement systems are almost ineffective. Equally, the older urban underground or metro systems, typically dating from the turn of the century, have suffered from a combination of increased patronage, deteriorating physical condition, and need for comprehensive renewal.

In London, traffic has steadily increased -- across the boundary cordon, by more than 2 per cent a year since 1976. Though speeds have not fallen as dramatically as some would think, there has been a marginal deterioration which, given the delicately poised nature of the system, can easily lead to breakdown. In California, the State Transportation Commission has estimated that traffic congestion results in 75 million lost hours annually within the state -- the equivalent of 8,000 Californians spending an entire year in a freeway standstill. In Los Angeles alone, 78.3 million hours were spent in traffic jams; that translates into roughly one-half billion dollars of lost time annually, or about $67 per capita per year. The costs of congestion are mounting, not only in the way of lost leisure time, but also in terms of increased day-to-day stress, declining worker productivity, and a deteriorating quality of life. Everywhere, the twentieth century equivalent of the man on the Clapham omnibus is convinced that things have got a lot worse; and almost certainly he or she is right.

Cities out of Kilter

My argument is that this is nothing new. If we take a broad historic sweep, we see that it is an endemic urban condition. Pick was saying it about London in numerous lectures he gave to audiences like this one in the 1930s. In a classic paper more than thirty years ago, the economist Colin Clark argued

that -- at least since the first industrial revolution in England, two hundred years ago -- the growth of cities had been shaped by the development of their transportation facilities. But these in turn were dependent on the evolution of transportation technologies. Thus the relationship was a mutual one: at any stage, the pattern of activities and land uses in the city, and the transportation system, existed in some kind of symbiotic relationship. But, Clark stressed, the two could get out of step, and indeed very often did so. That was particularly the case, because invariably, cities change more slowly than the available technologies change. In European cities, particularly, the constraints of the past hang heavy: the street pattern goes back to the middle ages or beyond.

The first such crisis of urban transportation happened around 140 years ago. At that time, most cities -- even the biggest ones -- managed virtually without what we would today regard as a transportation system. People had to get around on their own two feet, which meant that they had to crowd together close to their work. The result was cities that by our standards were extraordinarily small and dense -- hence the Dickensian overcrowding and squalor of the mid-nineteenth century city.

The answer to that first crisis, as you all know, was the steam commuter railway and the horse bus and tram. Steel wheels on steel rails were a great technological development, which reduced the frictional resistance of travel and made it possible to shift bulk goods, but also bulk loads of people, over land. But these technologies still contained an inbuilt contradiction: horse trams and horse buses allowed only limited suburban extension of the city, because they were very slow. Steam-powered commuter railways were better, but they accelerated slowly, so the result was more or less discrete blobs around the stations. There was a second crisis around the 1880s: the middle classes

were escaping the city but the ordinary worker was trapped, hence the great housing debate of that time.

The solution to the second crisis came around 1900 with new technologies. Electricity was applied to propelling trams and commuter trains. Underground railways were constructed in the biggest cities, and soon they were extended above-ground to serve new suburban rings, as classically seen in London. The internal combustion engine was put into the bus, and the horses were retired; the buses, as reorganized by Frank Pick in London Transport, fed the trains. The result by the 1920s and 1930s was a new kind of city, which we can call the classical public transport city. In the biggest cities like London, Paris, Berlin, and New York, there would be full-fledged underground or metro systems extending outwards perhaps ten or twelve miles; commuter railways would extend the zone of feasible commuting as far as twenty miles or more. Because electrified commuter trains could stop more often, the result was a more even spread of development: the first suburban sprawl.

However, this was controlled sprawl: radial sprawl. The lines converged on a traditional central business district. Pick, who was always crystal clear about everything, always emphasized the fact: London in the 1930s, the London that Albert Stanley had created, was a city in an uneasy kind of equilibrium: it already extended out as far as the tube and the classical Southern Electric would go, and beyond that there existed what Pick believed to be the ultimate nightmare: the outward movement of industry would bring what he called "an amorphous mass of building" in which "London's country would suffer from a confluent pox . . . layering first industry and then residences . . . indefinitely, but that would not be London."

