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מידע על שוויון וצדק חברתי בישראל

Road Transport, Environment and Equity in Israel

by

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CONTENTS

ROAD TRANSPORT, ENVIRONMENT AND EQUITY IN ISRAEL[1]

> I will return to Jerusalem, my holy city, and live there. It will be known as the faithful city... Once again old men and women, so old that they use a stick when they walk, will be sitting in the city squares. And the streets will again be full of boys and girls playing.
>
> -- Zechariah 8:3-5; [2]

INTRODUCTION

Israelis are only now beginning to discover what residents of American and European cities have learned over three decades of automobile-oriented development. Transport networks are not just a means of moving people from place to place, but a defining factor in how we live, how we relate to each other, and how equitable our society is. On the macro level, transport decisions being made today will set the shape and character of Israel's urban centers and rural periphery for decades.

The present government policy places a heavy emphasis on development of new road systems, over more environmentally sustainable alternatives. Without a radical change in thinking and direction, Israel risks duplicating the experience of southern California. The Los Angeles region covers an area of 35,000 square kilometers, roughly 62 percent larger than that of present-day Israel, with the same average population density as that forecast for Israel in 2020.[3] Los Angeles is the prototype of an automobile dependent city -- a sprawling, polluted and crime-ridden megalopolis -- where the already very high per capita vehicle travel *is still growing*, and residents live in isolation and alienation – phenomena that analysts trace in part to the powerful "city-destroying" force of the automobile.[4]

For Israel, as in Los Angeles of the 1960s and 1970s, rapid population growth and road-oriented expansion of the transport system is channeling new development into relatively "inexpensive" land in rural areas, where car-oriented shopping malls, housing projects and business centers sited at road interchanges will become the dominant landscape features.

If Israel follows a similar pattern, road-oriented growth will create a landscape of continuous metropolitan and suburban expansion, at least north of the Negev, until built areas meld into one another – rather than developing as more compact and distinct urban, town and village units, separated by green space. Investment in new roads and road expansion will exacerbate urban air and noise pollution, just as they have done in Europe and the United States.

As a result of these processes, road-oriented growth will have a negative effect on social equity -- one that will increase over time. In terms of shopping, work and housing opportunities, the dispersal of suburban housing, businesses and shops along major road corridors and at highway interchanges, together with a parallel decline in the scope and service level of the public transport system, will reduce the mobility of Israel's "transport-disadvantaged" groups -- children, elderly, poor, new immigrants, Arab citizens, women and ultra-Orthodox communities -- all of whom have lower-than-average access to automobiles. Already, road-centered development is providing Israel's stronger socio-economic groups with an incentive and opportunity to "escape" the congestion, noise and pollution of traffic-congested urban areas for less congested suburbs -- leaving the poor, elderly and other disadvantaged groups behind in aging downtown city centers.

On the macro-economic level, car-oriented development costs a society more than transit-oriented development and yields fewer economic growth benefits. The employment opportunities generated by road projects are mostly short-term, low-paying jobs, many of which may be filled by imported foreign workers -- as compared to the skilled, permanent jobs generated by transit. Road construction, moreover, feeds a wasteful economic dependency on imported automobiles and oil. And contrary to popular belief, road construction has a minimal impact on growth in other economic branches.

Over the long term, road development, rather than easing congestion, spurs more traffic as well as more long distance commuting -- costing time in lost productivity. Finally, in Israel today, road construction is subsidized by the government at a far higher rate than transit, creating an unfair competitive advantage for road-oriented transport modes. For instance, in the case of the Trans-Israel Highway project, the government commitment to compensate for revenue shortfalls in the toll-road's operation will actually create an incentive to *promote overall traffic growth* via government land use; pricing and public transport policies, *rather than to reduce growth.* This is due to the fact that a reduction in traffic growth would mean less

income for the road concessionaire -- and the government would have to cover the difference.

With all of the penalties associated with road-oriented growth, why does it continue to be the dominant development mode? Why, meanwhile, does most of Israel's once-extensive interurban rail network -- and right-of-way passages -- lie stagnant, deprived of government financing for even the most minimal development? The answer lies largely with the powerful economic interests that reap big profits from roads. Road-construction generates easy business for many of the country's largest construction firms, which are unfamiliar with rail, and also depend on government contracts for income, particularly in times of economic downturn. Similarly, large real estate developers find that the construction of new housing and commercial centers on vacant roadside sites may generate bigger and easier profits than the more complex task of "recycling" empty and degraded sites in existing urban centers, along rail or pedestrian corridors. Oil and vehicle importers, bus companies, food retailers and banks -- which control and develop the country's malls, supermarkets and superstore franchises -- are among those concerns that are heavily investing today in car-oriented development. In fact, it could be said that corporate greed -- not social equity, cultural legacy or even planning logic -- will shape Israel's post-2000 environment.

New roads and highway interchanges offer large corporations a horizon for growth and economic expansion *subsidized by the government in the form of cheap land, free parking and convenient transport access* -- competitive advantages which small and independent business contractors and grocers, working in existing urban frameworks, do not enjoy.

For some, more affluent consumers, as well, road-centered development creates new shopping opportunities outside of center cities -- in malls and superstores accessible primarily by car. These new shopping centers initially appear to be a consumer boon because they offer large inventories of goods at lower retail prices than many older urban stores. But in fact, the larger inventories and lower prices reflect hidden government subsidies of cheap land prices and low tax rates. The government in effect subsidizes the creation of these out-of-town centers for the benefit of car-owning consumers -- *and at the expense of the car-less*. Car-less consumers, who have no access to these new malls and superstores, continue to shop at older city centers, where prices may be relatively higher, reflecting the higher overheads of an urban area. If experience elsewhere in the developed world is any indicator, the large suburban superstores gradually edge smaller independent firms out of business, and

exert monopolistic control over both markets and prices.[5] This further disadvantages those without cars. Thus, the savings enjoyed by car-owners are offset by high social costs.

On the social level, the investment now being made in building big new roads -- rather than pedestrian networks, rail, bus and cycle systems -- defines the kinds of communities that will develop around the transport networks. Rather than fostering compact, European-style villages, towns and cities, where different types of social groups mix together, and neighbors know each other because they interact informally on the street while walking to work, stores and schools, road-oriented investment fosters single-function development along an American pattern. The neo-traditional village or town unit is thus replaced by disconnected housing projects, both high density and low density, shopping malls and industrial parks, all connected to each other only by roads. A society in which individuals make most of their daily trips in private cars, is one in which casual contact is reduced to the minimum, feeding insularity, alienation and social fragmentation.

What is lacking most of all in Israeli transport thinking is the recognition that transport involves interactions between people -- not just the movement of vehicles between different points on a map; that it involves communities in which children and families and elderly persons live, not just automobile drivers; and that transport is supposed to enhance the human quality of life, not merely supply mobility at ever increasing speeds. The assumption that greater mobility inevitably reflects a higher standard of living must be re-examined in light of the evidence that travel may degrade, rather than enhance living standards.[6]

Likewise, the public health implications of current trends have been recklessly ignored. Not only are the pollution and noise impacts of car use unhealthy and destined to grow dramatically along with urban sprawl -- but so is the very fact of car dependency. Countless studies have shown that groups who make walking and cycling a regular part of their daily routine -- for work, shopping and delivery of children -- are much healthier than those who don't, as are the cities that they live in. Yet in Israeli cities today, sidewalk systems are gradually being turned into de facto parking spaces, making walking difficult and dangerous. Not surprisingly, the tremendous car-oriented expansion of the Tel Aviv metropolitan area over the past decade has coincided with an estimated 50 percent reduction in the number of people who walk to work.[7]

Such social costs and hazards are largely invisible to Israeli government ministries, particularly the Finance Ministry. Decision-makers in general consider transportation decisions in only the most narrow economic or geo-political terms, rather than as a key shaper of the social fabric, ignoring the last two decades of findings on transportation and planning. Projects are considered separately, without the guidance of an overall policy on desirable motorization rates, and with minimal coordination between different transportation modes, between land use and transport policies or national environmental guidelines. Roads are built as political boundaries, rather than with a strong vision of how Israel, or its cities, will look two decades from now.

It is ironic, given these trends in Israeli transportation, that the vision of Jerusalem as described by the prophet Zechariah has been cited so frequently in the works of internationally prominent transport planners as an ideal.[8] Indeed, Zechariah's vision of Jerusalem as a city where children play in the streets and the elderly sit in the squares is strikingly in tune with the best of contemporary transportation planning. Such planning strives to make transport a truly humane activity and design streets where people not only travel, but inter-relate. The idealized image of "Jerusalem" for planners the world over is a model -- "the place where you live as it might be and as you are to help to make it. It is London, Berlin, New York, Paris."[9] But what of the actual Jerusalem?

Zechariah's vision stands as a rebuke, but also as a creative challenge, for Israel still has the potential to become a leading example of sustainable and people-friendly transport. The country still has relatively high levels of public transport use, a low rate of per capita car ownership, and the advantage of making major transportation decisions decades later than other developed countries. For the first decades of the state, planners worked painstakingly to develop the kind of self-sufficient, integrated communities of work, home and leisure that are so threatened by today's new development styles. Israel is still in a position to leapfrog over much of the decades-old car-based transportation technologies that other countries are struggling to abandon. Precisely because of its small size, growing population, and geo-political position, the general principles regulating good transport development are all the more relevant to Israel, which can ill afford to waste land and increase social inequities and alienation by repeating the failed land use and transport models of American suburbia.

A more forward-looking policy would strive to create dynamic, attractive pedestrian-friendly cities, towns and villages, shaped around public transit

--well-defined urban units separated by green, open space within and between them. A policy based on the principles outlined here would invest in a public transport system accessible to all levels of society, in which most routine tasks could be accomplished without cars. New urban and interurban rail, bus, taxi, *sherut*, pedestrian, and bike systems would channel private investments towards the task of recycling and revitalizing homes and businesses in older cities and towns, building them into model cities of the 21st century. A renewed investment in public transport would help correct some of the social gaps that have developed in Israeli society -- by offering equal access for both rich and poor to jobs, shopping, business and schools, and contributing to urban renewal efforts in areas where small and independent businesses thrive.

This kind of vision has been perceived by Israelis as one that would require a high degree of personal sacrifice or government manipulation and control. Indeed, the opposite is true. Regions where sustainable transport systems have taken root are places that offer a far higher quality of life to rich and poor alike -- due to the savings in noise, congestion, pollution, and the enhanced vitality of both urban and rural life. Government investment and legislation are indeed essential to shape a sustainable transport system -- but no more so than in the car-oriented society where the government finances and legally sanctions a wide range of hidden subsidies and incentives to car owners and car-oriented businesses and industries -- for the short-term profit of a few powerful economic interests -- but at enormous long-term public expense.

In a decade or two, we will be able to discern: Did "people-oriented planning" that considered the well being of children, families, the disadvantaged, and the elderly take priority over values of sheer traffic speed and flow and rapid returns on real estate investments? Were leaders brave enough to make the fundamental reorientation necessary, or did they settle for stop-gap measures? Did they succumb to powerful commercial interests that profit endlessly from developing roads -- or did they exert the kind of values and social leadership that brings the country closer to Zechariah's vision of humane and sustainable lifestyles for all.

) The authors wish to thank the many people and organizations who have contributed their time and insight to this report, including Dr. Gary Ginsberg, Health Economist; Dr. Joe Bazes, Air Quality Specialist; Michael Zwern, Environmental Intern; Leibe Kranzler, Adva intern; Dr. Ronnie Seeri, The Ministry of Environment; Dr. Mordechai Peleg, The Hebrew University; The Arava Institute for Environmental Studies; Arza Churchman, Yehuda Gur, The Israel Institute for Transport Research and

Planning, Pinchas Ben Shaul, The Israel Rail Authority; Health Effects Institute, Cambridge, Massachusetts, The Danish Transport Ministry; The European Federation for Transport and Environment; The Israel Union for Environmental Defense; The Society for the Protection of Nature in Israel.

[2] Quoted in the preface to P.W.G. Newman and J.R. Kenworth, Cities and Automobile Dependence: A Sourcebook, Australia 1989.

[3] Population and geographic dimensions of the Los Angeles region are provided by the: The South Coast Air Quality Management District, 1997 Air Quality Management Plan & Socio-economic Report, Diamond Bar, California., 1997.;

Geographic dimensions of Israel are found in the Statistical Abstract of Israel, Central Bureau of Statistics, 1997; Population projections are contained in theTrans Israel Highway Co., Traffic Analysis and Economic Evaluation, Final Report 1994 Table 3.7.

Note: The area of Israel, including the Jerusalem district and the Golan Heights is 21,946 square kilometers. Israel's projected population of 8 million citizens in the year 2020 will yield an average population density of 364 persons/square kilometer including the area of the Negev. Population today in the South Coast Air Quality Management District, commonly known as the Los Angeles region, is 11 million residents or 314 persons/square kilometer.

The West Bank, which is not included in this calculation, encompasses only about 25 percent of the land area of pre-1967 Israel, or 5,564 square kilometers and has a present day density of over 200 persons/square kilometer, which is growing at a more rapid rate than Israel's. (Statistical Abstract of Israel & Benvenisti-Khayat, The West Bank and Gaza Atlas, 1988: 5.5 million dunams=1,375,000/640 acres/square mile = 2,148 square miles * 2.59 square kilometers/square mile = 5,564 square kilometers.)

[4] Peter Newman, "Reducing Travel through Land Use Planning." in Travel in the City, Making it Sustainable, Proceedings of OECD International Conference, *June 7-9, 1993*, Dusseldorf. p.104 Newman states:

"There is growing awareness that automobile dependence on a city scale can be linked to many significant environmental, social and economic problems -- oil vulnerability, urban sprawl, photochemical smog, high greenhouse gas contributions, greater storm water problems, traffic problems, loss of community, loss of street life, loss of public safety, isolation in remote suburbs, access problems for the car-less and for those with disabilities, congestion costs, high infrastructure costs, and loss of productive rural land. These problems are obviously not divorced from other cultural, political and economic forces, and it is easy to go too far in blaming excessive dependence on the car for these diverse urban issues, but the power of the automobile to splinter and dissolve traditional city building forces *is like nothing else in the history of cities.* (Zuckerman, 1992, Schneider, 1979, Jacobs, 1961).

"There are, of course, those who do not see such fundamental problems with the Automobile City, rather they suggest that improvements to automobile technology will be sufficient to ensure sustainability. (Gordon and Richardson, 1989, Brotchie, 1992). For these commentators, the Automobile City is believed to be developing into a sustainable, self-regulating pattern of transport and land use as housing and jobs are dispersed locally. They suggest that Los Angeles, the archetypal Auto City, began to show these characteristics in the 1980s, (Gordon, Kumar and Richardson, 1989) and that we should therefore not be unduly concerned about the future of the car-based city

"Latest data, (collected as part of the 1990 update) show that Los Angeles is not stabilizing, *but is more out of control in its vehicle travel than ever before*. Figure 5 shows exponential increases in total per capita car use continued in the 1980s, and indeed accelerated. This evidence confirms our contention that automobile dependency is not self-regulating but is a powerful city destroying force that will always overwhelm incremental technological change."

[5] The market advantages enjoyed by out-of-town shopping centers are discussed further in Chapter 3.

[6] The conventional view that "increases in living standards, by implication, usually imply increases in mobility," is expressed in the document by Ilan Salomon, Yehuda Gur, and Eran Feitelson, "Land Transport in the Planning of Israel for the year 2020, Policy Document" (Draft for Review) Section 2.1.1. as part of the Haifa Technion, Master Plan for Israel in the Years 2000, Stage 3 (Gimmel). (in Hebrew)

[7] Trans Israel Highway Co., Traffic Analysis and Economic Evaluation, Final Report, November, 1994, Travel Habits Survey. (in Hebrew) **Note: All subsequent page references to this report refer**

to the Hebrew version, unless the English version of the document, which was published in 1995, is explicitly cited.

[8] The Zechariah passage is cited by Newman and Kenworthy in their introduction to Cities and Automobile Dependence: A Sourcebook.

[9] Ibid.

CHAPTER I
HEALTH IMPACTS OF ISRAEL'S TRANSPORT SYSTEM

CAR DEPENDENCY AND AIR POLLUTION

Road-oriented development is a major trigger for air pollution both directly and indirectly. Cars and buses generate more pollution per mile traveled than rail and pedestrian systems. Secondly, road-oriented development spurs patterns of urban sprawl which generate more automobile use over greater distances -- and therefore more pollution.[1]

The State of California Air Resources Board found that a major regional shopping center served primarily by automobiles generates 29 times more Carbon Monoxide emissions than a 1600 megawatt power plant. When a similar shopping center is located in an urban area, served by good regional transit and pedestrian systems, car travel to the center drops from 93 percent of trips to about 38 percent. At the same time, pedestrian travel and public transit trips increase from a combined 5 percent to 61 percent -- resulting in enormous savings in pollution emissions.[2]

Israeli Vehicle Emissions

Motor vehicles are a major source of air pollution in Israel, accounting for over 90 percent of Carbon Monoxide pollution nationally, and roughly 40 percent of pollution from NO_X.[3] In the Tel Aviv-Jaffa area, it is estimated that vehicle traffic accounts for nearly 40 percent of pollution from PM10s, small particles of pollutants that are one of the most health-damaging forms of pollution. **Such vehicle particulate emissions are estimated to cause about 293 premature deaths annually from cancers and lung disease**. Electric power generation accounts for about 47 percent of PM10 emissions in the city, and natural causes (sand and dust) account for most of the remainder.[4]

On a national level, **serious questions remain as to the true contribution of vehicle emissions to total air pollution across Israel,** as well as to emissions trends over the past five years -- when new technology has presumably begun to lower per vehicle emissions, but travel has also grown exponentially. The problem lies in a

history of **inadequate government monitoring of vehicle emissions and industrial air pollutants, as well as inadequate research and reporting of available data from government ministries to the Central Bureau of Statistics -- whose data is therefore, unavoidably obsolete**. Estimates of vehicle and industrial emission trends, of necessity, must often be extrapolated from tests done abroad, which do not always reflect Israeli conditions. In addition, no mechanism exists for quantifying pollution generated in Israel by (generally aging) Palestinian vehicles, or emissions from idling vehicles. The result is that independent research, based on a recent study sponsored by the Ministry of Environment, yields figures for recent emissions that vary from official CBS statistics, as seen below.[5]

Figure 1: Trends in Motor Vehicle Emissions

The planners of the Trans Israel Highway, parts of which are currently under construction (1998), projected a 266 percent increase in private car travel between 1992 and the year 2020; a 207 percent increase in truck traffic, and a 153 percent increase in bus kilometers traveled. Those trends may even be an underestimate since between 1992 and 1997 the *rate* of traffic growth reported by the Central Bureau of Statistics exceeded that projected by the planners of the Trans Israel Highway.[6] Considering the trends of the 1990s, as well as the Trans Israel Highway projections for vehicle travel over the next two decades, Ginsberg anticipates that emissions of Oxides of Nitrogen and Particulates will begin rising after the year 2000. Particulates will increase by 45 percent by the year 2020, while Oxides of Nitrogen will increase by 187 percent. The rise in these emissions will be **due primarily to the greater reliance on diesel fuels for small trucks and commercial vehicles**.

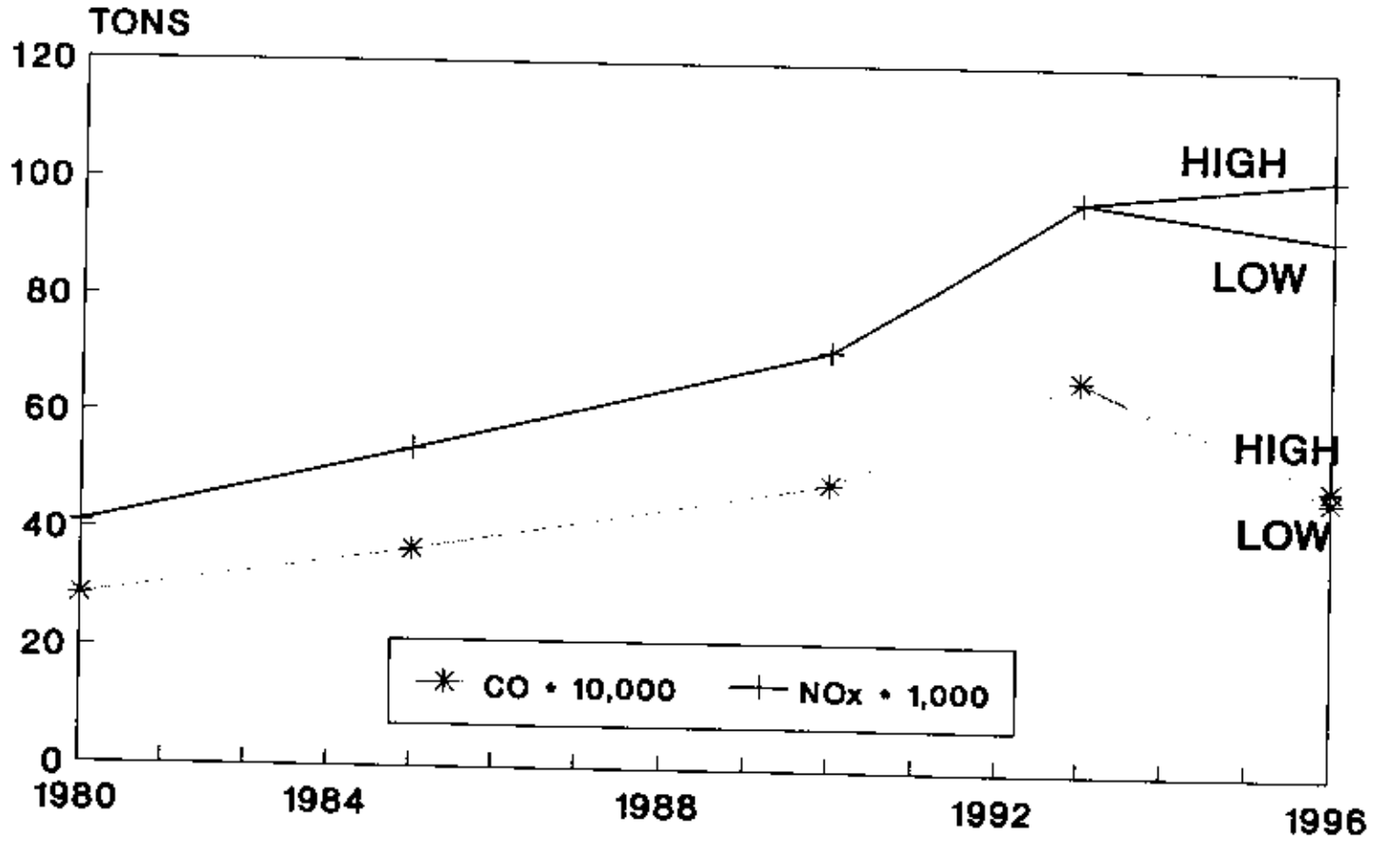
Transport Emissions in Israel (thousands of tons/year).

Year	Carbon Monoxide (CO)	Nitrogen Oxides (NO_x)	PM10s	Total Particulates
1996	487.5	91.3	4.61	4.79
2000	400.1	92.1	3.92	4.07
2010	312.0	125.9	4.25	4.41
2020	325.0	172.7	5.69	5.91

Source: Dr. Gary Ginsberg[7]

These increases in pollution are projected to occur despite anticipated technological improvements in diesel vehicle air pollution controls.[8] In particular, it

Fig 1: TRENDS IN VEHICLE EMISSIONS
CARBON MONOXIDE & NITROGEN OXIDES



Source: Ginsberg G. &
CBS Statistical Abstract 1997 (5)

should be noted that catalytic converters cannot be affixed to diesel vehicles, which are by far the biggest generators of dangerous PM10s. Moreover, even the most advanced auto emissions controls deteriorate with age and lack of motor maintenance -- which in Israel is less strictly regulated than in Europe.[9]

Emissions and Air Pollution: International Comparisons

Israel's transport emissions, per capita, are roughly on a par with those in small European states such as Denmark and the Netherlands. But because Israel is one-half the size of these states, transport emissions, per square kilometer, are more concentrated, particularly in populated areas.[10] See Figure 2 on the next page.

Figure 2: Annual Emissions of Nitrogen Oxides and of Carbon Monoxide

Due primarily to transport emissions, the air in Israel's central region is already moderately to severely polluted, according to U.S. Environmental Protection Agency (EPA) definitions.[11] In Figure 3, we present for comparison the maximum recorded 1991 ozone pollution levels in selected Israeli cities with their American counterparts, and the EPA definition of pollution severity.[12]

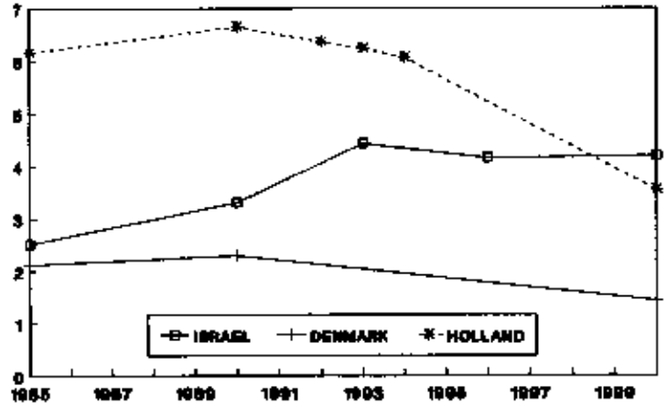
Figure 3: Maximum Ozone Levels

It should be noted that ozone is a "secondary" pollutant that develops as the primary pollutants (NO_X, hydrocarbons) emitted by vehicles and power stations are broken down by sunlight. As a result, large concentrations of ozone can often be found in relatively "green" areas hundreds of kilometers from their original source. Thus, Ceasarea registered high ozone levels when pollution from the Haifa-Acre area drifted out over the ocean and then returned to the Mediterranean sea coast with the winds. More commonly, westerly winds carry Tel Aviv area pollution east to the Judean hills, Jerusalem and the Jordan Valley.[13]

Health Effects of Transport Pollution

The most dangerous pollution generated by vehicles -- in health terms -- are particulates. Emitted mostly by diesel vehicles, particulates are closely associated with higher rates of premature death, as well as lung disease in adults and children. Small particles, of 10 micrometers or less in diameter -- commonly referred to as PM10s -- are the major culprits. They trigger respiratory illness, cardiovascular malfunctions and cancers by penetrating deep into the lung tissues, embedded with

Fig 2: ANNUAL EMISSIONS OF NITROGEN OXIDES: MOTOR VEHICLES (TONS/SQ KM)



Source: Gineberg G. (10)

ANNUAL EMISSIONS OF CARBON MONOXIDE MOTOR VEHICLES (TONS/SQ KM)

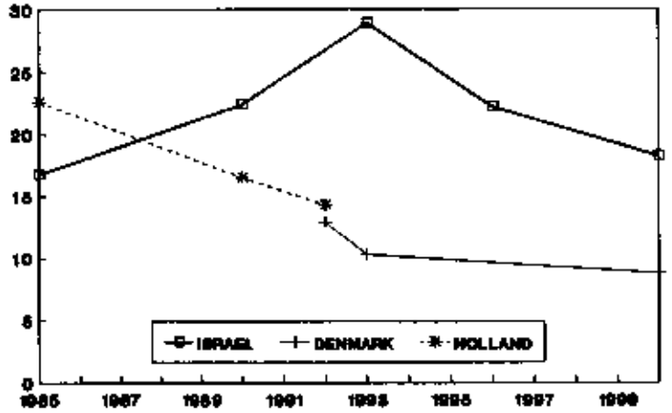
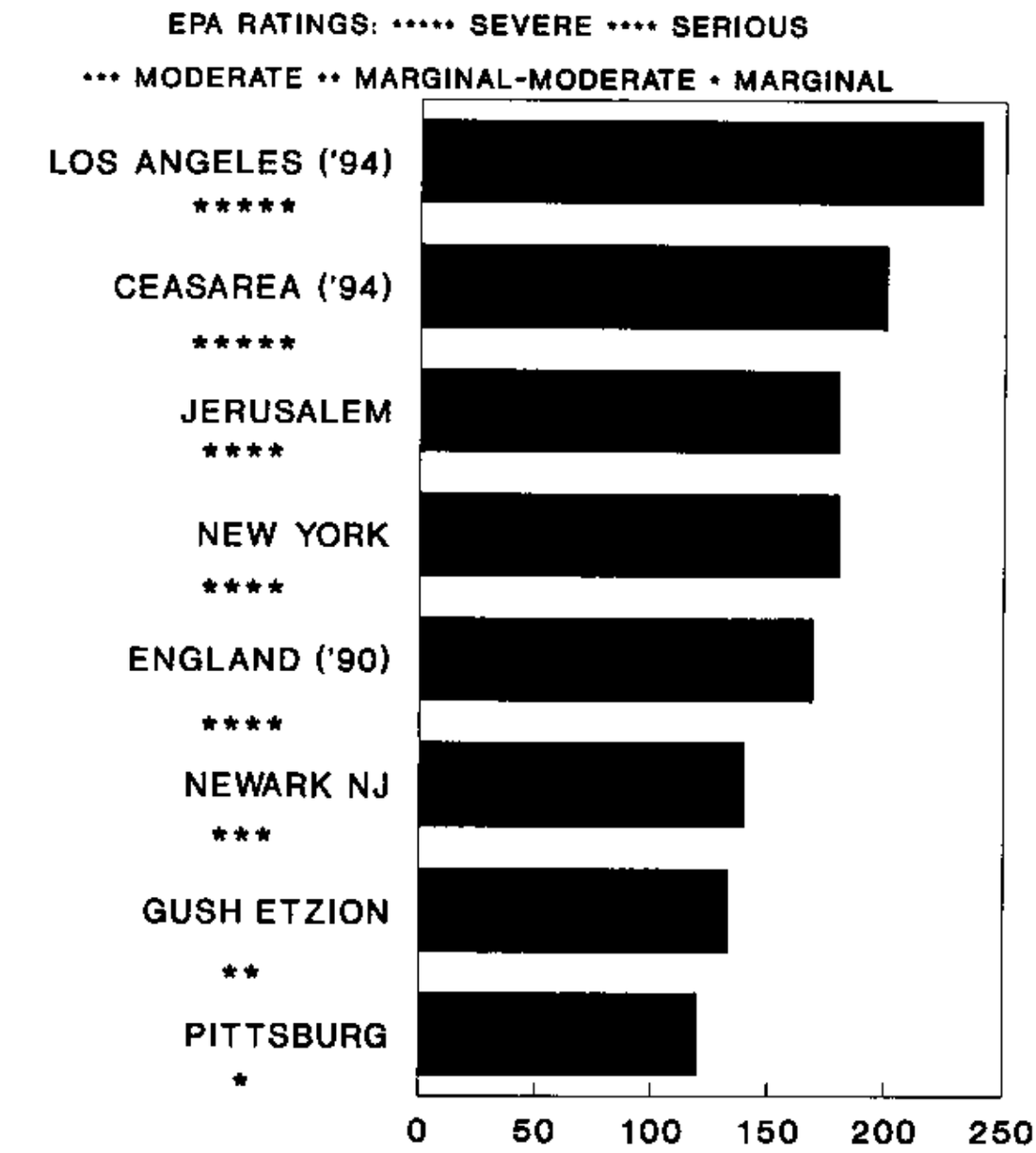


Fig 3: MAXIMUM OZONE LEVELS parts per billion (90/91)



Source: US EPA, CBS & Luria M. (12)

carcinogenic compounds like benzene. In several dozen recent U.S. and European studies, beginning with a landmark 1993 study of premature mortality in six U.S. cities, published in the *New England Journal of Medicine*, a direct relationship was found between PM10 pollution and higher rates of premature death: premature death rates were 26 percent higher in cities with the highest PM10 rates.[14] High PM10 rates have also been related to acute respiratory hospital admissions in children, school absences, and increased medication use in children and adults with asthma.[15] Because of the close association between PM10 pollution and premature mortality, methodologies have now been devised for estimating the number of premature deaths in a given city or region, based on the ambient air levels of PM10s.[16]

As the graph below shows, PM10 levels in Israel's two largest cities are as high, or even higher than levels in some of the most polluted cities in the United States, and thus constitute a major health problem in Israel.[17] In Tel Aviv-Jaffa, vehicles account for about 37 percent of total PM10 pollution (29 percent is from trucks and buses). PM10 pollution from vehicles causes an estimated 293 premature deaths annually among the 380,000 residents of the city.[18] **Reducing diesel emissions, particularly in urban areas, should clearly be a priority for public health professionals as well as transportation planners, who have so far ignored the problems of diesel.**

While cleaner gasoline and diesel vehicle technology appear to have brought about a temporary decline in PM10 emissions, the rapid increase in truck traffic, and particularly the massive shift underway from small gasoline-powered commercial trucks and vans to diesel models, will reverse that trend by the year 2000. As noted previously, deadly PM10 emissions are expected to increase between 2000 and 2020 by as much as 45 percent even as diesel technologies become cleaner.[19] This projection assumes that only a moderate share of the automobile fleet would shift to diesel vehicles – 10 percent by 2010 and 20 percent by 2020. Shifts from gasoline to diesel cars already are apparent in major Israeli sectors such as taxis, where 95 percent of today's fleet is now diesel.[20] **It is crucial, therefore, that diesel traffic be curbed and "greener" fuels be advanced for trucks and buses immediately, in order to reduce the health hazards from diesel emissions.**[21]

In Israel, as in Europe, the transfer from gasoline to diesel has been facilitated by government policies that price diesel fuel well below that of gasoline -- although in Israel, vehicle purchase taxes remain higher. In Great Britain, a country with a poor track record on sustainable transport policy, new diesel car sales are already 20

percent of total car sales -- prompting this caution from the British Department of the Environment: "Any increase in the proportion of diesel vehicles in our urban streets is to be viewed with considerable concern, unless problems of particulate matter and nitrogen oxides emissions are effectively addressed."[22]

Particulate Pollution in Selected Cities in Israel and the US
(PM10s in micrograms per cubic meter of air, annual average)

TEL AVIV – CENTER	**56**	**(1996)**
JERUSALEM – CENTER	**47**	**(1991)**
LOS ANGELES	**48**	**(1992)**
NEWARK, NEW JERSEY	**37**	**(1991)**

Sources: Dr. Gary Ginsberg, Mordechai Peleg, The Ministry of Environment, U.S. EPA and the South Coast Air Quality Management District, California[23]

Index of Air Pollutants and Health and Environmental Effects

Pollutant[24]	Source & transport	Health and environmental effects
Carbon monoxide (CO)	Transport is responsible for over 90 % of CO pollution in Israel. Emitted due to the incomplete combusion of fossil fuels.	Deprives body of oxygen. Causes unconsciousness and death in high amounts. Long term exposure may aggrevate cardiovascular disease.
Nitrogen oxides (NO_x)	Transport is responsible for 32-43% of NO_x emissions in Israel.	Irritates lung tissue, increasing susceptibility to viral infection, bronchitis and pneumonia.
Particulates and Hydrocarbons (HC)	37 % of particulate pollution in Tel Aviv-Jaffa is from transport sources, mostly diesel.	The most costly pollution, in health terms. Heavy metals and polyaromatic hydrocarbons carried deep into lungs on fine particulates are responsible for increased respiratory and cardiovascular illness, as well as cancers
Ozone (O_3)	NO_x and HC react in the presence of sunlight, forming ozone. Tel Aviv area traffic generates high levels in the Judean hills, Jerusalem and Jordan.[25]	Irritates eyes, nose, throat and lungs causing coughing, headaches and reducing resistance to respiratory infections. Aggravates asthma and bronchitis, worsens heart disease.
Carbon dioxide (CO_2)		The most important "greenhouse" gas contributing to global warming.
Lead (Pb)	Lead is an anti-knocking element used as a petrol additive in older Israeli model cars.	Impairs mental development in children, affects nervous, circulatory, and reproductive systems.
Sulphur Dioxide (SO_2)	Source: Sulphur in fuels	Exacerbates lung problems and asthma, irritates eyes and mucous membranes.
Benzene	80% of Benzene pollution in OECD countries is from auto emissions.	Associated with leukemia and other cancers.

Sources: The Public Health Alliance, Great Britain; Menachem Luria, Hebrew University;Israel Statistical Abstract; Dr. Gary Ginsberg.

PUBLIC HEALTH COSTS OF TRANSPORT

Pollution from Road Versus Pollution from Rail Transport

To measure the net pollution emissions from road and rail vehicles carrying different sized loads and different numbers of people, comparisons are usually made in terms of "passenger kilometers" or "ton kilometers," i.e. the cost of carrying one person, or one ton of freight, a distance of one kilometer. As seen in the graph on the next page, rail emits fewer pollutants per kilometer traveled by every passenger than either cars or buses. [26] In addition, pollution emitted by rail is largely indirect -- from electric power generation, where emissions can be controlled at the source or directed high into the atmosphere. In contrast, pollution from road freight vehicles, primarily diesel, is injected directly into community streets -- and into the lungs of passersby.

Figure 4: Emissions by Transport Mode

Diesel Traffic

In freight transport, where road vehicles are generally diesel, the difference between modes becomes even more pronounced.

Pollution Emissions for Freight Transport, by Mode (grams/ton-km)

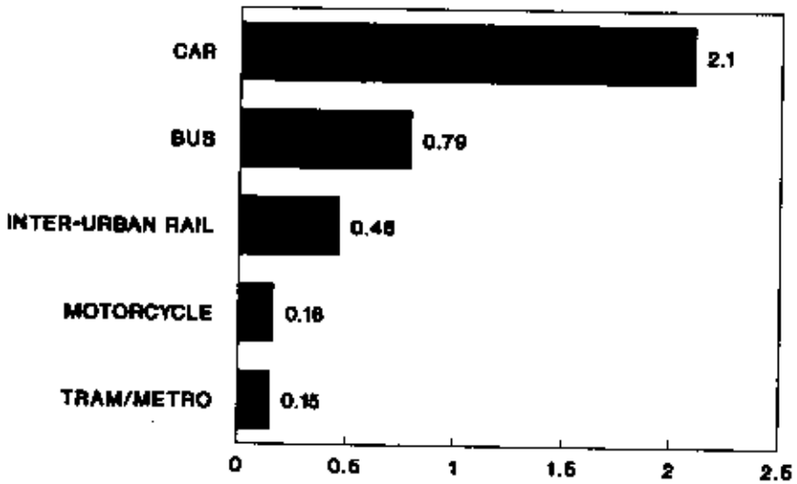
POLLUTANT	RAIL	ROAD	AIRPLANE
CO_2	41	207	1,206
CO	.05	2.4	1.4
NO_X	0.2	3.6	5.5

Source: The Royal Commission on Environmental Pollution, *Transport and the Environment.* "Freight Transport Modes, Energy Uses and Emissions," p 167.

Diesel trucks and buses also emit far more dangerous particulates than gasoline vehicles per kilometer. [27] In Israel this is a special concern -- where diesel traffic accounts for only about 17 percent of the road kilometers traveled, but for roughly 59 percent of the NOx emissions and about 81 percent of the vehicular particulate emissions.[28]

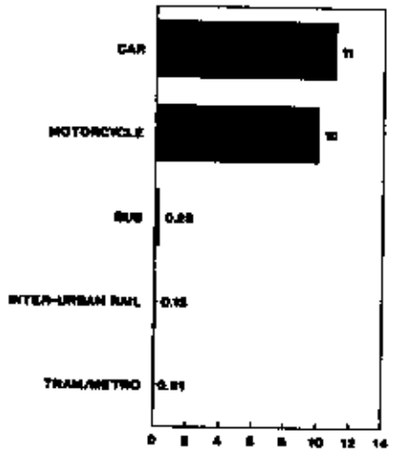
Figure 5: Diesel vs Petrol: Total Vehicle Emissions

Fig 4: EMISSIONS BY TRANSPORT MODE: NITROGEN OXIDE (gm/passenger km)



Source: Whitelegg J. (28)

CARBON MONOXIDE (gm/passenger km



CARBON DIOXIDE (gm/passenger km)

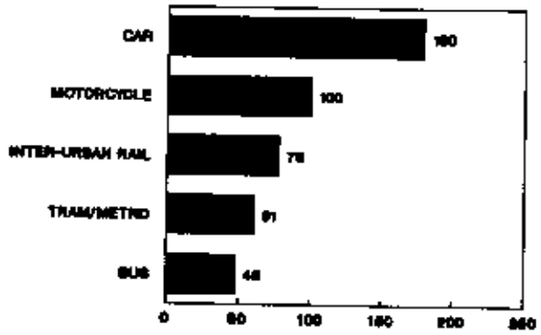
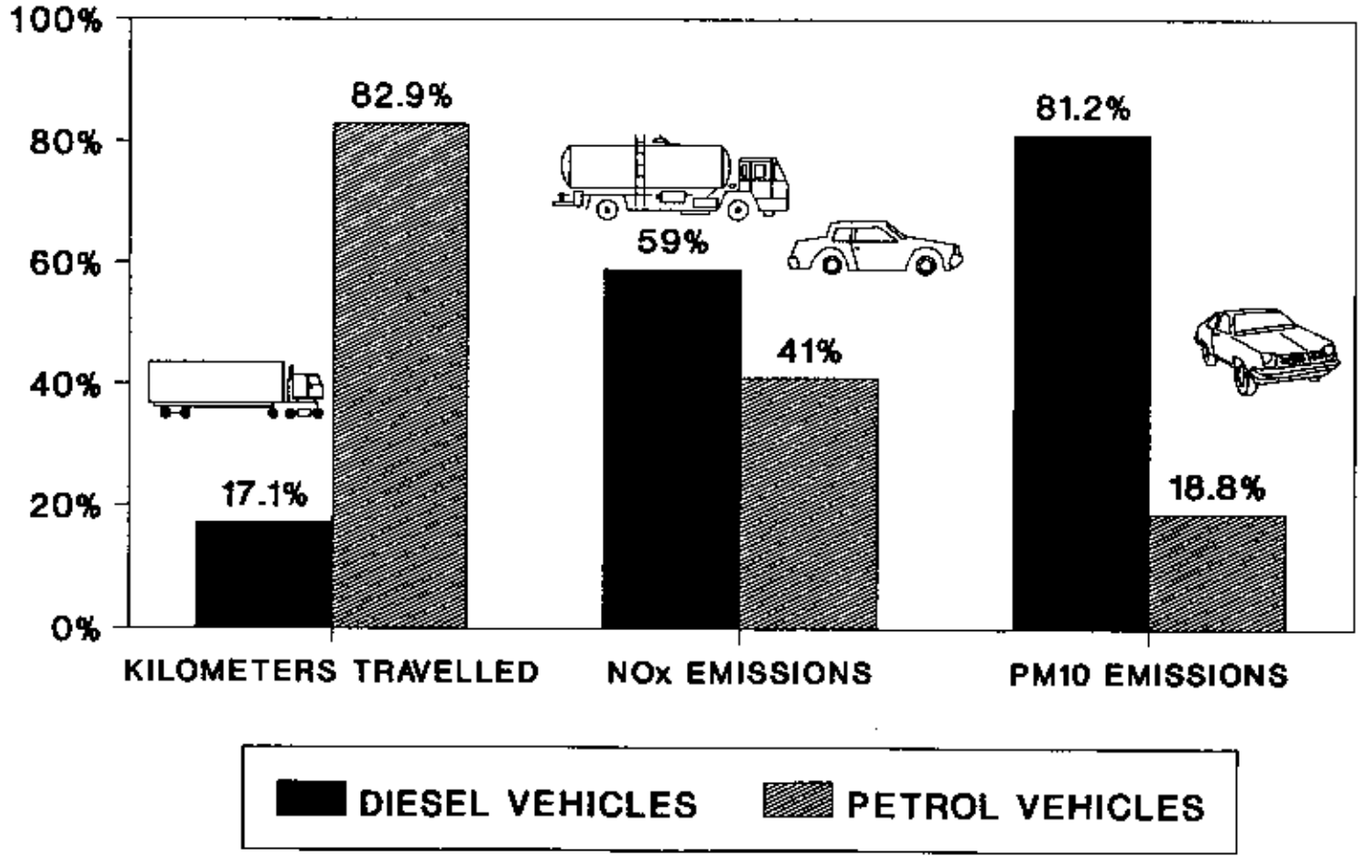


Fig 5: DIESEL vs PETROL: TOTAL VEHICLE EMISSIONS (1996)



Source: Ginsberg G. & CBS (28)

Other Social and Health Costs of Transport

Air pollution is only one among the long list of transport's health and social costs -- and not necessarily the most expensive. Figure 6 on the next page compares the total cost of different travel modes in 17 European countries in air pollution, noise, accidents, and CO_2 emissions that contribute to global warming.[29]

Figure 6: External Costs per 100 Passengers or Ton Kilometers

Accidents: The Highest Cost of Automobile Dependency

Traffic accidents are usually regarded as the highest single social cost of transport.[30] Road transport, moreover, is far more dangerous than rail, in terms of accidents per kilometer traveled. Accident statistics from the United States show passenger rail to be nearly 18 times safer than the private car, with 0.4 deaths per billion passenger kilometers as compared to seven deaths for the private automobile.[31] In Europe, fatality rates for rail users average less than one-quarter that of road users, and injury rates are even lower. Per passenger or ton-kilometer, the external cost of transport deaths and injuries in European car travel is 3 to 13 times higher than the cost of rail travel.[32]

Cost of Transport Deaths and Injuries in ECUs

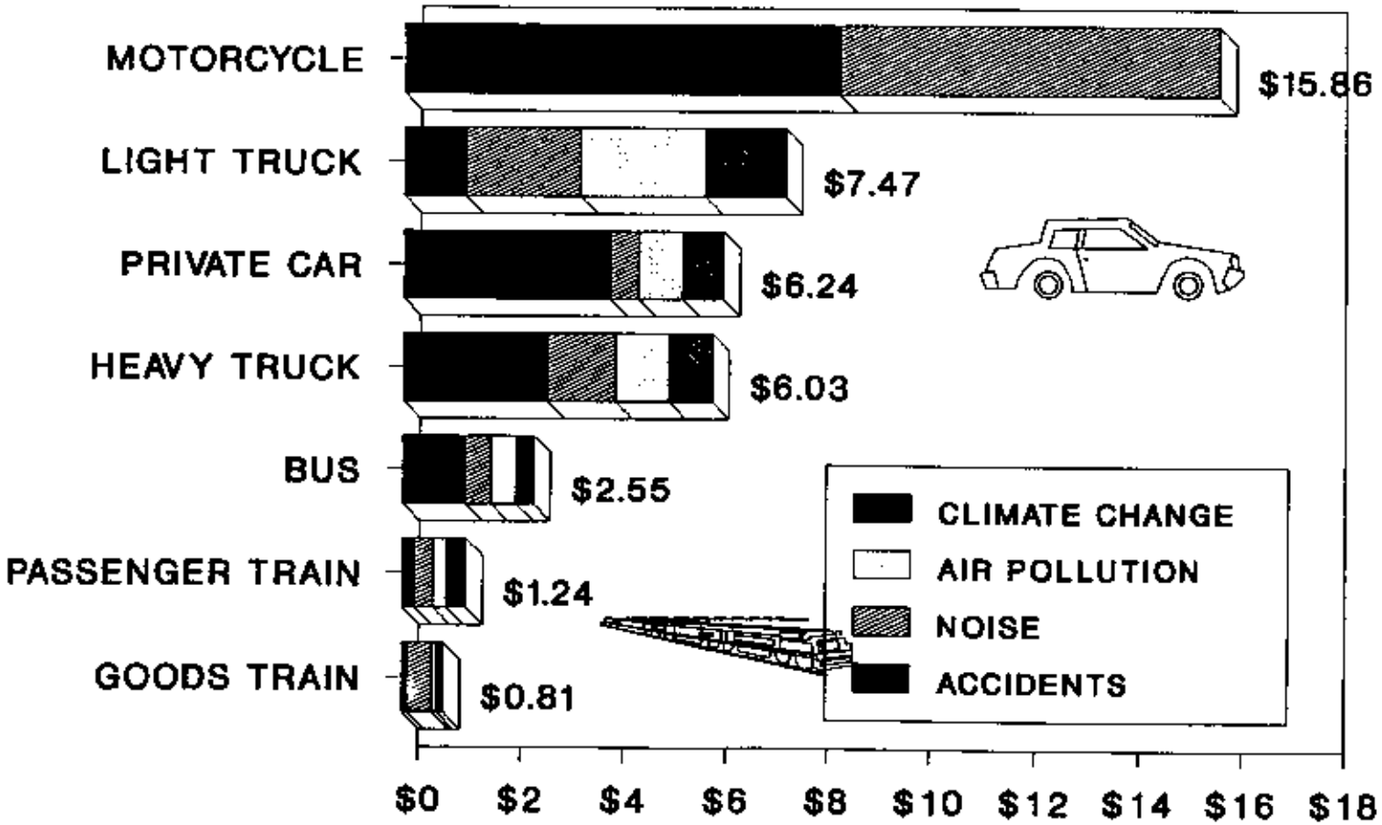
COUNTRY	CAR (per 1000 pkm)	TRUCK (1000 tkm)	TRAIN (1000 ptkm)
Denmark	8.5	2.2.	0.9
Germany	13.7	3 5	1.4
United Kingdom	8.9	2.3	3.8

Source: The European Federation for Transport and the Environment.

Among motor vehicles, motorcycles rank as the most dangerous. In Israel, motorcycle travel accounted for only 1.8 percent of motor vehicle kilometers traveled in 1995, but 10 percent of the vehicles involved in road accidents were motorcycles, as were nine percent of the casualties.[33] In contrast, trucks (both gasoline and diesel, under and over four tons) accounted for 30 percent of total kilometers travel in 1995, but only 19 percent of the vehicles involved in road accidents.[34]

Historically, poor road conditions in Israel were considered one of the chief causes of accidents. Yet between 1990 and 1993, when massive funds were poured

Fig 6: EXTERNAL COSTS: EUROPE (1991) PER 100 PASSENGER or TON KMS



Source: Israel Rail Authority (29)

into road building, accident casualties rose from 594 to 723 casualties per 100,000 persons annually.[35]

Figure 7: Trends in Road Fatalities in Small Countries

Figure 7 illustrates trends in road fatalities in five small countries. Overall, road injury rates between 1989 and 1993 placed Israel ninth highest in the world in the rate of road injury growth -- outpaced mainly by Third World countries such as Thailand, Swaziland, Mexico, Syria and Costa Rica.[36] See Figure 8.

Figure 8: Injuries from Road Accidents by Selected Countries

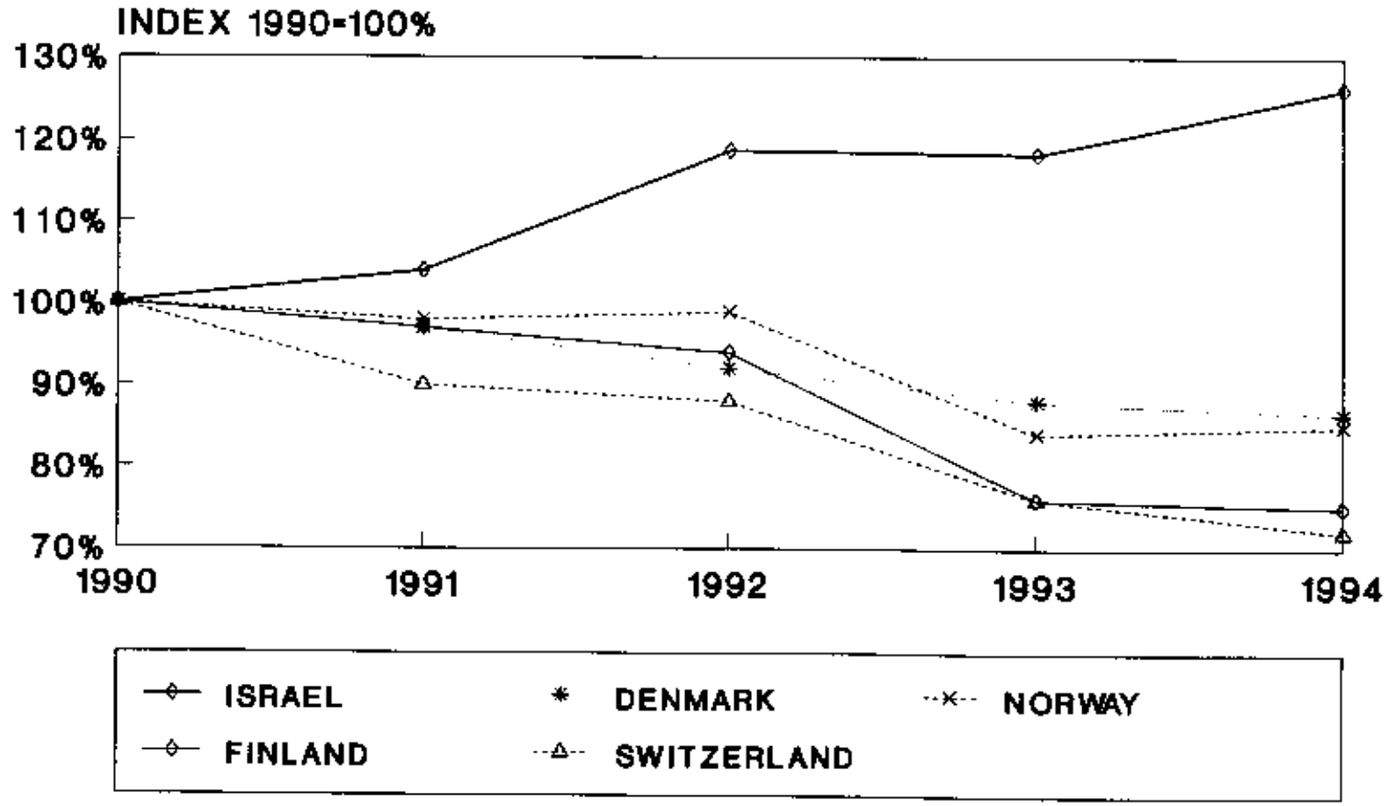
Traffic deaths and injuries rise with speed – and speed usually rises at least temporarily after major road improvements.[37] It has been projected, for instance, that construction of the Trans Israel Highway will translate into net highway death toll increases of at least 300 lives annually due to the increased travel speeds and new travel demands generated by the road -- despite its "safety-oriented" design.[38] The estimated accident toll from a highway oriented transport system is higher, over the long term, than fatalities in a transport system stressing safer public transport modes.

In the urban microenvironment, investment in "soft" transport modes, such as pedestrian networks, cycle paths, and traffic "calming" to slow down speeds is essential for protecting non-motorized groups from traffic accidents -- particularly vulnerable populations, such as children, the elderly and the disabled.

In 1990, 54 percent of the total trips made in Holland were on bicycle or on foot, yet the Dutch boast the lowest pedestrian casualty rates in Europe, due in part to the massive investment made in safe bicycle and pedestrian networks.[39] Conversely, Israel suffers from high per capita rates of pedestrian deaths. In 1995, twelve percent of accident casualties were pedestrians – even while pedestrian travel appeared to be declining.[40]-[41] See Figure 9 and Figure 10 on the following pages.