Pick may have had Los Angeles in mind. If you look at old pictures of L.A. from the 1920s, you will see that the downtown streets looked like those

of New York or Chicago, and there was the same congestion on them. But you will also notice very many more cars than in those other cities, and if you look at contemporary pictures of suburbs like Glendale, you will see very many more: rows and rows of Model Ts parked along the sidewalks. In fact, Los Angeles already had the same car ownership by 1924 that it took most of America until the 1950s to reach, and Europe the 1970s to achieve: about one car to every two households.

So, before any other great city of the world, Los Angeles began to experience the third great crisis of urban transportation that every other place was sooner or later to experience. The Angeleno answer was typically innovative: it was to let the public transportation system atrophy, and to consciously become an auto-oriented city. Some thirty years later, in the 1950s, the other cities of the world followed; Pick would have turned in his grave. But only a few major cities, all of them in the American west -- Los Angeles, Phoenix, Salt Lake, Dallas -- effectively went the route of full motorization. To achieve this, they had to restructure themselves radically or develop from the start in a new way, as in a city like Phoenix. The key was low-density dispersal not merely of homes but also of jobs; to work like this at all, a city must have no big downtown employment concentration.

But in London, as in New York and Paris and Tokyo, when they tried to go the same way, the story was different. These cities kept strong downtowns, and in the great redevelopment boom of the 1960s they often became stronger still. The result was that they could not adopt full motorization on the Angeleno model. In the words of Michael Thomson, they are "strong centre cities": they have one million and more downtown office workers crowded into an area typically ten square miles or less. And this makes them rail dependent: they depend very largely on their nineteenth and early twentieth century rail

systems to get people to work, because only rail systems can handle those kinds of flows along corridors: up to 40,000 people per hour on one lane or track.

This kind of city is essentially a hybrid city, because outside these dense cores it tends to be as car-dependent as the Los Angeles type of city. Everywhere, only a minority of the total metropolitan area workforce works in the central area, and very commonly that workforce is static or shrinking. There are suburban clusters of offices and shops, and these are growing. These clusters are highly car dependent, and often have weakly developed public transport systems (though that varies greatly from one city to another, and European cities in particular have better suburban public transport -- a point to which I shall return). Further, the people who live in these suburbs use the car almost exclusively in all their non-work journeys: for shopping, entertainment, recreation, and weekend social life. So, in effect, such urban areas have two transportation systems: one used by a minority of commuters and a small group of carless people, one used by virtually everyone else and indeed by the commuters outside commute hours.

And here the story ends. For the truly remarkable fact, in terms of the Clark analysis, is that there has been virtually no fundamental development in intra-urban transportation since 1890. Cities essentially exist on the basis of the same bundle of technologies as was available in the 1880s -- the internal combustion engine and electric traction -- even though one of these has greatly diffused since then. It is not surprising that percipient observers such as H.G. Wells already foresaw the shape of the late twentieth century city at the start of the century.

And meanwhile, quite dramatically, the system has broken down. We have a fourth great crisis of urban transportation. Pick would certainly have predicted it; perhaps, tucked away among his papers, he did. Everywhere in the world,

the dream of universal congestion-free automobility has proved a will-of-the-wisp: from Los Angeles to Stockholm, cities are gridlocked. And particularly, we see emerging everywhere the condition that my Berkeley colleague Robert Cervero has called suburban gridlock. But the strange point this time is that the development of the city has not lagged the development of the transportation; it has actually got ahead of it. Yet the result is the same: the available transportation technologies are not meeting the demands of the cities and their people. Cities are again out of kilter, as they were in the 1850s and the 1880s and in the long period that began in California in the 1920s and in most of the rest of the world in the 1950s.

The Underlying Shifts

That gets us approximately to the present day, for which you may feel some relief. In terms of the Clark hypothesis, what we now find is the following: the technologies are stuck in the mould of 1900, but meanwhile cities are changing. They are fulfilling the remarkable prophecy made by the American planner Clarence Stein in his paper Dinosaur Cities, in May 1925: they are turning inside out.

The first trend, long familiar since at least the 1950s, is the outward movement of people from central cities to suburbs. Especially in fast-growing areas like California, this process has produced a continuing outward suburban roll, taking the urban fringe 30, 40, even 50 miles from downtowns. Inner-city populations have continued to thin out, and the main commuter demand has continued to shift to increasingly distant suburbs, with demands for longer-distance travel -- which, in extreme cases such as London and Tokyo, may now extend up to 100 miles each way on high-speed inter-city trains. Paris still seems immune from this phenomenon: property prices in and around Le Mans,

served by the new TGV Atlantique since summer 1989, show no effect as yet, but maybe it is just a matter of time.

The second and newer trend is the parallel deconcentration of employment. True, employment in central commercial cores has at least stabilized and often increased somewhat. But this is as nothing to what has been happening elsewhere. The 1970s and above all the 1980s have witnessed the development of huge suburban office complexes in the suburbs of New York, Boston, Atlanta, Dallas, and San Francisco. Northern New Jersey now has more office space than the Chicago and Los Angeles downtowns. Currently, over 60 percent of all office floorspace in the U.S. is outside of downtown cores, up from 25 percent in 1975.

The main result is a dramatic increase in suburb-to-suburb commuting, which -- as Robert Cervero has shown -- now makes up over one-half of all journeys to work in the U.S. today. The traditional radial linkage patterns are increasingly overlain by a multitude of circumferential and criss-cross journeys from suburb to suburb. Increasingly, the "desire line" maps of today look like thousands of pick-up sticks dropped on the floor -- trips flow from everywhere to everywhere. Such a pattern is impossible to accommodate by fixed rail and almost impossible to meet by any conventional fixed-route public transport system. In the United States in 1980, only 1.6 percent of all journeys to work made within suburbs were via public transport; surely, the share is even less today. But it is equally impossible to handle on conventional highway networks either. While more and more commuters want to make lateral and cross-town trips, most road networks have been designed to funnel commuters downtown along radial lines. Increasingly, commuters are being forced onto the few ring roads and cross-town routes that exist, most of which were never designed to accommodate large volumes: the M25 syndrome, which is shared by every similar beltway around every American city.

And this has been exacerbated by demographic and social changes: the growth of middle-age, dual-worker households has dramatically increased car usage. Working women, for instance, tend to make more chained or triangulated trips (e.g., between work, a child-care centre, and a store), the sort of trips which are almost impossible to make by conventional public transport and therefore become almost totally reliant on the private automobile. With baby boomers entering the more active, mid-stages of their life cycles, more trips are also being produced per capita.

We might expect one benefit from all this: a shortening of journeys to work. On that, the evidence is confusing: from 1977 to 1983, in the United States, the average journey to work lengthened slightly; more recently, there has been a modest reduction. The explanation is almost certainly that at first, high housing costs, plus NIMBY planning policies, forced people to find homes farther from work than they would like or could expect; but that they then found the jobs following them out. Here in South East England, as you know, the zone of maximum population growth is between 60 and 100 miles from London. Employment growth is clustering in a number of cities in this outer ring, some new and expanded towns (Peterborough, Northampton, Swindon), some a result of spontaneous growth (Bournemouth-Poole, Cambridge, Ipswich). Research from Ian Gordon and his colleagues shows that the result is the same as in America: first a growth of long-distance commuting, followed by a fall as a high proportion of these migrants -- up to one-half -- find local jobs. And Paul Cheshire and Dennis Hay have shown that the outward movement was spreading generally to western Europe, including countries that had never previously experienced it: areas like Randstad Holland, the Rhine-Main area around Frankfurt, and the Mediterranean coast of France all demonstrated the same

pattern of outward deconcentration and weak centrality. Everywhere, car ownership and use was gaining at the expense of public transport.

There are some significant differences in this pattern of suburban job growth. Not only in Europe but also in Japan and the older parts of the United States, many of these new suburban jobs are housed in massive redevelopments in the heart of older towns and cities, invariably around commuter train stations: Reading, Stamford in Connecticut 40 miles from Manhattan, Omiya in Saitama 15 miles from Tokyo's Ueno station. They may also go into planned new towns, again next to commuter rail stations: Milton Keynes, the five Parisian new towns, Sha Tin and Fan Ling in the Hong Kong New Territories. All these, whether because of planning or market forces or some combination of the two, are public transport nodes, where commuter rail (and even inter-city rail) interchanges with radial bus routes. And in nearly all of them, a relatively compact pattern of residential development around them gives an advantage to public transport, allowing a substantial proportion of commuters to come in by train or bus.