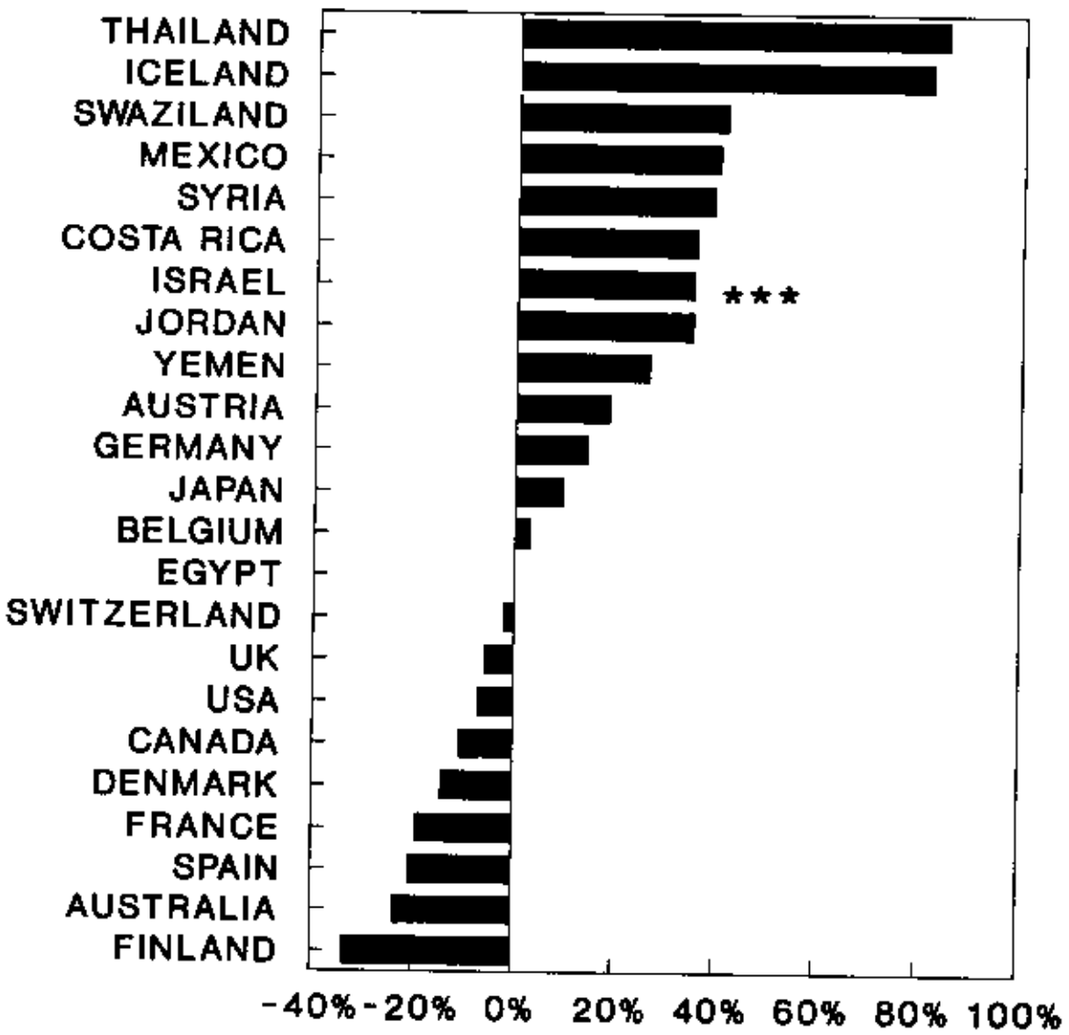
Figures 9 and 10: Pedestrian Deaths by Selected Countries and Pedestrian Deaths as Percentage of Road Deaths

Fig 7: TRENDS IN ROAD FATALITIES IN SMALL COUNTRIES



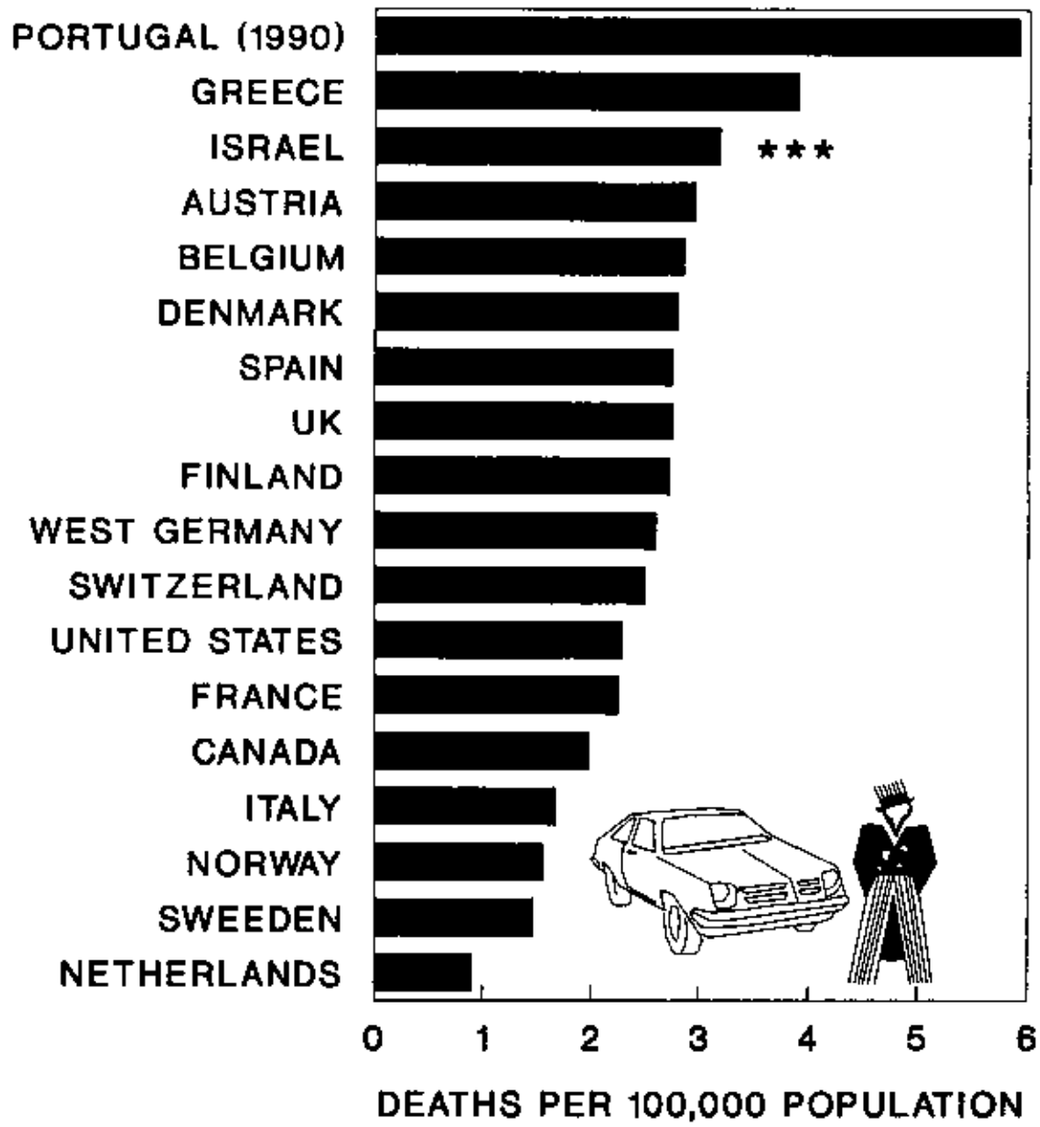
Source: Berdugo M. Hebrew University -Hadassah School of Medicine.

Fig 8: INJURIES FROM ROAD ACCIDENTS (% CHANGE 1989-1993) by SELECTED COUNTRIES



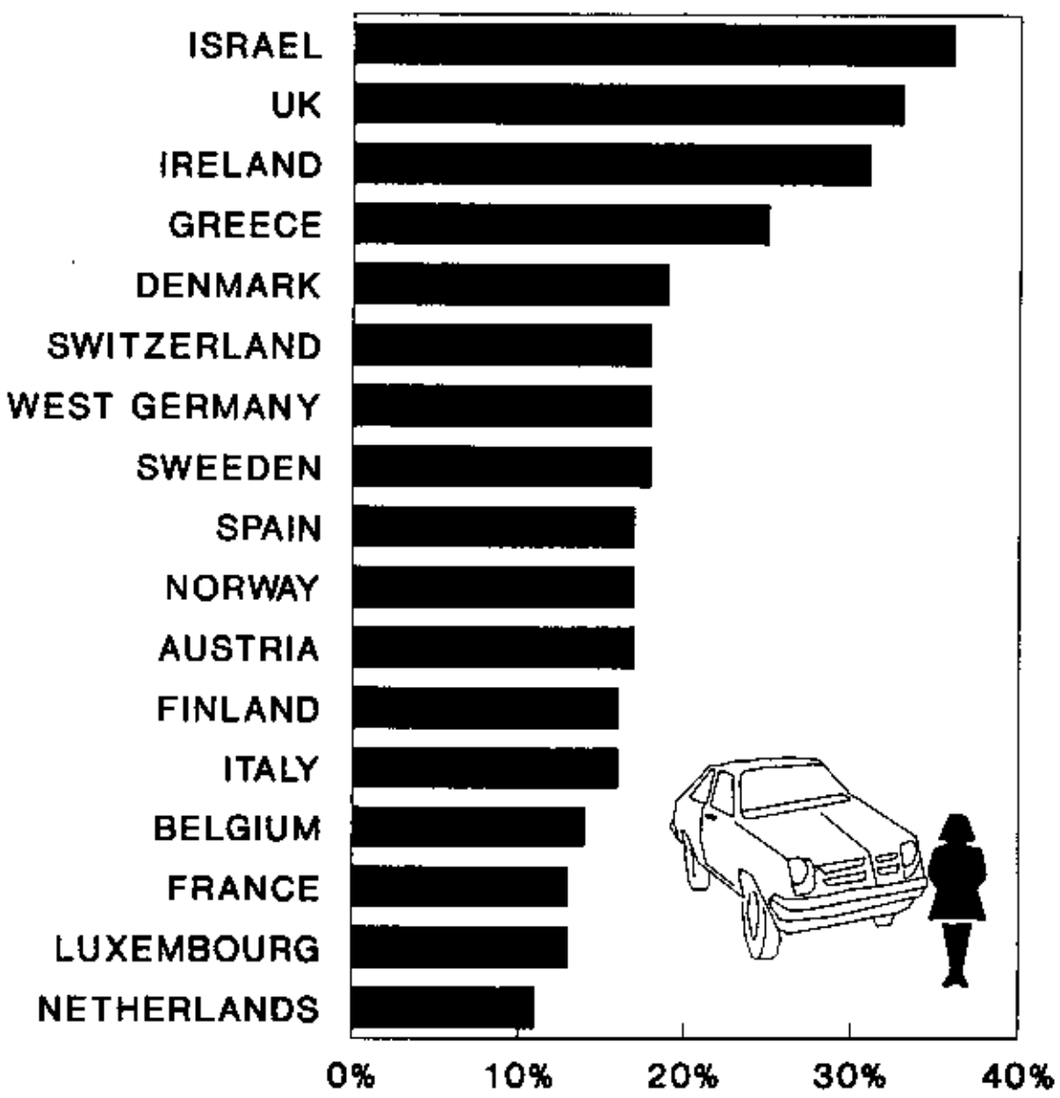
Source: International Road Federation, 1994 (36)

Fig 9: PEDESTRIAN DEATHS (1991)



Source: European Conference of Ministers on Transport (41)

Fig 10: PEDESTRIAN DEATHS as % of road deaths (1991)



Source: New Scientist & CBS Abstract, 1992 (41)

Speeding and Idling: Factors Overlooked in Pollution Generation

Cars that idle and cars that speed (above 90 km/hour) both generate excessive pollution. While emissions and fuel waste generally *decline* from 10 to 70 kph, emissions rise again at speeds above 90 kph. Optimal highway speeds in terms of fuel efficiency thus range between 70-90 kilometers an hour. Traffic flowing at 120 kph is as inefficient, fuel wise, as traffic at 20 kph.[42] The recent British Royal Commission report on Transport and the Environment recommended the slowing of highway traffic from 70 mph to 50 mph (90 kph) in order to lower pollution emissions, particularly emissions of ozone-forming NO_x.[43] Israel, meanwhile, has *increased* traffic speeds on some interurban roads from 90 to 100 kph, and the design speed for the Trans Israel Highway is 120-130 kph, increasing the likelihood that legal traffic limits on the road will be in the 100 to 110 kph range.[44]

The practice of idling is rampant in Israel. There is no driver's education that aims to curb it. In contrast, within European capitals such as Amsterdam, operating a vehicle engine for more than a minute while standing still is *illegal*. Warnings against idling are even printed in tourist maps of the city.[45] As of August 1998, Israel's Ministry of Transport was preparing to take a first step towards raising public awareness. The ministry had tentatively approved the issuance of a new directive to forbid the idling of buses, which often run their engines for hours while parked at tourism, educational and even nature sites.[46]

Towards a Full Accounting of Social Costs

One of the most pressing challenges in Israel today is the need for a full cost accounting of the various social costs of different modes of transport (i.e. car, bus, rail). Those costs include the health costs of air pollution and traffic accidents that are discussed in this chapter. They also include the quantifiable impacts of traffic noise and air pollution on real estate values, described in Chapter III, and the harder-to-quantify effects of traffic on community relationships and specific population groups -- discussed in Chapter IV.

Only when the full social, health and environmental costs of different transport development options is fully understood and quantified in money terms can policymakers make rational decisions about the value of shifting traffic to safer and cleaner modes like electric trains, gas-powered buses, walking and cycling.

[1] Daniel Carlson and Don Billen, Transportation Corridor Management: Are We Linking Transportation and Land Use Yet? University of Washington, Institute for Public Policy and Management, October, 1996.

[2] California Air Resources Board, "The Linkage Between Land Use and Air Quality," 1994, pp. 2,8. In the urban shopping centers surveyed, travel by private vehicle averaged: 38%; Transit: 32%; walking 29%; In the suburban centers, the modal split was: private vehicle: 93 %, public transit: 4 %; walking:1%.

[3] Central Bureau of Statistics, Statistical Abstract of Israel 1997, "Emission of Air Pollutants, By Type of Consumer," Table 1.8. The proportions cited here are obtained by dividing the total amount of CO and NOX emissions from all sources, by those generated from vehicles. However, since the CBS methodology for calculating vehicle emissions is obsolete, and is itself undergoing revision for the year 1998, the numbers cited here are estimates, reflecting not only the CBS estimates of emissions, but other alternative calculations which take into account more up-to-date data on vehicle emissions in the Israeli fleet (see note # 5).

[4] This mortality estimate is made by Dr. Gary Ginsberg, A. Seri, E. Fletcher, Dani Koutik, et al. in the paper, "Mortality from Vehicular Emissions in Tel Aviv-Jaffa," World Transport Policy and Practice, (Great Britain) Volume 4, No. 2, 1998, pp. 27-31. It is derived from local measurements of ambient air pollution levels and pollution emissions from industry, transport and natural sources, as recorded by the Tel Aviv Municipality's Department of Environment. Estimates for PM10 emissions per vehicle are based on data on comparative vehicles in the Dutch transport fleet in 1994 -- yielding a much more conservative estimate of overall emissions than that provided by the standard methodology of the Israel Central Bureau of Statistics, for its emissions estimates (see below). The methodology for calculating the deaths from particulate pollution is based, in part, on the World Health Organization's Office of Global and Integrated Environmental Health, "A Methodology for Estimating Air Pollution Health Effects," WHO, Geneva, 1996.
According to Ginsberg, (personal communication) the contribution of various sources to PM10 emissions in Tel Aviv-Jaffa are as follows:

Electric generation	47.1%
Other industry	1.3%
Gasoline Vehicles	7.7 %
Diesel Vehicles	29.5 %
Sand	14.4 %

[5] Dr. Gary Ginsberg, health economist, Ministry of Health, Dr. Ruth Chichesky, Central Bureau of Statistics, Dr. A. Seeri, Ministry of Environment, personal communications, 1998. Note: Emissions trends are usually calculated from the Central Bureau of Statistics, Statistical Abstract of Israel 1997, Table 1.8 "Emissions of Air Pollutants by Type of Consumer, in Tons." However, as noted previously, vehicle emissions data, as reported by the Central Bureau of Statistics in the 1997 Statistical Abstract, is based on vehicular emissions data from the 1980s, data which is out of date today, given the mass introduction of new vehicle emissions technologies. Revisions are now underway in the methodology for calculating vehicle emissions for the forthcoming 1998 Statistical Abstract. However, attempts to calculate up-to-date estimates, and to estimate the contribution of cars to total emissions, are still impeded by the absence of up-to-date Israeli test data both from vehicle emissions, as well as the scarcity of up-to-date emissions data from other sources, i.e. heating and industrial emissions.

To obtain more accurate measurements for vehicle pollution only, the Israel Ministry of Environment together with the Technion, initiated a program of research measurements of NOX and CO emissions from Israeli cars in 1997-98, but the program has yet to be extended to trucks and buses, a major source of pollutants. So far, no measurements have yet been made for vehicle particulates. Data on vehicle emissions is thus presented here as a graph of "high" and "low" ranges. The ranges are reflected in the table below. The complete 1996 CBS data on vehicle emissions is presented along with an alternative estimate of emissions by Gary Ginsberg. Ginsberg's alternative estimate is based on methodology developed in the paper by Ginsberg, et al., "Mortality from Vehicular Emissions in Tel Aviv-Jaffa," (see note #4).

In the case of CO emissions, Ginsberg's revised estimates take into account the recent testing for COs and NOX emissions in about 500 Israeli cars by the Technion. However NOX data on trucks and buses is not available locally, and is derived from the latest data from the British Ministry of Transport's Emissions Database. (http://www.london-research.gov.uk/emission.htm.) In the case of PM10s, no data is available locally, and Ginsberg's estimate is wholly derived from the British Ministry's of Transport's Emissions Database, as applied to the age and makeup of the Israeli vehicle fleet. The calculations do not include emissions from Palestinian vehicles traveling through Israel, or emissions from idling vehicles, which in cities may be of some significance.

It should also be noted that in Ginsberg's estimates, the kilometrage reported by the CBS for 1996 (31.656 billion kilometers) was also adjusted downwards by a factor of 8.1 percent as a "correction" to CBS kilometrage estimates. A similar downwards correction was originally made by the Trans Israel Highway Co. in the previously cited 1994 "Traffic Analysis and Economic Evaluation," on the basis of evidence indicating that actual Israeli vehicle gasoline consumption reflected a somewhat lower kilometrage than that reported by the CBS.

Ginsberg's final pollution estimates for 1996 exceed the official CBS estimate by 4 percent, in the case of CO, but are 10.7 percent lower for NO_x. In the case of particulates, his estimates are significantly lower than official estimates. The alternative estimate provided by Ginsberg here should still be compared very cautiously with data on other kinds of emissions -- i.e. statistics from heating or industry as recorded by the CBS-- since CBS date for those kind of emissions may also be obsolete, in some cases.

EMISSION (TONS)	1980 (CBS)	1996 (GINSBERG)	1996 (CBS)
CO	280,929	487,468	466,966
SO_x	6,976	--	12,220
NO_x	41,983	91,253	101,585
Hydrocarbons	34,383	--	31,660
Suspended Particulate Matter	4,797	4,789	15,367
PM10*	--	4,612	--

*According to Ginsberg, et al. PM10s constitute, on average, 96 % of SPMs from gasoline vehicles, and 99 % of SPMs from diesel vehicles.

[6] Trans Israel Highway Co. Traffic Analysis and Economic Evaluation, November, 1994, (in Hebrew) Section 4-17. "Summary of Projections for Annual Kilometrage Between the Years 2000 and 2020 by Vehicle Type." & Central Bureau of Statistics, 1997 Statistical Abstract of Israel; Central Bureau of Statistics, 1997 Kilometrage Survey; Central Bureau of Statistics, Motor Vehicles, 31.XII. 1997, Selected Data. No. 12, 1998.

Note: Estimated travel for the base year of 1992, as calculated by the Trans Israel Highway Co. report was 21.40 billion kilometers, as compared to the 22.795 billion kilometers reported by the Central Bureau of Statistics -- a discrepancy of about six percent. The lower estimate of the Trans Israel Highway report was based on reports of actual gasoline consumption for travel in the same year. However since 1992, the relative rate of increase in traffic kilometrage has been faster than that which was projected in the Trans Israel Highway report. By 1996, for instance, kilometrage reported by the CBS was roughly 17.6 percent higher than that projected by the Trans Israel Highway report. Between 1992 and 1996, therefore, kilometrage figures cited in this report are **the mid-point** between the CBS figures and the Trans Israel Highway figures and projections. For the years 2000, 2010 and 2020, we assumed that overall trends in kilometrage will follow **the pattern of the Trans Israel Highway Co. projections** (in a business as usual scenario). However, those projections were adjusted upwards by a **factor of 8.82 %** -- the 1996 midpoint average. This reflects the expectation that actual traffic growth will continue to outstrip the projections somewhat, as it has in the past decade. The kilometrage projections were also broken down more precisely by vehicle type, average amount of travel, type of engine (diesel or gasoline); and changes in fleet makeup (the transition from small gasoline trucks to diesel). In order to make more precise pollution projections in Chapter 1, trucks under four tons and small buses were removed from the category of "cars" and "other" and considered as a separate category.

For the purposes of travel projections, in Chapter 2, the Route Six definitions of "Private Cars" was preserved to include 2/3 of the commercial vehicles under four tons. Below is a summary of the kilometrage figures underlying all pollution and kilometrage projections in the report.

Vehicle Kilometrage Summary (billions of kilometers annually)

YEAR	ROUTE SIX	CBS	PRESENT STUDY
1992	21.40	22.795	22.10
1993	--	24,710	23.64
1995	--	30,633	28.54
1996	26 91	31.656	29.28
2000	32.43	--	35.29
2010	45.57	--	49 59
2020	55.13	--	59.99

[7] These projections, prepared by Dr. Gary Ginsberg, are based on the national kilometrage figures noted in note no. 6, as well as on methodology for pollution emissions calculations described in the paper "Mortality from Vehicular Emissions in Tel Aviv" cited in notes #4-5. Similar methods were used by Dr. Yosef Basis to generate long-term pollution projections in, "Preventing Pollution From Automobiles in Large Cities," The Biosphera, Volume 5-6, February-March, 1995. (in Hebrew)
Ginsberg's projections estimate emissions from the present -day vehicle fleet, based on vehicle kilometrage for different vehicle types. Emissions per kilometer were measured between 1995 and 1997 on Israeli vehicles at the Haifa Technion, as part of research sponsored by the Ministry of Environment. In the case of trucks and buses, as well as in the case of PM10 emissions, Israeli data was unavailable, and emissions factors were obtained from the British Ministry of Transport's Emissions Database. The British data provide emissions projections for all major vehicle categories and motor types from the present until the year 2020, projections which incorporate anticipated changes in technology. (see the internet site:http://www.london-research.gov.uk/emission.htm.)

Other factors considered in the calculation were average vehicle kilometrage in Israel by type of vehicle, differences in emissions factors in Israeli urban/rural driving conditions, the vehicle type and age spread of the Israeli car/bus/truck fleet, emissions according to the different categories of trucks and buses in the Israeli fleet, the rate of Israeli car, truck and bus vehicle turnover; a shift of small trucks and vans (under four tons) from gasoline-powered engines to diesel engines. It is expected that 60 % of small truck and van travel will be via diesel vehicles in the yea 2010 and 84 % by the year 2020. Also projected was a shift of 1.5 % of private car travel to diesel cars by the year 2000; 10 % by the year 2010 and 20% by the year 2020; as well as the fitting of all gasoline-powered cars with catalytic converters.

[8] Note: The British Ministry of Transport's emissions factors, used in the emissions projections made here, are projected year by year, and by vehicle type, until the year 2020. See also: Ewing and Reid, Transportation Quarterly, Vol. 49, No. 1, Winter, 1995, p. 94. See also California Air Resources Board, "The Linkage Between Land Use and Air Quality, 1994 p. 2.

[9] Jose C. Carbajo, Journal of Transport Economics and Policy, Editorial, London School of Economics and Political Science, and the University of Bath. January, 1995. p. 5.

[10] Sources of demographic data: EEC, Annual Bulletin of Transport Statistics, United Nations, 1995, p. 11. & Central Bureau of Statistics, Israel Statistical Abstract, 1996.

Demographics: Israel, Denmark, Netherlands

Country	1993 Population (thousands)	Area (km2)	Population Density (per km2)
Israel	5,260 (Yr. 2000: 6040)	21,946*	239.6* (Yr. 2000: 275.2)
Denmark	5,180	43,094	120.2
Netherlands	15,240	40,844	373.1

*includes pre-1967 Israel, the Golan Heights and east Jerusalem

European pollution data is from: "Strategies and Policies for Air Pollution Abatement," Economic Commission for Europe, Convention on Long-Range Transboundary Air Pollution, New York and Geneva, 1995, pgs. 81, 83, 108, 110.; Government of The Netherlands, Second Transport Structure

Plan: Transport in a Sustainable Society, 1989-1990, p. 11; Ministry of Transport, The Netherlands, Meerjarenprogramma Infrastructuur en Transport, 1996-2000, pp 9, 19.; Israeli data prior to 1996 is from the Central Bureau of Statistics, Statistical Abstract of Israel 1996, Table 1.8. For 1996 and 2000, emissions are calculated by Dr. Gary Ginsberg, as explained in notes # 4-7, and the graph "Trends of Motor Vehicle Emissions."

EMISSIONS TABLE (All Motor Vehicles) (THOUSANDS OF TONS A YEAR)

Year	Israel		Denmark		Netherlands	
	CO	No_x	CO	NO_x	CO	Nox
1985	367.8	54.0	496.1	91.4	923.0	262.0
1990	485.7	71.2	526.2	98.8	675.0	272
1992	603.7	88.1	542.6	100.3	584.0	262
1993	668.7	97.2	444.1	88.4	--	255
1994	667.2	91.3	--	--	--	248
1996	487.5	91.3	--	--	--	--
200	400.1	92.1	378.2	61.5	--	149

[11] Darnay, Arsen J. (editor). Statistical Record of the Environment, Gale Research Inc., Detroit, Michigan, 1992 Table: "Ozone: U.S. Urban Areas Failing to Meet Standards," p. 37.

[12] Sources: (U.S. Data) U.S. EPA, National Air Quality and Emissions Trends Report. "Metropolitan Statistical Area Air Quality Factbook: Peak Statistics for Selected Pollutants by MSA." 1991 & "EPA National Air Quality and Emissions Trends Report, 1994," Data Appendix, October 1995 from the EPA Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

(Israeli Data) Statistical Abstract of Israel, Central Bureau of Statistics, Jerusalem, 1991. Also, M. Peleg, M. Luria et al. "Ozone Levels in Central Israel," Israel Journal of Chemistry, Vol. 34, 1994, pp. 375-386. Also, D. Alper-Siman Tov, M. Peleg et al. "Recirculation of Polluted Air Masses over the East Mediterranean Coast," Atmospheric Environment, November, 1996.

Notes: Ozone readings for Ceasarea were measured in five minute averages daily between May and October, 1993. The maximum daily five minute average was in excess of 230 ppb, yielding an equivalent value of about 200 ppb for a half-hour period, according to Luria.

The translation from ppb to micrograms/cm^3 is ppb * 1.91 = micrograms/m^3 as explained in The Royal Commission on Environmental Pollution, Eighteenth Report, Transport and the Environment, His Majesty's Publishing House, London, p. 34.

The EPA reports the second-highest daily maximum reading of the year, rather than the highest day's reading. The aim in this practice is to discount severe weather aberrations. EPA readings are typically averaged in one-hour sequences, rather than in half-hour sequences as in Israel. Despite such differences, the numbers are still comparable, according to Luria.

Maximum Recorded Ozone Levels (1990/1991)

City	Ozone: Parts Per Billion (Israeli Standard -120 ppb)	U.S. EPA Pollution Rating	Measure
Jerusalem	180	Serious	Highest ½ hr. avg.
Gush Etzion	133	Marginal-Moderate	Highest ½ hr. avg.
Ceasarea (1993)	200	Severe	Highest ½ hr avg.
New York City	180	Serious	2nd highest avg.
Neward, N.J.	140	Moderate	2nd highest avg.
Pittsburgh, PA	120	Marginal	2nd highest avg.
England 4/8/90	169	Serious	Highest nationwide average since 1984
Los Angeles (1994)	240	Extreme	2nd highest avg.

[13] M. Luria, M. Peleg et al, "The Formation of O_3 Over Israel: A Growing Concern and a Potential International Issue," Y. Steinberger (editor) in Preservation of Our World in the Wake of Change, Volume VI A/B ISEQS Publishers, Jerusalem, 1996. pg. 13-16.

[14] DW Dockery et al, "An Association Between Air Pollution and Mortality in Six U.S. Cities," The New England Journal of Medicine, Dec. 9, 1993. p. 1756;

See also: David V. Bates, "Air Pollution, Time for More Clean Air Legislation?" British Medical Journal, London, Volume 312, March 16, 1996. p. 649.

B. Ostro et al. "Air Pollution and Mortality: Results from a Study of Santiago, Chile," Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Berkeley, U.S.A.

GD Thurston, New York University School of Medicine "A Critical Review of PM10 Mortality Time-Series Studies," Journal of Exposure Analysis and Environmental Epidemiology, Jan-Mar, 1996.

[15] CA Pope, "Particulate Pollution and Health, A Review of the Utah Valley Experience," Journal of Exposure Analysis and Environmental Epidemiology, Jan-Mar, 1996.

See also: J. Schwartz et al. "Acute effects of Summer Air Pollution on Respiratory Symptom reporting in Children," American Journal of Respiratory Critical Care Medicine, November, 1994.

Committee of the Environmental and Occupational Health Assembly of the American Thoracic Society. "Health Effects of Outdoor Air Pollution," American Journal of Respiratory Critical Care Medicine, January 1996. pp. 3-50.

I. Romieu et al. "Effects of Air Pollution on the Respiratory Health of Asthmatic Children living in Mexico City," American Journal of Respiratory Critical Care Medicine. August, 1996.

[16] See "A Methodology for Estimating Air Pollution Health Effects, Office of Global and Integrated Environmental Health, World Health Organization, Geneva, 1996. & Kenneth A. Small and Camilla Kazimi, "On the Cost of Air Pollution from Motor Vehicles" The Journal of Transport Economics and Policy, University of Bath, January 1995. Table 4, pg 13. See also the work of Joel Schwartz, Department of Environmental Health, Harvard University.

[17] See Particles in Our Air: Concentrations and Health Effects, eds. Richard Wilson and John D. Spengler, Harvard University Press, 1996

[18] Ibid. Dr. G. Ginsberg, A. Seeri, E. Fletcher, Dani Koutik Phd, et al. "Mortality from Vehicular Emissions in Tel Aviv."

[19] Dr. G. Ginsberg, personal communication. As noted previously with regards to CO & NO, the 1996 estimate of PM10 emissions by Ginsberg varies greatly from the baseline provided by the Central Bureau of Statistics, which based its calculations of emissions per/km of travel on vehicle emissions data from the 1980s. The estimates and projections are as follows:

	PM10 Emissions from Vehicles – In Tons			
	1996	2000	2010	2020
CBS*	14,800	--	--	--
Revised Estimate	4,612	3,920	4,250	5,690

* The CBS baseline figure cited in the 1997 Statistical Abstract of Israel is 15,367 tons. But this is adjusted here to reflect PM10s, only, which are generally assumed to constitute 96-97 percent of the Total Suspended Particulate matter emitted by vehicles.

[20] Aryeh Avraham, Transport Division, Central Bureau of Statistics, reports in a personal communication, May, 1998, that the total number of taxis registered in 1997 was 11,563, of which only 537 were gasoline powered, and the remaining 11,026 diesel.

[21] Dr G. Ginsberg, A. Seeri, E.Fletcher, Moshe Tenne PHd, et al. "Mortality Reductions As a Result of Transferring To Alternative Fuel Powered Vehicles in Tel Aviv-Jaffa," World Transport Policy and Practice, Vol. 4, No. 4, 1998, p. 4. Ginsberg estimates here that the transfer of trucks and buses to cleaner, compressed gas fuels can reduce PM10 tailpipe emissions, and hence deaths by about 80 percent, while fitting diesel vehicles with an oxidizing catalyst is a more immediate, and inexpensive measure that can reduce PM10 tailpipe emissions by about 25 percent.

[22] Ibid. The Royal Commission on Environmental Pollution, "Transport and the Environment," pp 129-130.

[23] For figures on PM10 pollution levels in Jerusalem see:Yosef Ben Ami, "Characteristics of Suspended Particles in Jerusalem," Hebrew University M.A. thesis, written under the direction of

Professor Menachem Luria and Doctor Mordechai Peleg. May, 1992. Personal Communication Tel Aviv PM10 levels are averages of tests from three monitoring stations maintained by the Israel Electric Corporation and the Tel Aviv Municipality, as reported to the Environment Ministry, and contained in G. Ginsberg et al "Mortality from Vehicular Emissions in Tel Aviv." Los Angeles PM10 level (Annual Arithmetic Mean) is contained in the 1992 Air Quality Report, supplied by the South Coast Air Quality Management District., Diamond Bar, CA. The Newark, New Jersey figure (Weighted Arithmetic Mean) is from the EPA's National Air Quality Emissions Trends Report, 1991, U.S. EPA office of Air Quality Standards and Planning.

[24] Table is adapted from Health on the Move: Policies for Health Promoting Transport. The Public Health Alliance, Great Britain, 1991, p. 7.

[25] M. Luria, M. Peleg et al, "The Formation of O_3 Over Israel: A Growing Concern and a Potential International Issue," Y. Steinberger, ed. in Preservation of Our World in the Wake of Change, Volume VI A/B ISEQS Publishers, Jerusalem, 1996. pg. 13-16.

[26] John Whitelegg, Transport for a Sustainable Future: The Case for Europe, John Wiley Press, 1993. Fig. 3.11, pg. 57-58.

[27] Dr. Gary Ginsberg, personal communication and http://www.London-research.gov.uk/emission/empm10.htm. Note: for automobiles: The weighted Israeli fleet average of gasoline automobile particle emissions are estimated to be .0325 grams/kilometer, based on British emissions factors, adjusted to the age of the Israeli fleet. In comparison, for Trucks and Buses: Estimated average particle emissions in 1996 were as follows:

Trucks (over four tons)-	urban cycle --	.996 grams/kilometer
	rural cycle -	.583 grams/kilometer
Buses	-urban cycle -	1.347 grams/kilometer
	rural cycle --	1.178 grams/kilometer

[28] Central Bureau of Statistics, Statistical Abstract of Israel, 1993, Table 1:19; Ibid. The Trans Israel Highway Company, Traffic Analysis and Economic Evaluation pp. 11, 30, 94 & Table 4-17. Total Israeli emissions of diesel and (petrol)gasoline vehicles were calculated by Dr. Gary Ginsberg according to the formula described in notes # 4-7. A breakdown of the fleet by diesel and petrol vehicles, and of average kilometrage for both diesel and petrol vehicle types, including trucks under and over four tons, was obtained from the Central Bureau of statistics, Statistical Abstract of Israel 1997, Table 18:17 & from Arye Avraham, Central Bureau of Statistics, personal communications, July, 1998.
The estimated breakdown in emissions for 1996 is as follows:

1996	Vehicle Kilometers (billions)	Nox Emissions (Thousand Tons)	PM10 Emissions (Thousand Tons)	
Diesel Vehicles	5.0 (17.1%)	53.83 (59.0%)	3.75 (81.2%)	
Petrol Vehicles	24.3 (82.9%)	37.41 (41.0%)	0.86 (18.8%)	
Total	29.3 (100%)	91.25 (100 %)	4.61 (100%)	

[29] From "External Effects of Transport" Interim Report, Infras, Zurich, IWW Karlsruhe, May 1994. Cited in Israeli Institute for Transport and Planning Research, Development Plan 2000: Economic Evaluation of Externalities, Working Paper No. 10, pg. 4.(in Hebrew).

[30] D..M.G. Newberry, "Road User Charges in Britain," The Economic Journal, Volume 98 (1988):161-176; Ibid. Getting the Prices Right, A European Scheme for Making Transport Pay its True Costs, The European Federation for Transport and Environment, May 1993. p. 108-9. John Whitelegg, Transport for a Sustainable Future: The Case for Europe pp. 109-112.

[31] Worldwatch Institute, State of the World, W.W. Norton, 1993, pg. 124.

[32] Per Kageson, Getting The Prices Right: A European Scheme for Making Transport Pay its True Costs. The European Federation for Transport and Environment, May, 1993, pp. 15-17. See also full report. pp. 108-109.

[33] Ministry of Transport, Representative Statistics of the Transport Branch, May, 1996. pp. 12,24 & Central Bureau of Statistics, Statistical Abstract of Israel 1996, Jerusalem, Table 18.22.

[34] Ministry of Transport, Representative Statistics of the Transport Branch, May, 1996 p. 24 and Statistical Abstract of Israel 1996, Jerusalem, Table 18.17.

[35] Central Bureau of Statistics, Statistical Abstract of Israel 1995, p. 551.

[36] International Road Federation. World Road Statistics 1989-1993, Geneva, p. 109.

[37] Paul Barach, "100 Kilometers Per Hour: What Have We Gained? Impact of Raising the Speed Limit on Interurban Highways on Accidents, Deaths and Injuries in Israel." Thesis for Master of Public Health degree. The Hebrew University, School of Public Health and Community Medicine, 1996. Following Yisrael Kessar's November 1993 decision to raise the speed limit on Israel's three interurban highways from 90 kph to 100 kph, the death toll jumped by an additional 40 to 60 fatalities annually -- both on the highways themselves and throughout the system

[38] G. Ginsberg, E. Fletcher, B. Michael and E.D. Richter, "Deaths Resulting from the Trans Israel Highway and Alternatives: A Risk Assessment." World Transport Policy and Practice, UK, 3/4 1977, pp. 4-10.

[39] Dutch Ministry of Transport, "Bicycle Master Plan," Structured Scheme for Traffic and Transport, 1993.

[40] Ibid. Trans Israel Highway Company, Traffic Analysis and Economic Evaluation pp. 12-13. A travel survey of Israeli holders of driver's licenses revealed that the number of people who walk to work declined from around 20 percent in 1984 to about 10 percent or less in 1994.

[41] Comparative statistics on pedestrian deaths per capita are drawn from: European Conference Of Ministers of Transport, Urban Travel and Sustainable Development, ECMT-OECD, Paris, 1995, p. 53; "Statistics on Pedestrian Deaths (1991) as a Percentage of Road Deaths" are from New Scientist and Central Bureau of Statistics, Statistical Abstract of Israel 1992, Table 18.27.

[42] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment p. 129. & Ibid. Per Kageson, Getting The Prices Right p. 88.

[43] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment. "Freight Transport Modes, Energy Uses and Emissions," pg. 167.

[44] Ya'akov Garb, "The Trans Israel Highway: Do We Know Enough to Proceed?" The Flournheimer Institute for Policy Studies, Working Paper No. 5, Jerusalem, April, 1997.

[45] City of Copenhagen, "P-Guide to Copenhagen," parking guide for tourists, 1996.

[46] Aharon Seeri, Ministry of Environment, personal communication, July, 1998.

CHAPTER II
ASSESSING TRANSPORT TRENDS FROM A QUALITY OF LIFE PERSPECTIVE

During the early years of Israel's existence, cars were almost exclusively a luxury good, earning the nickname of "private" as compared to the "public" transport that most people rode. Austerity measures, complex import regulations on cars, and the Zionist collectivist ethos checked the growth of motorization for several decades. There were only 7 cars per thousand people in 1952 (compared to 300 per thousand in the U.S. at the same time), and only 12 per thousand a decade later. As late as 1980, almost 50 percent of all travel was by bus.

Motorization began to soar in the 1980s. By 1988 there were 185 cars per 1000 persons. Growth in the car fleet has continued in the 1990s at the rate of about six percent annually, and in 1997 the country had over 1.6 million vehicles.[1] Public transport use dropped correspondingly – to 40 percent of all motor vehicle trips in 1985, and 36 percent of all travel in 1995. If current car -oriented trends continue, public transport will decline to an estimated 20-30 percent of all motorized travel after the year 2000. [2]

Many transportation professionals believe that rising living standards inevitably lead to an increase in car ownership and use. They argue that at 234 cars per thousand, Israeli motorization rates are still lower than those of Europe, and that Israeli public transport ridership is still significantly higher nationally—although not in urban areas. [3] They contend that restraint is impossible without the kind of draconian measures that would be unacceptable to contemporary Israelis. And they argue that higher car ownership rates will bring greater freedom and social equity. These claims are based on a misrepresentation both of European trends, of Israel's special problems of geographical size and population density, and of the real social equity issues that are at stake.

CAR OWNERSHIP VERSUS CAR DENSITY

Most fundamentally, in an era in which other advanced countries are attempting to reduce their reliance on private cars, Israel's low motorization rates should be regarded as a tremendous advantage, not a lag to be eliminated. Experience in

Europe and the United States demonstrates that as car ownership rates increase, public transport patronage tends to decline.[4]

A debate centered only around Israel's relatively lower rate of car ownership masks Israel's unique transport policy dilemma. Because this country is so small and densely populated, European levels of car ownership and use in Israel will generate more severe pollution and congestion impacts than they do in countries such as France, Germany or Great Britain, which enjoy a larger geographical area. To obtain an accurate comparison of congestion and pollution trends in Israel vis-a-vis Europe, we also need to compare the *density* of road vehicles and the *intensity* of vehicular travel per unit of area (kilometers squared). **Per square kilometer, vehicle travel in Israel north of the sparsely populated Negev already exceeds that of every country in Western Europe.**[5] Similarly, the density of cars, per square kilometer, will exceed that of every other Western European nation by the year 2010.[6] See Figure 11.

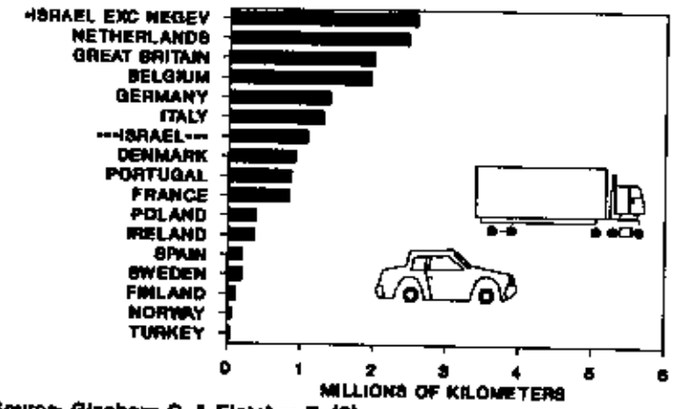
Figure 11: Vehicle Travel per Square Kilometer, 1993 and 2010

"CLEAN" TRAVEL MODES AND THE "CONSUMPTION" OF TRAVEL

In terms of the "mix" of travel modes, comparisons between Israel and Western European countries also underplay the destructive trends underway in Israel. For instance, many road developers cite the relatively high proportion of public transport ridership in Israel. They argue that even if extensive road development occurs, the proportion of public transport nationally will remain high when compared to Europe. Israel is even described as a "nature reserve" in the Trans Israel Highway Travel Forecast and Economic Analysis – which estimated that Israeli public transport ridership *nationally* averaged around 36 percent of motorized traffic in Israel in 1993, in comparison to an average of about 20 percent in Europe.[7] While technically accurate, such comparisons mask Israel's relatively greater dependence on socially and environmentally unsustainable transport modes:

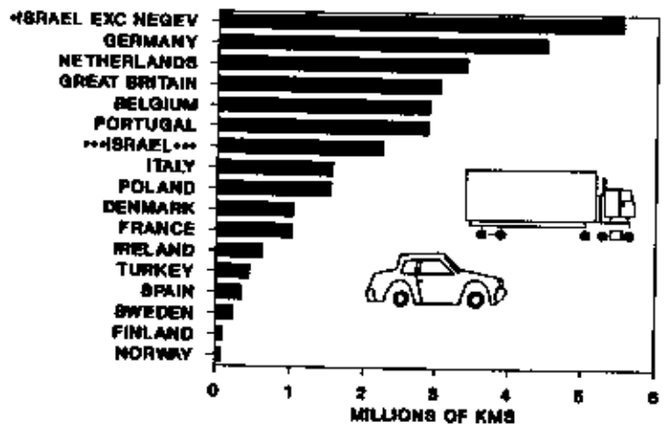
- Proportionally fewer Israelis travel via non-motorized modes – particularly bike and pedestrian. **In Denmark and Holland, the two European countries most similar to Israel size-wise, travel by bicycle constitutes seven percent of total passenger kilometers traveled via all modes, while in Israel it constitutes less than one percent of total travel.**[8] See Figure 12.

Fig 11: VEHICLE TRAVEL PER SQUARE KM (1993)



Source: Ginsberg G. & Fletcher E. (5)

VEHICLE TRAVEL PER SQUARE KM (2010)



• Israel's relatively greater dependency on motorized, as compared to non-motorized modes, spurs a higher overall "consumption" of travel. As noted previously, **PER UNIT OF AREA**, road travel by all motorized modes is already higher in Israel than in any other European country. In the future, car-oriented development will exacerbate current trends by promoting dispersed land use patterns that induce people to travel further distances for every daily task. Israelis will be literally "driving around in circles."[9]

• In Israel, public transport relies overwhelmingly on relatively "dirty" bus modes that consume more space and generate more pollution than rail. That dependency will be perpetuated in road-oriented development scenarios, where buses will naturally enjoy a continued development edge over rail.[10]

Figure 12: Bus-Rail-Bike Travel, Europe vs Israel

Bus vs Rail

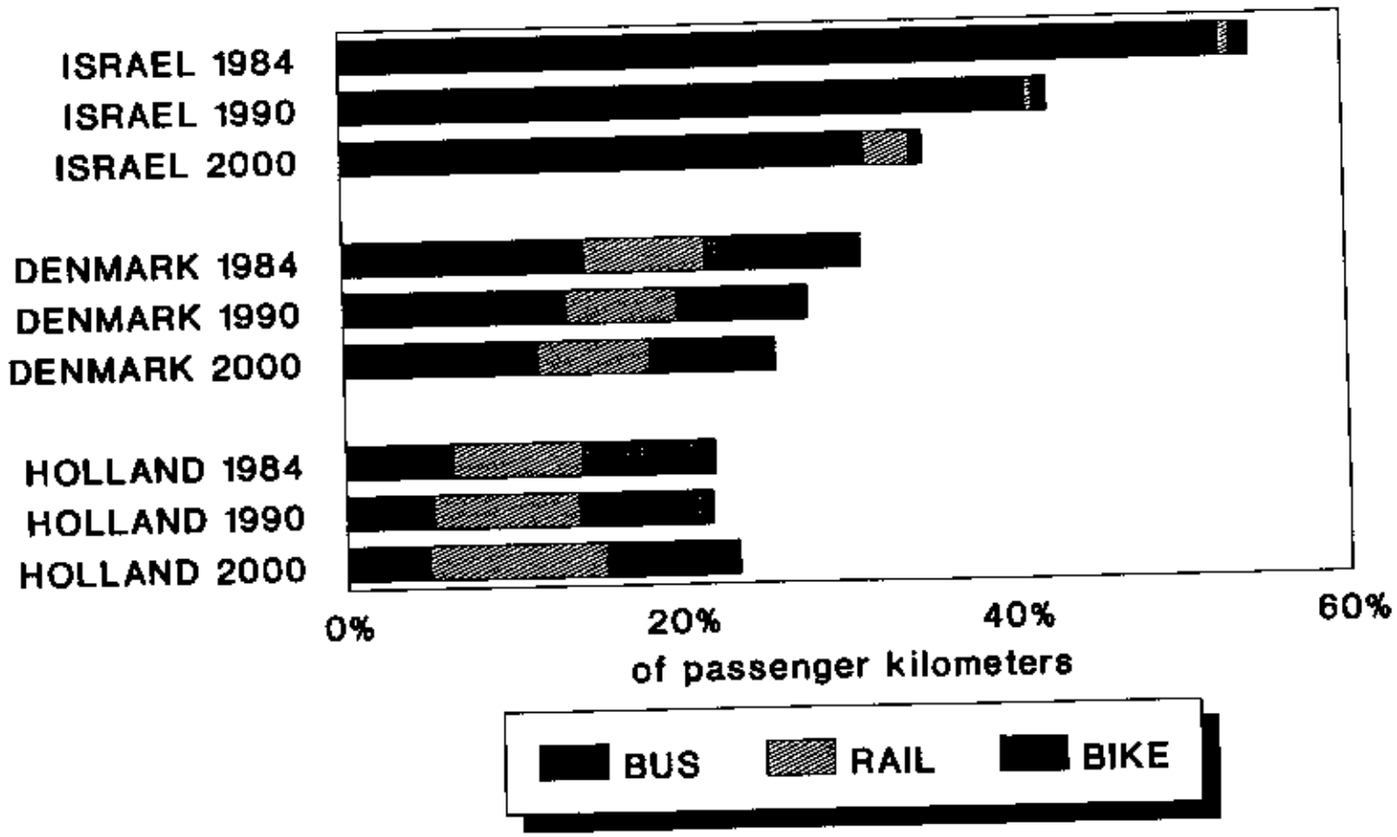
In terms of sheer capacity, urban bus systems are less efficient than rail in crowded urban corridors. Urban buses can on the average carry at maximum 5,000 to 8,000 passengers per hour, per lane in a typical urban bus-only thoroughfare. In Jerusalem's Jaffa Road, as well as in many Tel Aviv locations, peak time passenger bus travel has already reached or exceeded that ceiling, resulting in service delays and inefficiencies. [11,12] While a bus-only system can be more flexible than rail, and better serve low-capacity corridors, it has a higher pollution penalty than rail -- emitting both NOX and, in the case of diesel, PM10s directly into the street. Bus traffic noise also is generally more disturbing than rail traffic.[13]

Per passenger, rail uses less urban and interurban space. Due both to the larger space consumption and pollution emissions, rail integrates better with pedestrian and cycle modes in cities. Rail thus spurs indirectly more compact land use patterns -- which thrive in pedestrian-oriented environments. As a result, a rail line is generally perceived by investors as a far more effective trigger for high value-added commercial or residential development at station sites. It is also generally perceived by members of the public as a more reliable and higher quality means of transport than a bus. See Figure 13 on the next page.

The Royal Commission report on Transport and Environment sums up the overall benefits of urban light rail over buses this way:

"Diverting traffic to light rapid transit systems can improve the urban environment by reducing local noise and atmospheric pollution and by improving safety. These advantages are strengthened if streets are closed to other traffic (except for appropriate access to frontages). Tram systems are popular with the public, and are one of the most efficient travel modes in terms of primary energy requirements. Per passenger kilometer and

Fig 12: BUS-RAIL-BIKE TRAVEL
(EUROPE vs ISRAEL)



Source: Ginsberg G. & Fletcher E. (10)

with 50 percent occupancy, they use three quarters of the energy used by a similarly loaded double-decker bus, and only about a tenth of that of a car used for urban commuting. The construction of rapid transit systems can stimulate complementary improvements in town centers, as well as provide greater certainty of services, thereby encouraging developers to provide new facilities."[14]

Figure 13: Urban Space Required by Travel Mode

Often, increases in the share of rail and non-motorized transport by even a few percentage points can markedly improve social equity and quality of life and reduce pollution. It is government transport and investment policy that plays a major role in determining whether such incremental improvements will occur.[15]

Israel's Lag in Proactive Policy

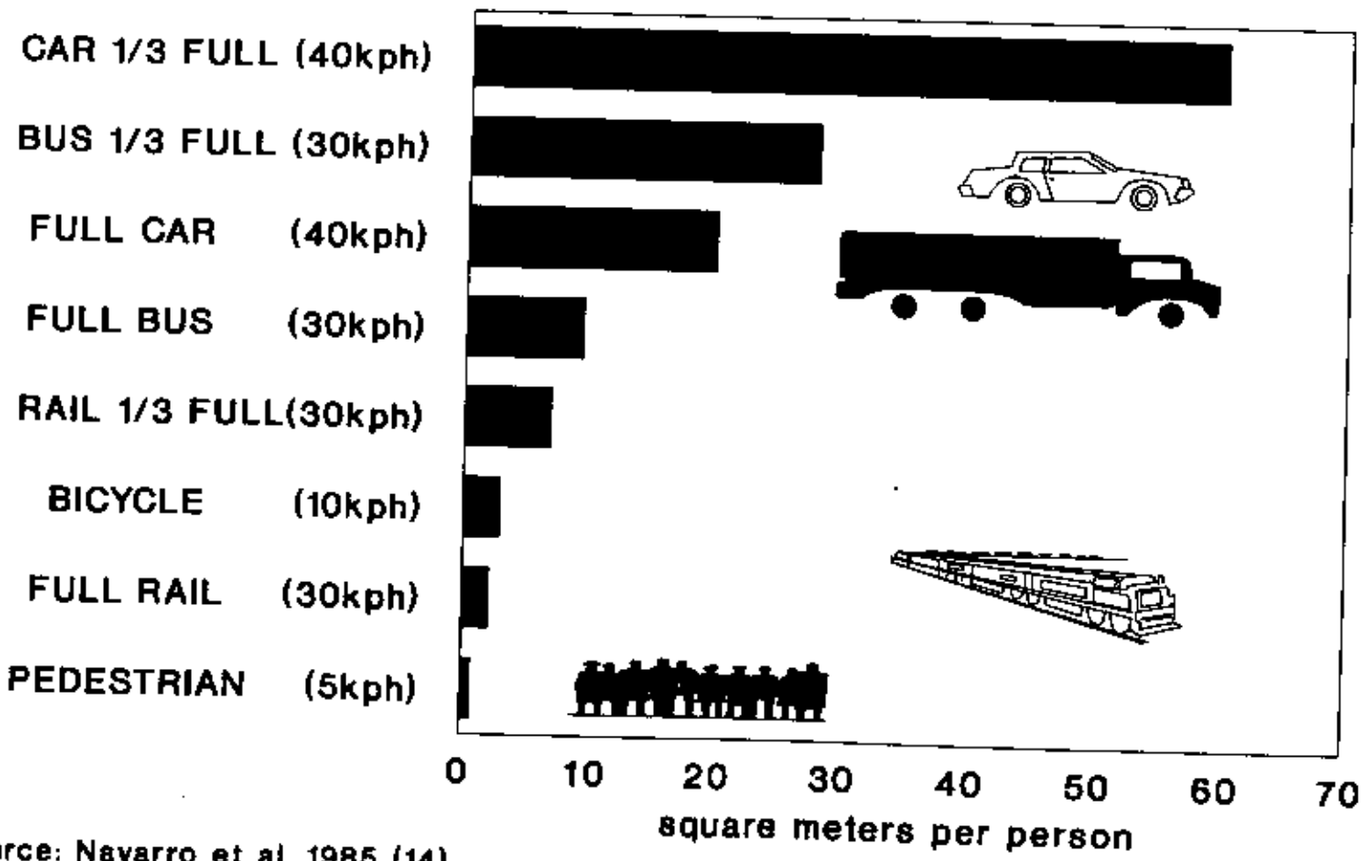
While the car lobbyists have complained that Israel is "lagging" behind Europe in car ownership rates, **the true lag Israel suffers is in the realm of effective policies to stem excessive car ownership and use.**

Managed, *proactive* policies to reduce car use in countries such as those in Holland and Denmark are beginning to yield results in stemming the tide of car dependency. In The Netherlands, for instance, passenger train travel grew by 60 percent between 1986 and 1994 -- while car travel grew by less than 20 percent. [16]

In contrast, Israeli policy is largely *reactive*. Since no national transport plan or targets exist, policy is driven by existing transport projects—most notably the Trans Israel Highway plan. The unquestioned assumption embedded into the Trans Israel Highway plan is that Israeli car ownership levels will rise to rates exceeding most countries in Europe today, generating massive new demands for road space According to Route Six projections, car ownership is to average 450 private cars per 1000 Israelis by the year 2020 -- nearly one car for every two citizens (of all ages!). [17] Such ownership rates would exceed those of most countries in Europe today – particularly Denmark, which boasts only 305 cars per thousand, or Holland's 363 cars per 1000. [18]

The difference between European and Israeli transport trends is most striking in city-by-city comparisons. Two outstanding facts:

Fig 13: URBAN SPACE REQUIRED by TRAVEL MODE



Source: Navarro et al. 1985 (14)

+ Major Israeli cities already have car ownership rates well within the range of European cities of comparable size and importance. [19] [20] In fact, car ownership even in low-income Jerusalem and Beersheba, presently exceeds that of Copenhagen, where transport policy has successfully blunted trends towards rising car ownership. In Copenhagen, car ownership between 1990 and 1995 **declined** from 188 to 165 cars per 1000 residents within the city limits, and in the Copenhagen region, from 273 to 256 cars per 1000![21] Meanwhile, 1995 traffic levels in Copenhagen were 9 percent below the 1970 level. [22] See Figure 14.

Figure 14: Car Ownership

+ Overall, Israeli urban dwellers USE cars more, and rely far LESS on public transport, biking and walking (See Figure 15) **than residents of many major European cities, particularly those on the continent.** [23]

Figure 15: Modal Split by Selected Cities

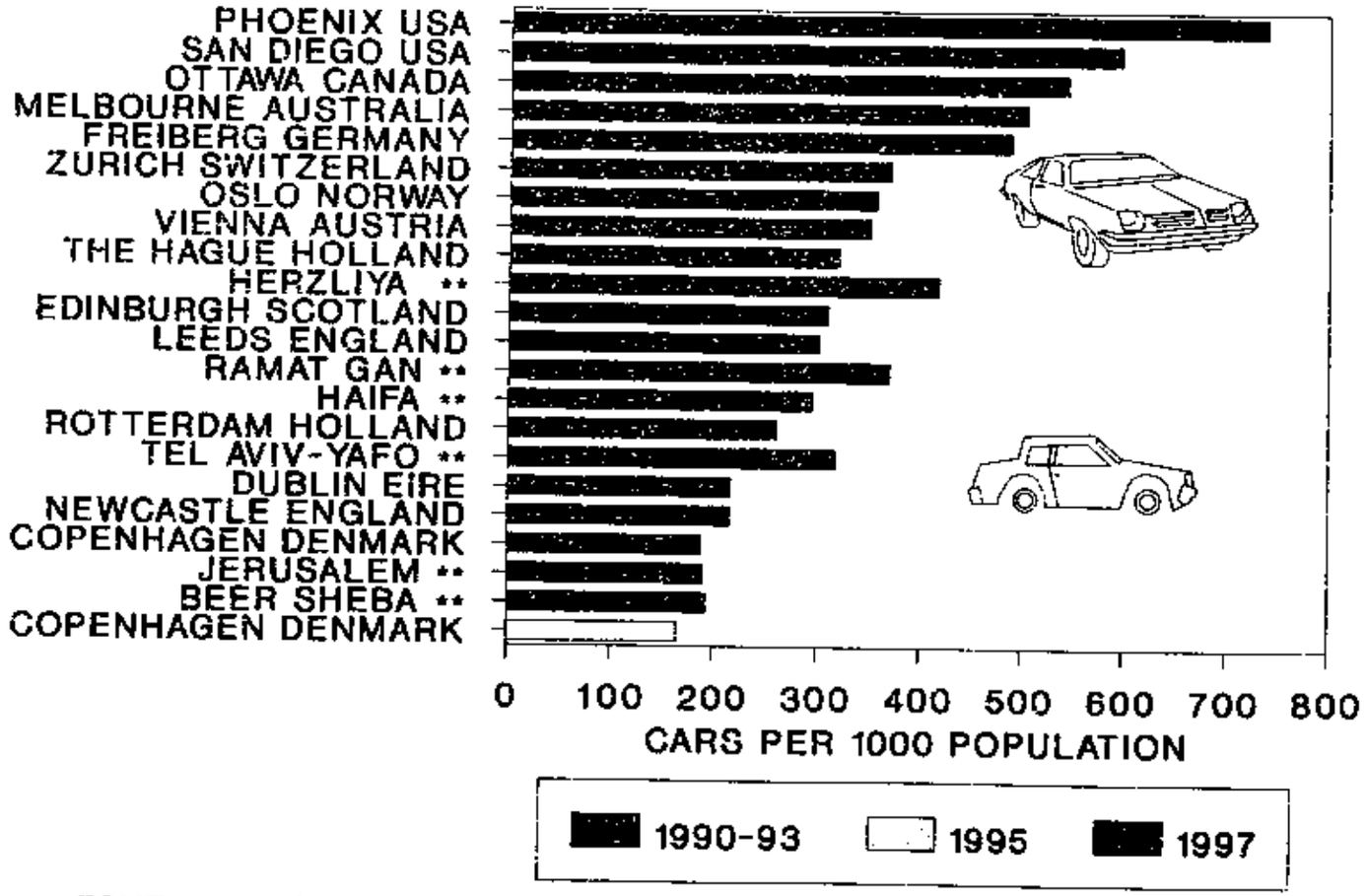
Does More Travel Mean a Higher Quality of Life?