But other of these new developments, especially in North America, follow a quite different model: they go into new campus-type developments like the Zip Strip in Princeton, New Jersey, some 50 miles from New York, or the I-680 corridor in the San Francisco Bay Area. Some of these American campus developments, like Tysons Corner outside Washington, D.C., or San Ramon-Dublin outside San Francisco, are so huge that they become in effect instant new towns. Tysons Corner, which twenty years ago housed a grocery and filling station, is now the biggest downtown in the state of Virginia. I-680, a highway ironically built to bypass the San Francisco Bay Area, is now lined with office developments, some (Walnut Creek) around existing urban nuclei, other newer examples (Bishop Ranch, Hacienda Business Park) designed as freestanding campus developments. The problem is that, in sharp contrast to the other examples,

they conspicuously lack any public transport service. (San Francisco's BART will get to Dublin in the mid-1990s, ten years after the offices did.)

The result is Robert Cervero's suburban gridlock on a huge scale: a disease uniquely arising from a new pattern of suburb-to-suburb automobile-based commuting. But even in those areas where suburban development takes a more traditional urban form, gridlock may all too readily occur -- as is evident on the highways of Berkshire or Yvelines or Kanagawa. The cause is not campus development in itself; it is the growth of employment in locations which have become almost completely car dependent, and in which public transport can hardly ever rival the automobile in the critical combination of price, time, comfort, and convenience. Hence the perverse outcome, which Peter Daniels noted in his earliest work nearly twenty years ago: decentralizing downtown offices may actually increase congestion, as employees exchange radial rail trips for orbital car trips.

There ought to be some good news in all this. It ought to be that, conversely, commuter loads on inner-urban subway and bus systems have tended to fall. But it has not happened. As everyone here knows, the actual situation is perverse: a 60 per cent increase in Underground traffic in only six years, precipitating an urgent need for major extensions to the network, but only a marginal increase in revenue to pay for the investment. And ridership is up not only on the Underground, but also on Network South East; while traffic on the roads across the London boundary cordon has also been rising.

There are some obvious explanations: the turnup in central London employment after 1985, coupled with the growth of longer-distance commuting over British Rail. But these surely cannot provide more than part of the explanation; there has to be also what the economists call an increasing propensity to travel. One explanation may be a big increase in in-work travel,

associated with greater need for personal contact in today's informational industries. Another may be tourism. A third may be discretionary journeys, for lunchtime shopping for instance, brought about by the Travelcard with its zero-marginal-cost fares. That this last may be significant is indicated by the fact that revenues have not risen by nearly as much as ridership. I stress these points, because no one is going to invest private capital without the most careful analysis of where the revenue is going to come from. As will emerge, the answer to that is somewhat problematic.

What is to be Done?

What then is to be done? The first instinct in dealing with both problems is to throw investment money at the problem: build new tubes or express rail lines, develop light-rail systems, build or extend more highways, weld more rails; build the Jubilee extension and Crossrail and Chelsea-Hackney, widen M25 and then build another one, electrify more of Network South East, build new light-rail systems for every town from Croydon to Milton Keynes. But there are two problems: first, the money is not there; second, even if it were, many of these investments could prove self-defeating.

That said, I want to look at possible answers under two heads. First, answers to the crisis in the centre; second, answers to the crisis -- much larger and less appreciated, in my view -- to the crisis in the suburbs.

Solutions in the Cities

The overwhelming problem is the centres is definitely money. In hardly any case will revenue alone cover the huge costs of building a new commuter rail system and comprehensively upgrading the old one. Some cities bit this bullet: from the 1960s on, they invested massively in heavily subsidized new longer-distance commuter rail systems catering for the new patterns of living and work-

ing. Such systems, like the Paris RER and the German S-Bahn networks, directly connect outer suburban (and exurban) homes with downtown jobs. London has belatedly, but just in time, joined this select club: the recently approved Crossrail link, together with the existing Thameslink, constitute the basis of an RER for London, which by the end of this decade will provide a single system, linking Reading with Colchester and Cambridge, Bedford with Brighton. But even in Paris, the original east-west "A" Line of the RER, opened in the early and mid-1970s, is completely overloaded and a relief line must be urgently provided.