Increased mobility is not always positive. The commuter who must drive an hour to work enjoys a **higher** rate of "mobility" than the pedestrian who walks ten minutes to the job. But the long distance commute in fact **lowers** one's "quality of life." While many Israeli planners tend to see increased "mobility" as a positive result of rising living standards, and increased traffic congestion as an unavoidable byproduct, the view in western Europe and progressive North American cities is that much of this new mobility represents an unnecessary **consumption of travel.**[24] Conversely, walking is seen as one of the most optimal means of transport, particularly when communities are designed to facilitate pedestrian travel for basic daily routines.[25]

In 1984, before automobile use in Israel began to soar, a full 35 percent of daily trips by Israelis were on foot.[26] Walking appears to have diminished dramatically over the past decade. The proportion of Israelis who walked to work declined from about 20 percent in 1984 to about ten percent in 1993.[27] In Jerusalem, a compact city in which public transport use is relatively high, the percentage of all residents who walked or rode a bicycle to work totaled only **8 percent** in 1996.[28]

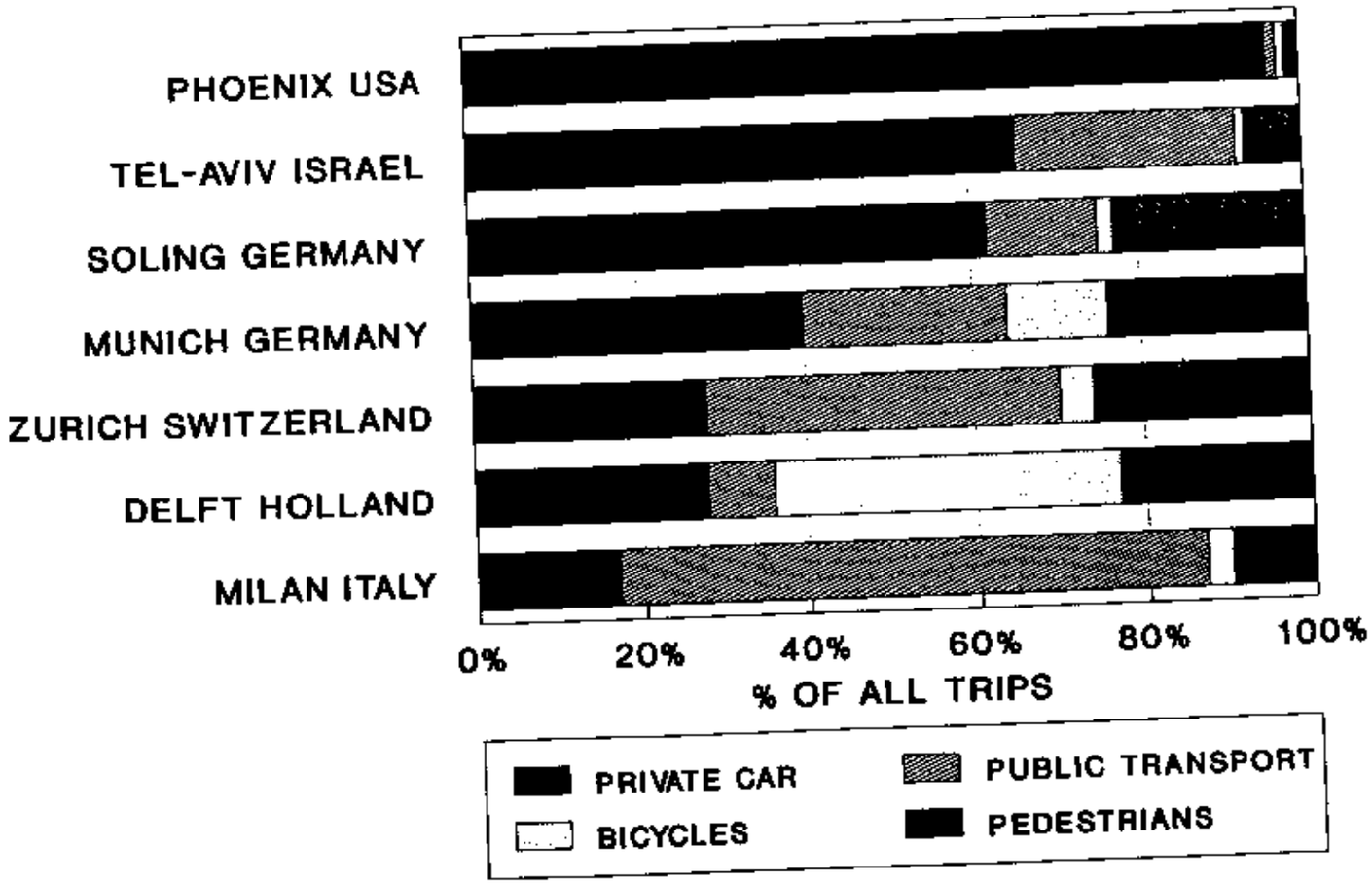
In many major European cities today, **one-quarter to one-third** of total trips are performed on foot or on bicycle. [29] In Vienna, a city of 1.6 million residents, **22 percent of trips** are made on foot. Motorized private transport trips remained a steady 37 percent of total transport trips between 1970 and 1990, and is projected to

Fig 14: CAR OWNERSHIP



Source: ECMT & CBS (19-20)

Fig 15: MODAL SPLIT BY SELECTED CITIES



Source: Ginsberg G. & Fletcher E. (23)

drop to 25 percent of all trips by 2010.[30] In Holland, 44 percent of *the total movements* made daily are performed on foot or on bicycle—and car trips constitute LESS THAN HALF of the total trips made during the day. [31]

Land use and traffic policies are all designed to promote walking and biking, and to reduce unnecessary "consumption of travel." In the city of Muenster, "quiet" zones forbid private car access and parking -- except to residents, cabs or service vehicles. Car traffic declined by about 5 percent between 1982 and 1990, while cycling increased by 20 percent.[32]

Israel's rapidly rising rate of COMMUTER TRAVEL and "INTERCITY" TRAVEL, also reflect the often unnecessary consumption of travel via motorized modes.

In metropolitan Tel Aviv, trips within the hometown community—which can more often than not be accomplished on foot or bike rather than by car -- declined by **59 percent** between 1984 and 1994.[33] Commuting distances, meanwhile, have soared. In fact, average commutes in Israel appear to exceed those of Denmark and Holland, particularly in the rural sector. This trend reflects the worrisome growth in distance between home and workplace, a factor that has a negative impact on the ability of groups with low mobility to find and hold jobs, including the poor, women with children, Palestinian Israelis, teenagers and the elderly.[34]

Pedestrians: Invisible Travelers in the System

Despite its importance, non-motorized transport is rarely considered by Israeli planners and policymakers. Except for the sparse statistics cited above, pedestrian movement is never measured, nor are goals and forecasts made for the future. There are virtually no "master plans" for pedestrian travel – although such plans exist on the municipal and national level for public transport, roads, and even parking. Israeli planners focus exclusively on motorized travel -- assuming that the trend towards longer and more motorized trips is inevitable. With a circular logic, road-oriented planners and policy makers then use these trends to justify the provision of even more motorized travel capacity - rather than seeking proactive ways to shift trips from motorized to non-motorized modes. As car-oriented transport and land use development accelerates, the distance between work, home, and shopping does indeed increase, and walking to daily tasks also becomes less feasible. A vicious cycle ensues where still more pedestrians begin to opt for cars, congestion increases, and roads are expanded, reducing the quality of the pedestrian environment still further.[35]

FINANCE AND TAX POLICY – COMPARATIVE TRENDS

Infrastructure Investment: Road Versus Rail

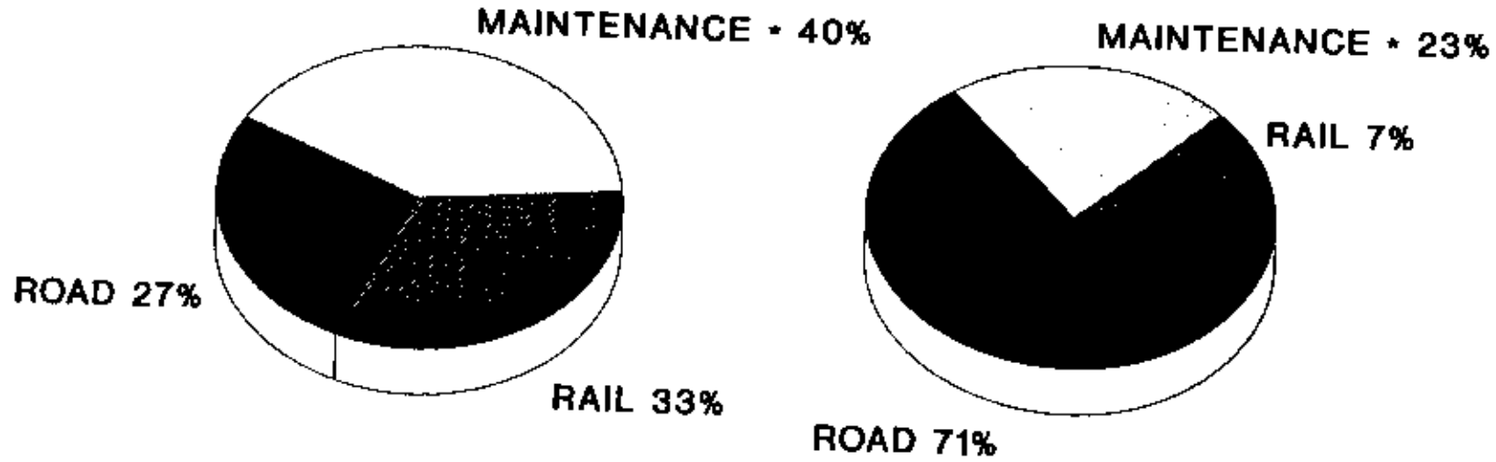
In the 1980s, about 71 percent of the European Community transport infrastructure investment was in roads.[36] Today that figure is shifting dramatically and the majority of planned new infrastructure investment is for rail, as opposed to roads. Planned European investments include 70,000 kilometers of rail lines, including 23,000 kilometers of expensive high-speed lines, as compared with 58,000 kilometers of roads.[37] European cities and metropolitan regions, meanwhile, are investing in light rail, pedestrian and cycle routes, and engineering innovations such as traffic light systems that give buses priority at road intersections.

In contrast, Israel continues to invest over 70 percent of its transportation budget in road construction and expansion (not including road maintenance).[38]- [39] See Figure 16.

Figure 16: Government Investment in Infrastructure

After several years of cautious rail development in the 1990s, Israel's net 1998 budget for interurban rail development plummeted to NIS 110 million -- as compared to NIS 254.2 million in 1995. That halted or severely delayed modernization and development plans on key lines from Tel Aviv to Petah Tikva, Kfar Sava, and Ashdod. Some Rail Authority officials believe that the government's strategic aim is in fact the "closure" of Israel's interurban rail system.[40]

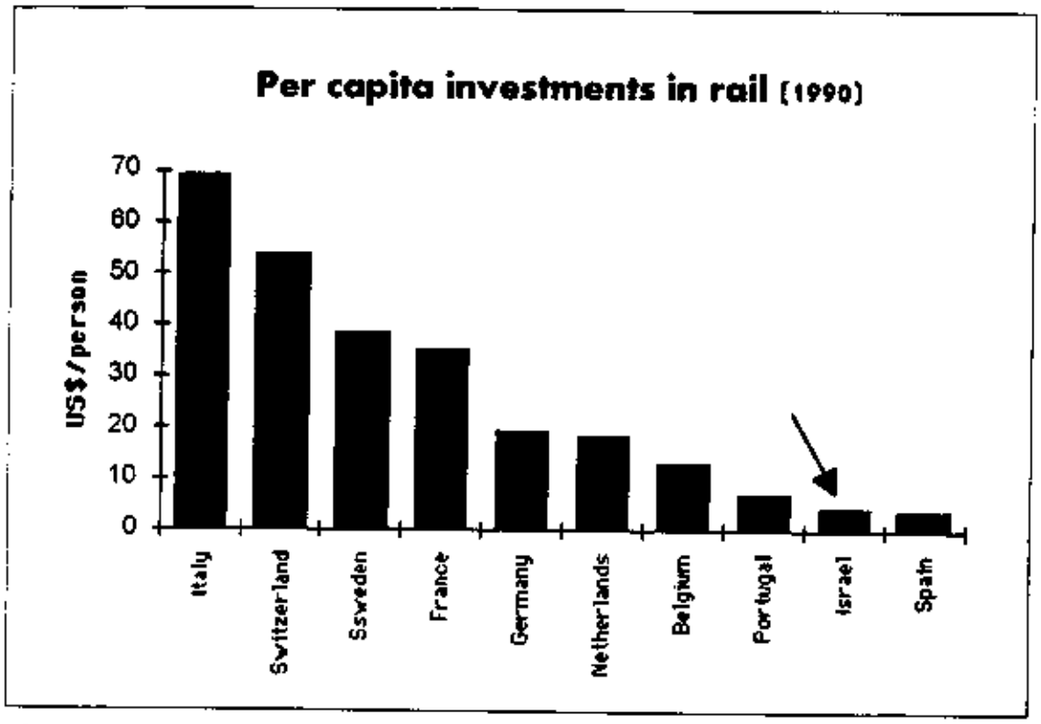
Fig 16: GOVERNMENT INVESTMENT IN INFRASTRUCTURE (1995)



* Public Transport Maintenance & Subsidies.

Source: Ministries of Transport, Israel & Holland (38-39).

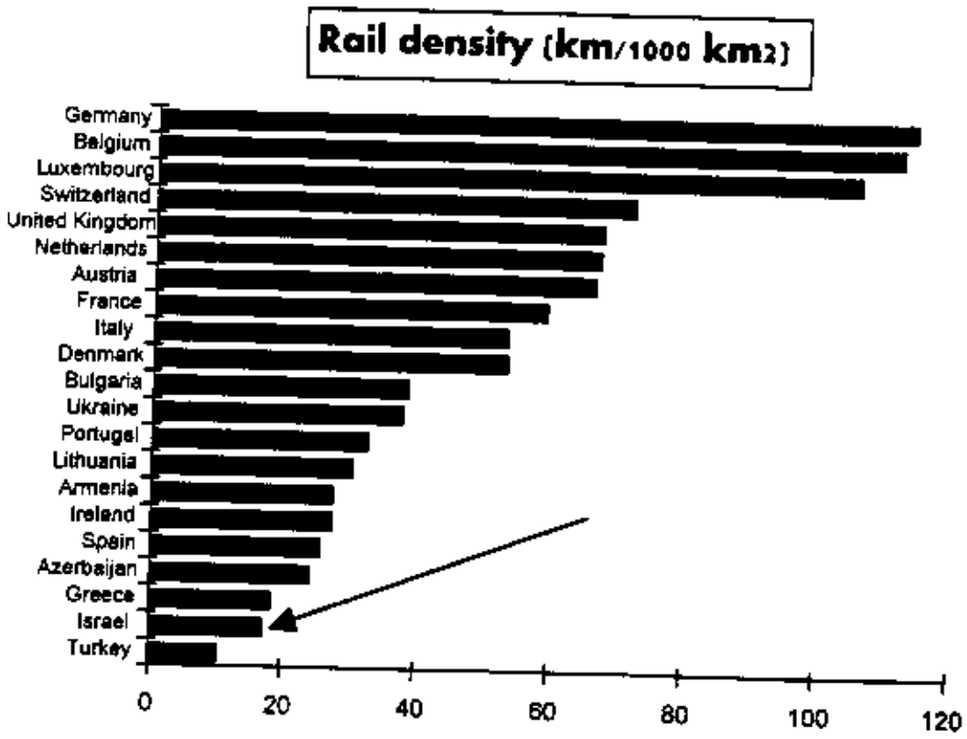
Per capita, Israel's investment in rail also is lower than that of most western European nations.



Source: Dr Ya'acov Garb, Floersheimer Institute for Policy Studies

Public support for rail ALONE in 13 European member countries of the Community of European Railways is .56 percent of GDP.[41] In Israeli terms that would translate into a rail funding program of NIS 1.5 billion annually, a rate 50 percent higher than the current level of support to the bus system and about 15 times higher than the current subsidy and investment support to the rail system.

Israel lags far behind most other developed countries in the density of its rail services. Compare the length of rail in Israel and Europe per unit area[42] on the next page.



Source: United Nations, *Annual Bulletin of Transport Statistics*, 1995.

The Cost of Travel

One of the major factors influencing use of vehicles is operating costs -- once the initial purchase has been made. When fuel is cheap, there is an additional incentive to travel via car, ship or truck, rather than using more sustainable modes of transport. Moreover, neither businesses nor individuals have an incentive to "economize" on their travel patterns.[43]

Fuel Taxes

Israel maintains a "cheap fuel policy" -- the cost of gasoline is roughly 15 to 20 percent lower than in Europe. **Health-damaging diesel fuel is sold at only about one-third of the price paid in Europe.**

In September 1998, the average cost of Israeli diesel transport fuel was $0.27 cents a liter, while the average cost of the fuel in six major European countries was $.0.78 cents. The enormous price differential is due largely to tax policy. In the European countries, taxes double or triple the basic consumer price of the diesel, while in Israel, the tax rate averages only about 30 percent.

Gasoline Prices in Israel and Six European Countries - September 1998

Type	In Israel	Six-country average	Israel/Europe ratio
Super Premium 98	$0.88/liter	$1.12/liter	78%
Unleaded 95	$0.88/liter	$1.03	85%
Diesel (Jan. 1996)	$0.26/liter	$0.78/liter	35%

Source: Ministry of Energy and Industry[44]

While the Israeli road lobby argues that gasoline price has no impact on demand, most evidence is to the effect that price *does* have an impact on consumption levels. Following a survey of 120 studies on the issue, a British Royal Commission report on Transport and the Environment determined that for every one percent hike in present-day prices, there would be a 0.7 percent decrease in fuel consumption. In view of the linkage between price and consumption, the Royal Commission white paper even called for a *doubling* in gas prices by the year 2005.[45]

Israel's Finance Ministry has little incentive to change its "cheap fuel" policy, since relatively low gasoline taxes are offset by high taxes on new vehicle purchases, the largest single income category from vehicle-related taxes. Israel's vehicle tax is currently 95 percent of the vehicle purchase price plus 17 percent VAT, while the range in Europe is between 18 and 43 percent. [There are, however, European countries such as Denmark, which impose vehicle taxes similar to Israel's, a policy that has been credited with curbing traffic growth.][46]

The real cost of purchasing a car in Israel has declined significantly in the past decade. Between 1987 and 1993, the cost of purchasing a car increased by 173 percent, while the general consumer price index increased by 242 percent.[47] That decline happened in a decade when Israel's per capita income virtually doubled.

Congestion Taxes

Recently the Ministry of Finance proposed the institution of congestion pricing -- charging fees for peak hour vehicle entrance into congested urban areas. Some research abroad has suggested that congestion fees could potentially increase equity in the transport system -- if the additional income is used to improve transport and reduce pollution in poorer regions or areas. Notably, peak period drivers tend to be wealthier than average. And the pollution generated by commuter traffic affects low income areas (often concentrated along congested arteries) more than high income areas.[48]

Yet in general, the evidence in Europe and the United States suggests that gasoline price hikes may still be preferable as an equity measure – as well as a more equitable strategy for prompting a long-term switch from private cars to more sustainable transport modes. The Royal Commission report on Transport and the Environment notes that congestion pricing often merely "redistributes" traffic – by prompting drivers to travel at different times or to different locations, and prompting businesses to move to suburban locations -- promoting more sprawl.[49] Conversely, since high income groups tend to use cars more than low income groups, high taxes on automobile *use* are regarded as a progressive form of taxation -- particularly when tax monies are channeled into the public transport system.[50]

Parking Policy

In urban centers, parking spaces for cars that commute from the periphery of the city consume valuable space that could be otherwise allotted to functions that would better serve central city residents -- i.e. pedestrian corridors, parks and playgrounds. [It has been estimated that U.S. cities maintain five to eight parking spaces in various locations for every car.][51]

Both Americans and Europeans have found that raising parking prices downtown can offer one of the greatest incentives to car owners to switch to public transport.[52] Major European cities -- including Paris, Milan, Geneva, Amsterdam, Copenhagen and Salzburg, are not only freezing but *reducing* the overall amount of parking space in their downtowns, limiting on-street parking space to residents only, and even selling street parking spaces to residents – while upgrading pedestrian, bike and public transport access[53]

Restricting the supply of center city parking, raising center city prices and more rigorous enforcement of illegal parking restrictions have been found to have a positive equity impact on center city residents -- who generally tend to be "transport-disadvantaged": the poor, the elderly, the ultra-Orthodox, and inner-city children. Like congestion pricing, high parking fees make wealthier commuters who drive into the city pay for the pollution and congestion they generate and for the urban space their parked cars consume -- space which cannot be used by central city residents themselves for parks, sidewalks, bikeways, etc.

In Israel, car owners are often perceived as having a fundamental "right of access" to city centers with their private vehicles. The preservation, and even expansion, of central city parking space has thus continued in many cities.
In 1994 there were 7,341 parking spaces in downtown Jerusalem's central business district. **Another 3,730 places are planned to be built by the year 2,000 -- all in the downtown area -- a 50 percent increase in space. This counters accepted practice in major European cities of limiting parking spaces and raising fees, and reserving existing parking, particularly in historic areas, for residents, tourists and very short term stays.** The overall expansion of off-street parking occurs without regard for lower-income sectors living downtown, which are impacted by the increased pollution, noise and congestion created as a result of traffic generated by increased parking availability.[54]

Privatization

Israeli ministries currently are moving towards greater privatization of the public transport system to stimulate better service and higher patronage levels for public transport systems, while saving public funds.[55]

But privatization and subsidy cuts can also result in substantial rate increases, service cuts, and a shift towards greater dependence on automobile transport. These trends are apparent in the United Kingdom, which has undergone the most extensive deregulation experience in the developed world, beginning in 1980. Such shifts have a negative impact on transport equity -- since poor and disadvantaged groups are more dependent on public transport than more affluent social groups.[56]

Transport analysts Pucher and LeFevre attribute the sharp decline in public transport use in Britain between 1975 and 1990 to a public policy which favored subsidy reductions and fare increases at a time when France, The Netherlands and Germany were massively increasing public contributions to improve public transport and reduce fares. While public transport use in France increased by 58 percent, it plunged in Britain by 26 percent, and even walking and bicycling declined, as a result of the British policies. As the analysts note, "No other Western European country has experienced such a rapid shift towards the automobile."[57]

[1] Central Bureau of Statistics. Motor Vehicles as of 31/12/97, Selected Data, No. 12, 1998.

[2] Pioter Vopshaw, of the Transport Master Plan team of the Israel Institute for Transportation Planning and Research estimates that by 2010 public transport will constitute 21 percent of total passenger-kilometers traveled in the metropolitan Tel Aviv area and 33 percent nationally in a "business as usual scenario," (personal communication, May 1, 1997). A figure of 15 -20 percent is projected by Y. Safran, Ministry of Transport, as cited in Amran Pruginin and Jonathan Glass, Environmental Quality in Israel, 2000-2025, The Jerusalem Institute for Israel Studies, Ministry of the Environment. 1992, p. 87-91.

[3] Central Bureau of Statistics, Publication No. 1093. There were 1.617 million motor vehicles in 1997, including 1.228 million private cars and another 154,011 light commercial vehicles that function as private cars, according to the Trans Israel Highway definition of the car fleet. The population at the end of 1997 was 5,900,000.

[4] Parsons, Brinckerhoff, Quade & Douglas, Inc., Transit, Urban Form and the Built Environment: A Summary of Knowledge, Transit Cooperative Research Program, Transportation Research Board, National Research Council. U.S.A. April, 1996. p.41.

[5] Sources of Data are as follows:

Danish projections on mileage are from: The Danish Transport Ministry Projections, trends and projections of passenger and vehicle travel from 1990-2010, from "Traffic 2005" Personal Communication from Kasper Ovesen, April, 1997

Dutch projections are from: The Netherlands, Ministry of Transport, Annual Report on Transport in the Netherlands, 1995. & Dutch Ministry of Transport, Meerjarenprogramma, Infrastruur en Transport, 1996-2000 , 1996 (in Dutch) p. 8.

Israeli projections are from: The Trans Israel Highway Company, Traffic Analysis and Economic Evaluation, Table 4-14 (in Hebrew), adjusted to reflect the faster-than-projected growth in actual kilometrage between 1992 and 1997, according to the methods noted in Chapter 1. Vehicle Travel/km2 in 1993 is estimated at 1.077 million kms/km2 in all of Israel and at 2.595 million km/km2 for Israel excluding the Negev. For 2010, the vehicle travel/kilometer squared is estimated at 2.260 million km/km2 and 5.443 million km/km2 for Israel excluding the Negev.

Statistics and projections for other European countries are derived from the International Road Federation, World Road Statistics, 1994, Table V, Traffic Volume in Million Vehicle-Kilometres, 1989-1993. Annual rates of growth in kilometrage for each European country between 1989-1993 were extrapolated to the year 2010. See also the discussion in Urban Travel and Sustainable Development, ECMT-OECD, 1995, p. 141: Overall, OECD countries in Europe are projected to increase vehicle kilometrage by 50 percent between 1991 and 2015, a far lower rate of increase than that projected for Israel.

[6] Sources of Data: Central Bureau of Statistics, Israel Statistical Abstract 1997. Economic Commission for Europe, Annual Bulletin of Transport Statistics for Europe and North America, Geneva 1995; International Road Federation, World Road Statistics, 1994. Trans Israel Highway Company, Traffic Analysis and Economic Evaluation, 1994. (in Hebrew)

The projections of vehicle growth in European countries until the year 2010 are extrapolated from annual growth rates in individual European countries between 1989-1993, as reported by the International Road Federation. See also Urban Travel and Sustainable Development, OECD-ECMT, which projects a 45 percent increase in car ownership in the EU between 1987 and 2010 (p. 35). Israeli projections are based on forecasts from the Trans Israel Highway Company, Traffic Analysis and Economic Evaluation, (in Hebrew), Table 3-44, adjusted to reflect current vehicle growth rates as reported by the Central Bureau of Statistics between 1992-1997.

[7] Ibid. (Israel Highway Company, Traffic Analysis and Economic Evaluation. (in Hebrew) Table 4-6.

[8] Bike kilometrage: Israel- 10.8 million kms/year (1997); The Netherlands - 12.9 billion kms/year (1994); Denmark - 5.8 billion kms/year (1997).

Data on bike travel:

The Netherlands, Ministry of Transport, Annual Report on Transport In the Netherlands, 1995. p. 13. Denmark: "Traffic 2005" Danish Ministry of Transport, Kasper Ovesen, personal

communication, April,1997.
Israel: Since there has never been an official survey of bike ridership in Israel, travel estimates are inferred from three unofficial sources: Haim Avnaim, Dunhill Bike manufacturers, who estimates that there are 50,000 adult bikes sold annually in Israel every year. Gad Natan, Statistics on Bikes, Jerusalem Bike Club, 1997 estimates that there are approximately 400,000 mountain bikes in Israel, based on CBS statistics citing the annual value of bike imports between 1991-1995 as $11.5 million. Gary Ginsberg and Don Silverman estimate that there are approximately 450,000 bikes in use in Israel in, "Cost Benefit Analysis of Legislation for Bicycle Safety, American Journal of Public Health, 84. Allan Katz, in "Some Characteristics of Bicycle Travel and Accidents in Towns," Technion Research and Development Foundation, Haifa, Road Safety Centre, 1978, estimates that there are approximately 85 bikes per 1000 Israelis, or about 501,500 bikes. Katz estimates that each adult-size bike has 1.85 riders, and travels about 2100 kms a year. Assuming a maximum estimate of 500,000 bikes in use today, the total bike kilometrage traveled annually would be 10.8 million kms a year, or less than one percent of total vehicle travel of 33.8 billion kilometers in 1999.

[9] Past, Present and Future estimates of vehicle kilometers per square kilometers:

Bus/Car/Taxi Millions of Kilometers/Square Kilometer

	Denmark	Holland	Israel	Israel w/out Negev		
1985	.622	1.623	.411	.969		
1990	.696	1.655	.585	1.409		
1995	.769	1.825	.889	2.165		
2000	.831	1.905	1.127	2.716		
2005	.864	1.931	1.345	3.239		
2010	.988	1.983	1.562	3.762		

Sources:
Israel: Trans Israel Highway Company, Traffic Analysis and Economic Evaluation, Final Report, November, 1994. p. 4-17 (in Hebrew); The Netherlands: Dutch Ministry of Transport, Annual Report on Transport In the Netherlands, 1995. p. 13. & Meerjarenprogramma, Infrastruur en Transport, 1996-2000 , 1996 (in Dutch) p. 8. Denmark: "Traffic 2005" Danish Ministry of Transport, Kasper Ovesen, personal communication, April,1997.

Note: The estimate is for vehicle kilometers traveled by passenger road vehicles only (cars, taxis, buses). The Israeli projection in this graph assumes that travel patterns will develop according to the car-oriented model of the Trans Israel Highway Co.; with gross kilometrage calculated according to the methods cited in Chapter 1.
The following adjustments were also made in the data:
– Data for Israel includes 2/3 of light goods vehicles under four tons, since the Trans Israel Highway projections regard such vehicles as "cars" in terms of their use by households.
– Data for Israel excluding the Negev omits the Beersheva subdistrict from the calculation. 21,946 - 12,835 = 9111 square kilometers, and assumes that 5.15% of all cars and 5.88% of buses and 4.82% of taxis are registered in the Negev Region (Central Bureau of Statistics).
– In the case of Denmark and the Netherlands, official projections upon which the calculations were based are cited in passenger kilometers, which were translated here to vehicle kilometers at a rate of 1.7 passengers per car and 19.14 passengers per bus, (the comparable Danish and Dutch estimates of occupancy rates.) Projections for Denmark until the year 2010 are official Ministry of Transport Projections. In the case of the Netherlands, estimates of travel for 2005 and 2010 are based on extrapolations of the 1995-2000 years trend and projections.

[10] Ibid. Notes 8&9 for sources and methodology. The conversion of vehicle kilometers to passenger kilometers for Israel is 1.5 passenger kilometer/vehicle kilometer for cars and 35 passenger kilometers/bus kilometer, as estimated by Pioter Viopshaw, of the Transport Master Plan Team of the Israel Institute for Transportation Planning and Research, May 1, 1997).Table of values portrayed in the accompanying graphic is as follows:

BUS-BIKE-RAIL TRAVEL – EUROPE AND ISRAEL
MODAL SPLIT OF TOTAL PASSENGER KILOMETERS

	CAR %	BUS %	RAIL %	BIKE %
Israel 84	45.5	52.7	0.7	1.1
Israel 90	57.6	41.1	0.4	0.9
Israel 2000	64.4	31.3	2.7	0.8
Denmark 84	68.9	14.5	7.2	9.2
Denmark 90	72.3	13.4	6.6	7.8
Denmark 2000	74.3	11.7	6.6	7.5
Holland 84	77.8	6.5	7.7	7.9
Holland 90	78.2	5.3	8.7	7.9
Holland 2000	76.5	5.0	10.6	7.9

[11] Mark Render, AMAV Transport Planning and Engineering, Jerusalem, personal communication, May 11, 1997.

[12] Rebecca Shliselberg," Why Tel Aviv Needs High Capacity Rail Transit" in Preservation of World in the Wake of Change, Vol. VI A/B ISEEQS Publications, Jerusalem, Israel, 1995. ed. Y. Steinberger. p. 299.

[13] Ibid. Dutch Ministry of Transport, Annual Report on Transport in the Netherlands, Dutch Ministry of Transport. p. 36.

[14] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment, p. 188. For the breakdown on "Urban Space Required by Travel Mode" (Figure 13), see Navarrro et al (1985) as cited in John Whitelegg, Transport for a Sustainable Future, The Case for Europe, John Wiley Press, 1993.

[15] For instance, modal split forecasts developed by the Israel Institute for Transport Planning and Research, Transport Master Plan, indicate that a significantly higher percentage of future travel would be shifted from private cars to public transport, and more important, from road vehicles to "cleaner" rail, if the infrastructure investments being made in the road system today were redirected to the rail and bus system. Personal Communication, Pioter Vopshaw, May 1, 1997.

PASSENGER KILOMETER PROJECTIONS

	TOTAL PK	% CAR	%BUS	%TRAIN	
PUBLIC TRANSPORT SCENARIO					
1995	39.11 Billion	64	35.3	.7	-
2010	43.66 Billion	64	24.	11.5	
2020	91.53 Billion	59	19.7	21.1	
ROADS SCENARIO					
1995	39.11 Billion	64	35.3	7	
2010	72.11 Billion	67	28	5	
2020	94.12 Billion	68	29.9	4	

[16] Ibid. Dutch Ministry of Transport, Meerjarenprogramma, Infrastructuur en Transport, 1996-2000. P. 9.

[17] Ibid. Trans Israel Highway Company, Traffic Analysis and Economic Evaluation.(in Hebrew) Section 4-14.

[18] The Danish Ministry of Transport 1995 estimate of passenger cars is 305/1000; Road Department, Copenhagen, 1997, personal communication, Kasper Ovesen. An alternative estimate of 340 cars/1000 in 1995 is reported by the International Road Federation in CBS Publication #1065.

[19] Municipal Israeli rates (1997), are derived from CBS Publications #1065, Motor Vehicles as of 13-12-1996, Table 8: "Motor Vehicles in Municipalities, By Type of Vehicle." Country motorization rates (1995) are from Table 6: "Population, Motor vehicles and Rate of Motorization in Israel and Selected Countries." In the case of Denmark, the motorization rate is provided by the Danish Ministry of Transport (personal communication, Kasper Ovesen, 1997). In the Israeli national and municipal estimates, 2/3 of light commercial vehicles (under four tons) are counted as "cars" for the purpose of this evaluation, since a significant part of their use is for private purposes, according to the formula devised by the Trans Israel Highway Company. (See the November, 1995 Trans-Israel Highway Company prequalifying report, Vol. 2, Traffic Forecast and Economic Analysis (English version) fig. 3.8, p. 66. or the November, 1994, (Hebrew version) Sections 3-34/3-35. The actual rate of cars/1000 for Tel Aviv-Jaffo was adjusted downwards by 31 % while the ownership rate in the Tel Aviv suburbs, was adjusted upwards in accordance with the procedure used in the same report – which determined that only 69 % of company cars registered in the city of Tel Aviv are actually used by households in the city, while actual use of cars by households in the surrounding area is about 4-11 percent higher than registration. See section 4-1/4-2 (Hebrew version)

Motorization Rate - 1997

City	Cars per 1,000
Herzliya	418
Ramat Gan	370
Tel Aviv-Jaffa	318
Haifa	295
Beersheva	193
Jerusalem	190

[20] For motorization rates for 1990-93 in Israel, see The Trans Israel Highway Company, Traffic Forecast and Economic Analysis, November 1994, Figure 3.8 and Table 3.18. For rates in major European and American cities see: European Council of Ministers of Transport, Urban Travel and Sustainable Development, ECMT-OECD Paris, 1996 Urban Motorization Rates, 1995;& Danish Ministry of Transport.

[21] Ibid. Kasper Ovesen, "Registered Motor Vehicles in the Municipality of Copenhagen," The Copenhagen Region, Copenhagen Road Department.

[22] Municipality of Copenhagen, "Copenhagen, City of Cyclists," June 1996, Bicycle Account, 1995. p. 6.

[23]

MODAL SPLIT BY SELECTED CITIES- AS A PERCENT OF ALL TRIPS

CITY	Car	Public Transport	Bicycle	Pedestrians
Phoenix, USA	96	1.3	1	1.7
Tel Aviv	65.6	26.4	1	7
Soling, Germany	62	13	2	23
Munich	40	24	12	24
Zurich	28	42	4	26
Delft, Holland	28	8	41	23
Milan, Italy	17	70	3	10

Sources: The Wuppertal Institute, Germany; European Council of Ministers of Transport, Urban Travel and Sustainable Development, Paris, 1996; ECMT-OECD, Travel in the City

Making it Sustainable, "Modal Shares in Transport, 1990," Dusseldorf, 1996., p. 170; Pioter Vopshaw, Transport Master Plan, The Israel Institute for Transportation Planning and Research, Tel Aviv.; Note: Since the model from the Israel Institute for Transportation Planning considers only car versus bus travel (cars 71 %/buses - 29%), they were adjusted to include estimates of pedestrian and cycle travel in the city. The estimate that eight percent of trips in Tel Aviv are made by pedestrians and cyclists is derived from the Trans Israel Highway, Travel Analysis and Economic Evaluation, Travel Habits Survey, (in Hebrew), which indicates that 10 percent of trips to work are via non-motorized transport; and the Jerusalem Transport Master Plan Transport In Jerusalem, Jerusalem Institute for Research on Israel, 1996; which estimates that 8 percent of trips to work are via bike or on foot. p. 23.

[24] The conventional Israeli view that increased mobility represents a rising standard of living is expressed in Ilan Salomon, Yehuda Gur and Eran Feitelson, "Overland Travel in Israeli Planning for the Year 2020," National Master Plan for Israel in the Years 2000, Stage III (Gimmel), Draft for Comments, May, 1996. (in Hebrew)

[25] For a summary of the relationships between pedestrian travel, land use, and air quality, see: Parsons, Brinckerhoff Quade and Douglas, Inc. with Cambridge Systematics and Calthorpe Associates, The Pedestrian Environment, Volume 4A, 1000 Friends of Oregon, 1993.

[26] Central Bureau of Statistics, Travel Habits Survey, 1984, Jerusalem.

[27] Ibid. Trans Israel Highway Company, Traffic Analysis and Economic Evaluation. Travel Habits Survey, p. 13.(in Hebrew)Note: The figure for pedestrian commutes to work refers to holders of drivers licenses only, but in fact it varies little from travel habits in the general population, as reflected in a 1994-1996 Jerusalem travel habits survey, cited below.

[28] The Jerusalem Transport Master Plan & Report of a Travel Habits Survey in the Years 1994-1996, Selected Statistics, Jerusalem Institute for Israel Studies, Publication No. 1, Jerusalem, 1996 p. 23. (in Hebrew)

[29] European Council of Ministers of Transport, Urban Travel and Sustainable Development, ECMT-OECD, p. 170, (breakdown of modal splits in over 20 European cities).

[30] Arnold Klotz, City of Vienna. "Development Planning with Railways," in Travel in the City, Making it Sustainable. Proceeds of an International Conference, Dusseldorf, Germany, June 7-9, 1996. p. 154.

[31] Dutch Ministry of Transport, Bicycle Master Plan, Structured Scheme for Traffic and Transport, Page 4.

[32] This description of Muenster traffic and parking policies was given by Michael Schlikwei, former Muenster City Council member, in a presentation on Transport policy in Israel and Europe at the Israel Center, Jerusalem, May 26, 1997.

[33] Ibid. Trans Israel Highway Company, Traffic Analysis and Economic Evaluation, "Travel Habits Survey," – from interviews of 476 respondents in the Tel Aviv area, holders of drivers licenses only. p. 54. (in Hebrew)

[34] The comparison of commuting distances was derived from the following absolute values for daily commuting distances. Dutch and Danish figures, averaged over a seven-day week, were adjusted to be compatible with an Israeli 5.25 day workweek. Dutch figures were also adjusted to reflect commuting distance for the adult population only (aged 17 and older).

Daily Commuting Distances- Israel, Denmark, Netherlands

Country	Distance	Date	Comments
Netherlands	8.5 kms	1994	Round-trip, annual average, per capita
Denmark	9.8 kms	1995	Round-trip, annual average, ages 16-74
Israel	19 kms	1993	One-way, workday average, ages 17+
Tel Aviv, Petah Tikveh, Netanya, Haifa, Holon	12 kms	1993-1996	One-way, workday average, adults
Rural Israel	26.8	1993	One-day, workday average, adults

Sources for the Table are as follows:
--The Netherlands --Dutch Ministry of Transport, Annual Report on Transport in the Netherlands,1995. p. 15.
-- Denmark -- Danish Ministry of Transport, "National Survey of Danges, age 16-74," personal communication from Kasper Ovesen, Minsitry of Transport, April 11, 1997.
-- Israel (national, Tel Aviv & rural Israel) -- Trans Israel Highway Company, Traffic Analysis and Economic Evaluation, National Travel Habits Survey, p. 14, Appendiz 1.1. (in Hebrew).: While the survey questioned holders of drivers' licenses only, the difference between the commuting distance of drivers and non-drivers is less than the statistical deviation of the survey results, according to Shuki Cohen, survey coordinator.
-- Israel --Petah Tikveh, Netanya, Haifa, Holon -- The Israel Institute for Transportation Planning and Research, Tel Aviv, Survey of Commuting Habits, 1993, 1995 &1996, Personal Communication from Pioter Vopshaw, May 1, 1997.

[35] R. Peterson, Wuppertal Institute, Germany. Presented at the EcoPeace Environmental Conference, Jericho, December, 1996.
[36] ECMT, Investment In Transport Infrastructure in the 1980s, Paris, 1992 p. 23. Investment was 73.% roads and 24.9 % rail in 1980 and 70.6 percent roads and 27.7 % rail in 1988.
[37] Ibid. p. 26. See also, TransEuropean Networks Report. The Group of Personal Representatives of the Heads of State or Government, Luxembourg: Office for Official Publicarions of the European Communities, 1995.
[38] For a comparison of Israeli and Dutch investments in transport infrastructure see: The Netherlands, Ministry of Transport, Netherlands, Annual Report on Transport in the Netherlands, p. 29.

DUTCH INVESTMENT IN ROADS VERSUS PUBLIC TRANSPORT (in NLG million)

	1986	1995	%
Road development	364	776	26.9 %
Rail development	282	948	32.8 %
Bus/Rail maintenance	N.A.	1162	40.3 %
TOTAL		2886	100.00 %

[39]

ISRAELI TRANSPORT INVESTMENT -- (Millions of Shekels, 1995 prices)

YEAR	1990	1995	%
Road development	1,046.9	2,775.0	70.9%
Rail development	65.4	254.2	6.5%
Bus/Rail Maintenance	1,040 (91)	883.0	22.6%
TOTAL		3,912.2	100.0%

Sources. Ministry of Transport, Representative Statistics of the Transport Branch, May, 1996. P. 8. (in Hebrew) Investments are for rail and road development. Statistics on bus/rail maintenance (including operating subsidies) are from Baruch Yona, director of economics and finance, Ministry of Transport, personal communications, May, 1997 and June, 1994 & from Pinchas Ben Shaul, Rail Authority, May 18, 1997, personal communication. Note: In 1996 and 1997, the investment in rail was slashed dramatically, partly as a result of the government decision to separate the Rail Authority from the profit-making Ports Authority, which had invested in rail development. Approved investment in rail infrastructure for 1997 was NIS 90 million, as compared to infrastructure investment averaging NIS 400 million annually between 1991 and

1995. Due to the uncertainty created by the structural changes, as well as income losses, Ben Shaul estimates that the program for modernizing the rail system, "Rail 2000," was set back by four years.

[40] Pinchas Ben Shaul, Rail Authority, November 6,1997. Personal Communication. The government's approved 1998 budget was NIS 195 million. Of that, NIS 85 million was to be transferred to the Ports Authority, in repayment of Port Authority investments made in previous years. NIS 30 million was allocated for the completion of the Tel Aviv-Lod line, and NIS 80 million for remaining renovations. Says Ben Shaul, "The policy of the government is to close the Rail System. That's the meaning of the budget."

[41] Ibid The Royal Commission on Environmental Pollution, Transport and the Environment, p. 116.

[42] Economic Commission for Europe, Annual Bulletin of Transportation Statistics, 1995, Table 2A, "Rail Network at End of Year," United Nations, Geneva, p. 14.

[43] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment. Chapter 7. See also: K.A. Small and C. Kazimi, On the Costs of Air Pollution from Motor Vehicles, Journal of Transport Economics and Policy. January, 1995, Bath, England.

[44] Ministry of National Infrastructures (Energy), Hagit Ben Hammo, "Prices of oil products in Israel and in a select number of European countries as of September 1998" (including Italy, Belgium, Holland, France, England, Germany) - personal communication.

[45] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment, pp. 110-115.

[46] For a history of Israel's vehicle tax rates, see National Income Authority, *Annual Report 1997*, Number 47, p. 186. For tax rates in Europe, see "Rates and Basis of Assessment of Road User Taxes," International Road Federation, World Road Statistics, Geneva, 1994.

[47] Central Bureau of Statistics & Ministry of Transport, "Transport Statistics Quarterly: The Consumer Price Index of Transport and Communication," Jerusalem, 1994. Summary Tables 8&9. (in Hebrew)

[48] Douglas Lee, Principal Investigator, "Highway Pricing as a Tool for Congestion Management," Transportation Systems Center, Cambridge, Mass. October, 1989. p. 13. and Michael Cameroon, "Efficiency and Fairness on the Road," Environmental Defense Fund Oakland, 1994. as cited in Todd Litman, Transportation Cost Analysis, Techniques, Estimates and Implications Victoria Transport Policy Institute, December 6, 1996. Lee notes: "...Peak tolls (in the peak direction during peak hours) would be a progressive source of revenue. All existing user and non-user funding sources (such as property and sales tax) are less progressive or are regressive."

[49] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment: 193.

[50] Ibid. Todd Litman, Transportation Cost Analysis, Techniques, Estimates and Implications p. 7-2.

[51] Peter Newman, "Reducing Travel Through Land Use Planning. Cities and Automobile Dependence," from Travel in the City, Making it Sustainable, Proceeds of an International Conference: June 7-9, 1993, Dusseldorf. OECD. p. 101.

[52] Walter Arenstein, USEPA, "Clean Air Mobile Source Emission Reduction Programs: Where We've Been and the Lesson's We've Learned," Presentation at conference "Towards a Clean Air Act In Israel," Tel Aviv. June 12-15, 1995. p. 23. Arenstein notes, however, that parking restrictions in the United States are still politically unpopular.

[53] Marcia Lowe, "Shaping Cities," State of the World 1992, p. 126. & The European Federation for Transport and Environment, Greening Urban Transport Series, "Cycling in Cities," Brussels.

[54] Ibid. The Jerusalem Transport Master Plan, Transport in Jerusalem, Selected Statistics, pp. 17-20. (in Hebrew)

[55] Reuven Gruneau, "Public Transport Policy in Israel 1970 to 1995." Draft, presented at the conference "Public Transport Policy Towards the Year 2000. Competitive Structure and Alternative Solutions," Kort Foundation Conference. Jerusalem, June 9, 1997.

[56] Yossi Berechman, "Public Transit Deregulation, Privatization and Competition: The International Experience," presented at the conference, "Public Transport Policy Towards the Year 2000: Competitive Structure and Alternative Solutions," Kort Foundation, Jerusalem, June 9, 1997.

[57] John Pucher and Christian LeFevre. Urban Transport Crisis in Europe/North America. "Overview of Urban Transport Systems," Macmillan, London, 1996. p. 19.

CHAPTER III

THE IMPACT OF TRANSPORT ON DEVELOPMENT AND EQUITY

Planners and policy makers often assume that increased mobility -- facilitated by rising rates of car ownership and use and constant road expansion -- spurs economic growth, a rising standard of living and improved quality of life from which most Israelis will ultimately benefit.[1]

In fact, however, car-oriented development induces a wide array of negative impacts on the economy, on the quality of life and on equity, impacts that are explored in this chapter.

* In terms of **economic opportunity and equity**, car dependency squanders national resources and may impede, rather than spur, economic growth. Road oriented development tends to favor more powerful corporate monopoly over small and independent business. It limits the access of urban dwellers to shops and to social opportunities that develop in the suburbs.

* In terms of **land use**, road-oriented development fosters sprawl and more long distance travel, which irreversibly degrades the social and economic vitality of Israeli cities.

* Finally, the increased traffic and dispersal of homes, stores and businesses in a mode of automobile-oriented development **diminish non-motorized travel**, particularly walking. This impedes the mobility of disadvantaged groups for whom walking is an essential travel mode, degrades quality of life, lowers physical fitness, and impinges on community life and social interactions.

ROADS AND ECONOMIC DEVELOPMENT - A TENUOUS LINK

Since economic security is an important factor in promoting social equity, it is important that transport systems contributes to a strong and efficient economy. Yet while basic infrastructure development may be regarded as essential to economic development, particularly in peripheral regions, the link between road building and economic prosperity is tenuous. Road building often redistributes economic activity,

undermining the economic vitality of central business districts, and contributing to urban decline and flight, an issue to be explored in Chapter 4.

In terms of macro-economic growth, it is far from certain that road development creates the long-term job and economic benefits generally assumed.[2] Notably, David Aschauer, one of the main proponents of the theory that infrastructure investment promotes growth, has himself recently documented **the far greater economic benefits of public transit investment over that of highways.**[3]

The National Cost of Car and Gasoline Imports

A road dependent economy also spurs private vehicle imports -- which constitute a major Israeli foreign currency expenditure contributing to the balance of trade deficit. In 1995, more than one quarter of Israel's foreign trade deficit could be attributed to the cost of vehicle imports and vehicle related fuel imports.

Value of Vehicle and Vehicle Fuel Imports, 1995[4]

	Value (millions $)	Percent of Deficit
Car Imports	927.6	9.1%
Total Vehicle Imports	2,112.0	20.9%
Oil Imports for Vehicle Fuel	577.3	5.7%
Total Cost of Imports	2,689.3	26.6%

Source: Central Bureau of Statistics, Ministry of Transport & Fuel Authority

Road Development and Economic Prosperity

Contrary to what is normally assumed in Israel, road-building in a developed country does not necessarily lower transport costs – or spur significant economic growth.

A recent survey of logistics costs in Europe found that manufacturers spend on average only 1.5-2 percent of sales revenue on transport, so that even if a road-building program reduced transport costs by a full 10 percent, and ALL of this was translated into lower prices, the price of manufactured goods would fall by less than 0.2 percent on average - and would have a negligible impact on overall economic activity. [5,6]

The landmark "SACTRA" report commissioned recently by the British Department of Transportation, determined that *"transport investment has little detectable effect on the overall level of economic activity."* [7] Similarly, another British study determined that the contribution of road building to economic growth was small:

"... given the small per cent of transport costs in total production costs and the small difference in transport costs between accessible and inaccessible areas, it is implausible that road schemes will lead to a significant net increase in GDP (over and above user resource savings)" -- i.e. the time and user operating costs of the highway already considered as "benefit" factors by highway planners. [8]

Studies around the world have also determined that the investment cost of a rail-oriented public transit-oriented system is less, over the long term, than a road-oriented, car-dependent system.

"If all costs are considered, a car-based system is around 50 % more expensive than a transit system (Newman, Kenworthy and Vintila, 1992) and light rail is cheaper than buses after 10 years of operation (Flood and Newman, 1993)." -- Peter Newman, Murdoch University, Western Australia. [9]

In Israel, a preliminary assessment by the Israel Institute for Transport Research and Planning of transport options for Israel until the year 2020 determined that a rail and bus-oriented system would cost about $35-40 billion -- $10 billion less than investment in a car-oriented system -- even without a calculation of the "external" costs such as the increased air pollution, traffic accidents, water contamination, congestion and inefficient land use that road-oriented development spurs. Outright, direct savings would be gained through relatively lower land acquisition costs; a diminished need to build very sophisticated highway systems, including interchanges and multi-leveled expressways, not to mention the longer life span of rail systems as compared to roads and bus systems. [10]

Moreover, road development does not necessarily redistribute economic growth more equitably between affluent and less affluent regions. The British Royal Commission report on Transport and the Environment notes that "road building is not the key to economic growth in the regions...Indeed, it seems that good roads can sometimes speed the decline of less prosperous areas by allowing their needs to be met conveniently from sources outside the area."[11]

Thus road projects like the Trans Israel Highway, build to facilitate national population dispersion, may in fact promote more centralization towards a stronger economic center. Rather than spurring growth in the Galilee and the Negev the north-south network could accentuate the pre-existing economic advantages of the central region – albeit on its suburban fringes.

Roads and Jobs

Too often, public transport systems are viewed as unprofitable drags on the government and the economy, while road construction is perceived as an expedient way of creating jobs. In fact, a public transit-oriented infrastructure investment generates more local "value-added" economic benefits than car-oriented infrastructure. For instance, while major road projects serve as a temporary source of employment -- particularly for imported foreign "guest" workers, a road does not in and of itself create the kind of permanent, skilled job opportunities for Israel's citizens that the Egged and Dan bus systems create, or that the Israel Rail Authority potentially could -- regardless of current inefficiencies.

One study in California, for example, determined that 85 cents out of every dollar spent by local residents on gasoline leaves the regional economy -- much of it going to pay for oil imports. In contrast, out of every dollar spent on public transport fares, an estimated 80 cents goes towards transit workers' wages, which in turn buys more than $3.80 in goods and services in the region.[12]

Roads and Time-Savings

Congestion relief is another economic benefit that is mistakenly credited to road-building. In fact, highway expansions generate new travel demands that absorb the additional road capacity within a relatively short period -- **without alleviating congestion**. This phenomenon, called "induced traffic," has been well documented internationally in reports such as the 1994 British SACTRA Commission report, *Trunk Roads and the Generation of Traffic*.[13]

One of the major sources of "induced traffic" is the fact that new roads and road improvements trigger massive changes in lifestyles, and as a result, in travel patterns. Road improvements stimulate development of highway oriented malls, superstores and business complexes which are dependent primarily on automobile access, and developers find ways to circumvent even strict land-use regulations seeking to curtail such development. Freight haulers change warehouse and loading points to take advantage of the new or improved route.[14]

Lured by the new "improvement" in the road and the new superstore or mall development at road interchanges, people begin making longer trips to shopping or entertainment centers, and commuters may opt to live further from work than they

would have before the improvement was made. In the end, travelers eventually spend as much, or more time on the road as they did before the improvement.[15]

Recently, critics of the country's escalated road-building plans have raised the issue of induced traffic in Israel as a phenomenon that undermines the logic of more road expansion.[16]

The unique financing structure of the Trans-Israel Highway project, in which the government has committed itself to compensate the private road concessionaire annually for any shortfalls in projected revenue from the toll-road's operation, will actually create a perverse incentive to promote traffic growth via government land use, pricing and public transport policies, rather than to reduce traffic growth, since a reduction would mean financial losses for the road company -- costs which would be borne by the government.

THE "MALLING" OF ISRAEL: THE IMPACT OF ROAD-ORIENTED DEVELOPMENT ON CITY AND NEIGHBORHOOD BUSINESSES

Road expansion tends to redistribute economic activity, creating single unit shopping sites at decentralized highways located at city outskirts or highway interchanges. [17]

Developers who seek out vacant highway parcels take advantage of numerous hidden government "subsidies" They enjoy the benefit of new roads and interchanges, built at government expense, as well as the economies of scale generated from large rural land parcels priced by the government below their real long-term economic and social value – if all of the social and environmental impacts of such development were considered. Highway-oriented retail developers also enjoy hidden subsidies in the form of lower taxes in areas under the control of regional councils, rather than municipalities, as well as fewer constraints in terms of architectural style and building size than may be prevalent in city centers. Also in cities, where vacant land is more limited, development may require complex "redevelopment" of existing spaces and buildings.[18]

The lower overall costs of roadside land, therefore, translate into consumer "perks" unavailable in the city, such as large, free parking lots, lower prices, and huge store inventories. [19]

Since such developments are car dependent, however, they remain inaccessible to the poorer segments of society that do not own cars. Higher income urban residents also suffer, moreover, when the selection of stores near them becomes more limited, due to a flight of business to the suburbs.

A market research report on Israel's largest food chain, Supersol, describes how such trends take place in Israel -- as a result of both corporate and government land policy that tolerate, or even encourage, auto-oriented commercial development:

"Supersol has shifted its focus from neighborhood supermarkets to suburban hyper-markets. The lower mark-ups in Hypermarkets are compensated by the larger volume of sales and low maintenance and overhead costs. It also reflects the preferences of shoppers to make one weekly shopping trip (or even less) to a single location that offers a wide range of products and free parking." [20]

The research report also confirms that suburbanites and car owners pay less than urban dwellers and the carless for the same products:

"Supersols, which are directed to older, urban shoppers command the highest markups . . Hypercol, directed to younger suburban familes has lower margins and service, while Green Wave and Food Warehouse chains, aimed at budget shoppers, have still less." Hypercol and Food Warehouse, are located in "suburban areas, on commercial strips or industrial zones accessible only by car. [emphasis added]."[21]

Israel's largest corporations are investing heavily in car-dependent development. Corporate power, not government policy or public interest, is shaping Israel of the future.

Supersol, for instance, owns the following percentages of new shopping malls: Bat Yam (50 percent) Lev Ha Mifratz, Haifa (37 percent); HaTzomet, Kfar Saba (50 percent); Beit Shemesh (100 percent); and Ashdod (50 percent). Supersol also controls 40 percent of the do-it-yourself chains, *K'nei Ub'nai* and 56 percent of Super Office, which depend on the economies of scale that suburban highway sites can most easily provide to developers. The investment in car dependent development is marked by many financial convergences between building contractors, retailers and fuel suppliers -- all powerful players in Israel's economy. For instance, Delek Investments, a major Israeli gasoline marketing company and automobile importer, holds 12.7 percent of the shares in Supersol.[22] And the Africa Israel Company, which builds shopping malls and is a major investor in the Trans Israel Highway and 25 percent-owner of the Alon Gas Station chain, has announced plans to build a chain of

and convenience centers at rest stops along the highway.[23] Indeed, convenience food stores -- in Hebrew "markolim"-- are increasingly a feature in gas station sites around the country.[24] Such enterprises offer the car-dependent alternative to the pedestrian-oriented and family-owned grocery store or neighborhood commercial centers. They also represent the growing financial stake of the country's top business interests (building companies, automobile importers, gasoline suppliers, supermarkets and retail chains) and even kibbutzim in the promotion of automobile dependency -- to the detriment of the broader public.

The long-term impact of such trends are readily apparent in Great Britain, where large, car-oriented supermarket chains squeezed out community-based, family run grocery stores over the past four decades. Whereas in 1950, family-owned grocers had a 58 percent share of the UK grocery market in terms of sales, by 1991 this share had dropped to 12 percent.[25] While the large chains gain in profit and control, small store owners lose markets, and consumers lose access and variety in shopping choices. [26] A similar process is now happening in Israel, as the food corporations themselves now acknowledge:

"As recently as a decade ago, the supermarket chains held only a 10 percent share of the retail food market. Since then, shopping habits have changed and the share claimed by the large supermarket chains is currently estimated at about 30 percent."[27]

From an equity perspective such a process is devastating. City and town business areas are usually characterized by more "democratic" patterns of land ownership, with many different types of landowners, large and small land parcels and a variety of business lease arrangements that may be attractive to small, independent businesses. In contrast, a shopping center or superstore is usually owned by a corporation or a consortium of corporate owners and developers, which control all of the leases and terms of business in the complex. If a superstore or large chain is located on a downtown parcel, it can at least act as an "anchor" and a "draw" to smaller, independent businesses in the area. Thus Tower Records and McDonalds were viewed as a "draw" to a troubled downtown Jerusalem economy when they opened outlets there. More important, when such chains locate in a traditional urban or town center, they must compete with independent business on more equal ground in terms of tax policy and parking availability.