But the era of generous public money is over, except possibly in France. Logically, cities are looking to private development, which is generating much of the extra traffic, to meet at least some of the cost. Historically, of course, that is how railways financed their investments. After all, throughout the heroic period of urban rail building both here and in the United States, that was the primary motive for commercial involvement. The world's first underground railway, the Metropolitan, almost from the first extended itself through land sales conducted by a subsidiary company. Buccaneer capitalists like Charles Tyson Yerkes of Chicago, who came to London to repeat his successes but died before his tubes were opened, provide another model; in California, railway magnets like F.M. "Borax" Smith and Henry Huntingdon were the earliest agents of mass suburban growth. And the model is being revived today. Tokyo pioneered with the huge air-right developments at rail interchanges like Shinjuku. Joint development in various forms is now becoming standard practice in the United States, especially in helping to finance new public transport investments (as in Washington, D.C.), but also in refurbishing old ones (as in New York, where it is being used both on the city subway and on the New Jersey PATH system). London will recoup almost half the cost of the Jubilee Line extension through a contribution from Olympia and York, who need it to serve

Canary Wharf. Even Hong Kong, where astronomical densities make unsubsidized public transport investment uniquely possible, had to use sale of air rights to finance the Island Line of the Mass Transit Railway.

But there are problems. The old Metropolitan model of paying for new rail lines via residential development is nowadays vitiated by the fact that we have a highly organized and highly restrictive planning system. There is no conceivable way of developing new commuter rail lines in the South East in this way -- unless, possibly, the government were to grant permission to developers for major new communities in the Home Counties on the basis of Section 52 agreements to build new lines.

There are two possibilities. The first would be to finance the schemes by commercial developments in the heart of London itself, on the Canary Wharf model. But this would demand development on the Canary Wharf scale. Such development would require a completely new express public transport system like Crossrail, which provides rapid access to a few selective central sites from all points of the compass, thus filling the most obvious gap in London's commuter rail system in the 1990s. It could become a highly visible new element -- perhaps the distinctive new element -- on London's transport map, as were the tube extensions in the 1930s. Above all it will give an extraordinary position of centrality to the Farringdon interchange, which will become the Chatelet-Les Halles of the London RER. So, logically, massive redevelopment in that area ought to contribute a substantial share of the overall cost. But I see no evidence whatsoever that anyone in government has taken the necessary steps to extract development value from this bonanza to pay the cost of providing the very infrastructure that will allow it to happen.

Also, if it is to be achieved in this way, it is going to need a new formula for cooperation between LRT, BR's Network South East, and the private sec-

tor. At present, as the Central London Rail Study only too clearly shows, there is no sense at all of a grand design; instead, we have directly competing proposals from the two public agencies. The model is the Parisian one, where the equivalents -- RATP and SNCF -- cooperate in running what is effectively a single system. There, as so often, the RER was the product of a grand design. If the private sector is to be attracted, we badly need the same quality of vision.

The other possibility for recouping development costs might be new high-speed railways. There are not many opportunities here, because of a rather ironic fact: our Victorian engineers built our railways not for their century, but for ours. So, unlike Japan or France, for the most part we do not need new dedicated track to get high-speed operation -- at least up to that Shinkansen standard, which is 140 mph.

There is, however, a window of opportunity. It is actually a double window. The West Coast Main Line from Euston to Birmingham, Manchester, and Liverpool, the first to have any kind of semi-high-speed operation back in 1966, is now sub-standard. British Rail plan to upgrade the track to Inter-City 225 standard. The Labour Party propose a completely new line on the route of the old Great Central, closed by Dr. Beeching in the 1960s, which could operate at the speeds of the French TGV, which the SNCF plan eventually to take up to 240 mph -- a speed at which London to Manchester would become a 45-minute commuter ride, and Manchester to Paris would become a natural rail corridor. Speeds like this will totally transform geographical space throughout Europe, including Britain. And that means that they will transform development opportunities, making peripheral areas into central ones.

The reason is that the idea of planned new communities is still more popular in the Midlands and North than in the NIMBYist South East. If developers came into a consortium to build the new rail line, it could become the 21st

century equivalent of what Sir Edward Watkin, the entrepreneur who built the Great Central, hoped to achieve along his Metropolitan Railway: a new commuter line, along which London commuters could find homes in Warwickshire, Staffordshire, Cheshire, and even Lancashire. If this sounds fanciful, the idea of opening up west Hertfordshire and southeast Buckinghamshire was equally fanciful in the 1880s. It is all a matter of recognizing the changes wrought by the new technology, and seizing the resultant opportunity. Where is the new Watkyn?