The economic vitality of traditional town and city commercial centers is sacrificed in the "malling" process that happens on the periphery. The flight of shoppers from

Jerusalem's downtown to the new Malha mall on the edge of the city limits is a case in point. In 1994, 21 percent of shopping for consumer durables by west Jerusalemites was carried out at the recently opened Malha mall, accessible primarily by car -- while 57 percent of such shopping was performed downtown. By 1996, just two years later, downtown's share in shopping for consumer durables had declined to 42 percent of the total shopping -- while Malha's share increased to 28 percent.[28] And as noted in the very beginning of Chapter I, suburban malls generate far more traffic, and pollution than city or neighborhood business centers.

Socially as well, the design of most malls removes important communal spaces from the public domain, impinging on important democratic freedoms. The streets of a traditional town or city center belong to the public, and public bodies like the municipality and the police set business hours and issue permits for the staging of controversial demonstrations or cultural events. In the case of indoor malls, many such decisions become the exclusive domain of a private consortium of developers.

Sustainable Growth: The New European Approach

In contrast to Israel, many European countries are now acting vigorously to halt the "malling" of their countryside. In Holland, Great Britain and France, the governments have even set policies banning or restricting highway-oriented shopping centers.[29] Under a new Dutch zoning policy -- "The Right Business in the Right Place," only land-consuming businesses -- i.e. a lumberyard or heavy industry -- are permitted at roadside locations. Consumer stores and client-oriented businesses must be in locations that would permit most customers to arrive via train/bus or on foot and bicycle. The commercial areas must be "integrated" into existing neighborhoods and city centers. As a result of such policies, the Dutch report that **"the construction of office buildings along highways has lost popularity and (transit) station locations are regarded as sites of future value."** [30]

THE IMPACT OF CAR DEPENDENCY ON LAND USE AND EQUITY

There is a synergistic relationship between transport and land use -- together the two systems have a defining impact on the shape of cities -- and also on patterns of social equity. **Environmentally sustainable land use usually fosters more equitable social patterns, i.e. better access for all groups to basic services and opportunities for social interaction between different kinds of people. Conversely, the "malling" syndrome creates more social alienation.** Experience from rapidly growing regions of the United States highlights the importance of building sustainable micro-and macro-transport systems --(pedestrian networks, rail, bus and minibus

networks) – as part of the initial infrastructure investment. As many gridlocked and polluted western U.S. cities have discovered, when such investment is delayed, car-dependent development becomes the dominant mode, making it difficult or impossible to shift later to more sustainable patterns.[31]

Metropolitan Growth Boundaries
Maximizing Social Access, Minimizing Land Waste

As noted previously, the access and mobility of disadvantaged social groups is damaged when cities expand into sprawling metropolitan agglomerations. Chapter Four will discuss how suburban growth on the periphery of cities tends to benefit mostly upper income groups, while the poor and elderly remain trapped in urban areas. Environmentally, there is also a high correlation between urban sprawl and car dependency. Cities with dispersed, low-density construction have higher car use -- and thus higher gasoline consumption. [32]

Regional Growth: Compact or Sprawl

Unnecessary travel and energy waste are lower in regions with a number of geographically distinct towns and cities with distinct urban boundaries, than in regions which develop a single urban agglomeration with satellite suburbs. In a study of 15 commuting regions in Sweden, energy use for transport was on average 25 percent higher in the most centralized regions, compared to the most decentralized.[33] [34]

Besides reducing transport pollution and energy waste, the institution of urban growth boundaries, ringed by greenbelts or agricultural reserves, also have been shown to have far-reaching social and economic benefits, **particularly in regions undergoing rapid growth**. In the 1970s and 1980s, the fast-growing Portland, Oregon metropolitan area canceled plans for new suburban highways and established "growth borders" and greenbelts around the edges of the metropolitan area as part of a set of policies designed to encourage compact, pedestrian and transit-oriented growth.[35] Today, while other rapidly growing cities in the western United States are suffering from sprawl, urban blight, and traffic pollution, Portland has been hailed as a model U.S. city. Its air is cleaner than ever, and its urban center and economy are one of the most vibrant in the nation.[36]

In Israel, and particularly in the Tel Aviv metropolitan area, development is blurring urban boundaries, and such development is affecting travel trends. For instance, in its 1994 road-feasibility report, the Trans Israel Highway Company noted that only 39

percent of residents with drivers' licenses in metropolitan Tel Aviv work in the town in which they live. Long trips between different parts of the metropolitan region are becoming increasingly common. In comparison, nearly 87 percent of Jerusalem and Haifa residents and 78 percent of Beersheva residents work in their home cities.

Rather than preserving the advantages of the Haifa, Beersheva or Jerusalem model by establishing metropolitan growth boundaries and channeling new growth into semi-autonomous cities rather than suburbs, national policy is encouraging other metropolitan regions towards the more energy-wasteful and socially inequitable model exemplified by Tel Aviv.

For instance, the 2020 plan developed by Israel's Technion foresees the creation of gigantic "urban blocs" in which Jerusalem and Tel Aviv will virtually merge, as will Haifa and its suburbs, and Beersheva and its satellites in the south. A more transport-efficient alternative, rejected by the 2020 team, proposed greater concentration of development into distinct, autonomous cities and towns separated by better-defined blocs of open space.[37]

Mixed-use Development: Another Critical Ingredient for Access and Equity
In early industrial societies, separate residential and commercial zoning was originally designed to be socially beneficial – by moving heavy, polluting industries away from homes. In today's service-oriented societies, such patterns are often socially destructive as well as obsolete.

The separation of residential, commercial and leisure centers into distinct and decentralized blocs of services, i.e. shopping malls, office centers, high tech-parks, and residential "communities" feeds social divisions, as poor residents cannot afford to live in the new suburbs or shop in suburban malls. An alternative is the integration of residential, business and "clean" industrial functions into "mixed use" urban areas, or neo-traditional "village centers" and "urban villages."

On the environmental plane, industry employed only 23 percent of Israel's workforce in 1992 and will employ only 15 percent of the workforce by the year 2020. "Clean" industries -- such as retail services, tourism, and offices employ 59 percent of the work force today and are projected to employ up to 71 percent of the workforce by the year 2020.[38]

In the meantime, separate use development fosters car dependency, while mixed-use development fosters transit -- by creating centralized nodes of activity.[39] Mixed use development reduces the **need** for motorized travel, thus improving access for groups that rely on pedestrian modes, like children, women and the elderly. Mixed-use development is more likely to offer a variety of different housing styles and price ranges in the same community and thus promote social integration. On the macro-scale, mixed-use development permits the growth of self-supporting communities, rather than suburbs dependent on a larger city center. In contrast with this concept, a cursory review of the 30 or more projects that were planned for the Trans Israel Highway corridor reveals a preponderance of plans for single function, residential or commercial developments that will be almost exclusively car dependent.[40]

Moderate Densities: Enhancing Quality of Life

Both **very low-density** American-style suburbs and Asian-style **super-concentrations** of high rises degrade urban life, foster social segregation, and induce major transportation policy dilemmas.[41] Suburbs become enclaves for affluent Israelis who can afford to escape blighted urban areas. High rise towers, which require expensive maintenance fees from tenants, are generally urban enclaves for the rich -- which degrade the lower-rise business and residential districts standing in their shadow. Super high rise concentrations may also require the creation of subway networks that are more expensive to build than light rail – and thus tend to leave older, low-rise neighborhoods out of the transit loop.[42] Similarly, single family housing tracts on the periphery require massive road construction undertaken without reference to the transport needs of older, urban neighborhoods. For example, the very low residential densities (1-2 units/dunam (1/4 acre) seen in fast-growing suburbs like Rosh HaAyin, Hod Hasharon and Ramat Hasharon make public transport unfeasible, and care dependency inevitable.[43] In contrast, "terraced-style" cottage construction common in Jerusalem (*meduragim* in Hebrew) achieves minimal net densities of three units per dunam or more, sufficient to support a light rail system or good bus service. This style allows for environmental amenities like private gardens, balconies and easy access to the streets, along with an architectural framework more conducive to building "community" pedestrian networks.[44]

PEDESTRIAN TRAVEL - THE MOST EQUITABLE TRANSPORT MODE

Pedestrian networks play a pivotal role in building socially integrated urban neighborhoods, creating vibrant links between residential and commercial areas; reducing air pollution and traffic; fostering safe streets and community social

relationships; and improving the "access" of disadvantaged groups like the elderly, disabled, children and women to basic services. [45]

Walking has important social benefits over most other modes of transport -- which are almost never considered by Israeli policymakers:[46]

--Walking is essential to health maintenance, particularly for women, children and the elderly. It helps prevent serious chronic disease ranging from osteoporosis to heart ailments. [47]-[48] In a six-year follow-up study of 600 elderly Jerusalemites in their 70s, study subjects who walked at least one hour a day had lower mortality rates than those who exercised or engaged in sports twice a week.[49]

--Walking is pollution-free. It doesn't intrude on landscapes or sever communities as motorized traffic does. Walking facilitates human interaction. Emptied of pedestrians, streets rapidly become avenues of crime, fear and delinquency.[50]

--Walking in a vehicle-free environment is almost accident free.

-- Walking is cheap and universally accessible. Over 90 percent of the population can walk. Children make over half of their weekly trips by foot, while people over 60 make two-fifths of their weekly trips by foot. [51] In fact, most of the population -- women in single-car families, large families with one or no cars, low income families -- depend on walking for much of their independent movement. In addition, areas that offer good pedestrian access are usually areas that can be accessed easily by wheelchair disabled and by parents wheeling strollers.

-- Walking is popular. Walking remains the most widely practiced exercise activity in Israel today. According to a 1996 survey, 25 percent of Israelis who regularly exercise prefer walking (18.7 percent) or jogging (6.6 percent). Since 1992 walking as a sport has doubled its participation rate.[52] Walking is the only form of transport permitted by Orthodox Jews on the Sabbath. [53]

Shaping a Pedestrian-Friendly Environment

The choice to walk is highly dependent on policy choices that impact the walkers' micro-environment in subtle but powerful ways. Pedestrian trips are much more frequent in densely populated areas and in "self-sufficient" communities where the distance between home and work are short. Equally important is the micro-environment -- a dense network of connections and shortcuts (through

footpaths, pedestrian bridges, and underpasses), and the reduction of waiting time at intersections.[54]

Pedestrians also prefer to move in areas where there are architectural features that are in human proportion—mid-height buildings and store fronts with attractive window displays that are easily approachable on foot, as well as trees, arbors and benches. Factors that deter travel by foot include: heavy traffic, pollution, noise, hard-to-cross intersections, large blocs of asphalt, and monotonous superstore blocs with no windows, poorly-lighted, poorly maintained or narrow walkways that impair both safety and a sense of security -- particularly at night. [55] In Israel, notably, threatening dogs which often roam loose on residential streets both in cities and smaller communities also pose a serious obstacle -- in some cases life-threatening -- to a sense of pedestrian safety and freedom.

Jerusalem's "Invisible" Pedestrians

Israeli pedestrians are perhaps the most marginalized travelers on the transport network – as is evident from the high rate of pedestrian accident casualties. In Jerusalem, a historic city once known for its attractive walks, the importance of pedestrian byways and circuits has been ignored and degraded by car dependency, outside of the major tourism circuits of the Old City and Ben Yehuda Mall. Overall, the factors that discourage pedestrian traffic include:

- Stoplights timed so that pedestrians cannot pass in one traffic cycle.
- Traffic islands too narrow to accommodate more than one pedestrian on major roads, and not wide enough to accommodate a pedestrian and stroller.
- Sidewalks too narrow for passage by two persons; residential sidewalks lacking continuity or blocked by cars or other obstacles.
- New neighborhoods emphasizing broad, high-speed urban boulevards, and dispersed commercial sites, making walking and street crossings more difficult and unpleasant.
- Obstacles that impede non-motorized access to new shopping malls from nearby residential areas i.e. big parking lots and roads, the absence of sidewalks and landscaping, and vacant land that isolates the mall from its surroundings.
- The absence of pedestrian overpasses or underpasses around busy streets.
- The absence of separate pedestrian/cycle routes that could offer residents both travel and leisure outlets, and safe play and travel space for children.
- The lack of speed limits and traffic calming measures such as road speed bumps and enforced traffic speed limits in residential areas. [56]

Over the past decade, many cities in Europe and the United States have discovered the vital importance of pedestrian traffic to urban quality of life, equal access to services, and urban economic vitality, and they have commissioned studies of existing pedestrian connections. Residents in the City of Portland, Oregon, for instance,

created a rating system of "Pedestrian Environment Factors" by which urban and residential pedestrian networks could be ranked objectively for connectivity, aesthetics, ease of street crossings, etc. -- and improved.[57] In major Israeli municipalities, meanwhile, the planning of "hotzot ha-ir" -- urban open spaces as they are called in Hebrew, is only beginning to receive attention -- and is generally viewed more as a quality of life "enhancer" for central downtown areas than as an important 24-hour transport corridor for residential as well as commercial areas.[58]

Parking Space vs Pedestrian Space

In many, if not most parts of Israeli cities, individual car owners have illegally encroached on much of the available sidewalk space—for use as overflow parking—rendering sidewalks useless and even hazardous to pedestrians. Motorcycles have also begun to use sidewalk space to "shortcut" traffic congestion as well as for parking. Cultural biases, which grant cars a higher status than pedestrians, may be at the root of the problem, but lax enforcement of urban parking regulations is also to blame. Cities have little incentive to write parking tickets – since parking fine monies cannot always be forcibly collected at the time of driver's license renewal. Millions of shekels in potential urban revenues are thus lost annually – as well as losses in pedestrian lives and injuries.

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[1] Eran Feitelson, "Directions for a Sustainable Transport Development Policy," Towards Sustainable Development in Israel, (in Hebrew) Israel Ministry of the Environment, 1996, page 42.

[2] For useful summaries of the arguments see Alan C. McKinnon, "The Contribution of Road Construction to Economic Development," paper presented at the Transport & Environment Workshop on Roads and the Economy, Brussels, December 8, 1995. Note: Much of the recent debate on the macroeconomic consequences of road-building has revolved around the work of David Aschauer, who was one of the first to trace the close correlation between growth rates of public capital stock (PCS) and total factor productivity in the private sector. But this work has been challenged from many angles: the correlation does not always hold; correlation does not imply causation; and the validity of these findings for road infrastructure is unclear, as described in McKinnon.

[3] David Aschauer, "Transportation Spending and Economic Growth: The Effects of Transit and Highway Expenditures," American Public Transit Association, September, 1991.

[4] Central Bureau of Statistics, Statistical Abstract of Israel 1996, Tables, 8.1 & 8.10; data on the cost of land vehicle imports is from the Ministry of Transport, Representative Statistics of the Transport Branch, May, 1996. p. 8.; Data on quantities of fuel consumption and costs of imported oil, crude oil and finished products are from Marina Mogerman, Information Coordinator, Minhal Ha Delek (Fuel Authority) (personal communications, 1998)

Note: The cost of fuel imports used for land transport is an approximation, calculated according to a method recommended by Arye Zuckerman, Coordinator's Office, Israel Oil Refineries. The problem in calculating the cost of oil imports for transport lies in the fact that the refinement of crude oil to produce gasoline and diesel fuels also produces other products of economic value, including kerosene, propane, naptha, and industrial fuel oil. If, in the

most extreme scenario, transport no longer required the use of imported fossil fuels, then either the gasoline and diesel produced during the refinery process would be re-exported, generating new foreign currency earnings, or else, local refinement would become unnecessary, and other petroleum fuel products, i.e., kerosene, propane and industrial fuel oil, could simply be purchased on the international spot market, generating a savings in foreign purchases of crude oil for transport.

Refine & Re-export Scenario: Income Foregone

In this scenario, we assume that gasoline and diesel fuels are no longer consumed by transport vehicles inside Israel -- but that the refineries continue operating in order to produce other petroleum products necessary to the economy. The diesel and gasoline thus produced are sold to a third country. To estimate the "income foregone" from such a scenario in 1995, we multiplied the total quantities of diesel and gasoline consumed by land transport vehicles (2.133 million tons of gasoline and 1.949 million tons of diesel fuel) by the average price of a ton of refined fuel on the international spot market in 1985 ($185/ton for gasoline and $158/ton for diesel) = $702.547 million in foregone income.

Import of Refined Products Other than Transport Fuels – Potential Savings

In the second scenario, we assume that once gasoline and diesel are no longer consumed domestically, continued operation of the refinery might no longer be justified economically, environmentally, etc. Petroleum products that are still needed for home heating, cooking and industry would be imported as refined products from abroad. To calculate the potential savings, we first calculated the total import cost of the petroleum products that were consumed in 1995 -- other than gasoline and diesel fuel – according to the average price of each product on the international spot market ($908.240 million) and subtracted that cost from the total import cost of the crude oil that was consumed in 1995 (1.485 billion) $1.485-908.240 = $577.277 million in potential savings.

Summary

Taking the more conservative figure of $577.577 million, the percent of the trade deficit that can then be allocated to imports of crude oil for transport fuels in 1995 is $577,277,000/10,084,000,000 (1995 trade deficit)=5.72%

It is important to note that the calculations above are made merely in order to understand, in principle, the overall contribution of transport-related oil imports to the foreign deficit, and not as a policy recommendation. The calculation also does not include the many auxiliary costs that would be associated with a major change in oil production strategies, such as new kinds of transport and financing costs, price fluctuations, the economic and social cost of closing Israel's refineries, in the first scenario, or alternatively, the environmental, economic and social costs of continued production, in the second scenario.See Annex # 1 for spreadsheet.

[5] Touche Ross, Consultants, "European Logistics: Comparative Costs Practice," 1995, Institute of Logistics, Corby, as quoted in Alan C. McKinnon, "The Contribution of Road Construction to Economic Development," paper presented at the Transport & Environment Workshop on Roads and the Economy, Brussels, December 8, 1995.

[6] M. Parkinson, "The Effects of Road Investment on Economic Development in the UK," Working Paper #43, (British) Government Economic Service, 1981, as quoted in Alan C. McKinnon, "The Contribution of Road Construction to Economic Development," paper presented at the Transport & Environment Workshop on Roads and the Economy, Brussels, December 8, 1995.

[7] The Standing Advisory Committee on Trunk Road Assessment,(SACTRA) Trunk Roads and the Generation of Traffic, The Department of Transport, London, December, 1994, p. 43.

[8] Ibid. M. Parkinson, "The Effects of Road Investment on Economic Development in the

UK."

[9] Peter Newman, "Cities and Automobile Dependence," in Travel in the City, Making it Sustainable, proceeds of an OECD-ECMT International Conference: June 7-9, 1993, Dusseldorf. p. 105.

[10] Pioter Vopshaw, The Israel Institute for Transport Planning and Research, personal communication. May 1, 1997.

[11] Ibid. Royal Commission on Environmental Pollution, Transport and Environment, p. 15.

[12] Marcia D. Lowe, "Rediscovering Rail," State of the World, 1993, W.W. Norton and Company, New York. p. 122. Reference is to a study by the Los Angeles Regional Transportation Commission.

[13] Ibid. SACTRA Trunk Roads and the Generation of Traffic For a discussion of induced traffic in Israel see also, Eliahu Stern, "Congestion on the Roads and Spatial Planning in Israel," pp. 19-31 & Yehuda Gur, "Investment in Transport Infrastructure: The Demand for Transport and the Level of Service. What Can We Learn from the Experience of Other Countries." pp. 33-40, in Environmental Planning, (Hebrew) No. 48-49, 1993. States Gur: "There is a large latent demand for private car travel in peak times and therefore any enlargement in the system results only in a temporary easing of congestion. In cases where concerted efforts enabled the massive paving of roads, (California of the 1960s and Germany of the 70s and 80s are good examples), increases in motorization to unexpected levels neutralized the anticipated easement of congestion, a process that occurred very rapidly."

[14] Ibid SACTRA Trunk Roads and the Generation of Traffic, Chapter 4 & The Royal Commission on Environmental Pollution, Transport and the Environment, p. 147.

[15] Ibid.

[16] Ya'acov Garb, The Trans-Israel Highway: Do We Know Enough to Proceed? The Floersheimer Institute for Policy Studies, Working Paper No. 5, Jerusalem, April, 1997.

[17] Ibid. SACTRA, Trunk Roads and the Generation of Traffic. Chapter 4, & The Royal Commission on Environmental Pollution, Transport and the Environment, p. 147

[18] For a discussion of the influence of tax policy on suburbanization see Eren Razin and Anna Hazan, "Steps to Counter Dispersed Suburbanization," The Flourshеimer Institute for Policy Studies, December, 1996. Jerusalem. (in Hebrew)

[19] Ibid. Note: Business profits are enhanced by keeping low inventories and relying on more frequent "just-in-time" deliveries, using the new or improved road. Yet the frequency of "Just in Time" varies according to the quality of the transport system. In Japan, deliveries are consolidated and coordinated more efficiently to save travel time because the road system is of a lower quality. Thus, the lower quality road links can, paradoxically, spur business to operate with greater efficiency and also save energy.

[20] Orna Telem, "Report on Supersol Food Retail chain," Pacific Mediterranean Securities Ltd. Israel Equity Research, June 14, 1995.

[21] Ibid.

[22] Ibid. Note: The shares of Dekel Investments in Supersol declined from 15 percent in 1995 to 12.7 percent in 1998.

[23] Lev Levaiev, CEO and Director General of Africa Israel Investments, LTD. made the announcement in the annual shareholders meeting of Africa Israel, March, 23, 1998., personal communication, Africa Israel Investments.

[24] Zehava Dovrat, "I Ran Out To Get Gas At The Supermarket." Globes, December 7, 1995. (in Hebrew) & Yael Wagner, spokeswoman for Elite, April 2, 1998. Personal Communication.

[25] Tim Lang, Professor of Food Policy at Thames University. "From Market to Hypermarket. Food Retailing in Britain." The Ecologist, July/August 1994.

[26] John Whitelegg, "Driven To Shop, Transport Intensity and the Environment." A Report for the Sustainable Agriculture, Food and Environment Alliance. Great Britain, January, 1995.

[27] Ibid. Orna Telem, Report on Supersol Food Retail chain.

[28] Ibid. The Jerusalem Transport Master Plan, Transport in Jerusalem, Selected Statistics, 17-20. (in Hebrew)

[29] OECD-ECMT, Urban Travel and Sustainable Development, Paris, 1995. pp. 89-93. The document describes how The Netherlands "Fourth Report on Physical Planning, 1991" set out new land use guidelines for business as did the UK government's new planning policy guidance to local authorities in 1994.

[30] M. Barendrecht, National Physical Planning Agency, The Netherlands, "Reducing Travel Through Land Use Planning, Planning in the Netherlands," Travel in the City - Making it Sustainable. International Conference. OECD-ECMT, Dusseldorf, June 7-9, 1993. pp. 117-118.

[31] For a review of the experiences of rapidly growing U.S. regions see: Daniel Carlson and Don Billen, Transportation Corridor Managment: Are We Linking Transportation and Land Use Yet? University of Washington, Institute for Public Policy and Management, October, 1996. See also: California Air Resources Board, Office of Air Quality and Transportation Planning. "The Linkage Between Land Use and Air Quality," Sacramento California, 1994. See Also: Samuel Seskin, "Development Near Transit: An International Perspective," Parsons Brinckerhof, Quade & Douglas. Portland, Oregon.

[32] Peter Newman, "Cities and Automobile Dependence, Reducing Travel Through Land Use Planning," Travel in the City Making it Sustainable. International Conference June 7-9, 1993. OECD-ECMT, Dusseldorf. p. 101. .

[33] Naess et al 1993. cited in "Land Use Planning," Greening Urban Transport Series #8, The European Federation for Transport and Environment, Brussels. n.d.

[34] Ibid.

[35] For a description of the importance of growth boundaries in urban transport design see: Samuel N. Seskin, "Development Near Transit: An International Perspective," Parsons Brinckerhoff, Quade & Douglas, Inc. , Portland Oregon, 1995. & The California Air Resources Board, "The Linkage Between Land Use and Air Quality," 1994.

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(1/4 acre) of built space is regarded by US transportation engineers as a "threshold" level for light rail service.

[45] Gerard Kajzers, "The Dutch Attitude Towards Sustainable Development," Towards Sustainable Development in Israel, Israel Ministry of the Environment, 1996. p. 90: He notes that European transport systems are increasingly measured by the degree of "access" they provide, rather than by the sheer mobility they generate.

[46] Pedestrians Policy Group, Great Britain, "Walking Forward" (n.d.) See also Johanna Cleary and Mayer Hillman, "A Prominent Role for Walking and Cycling in Future Transport Policy," in Roberts et al, Travel Sickness: The Need for a Sustainable Transport Policy for Britain, Lawrence and Wishart, 1992.

[47] R. Paffenberger, R. Hyde, et. al. "Physical Activity, All-Cause Mortality and Longevity of College Alumni," New England Journal of Medicine, 1986, 314:605-613. Daily walking removes excess cholesterol from the body; improves aerobic fitness, and improves bone density – reducing the possibility of life-threatening osteoporosis in the elderly. 70-year-old subjects who walked at least 30 minutes a day had higher bone mineral content than subjects who walked less than 30 minutes per day.

[48] M. Pollock, H. Miller Jr. et al. "Effects of Walking on Body Composition and Cardiovascular Function of Middle Aged Men," Journal of Applied Physiology, 1971, 30:126-130. Middle-aged men who walked at a brisk pace for 40 minutes, four times a week, had the same cardiovascular improvements as men the same age who jogged for 30 minutes, three times per week.

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[56] Judy Siegel, in The Jerusalem Post, "The Long and Winding Road," March 22, 1996. page 9. : She describes the city of Jerusalem's refusal to install speed bumps in the ultra-Orthodox neighborhood of Har Nof , where 45 percent of residents are children, even after a series of pedestrian deaths and injuries.

[57] For the Portland, Oregon study see: Parsons, Brinckerhoff, Quade and Douglas, Inc. The Pedestrian Environment, Volume 4A, 1000 Friends of Oregon, Making the Land Use, Transportation, Air Quality Connection, December, 1993.

[58] The Council For a Beautiful Israel, Proceedings on Seminar on Urban Outdoor Spaces ("hotzot ha-ir"), May 10, 1996. Tel Aviv. (In Hebrew) Note: Petah Tikveh and Yavneh, which have developed systems of pedestrian paths connecting key cultural and residential locations, are cited here. A similar plan for the Golda Center in Tel Aviv would seek to connect the Court House, Ichilov Hospital the Museum, the municipal library and the municipality with green pedestrian corridors, removed from traffic.

ANNEX TO CHAPTER III

1995 Israeli Consumption of Petroleum Fuel Products and Their Average Per/Unit Cost on the International Market

Product	Percent	Consume (*1000)	* Import cost (NIS)/$	$VALUE(*1000)
1. Gasoline	18.7 %	2,133	556/ton =$185/tn	$394,605
2. diesel-transport	17.1 %	1,949	477/ton= $158	$307,942

3.diesel (heating)	3.0 %	350	477/ton=$158	$ 55,300
4.Kerosene	8.3%	946	496/ton=$164	$155,144
5.LPG (Propane)	4.0 %	459	470/ton=$156	$ 71,604
6.Light Naptha	5.6%	645	460/ton=$152	$ 98,040
7.Industrial fuel oil (Mazut)/Gas	43.3%	4,936	324/ton=$107	$ 528,152
Total consumption	100 %	11,418		
Losses in production	~7 %	859		

$1,485,517 12,277 $121/ton $1,485,517

Scenario A:
Potential earnings from sale of Gasoline and diesel fuel consumed in Israel to third country.
(#1+2)

$394,605
+ $307,942
= $702,547

Scenario B:
Total import cost of finished products other than transport fuels
(#3+4+5+6+7)

$908,240

Foreign currency savings in the event gasoline and diesel were not consumed by Israeli transport

$1,485,517-$908,240 =$577,277

Gasoline -- 1 Kilolitre = .75 tons.
NIS 417 /kilolitre = NIS 556/ton
Solar -- 1 kilolitre = .85 tons
NIS 406/kilolitre = NIS 477/ton
Kerosene - 1 kilolitre =.82
NIS 407/kilolitre = NIS 496/ton

Exchange Rate =$1= 3.01 four quarter average 1995, Table 9.12, Central Bureau of Statistics, 1996 Statistical Abstract of Israel
Crude oil could be refined and sold elsewhere.
Note: Import costs quoted for the refined products are the average cost of spot purchases (Mechirei Ha Seif) on the international market in 1995. Crude Oil purchase price is the average price for 1995.

SOURCE: FUEL AUTHORITY (Minhal Ha Delek)

CHAPTER IV

THE IMPACT OF CAR DEPENDENCY ON SOCIAL EQUITY

Over half of all Israeli households own cars. Yet at any given time, 80 percent of Israelis do not have a car available to them personally - or they are too young or too old to drive. Broad social gaps exist with regard to who enjoys access to the car, with affluent men at the top of the ladder. Fewer women have drivers' licenses than men -- and those who do have less access to the family car. Children and senior citizens are much more dependent on others for car transport, or on public transit and walking. Although car ownership is more widely distributed among households than it was in the past, it still follows income lines, which means that the ultra-Orthodox, Jewish North African and Arab communities have less access.