Solutions in the Suburbs

The problem in the suburbs is just as intractable, but less well recognized; which is why I want to spend the rest of this lecture on it. Most public transport investment, however generous, would not even serve the main patterns of demand, while others will probably prove white elephants: there is very little evidence that commuters in low-density suburban areas will abandon their cars for less-convenient public transport, and that will be true even if the quality of the car commute declines quite notably. The reason, first noted with BART, is that people care not about the speed on the line haul but on the total door-to-door elapsed journey time, and on this criterion the car is hard to beat. In particular -- and I have to emphasize this -- many of the light-rail schemes now projected for the South East seem to exist in the realms of fantasy. At the latest count, I counted no less than thirteen such schemes: for Cambridge, Chatham, Chelmsford, Croydon, Kingston, Luton, Maidstone, Milton Keynes, Portsmouth, Reading, Southend, and Watford. Many, though perhaps not all, simply do not answer to the actual travel needs of citizens in these places, which are for dispersed many-to-many journeys. The dismal record of recent rail projects in the United States, which are carrying tiny fractions of

their forecast riders, should cause us all to pause before rushing down this particular solution to our transportation ills.

Better returns, out here, would come from selective road investment: an outer M25, linking the major towns of the Rest of the South East at a distance of about 40 miles from London, perhaps built as a private toll road (as they are doing with a similar outer beltway in the San Francisco Bay Area); and, perhaps even better, short stretches of new road on the congested approaches to the centres of these towns in the Outer South East. They could be privately financed and operated as toll roads, at least at the busy hours, with incentives built in to encourage ride-sharing. In some few places -- Reading is one -- abandoned stretches of old railway could be profitably pressed into service, as has been done so successfully in Edinburgh and in Blackpool. The Blackpool scheme is particularly worth looking at because, though it was built by the local authority, it recoups its costs by parking tolls at the central end of the journey. Just as there, the new roads could simply feed into parking garages, with no access on to the congested town centre streets -- which might indeed aid their pedestrianization.

Beyond the Car

But, as everyone in the room will by now be muttering, roadbuilding by itself is likely to be a self-defeating exercise. It needs to be combined with policies to try to reduce the overall demand for private car travel, and the means to achieve that is by trying to develop a system which could compete with the car on its own terms, supplementing and even eventually supplanting it. I want now to isolate what I think are some extremely interesting developments -- some technological, but mostly organizational -- which I believe presage an entirely new answer to the problem of moving people around in dispersed cities.

Let me outline each in turn, and then try to put them together; in other words, to describe the system I see emerging.

First, Transportation Systems Management. America has taken the lead here: everywhere, carpools, vanpools, and public transport are still being aggressively promoted. Some suburban employers, such as Fluor Corporation in Irvine (California) and Rockwell International in Golden (Colorado) have managed to lure 40 to 50 percent of their workforce into vans, buses, and carpools, by offering such perquisites as travel allowances, free lunches, and gifts. Such schemes can be promoted, indeed are being promoted, by a judicious combination of sticks and carrots, which reward people who use these high-occupancy modes and penalize those who use the single-person no-passenger car mode. HOV lanes can be reserved, for all or part of the day, for High Occupancy Vehicles including buses, taxis, car-pools, and van-pools. Whole expressways can be managed this way, as on I-66 into downtown Washington, D.C., from the western suburbs. Some cities, such as Houston in Texas, are introducing whole networks of these HOV lanes. California has made extensive use of vanpools and ride-sharing generally, and we can see the success of such informal ride-sharing schemes in the commute across the bridge from the East Bay, which is even hurting the local bus system.

Land use policies can also, indeed must also, be enlisted as part of this bundle of incentives. By clustering suburban development around suburban employment nodes, as is done in the 1950s and 1960s Stockholm satellite towns and in our new towns, more people can be brought within walking or biking or bussing distance of job opportunities. Higher densities, mixed-use development, jobs-housing balancing, new town planning, and pedestrian-friendly site designs can be used. Cities like Toronto, Stockholm, and Tokyo all demonstrate how to successfully combine rail public transport investments with new town

development. Bellevue, Seattle's largest suburb, has one of the highest commercial densities of any suburban community in the United States, symbolized by five twenty-storey-plus office towers. It also deliberately restricts car parking provision. And it is the main suburban terminal-transfer point on Seattle's synchronized regional bus network that interconnects town centres. As a result, no less than 27 percent of Bellevue's workforce arrive to work by bus, carpool, or vanpool, a figure far higher than almost any other suburb in the United States. The lesson is that it is possible to adopt a balance portfolio of investments and policies that make it positively attractive to use alternatives to the car.

The second innovation is the growth of demand-responsive transit service. We have heard a great deal about such services, in the form of dial-a-bus or frequently circulating mini-buses (the model used in many cities in developing countries, and now used, since deregulation, in so many provincial British cities) or van or car-pools. In the United States, there has been a remarkable growth in such services in the 1980s for travel between homes, hotels, and airports. The proprietor of one of the largest and most successful claimed earlier this year in the Wall Street Journal that, were he allowed to do so, he could solve suburban America's commuting problem. (I ought to remind you that in that home of free enterprise, public transport is much more fiercely regulated than here.)

These services should be encouraged by fiscal incentives as well as by physical priorities such as special lanes for high-occupancy vehicles. These might indeed be physically separated from ordinary highway traffic and there allowed to operate at higher speeds. Curitiba in Brazil has a very extensive network of exclusive, segregated bus lanes in central median streets. In Adelaide, Southern Australia, the O-Bahn bus guideway system collects passengers

near to their homes on suburban streets, then joins its own special guideway where it runs at high speeds, much as a train does. It has all the advantages claimed for light rail, plus flexibility. Such schemes are well adapted to suburban, low-density, many-to-many type journeys from dispersed origins to dispersed destinations. But they can be used, indeed have been used, in radial journeys to city centres also. (That's the way they've been used in Adelaide, Nancy, and Curitiba in Brazil, to name three.) And experience on the unguided busway in northern New Jersey shows that buses running in this way can even deliver the same numbers of downtown commuters, per hour and per lane, as traditional commuter rail systems. So such systems may provide low-cost alternatives to expensive rail public transport schemes, especially where the future of downtown employment is uncertain. The point is that once a high-occupancy exclusive right-of-way comes into existence, then it can be utilized by many different kinds of vehicles in a way that an exclusive rail right-of-way cannot.

The third development is <u>new types of bus service</u>, which depart from the traditional pattern of radial spokes with occasional circles. Both Houston in Texas and Ottawa in Canada have a hub-and-spoke bus system, based on the concept now widely developed for North American inter-city air traffic, which in turn was based on the remarkable concept first developed by Federal Express for moving packages. In this system, buses make reliable interchanges at key nodes, allowing anyone to get from any part of the city to any other conveniently and comfortably -- no small consideration in the Houston summer or the Ottawa winter. I should add that with buses travelling on exclusive lanes, as they do in Ottawa, hub-and-spoke bus systems are likely to be a good deal more reliable than the average hub-and-spoke air system.

There is however one defect of such systems: just as you have to do at Chicago or Atlanta airports, or the packages do at Memphis, you have to change

vehicles. Moving passengers around still lacks the elegance of the system devised in the last thirty years for the movement of cargo, whereby the freight sits in one container from start to finish. We need to find a way of containerizing personal travel. Of course we have done it, in the car, which is why the car is so successful. The question is, can we do it outside the car? I think we can. Let me continue.

There is yet another innovative factor, this time technical: alternative energy sources -- which will surely receive a massive fillip from California's new air control standards, mandating as they do development of electric vehicles. Everyone here has heard of the return of the trolleybus in West Yorkshire. The city of Nancy has pioneered dual-mode vehicles which operate as trolley buses in the centre of town and in the inner city, but change over to diesel for the ride to the suburbs. In Essen, Germany, they have the same kind of dual-mode bus on the O-Bahn system, running in a tunnel into the city centre; it is almost indistinguishable from a rubber-tyre French metro system except that it can take off under its own power into the suburbs. General Motors has developed a vehicle capable of running 100 miles on batteries, and this could be combined with electrical pickup and recharging along selected motorway lanes.

For the longer-term future, one guess -- it can be no more than that -- is that superconductivity will result in a new system of transportation for people and goods, especially for longer-distance inter-city travel. This will take the form not of magnetic-levitation trains, though those will certainly come into use in some corridors, but of individual vehicles capable of being driven onto magnetic levitation paths. Such vehicles would need to be dual-mode in respect of power (internal combustion/electricity), roadbed (tires on road/magnetic levitation), and control (individual/automatic). These would require a totally new infrastructure either supplementing or replacing the

motorway systems created in the 1950s and 1960s. A major question, which it now seems impossible to resolve, is whether or how far such a system could be extended to operate on ordinary city streets.

On top of this, advances in information technology promise revolutionary changes within the next few years. Already, drivers have limited access to information via radio messages -- one L.A. station broadcasts traffic news all day -- and roadside electronic signs. The next step, embodied in such developments as Autoguide, is to put the information on board the car, giving the driver constantly updated information on his or her best route. Not far behind this is the Smart Highway, under experimental development at the University of California at Berkeley, on which vehicle spacing and lateral movements would be electronically monitored and guided.

In Berkeley, they are already confident that, within a few years, they will be able to run platoons of specially equipped vehicles along special lanes of the California freeway system at a spacing of only ten feet; they would in effect be electronically coupled together. And in turn, this may lead to the dream of a completely automated highway, on which dense streams of traffic would be electronically managed while drivers read newspapers or drank coffee. Prematurely touted during the 1960s, when the technology was simply not up to the job, this notion at last seems close to realization. It is likely to come first on new dedicated lanes on densely used freeways, or on new relief freeways, where the expensive investment could be justified. Quite possibly, this would provide a role for private investment in special toll facilities. But in any event, the vehicles using the system would need to be specially equipped -- again, at a price to their owners.

Now if we put these ideas together with some others, we can begin to see how to provide a new system of urban transportation that will compete with the

car on its own terms. It would need to offer door-to-door service in the same or less time, in conditions of equal personal comfort and convenience, and it would need to compete on price. It would represent a gradual convergence between a successor to the traditional public transport system and a successor to the equally traditional private car system. Let me give you an example of each.

The O-Bahn system could be enhanced by developing a system of dual-mode (or completely electric) mini-buses or vans, some driven by part-time professional drivers who would earn extra income on their way to and from work and who would offer an on-demand responsive service, while some were driven as pool vehicles by commuters who would rotate in driving them. They would circulate around neighbourhoods but would be coupled together -- either mechanically, like these buses in Honolulu airport, or better still electronically -- into trains for the line haul on a physical or electronic guideway; they would be automatically controlled on this guideway. The resulting system would look rather like those systems in airports, which almost everyone has seen. These guideways, developed on selected motorways and trunk routes as well as on their own rights of way, would be available only to licensed and equipped vehicles; they could include ordinary cars which were suitably equipped and whose owners agreed to make them available for high-occupancy use at peak hours. Thus the two systems of travel, the collective and the individual, would converge on to a common high-quality reserved right of way. Whether nominally cars or nominally bus-vans, the two sets of vehicles would be remarkably alike one another, particularly if the vehicles were dual-mode or all-electric. Both would provide ways of moving many more people on congested corridors than now.

Such a dual system could presage a greatly extended deconcentration of cities, since it would combine the characteristics of very-high-speed and very-low-cost travel. This would provide a perfect complement to a low-cost

informational economy based on the development of a true IT infrastructure network, as seems likely to develop in the next ten years. What is still uncertain is the degree of reconcentration that might occur. Up to now, the tendency seems to have been for activities to disperse at regional scale but to reconcentrate in suburban or exurban nodes, leading to the development of a polycentric city region. Recent reports indicate that "telecommuting," once thought so promising as a means of taking work back to the home, has not proved either pervasive or successful. And the new technologies, particularly magnetic levitation, may -- like earlier transportation technologies based on fixed linear routes -- give particular locational advantages to nodal points. If this is the case, we might see very-far-spread metropolitan areas several hundred miles in diameter, with nodes at intervals of perhaps 50-100 miles, linked by a very high-speed, inter-city system.

This, ironically, seems close to Wells' 1901 vision of late twentieth century motorway Britain. I suspect that it is what Wells would be predicting now, were he to be brought back to provide a new edition of Anticipations. And I suspect that Pick, were he also able to come back to us, would be backing something like it as an answer to our fourth great crisis of urban transportation. What is certain is that someone has got to come up with it soon.