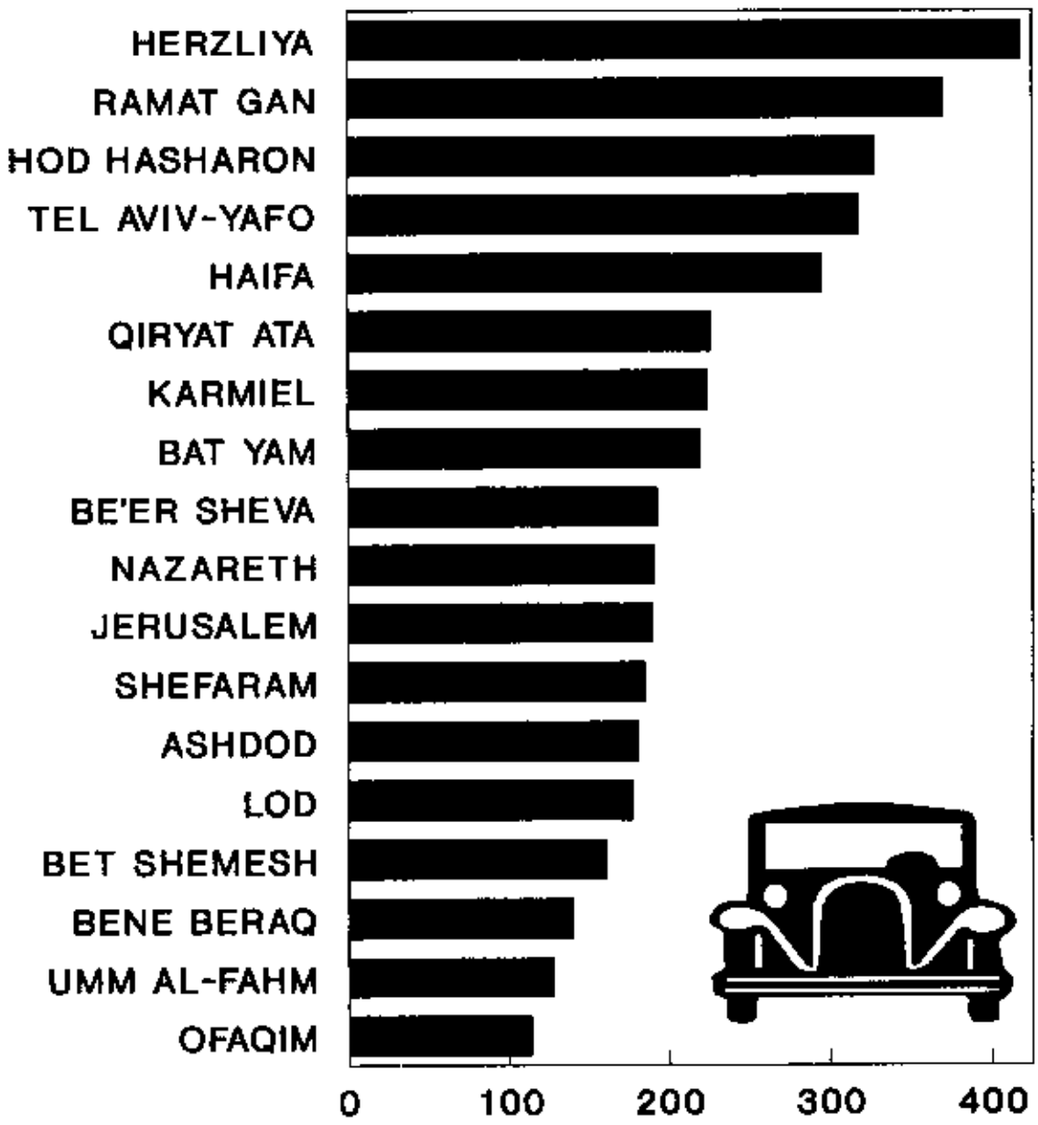
Different sectors of society also differ in their ability to escape the destructive effects of increasing motorization. Affluent households with several cars available can escape cities degraded by traffic to garden suburbs, from which they can commute for work and shopping. Poor urban dwellers cannot escape, however, and they suffer even more from the increased traffic noise, congestion and pollution generated by the new commuters. Overall, car dependency offers relative freedom to the privileged at the expense of the mobility, freedom and quality of life of the majority.

CAR OWNERSHIP – A DECEPTIVE MEASURE OF EQUITY

Even when car ownership rates grow dramatically, affluent groups continue to enjoy preferential access to cars and car-oriented services. Already in the early 1990s, over 50 percent of Israeli households owned at least one car; more than 67 percent of households of four and five members owned cars.[1] In 1996, ***73 percent of Jewish households in Jerusalem, a relatively low-income city, had at least one car.***[2] Still, car ownership remains closely linked to income, with most low-income families remaining carless, and average car ownership rates remaining lower in poor communities than in affluent ones. Moreover, the gap between car ownership in low-income and high-income communities has remained rather constant over the past two decades, even as overall car ownership rates rose dramatically.[3]-[4]

Figure 17: Car Ownership per 1,000 Population

Fig 17: CAR OWNERSHIP PER 1000 POPULATION (1997)



Source: CBS (3-4)

Car Use and Income

Higher income groups not only own more cars, they also travel more by car -- and therefore benefit more from a car-oriented infrastructure, low gasoline taxes and parking fees. Conversely, higher taxes on *automobile use* can be considered a progressive form of taxation -- particularly if the tax monies are channeled into the public transport system.[5, 6]

In Israel, business executives make twice as many interurban trips weekly as service workers and clerks/secretaries. Executives, professionals, academics and standing Army personnel all travel more than lower-paid secretaries, sales workers and service personnel.

Travel and Occupational Status

Profession	Interurban Trips Per Week
Standing Army/Police	2.99
Executives	2.68
Professional Employees in Industry	2.11
Academics	1.93
Unskilled Workers	1.81
Teachers, Technicians and Nurses	1.61
Sales persons	1.56
Secretaries/clerks	1.32
Service workers	1.27
Total	1.77

Source: The Trans Israel Highway Co., 1994 [7]

Even the acquisition of a driver's license appears to be linked to socio-economic status. Development towns, Arab communities and communities with a high proportion of ultra-Orthodox Jewish residents like B'nai Brak have the lowest proportion of licensed drivers per capita in Israel, while the highest proportion of qualified drivers can be found in upper-income areas of the center of the country (Gush Dan). [8]

Trends in Car Ownership

In a car-oriented development scenario, even if car ownership overall increases dramatically, it will remain disproportionately higher among high-income groups.

An examination of car ownership projections developed by the Trans Israel Highway Company reveals that lower-income Israeli towns and rural regions still would own fewer cars, per capita, than households in higher income areas -- even if car ownership rates more than doubled. For example, in the northern Negev, there would be 345 cars per 1000 residents in the year 2020, while the projected rate in upper-income Ramat Ha Sharon and Herzliya is 656 cars/1000, or nearly double. [9]

In a car dependent society, shopping, housing and recreational sites become increasingly dispersed, and highway oriented business parks, shopping malls, and suburban housing projects become important travel destinations, which traditional public transport or pedestrian routes cannot serve well.

One car becomes **insufficient** for a household to perform its daily tasks, and two and three car families become more common, at least in upper income brackets. Middle and lower income families that own only one car, or no car at all, find their mobility increasingly limited – and their access to work, social and cultural opportunities constrained as well.

Rising car ownership rates, therefore, generate new social inequities -- a car dependent society exacerbates the "mobility" gap between the car-rich and the car-poor.

The unequal distribution of cars between rich and poor persists **even in the most car-oriented** societies. In Great Britain, which has the highest rate of automobile ownership per capita in Europe, one-third of households do not have access to a car. [10] In the United States, which boasts the highest per capita car ownership rates in the world, between 11.5 and 15 percent of households do not even own a car and a full ONE-THIRD of the population are regarded as "transportation disadvantaged" because they do not drive or have regular access to a car – those populations include 26 million elderly, 24 million disabled, and 25 million poor -- as well as many young people aged 7-17.[11]

It should also be stressed that car ownership is not the only way to provide car access to those who do need the flexibility of a car. Indeed, in countries like Holland or Switzerland, car-sharing schemes have become widespread and popular. In Switzerland, one car share scheme involves 20,000 subscribers with access to 1000 cars in 350 cities and towns across the country.[12]

THE IMPACT OF CAR DEPENDENCY ON SELECTED SOCIAL GROUPS

City Dwellers

Historically, wealthier Israelis settled in moderately dense neighborhoods of apartments that often were located quite close to the central city, while new urban working class neighborhoods were located at less prime locations further from the center.

In the past decade, however, with the onset of suburbanization, the socio-economic balance of urban areas has shifted, and there has been an exodus of the middle class from the central city. The poor, new immigrants, foreign workers, the elderly and the ultra-Orthodox (in the case of Jerusalem) are increasingly left behind in the urban setting.[13] Trends in Jerusalem also reflect an outmigration of population from central city areas to neighborhoods on the fringes of the city -- or new suburbs in the Jerusalem district.[14]

Although Tel Aviv as a whole still retains a relatively strong socio-economic base, many stronger socio-economic households in older central city neighborhoods are gradually moving to newer locales on the periphery.

Policymakers and researchers generally link such outmigration to the price, size and condition of city housing -- failing to examine the extent to which quality of life factors, including traffic pollution and congestion, may also spur urban flight. For instance, in a survey of Jerusalem residents who left the city, housing was cited as the main reason for outmigration, but the decline in the quality of urban life was cited as a stronger motive than poor school quality or Arab-Jewish tensions.[15] The subjective perception of housing quality may be strongly influenced by neighborhood environmental factors. There are, for instance, central city neighborhoods where average apartment size is very large, but which still have suffered population stagnation or decline. Jerusalem's Rehavia quarter, where average apartment size is one of the largest in the city -- 81 meters -- suffered a net population loss in 1994, reflecting a stagnation in the "recycling" process of homes that should naturally occur. Not incidentally, Rehavia, once a quiet garden neighborhood, is today badly congested with traffic.[16]

It appears, then, that urban quality of life is not exclusively a function of housing size or quality -- but rather the result of a complex set of factors in the built environment.

Among those factors, car-oriented transport systems can become one of the most powerful triggers in urban decline -- generating excessive traffic, noise, congestion and pollution that render the "outside space" of city dwellers unsafe or unappealing.[17] Urban road construction, often designed to accommodate increased commuter traffic into the city to the benefit of suburbanites, means a loss of green "backyards" to cramped city dwellers. Air pollution generated by increased traffic in the city prompts a quantifiable decline in center city home values, as does noise. [18]-[19]

Excessive traffic is now emerging as one of the biggest environmental concerns of urban dwellers in Israel. In one recent survey of residents in industrialized Haifa, 56.6 percent named vehicles as the most problematic source of neighborhood pollution. In contrast, only 22.7 percent of those surveyed cited the oil refineries, which have been the focus of much public attention in recent years. In neighborhoods such as Bat Galim and Central Carmel, vehicles were ranked as the biggest source of pollution by over **80 percent** of respondents. [20]

A 1990 study by the Haifa Area Association of Cities for the Environment found that noise problems -- mostly from transport -- bothered local residents more than air pollution or poor trash collection.[21] In Mercaz Hadar, a central city area of Haifa troubled by outmigration, 83 percent of residents noted that noise was the greatest environmental disturbance. Another Haifa-based study of 100 apartments for sale in the Carmel Ridge area found that similarly valued apartments sold for less when the apartment was exposed to heavy traffic or street noise. A 100-meter third floor apartment with no sea or mountain view would be valued at $178,000 if it was facing a quiet street, but at only $165,000 if it faced a noisy main street -- a difference of $13,000.[22]

Traffic noise also has health and psychological effects. Noise can contribute to, or aggravate, stress-related health problems including high blood pressure, minor psychiatric illness and sleep disturbance.[23] Recent studies also have uncovered associations between noise exposure and fetal development, and childhood cognitive development (near a local airport).[24] In Europe, where rail is a more prevalent transport mode, rail noise is generally perceived as **less disturbing** than road traffic noise, possibility because of the more steady quality of the noise disturbance. [25]

The Impact of Traffic Congestion on Neighborhood Social Fabric

Traffic patterns also have a decisive impact on social relationships within neighborhoods. When a neighborhood is pedestrian-oriented, streets and community

shops and service centers provide an informal meeting ground for people who live near one another—helping to bind the diverse populations into a more cohesive social unit.[26] When road traffic increases, pedestrian traffic and social contacts diminish.[27]

As traffic congestion increases, and the subjective feelings about the neighborhood become more negative, changes in behavior occur. When traffic is heavier, people no longer linger on the pavement, they do not use front porches and gardens, and those who can afford to do so, move away to the suburbs. [28]

Commuters: Squandering of Urban Space for Roads and Parking

Those who flee to the suburbs return to the city in their private cars as commuters. Commuter traffic requires new or expanded urban highways, bypass roads, and city parking facilities -- which policymakers usually justify as traffic improvements for the city itself. In fact, however, the benefits of such infrastructure are enjoyed almost exclusively, and at almost no cost, by the suburbanites traveling to and from the city daily, rather than by the urban residents, whose tax monies finance many of the road improvements, and then who suffer the resulting congestion. As the British Royal Commission on Environmental Pollution notes:

> **"Space which was an important possession of local people has been taken from them over the years and made the preserve of people in cars who happen to be passing through. Children no longer play on the pavement or make unaccompanied journeys along the street to school. A reduction in the numbers of people walking through the streets creates the conditions for an increase in the crime rate."[29]**

Thus, increased car traffic feeds a spiral of diminished pedestrian activity, urban flight, and more commuting. Attempts to accommodate increased congestion via expansion of the road and parking network spurs even more urban flight.

Urban Flight and Social Fragmentation

Urban flight, in and of itself, feeds the social schisms already present in Israeli society -- between rich and poor, immigrant and native-born, and ultra-Orthodox and secular Israelis. Those gaps widen as groups become increasingly segregated geographically between the "haves" on the periphery of towns and villages and the "have-nots" in the central city.

Over four million Israelis, or 73 percent of the population, live in or near urban areas -- and yet in 1995 alone, 10,000 people left the city for rural locales. Rural

communities and towns of less than 20,000 in population are growing at rates of 4 percent to 15 percent annually, while most cities of over 100,000 are growing by a rate of 1 to 2 percent -- with the exception of Beersheva and Rishon Le Tziyyon.[30] Many planners have warned that massive suburbanization is not only undesirable, given Israel's land scarcity, but also undesirable socially.[31] Still, only when sustainable transport systems such as rail, "clean" gas or electric buses (pedestrian and cycle routes) are widely available in cities to minimize traffic noise, air pollution and congestion impacts, will the quality of urban living be able to compete with suburban living -- both for those who have the means to make the choice, and for those who do not. Generally, however, urban road plans progress far more quickly than rail systems, which require greater political will and foresight to develop.

Public Transport Patrons

Israelis as a whole still use public transport as much or more than their European counterparts. Nationally, some 36 percent of total travel is via bus, although the figure drops to 25 percent in the Tel Aviv area.[32] Yet as bus travel becomes less and less popular, public transport riders have become disproportionately poor, elderly, urban, ultra-Orthodox, female, and young.[33]

Percent of Group Using Public Transport at Least Once a Week
Jerusalem, 1996

Men	59 %
Women	79 %
Youths (under age 24)	85 %
Adults (ages 25-59)	65 %
Senior Citizens (65+)	87 %
Religious/ultra-Orthodox	84 %
Secular	62 %
Low Income Persons	82 %
High Income Persons	57 %

Source: *The Jerusalem Transport Master Plan, Travel Habits Survey, 1994-1996*

Nationally, car owners rarely travel by public transport. Among holders of drivers' licenses, only 19 percent of men and 25 percent of women nationally travel to work via bus, and only 10 percent travel by bus on interurban trips. In one-third to one-half of those instances, the only reason for using public transport is that the car is not available.[34]

The cost in real terms of riding public transport rose by 98 percent between 1980 and 1996, while the cost of driving and maintaining a car declined by 27 percent.[35, 36, 37]

Bus Patrons - Paying More and Getting Less

In Israel, public transport patrons are disadvantaged in other ways as well.

- Public transport patrons, particularly in urban areas, share in the economic burden of urban freeway development, from which they do not benefit. They also pay the health and social costs of congestion, noise and pollution that they did not create.

- Public transport patrons shoulder the burden of contraction in service routes and declines in service frequency when other bus patrons abandon the system and opt for automobiles. Between 1985 and 1995, the population increased by 31 percent but the number of kilometers traveled annually by public buses increased by only 5.3 percent—reflecting the overall shrinkage of the system.[38]

- In times of security tensions, it is the public transport riders who have been prime bombing victims.

- Public transport riders who are employed do not get the cash benefits of car allowances enjoyed by their colleagues, nor can they "cash out" parking subsidies given to car owners. Some 20 percent of Israeli households with cars receive employee car allowances. Another 10 percent have company cars. [39]

As a result, the relative cost of travel from any one point to another is generally higher for public transport riders than for automobile drivers. The gap between the mobility "haves" and "have-nots" increases as communities become more automobile dependent, destinations become more dispersed, and the public transport contracts further -- in both service span and quality.

In many countries, taxes on automobiles are directed into the public transport, pedestrian and cycle systems to compensate for the extra cost and the negative impact car users have on public transport patrons. In Israel, there is no direct relationship between automobile taxes and transport expenditures, let alone automobile fares and public transport support.

Automobile drivers, who consume more road "resources" in sheer space and generate more pollution per passenger kilometer than buses or trains, in effect gain a larger subsidy from government subsidized road-building than bus or train riders. Yet **policy debates tend to focus on ways to reduce subsidies to public transport, rather than to eliminate the hidden subsidies road-users enjoy.**[40] The reluctance to invest in rail, which is often faster, more convenient and more comfortable than bus services, reflects the low priority of public transport.

Much of the problem lies in the perception of public transport investment as a "welfare measure." Instead, public transport should be perceived as an investment benefiting the broad public.[41]

The "Car Allowance" - Subsidizing Car Owners

One of the most common subsidies car owners receive is the employee car allowance. In Europe, employee car allowances are gradually being eliminated in favor of a more equitable "travel" allowance system that allows employees the freedom to choose their own mode of travel without being financially penalized, or in favor of direct employer purchases of tickets for public transport.[42]

In Israel, the Histadrut has considered, but not moved on a proposal to translate car allowances into travel allowances. Employees who want to purchase and use an alternative form of transport lose both the value of a car allowance and parking subsidies. The economic distortions created by the present system are illustrated by the case of an Environment Ministry official, Dr. Stillian Gilberg, who in 1995 forfeited his rights to free car parking space, valued at NIS 350 a month, but requested that the Ministry purchase a bicycle instead (a one-time purchase of NIS 1,000) for use in commuting to and from the office. His proposal was approved by the Ministry's comptroller—but only on condition that Gilberg also forfeit his free monthly bus pass.[43] Gilberg, who uses the bus to get to work when it rains, refused.

Women: The Second Sex in the Transport System

At first glance, it might seem that increasing motorization can improve the mobility of women who otherwise might remain dependent on men for transport. And indeed, in the case of more affluent women living in households that can afford to purchase a second family vehicle, this often seems to be the case. However, as society becomes car dependent, the lifestyle changes that occur ultimately are detrimental to most women, particularly those living in households with only one family car. Even affluent women eventually discover that the more car dependent they are, the more time they must spend traveling to work and shopping destinations, as well as transporting children and/or elderly relatives -- who can no longer rely on pedestrian or public transport modes.

The special transport needs of women are defined in large part by the **multiple roles** they play -- combining paid employment with the unpaid domestic work and childcare, care of elderly relatives, and possibly study. As a result, sustainable land use and transport systems in which home, work and shopping destinations are located in close proximity to one another make the juggling of various tasks easier for women.[44] Similarly, transport systems permitting children maximal independent movement on public transit, foot and bicycle release women from time-consuming duties of "escorting" children everywhere.[45] [46]

Major highway projects are usually based on cost/benefit analyses in which the value of time saved on car travel, especially travel to work, is weighted heavily. Yet highway development, which also encourages suburbanization and fragmentation of commercial and residential functions and degrades public transport, leads to a loss, rather than a saving, of women's time.

Combining Work, Family and Transport

Some 959,200 Israeli women were employed in the work force in 1996 -- 45.6 percent of the female population over the age of 15. In the Jewish sector, an average of 70 percent of women with children under the age of 14 are employed outside of the home.[47] In the Arab sector, nearly one-quarter of women between the ages of 18 and 34 work outside of the home. [48]

Women in Israel earn, on average, 52 percent of men's salaries.[49] About 38 percent of women workers are employed part-time.[50] And among women who work part-time, 13 percent cite their studies as the reason for working part rather than full time, while 21 percent cite their role as homemakers.[51]

As lower income earners, women have less access to cars overall and are more dependent on public transport than men. In 1992, 65 percent of Israeli men held drivers' licenses, compared to 35 percent of women.[52] Even among license holders, 37 percent of women go to work by bus, foot or other means, as compared to 29 percent of men, reflecting in part the fact that men have priority use of the car in one-car households.[53]

Employee car allowances also are a predominantly "male-only" perk. A 1995 survey by the Israel Women's Network found that 95 percent of male civil servants receive car allowances, averaging 300 shekels a month. Only 53 percent of women receive a

car allowance, averaging 225 shekels a month. The report notes: "There is a positive connection between the job rank and the level of mobility in a service vehicle. Because they occupy mainly the lower and middle levels, women do not receive those benefits."[54]

Special Travel Patterns of Women

Women make more short journeys than men; thus good short-distance transport and local access is key for them. In metropolitan Tel Aviv, women make 0.71 trips daily in their community of residence, compared with 0.52 trips for men.[55] Conversely, men make more interurban trips than women: 1.92 trips daily as compared to 1.19 trips for women drivers.[56]

Since women work far more than men in part-time jobs, more of their travel is outside of "peak" travel times, and they are differentially disadvantaged by transport services that are less frequent during these off-peak hours. The availability of job opportunities close to home may determine whether or not a woman is able to work outside of her home, particularly in a part-time job where commuting time must be kept to a minimum.

Conversely, a woman may be freer to opt for employment opportunities for more hours in the afternoon, and further from home, if she knows that her children can get home and around the neighborhood independently.[57]

Because of a woman's social role, a significant portion of her travel is made in the company of children, making even the most basic movements in congested urban areas complex and dangerous.[58] A transport system that facilitates the independent movement of children and the elderly via pedestrian and public transport modes, and permits independent child's play on streets and sidewalks, lessens the burden of social support that women must assume as escorts and travel companions.[59]

Low-floor trains and tilting buses are more convenient for women accompanying children than present-day buses, which are difficult to alight. The encroachment of parked cars on sidewalks, and the overall deterioration of pedestrian networks has a particularly severe effect on women escorting children.

The quality of the pedestrian environment is also particularly important to women traveling alone, since their lower social status and smaller size makes them more vulnerable to harassment and attack. Problems affecting women's sense of safety in

the street include: poor lighting; blocked sidewalks; untrimmed vegetation blocking sidewalks, and holes and breaks in the sidewalk.[60]

Women and Car Dependency

Ironically, while "time savings," especially in work commutes, is such a critical factor in justifying the construction of roads, over the long term, automobile-dependency may create new time costs and inefficiencies in a woman's daily schedule that may not be calculated by transport economists.

As low-density suburbanization disperses homes, workplaces, schools, and shops further and further, women's mobility is adversely affected. A second family car may temporarily solve individual problems, but it exacerbates the long-term dilemma of society. The suburb that can accommodate a two-car lifestyle often lacks pedestrian and public transport access to services, stores, schools and cultural centers. Rather than liberating women, an automobile society leaves children more dependent on car transport for even short trips, forcing women to become "chauffeurs."

An "urban village" style residential environment featuring relatively high densities, mixed land use, public transportation and a variety of services is thus a more "user friendly" environment for women in general and for working women in particular.[61] Such a "mixed use" community—be it city, small town, or kibbutz—can allow women to move easily between home and a wide range of local job and shopping opportunities. It also allows young children to move independently between school and after-school activities.

Children and Teenagers

Cars, we are sometimes told in advertisements, spell freedom to move when and where we want. This "we" is very age-specific; the automobilization of society has eroded the freedom of children. While policy makers have supported the rights of older teenagers to obtain drivers' licenses and access to cars, few Israeli transport researchers have bothered to ask what impact massive motorization and car-oriented urban development is having on the 1.9 million Israelis who are children and teens of pre-driving age -- a sector that constitutes **more than one-third of Israel's population** – most under the age of 14.[62] About half of the households in Israel include children and teens under the age of 17 -- in the Arab sector the figure is 73.6 percent.[63]

The evidence suggests that our younger citizens are increasingly constrained in their freedom of movement on foot and on bicycle -- increasingly unable to cross roads, play outdoors, get to school and back, and visit friends on their own. And with growing bodies, those who live at exhaust-pipe level are most at risk from automobile pollution.

In general, child mobility has very low priority for transport planners in Israel. But in other western countries, it has been demonstrated that rising motorization has paralleled a decline in the independent mobility of children. In England, 80 percent of seven and eight year-old children were allowed to go to school without adult supervision in 1971. By 1990, only 9 percent were allowed to do so. While 80 percent of children walked to school in 1971, only about 60 percent did so in 1990, and the proportion of those driven to school jumped from 10 percent to over 35 percent. In 1971, about 65 percent of children aged eight were allowed to cross the road by themselves; by 1990 that number had dropped to 25 percent. [64] While the number of child pedestrian casualties also dropped sharply, roads were "safer" because they had been cleared of children.

Child Health and Child Mobility

Such findings are particularly worrisome, since there is a strong correlation between overall health and walking habits -- a link that begins early in life. Incidence of childhood asthma may be higher when children play less outdoors.[65] Since children are physically closer to the ground, they also inhale relatively higher concentrations of pollution from passing traffic. At the curbsides of major roads, concentrations are two or three times the urban background level, notes The British Royal Commission on Transport and Environment.[66]

High rates of pollution translate into reduced child lung capacity and higher rates of respiratory infections and asthma.[67] School children exercising or bicycling in areas of unusually heavy or congested traffic are at greater risk for CO poisoning than office workers or drivers.[68]

Fast-speeding cars and difficult-to-cross intersections pose a particular threat for young children since they cannot accurately estimate the time needed to cross a street. As roads are widened, cars move faster, raising the likelihood that a hit will be fatal.[69]

Streets as Play Space

Creating "safe" space for children to move about in their neighborhoods is important to mental development as well as physical health. The undirected exploration of space in play is a crucial element in developing physical, intellectual and motor skills.[70] For children over the age of five, a static playground site does not represent a desirable play site. Instead, older children seek out activities on the sidewalk and the street -- and routes for riding bicycles, roller skating, moving back and forth to the homes of friends, and observing the comings and goings at neighborhood stores or residences.[71]

In Israel, community transport planning often fails to reflect this need of children. In particular, the gradual reduction in urban sidewalk space---largely due to encroachment by illegally parked cars—leaves children less and less "safe" play space outside of their homes. Children have no alternative but to move directly into the streets, where there is a higher risk of injury and death.

Even when sidewalks are maintained, they are not always appropriate for cycling.[72] The absence of urban pedestrian and bicycle space for children is especially unfortunate given the fact that biking and roller skating are popular and cheap play activities for children in families of all income levels. An estimated 120,000 children's bicycles (for ages 14 and under) are sold every year in Israel. If the lifespan of each bicycle is just six years, then an estimated 720,000 Israeli youngsters -- or 40 percent of all children under 14 -- own bicycles, while many of the estimated 50,000 mountain bikes sold annually are purchased and used by teens aged 13-18.[73]

Public Transport and Children

Few policy makers have examined the role school bus transport plays in child mobility -- or in time savings for parents. When free school buses are available, they reduce the need for parents to make trips to multiple destinations as part of their daily commuting schedule. That, in turn, makes public transit more feasible for the adults. But school buses in many parts of Israel are an add-on extra that parents pay for privately -- the result being that many parents try to "economize' by chauffeuring their children to school -- generating more traffic and macro-economic inefficiencies.

Children and teens also suffer socially when local public transit systems decline. For instance, when very high quality public transport is available, teens may feel less pressure to begin driving at an early age -- and policymakers may feel less pressure to lower the driving age. Teens begin driving earlier in car dependent United States than in Europe. And in the United States, teenagers in remote rural regions and suburbs

often begin learning to drive even earlier than those in major cities boasting a high quality transit network. Moreover, in Israel, the investment in a car by an older teenager seeking status may mean forgoing other important experiences, such as study, travel abroad or savings for an apartment purchase.

Children also may be dependent on good interurban transport systems in order to experience the world outside of their local community. For instance, about 26 percent of Israeli families contain more than five members -- and such households therefore cannot fit into one standard-sized car for out-of-town leisure trips.[74]

Land Use and Children

Neither super high rise housing nor dispersed single family suburbs create optimal space for children. In high rise buildings, merely to go outdoors, children must move further away from home, down many flights of stairs, and past many strangers -- travel which is more likely to require adult supervision. Legally, children under 14 are not allowed to take elevators unaccompanied by an adult.[75] Single-family housing also may be isolating to young children, who may have access to a private yard -- but lack the common yards or play spaces often available in small and medium size apartment blocs. Educational, cultural and commercial activities may not be within walking, biking or bus reach in a typical single-family dwelling.

Medium density housing in a mixed use setting-- be it semi-rural or urban -- offers children the greatest range in mobility and sources of stimulation. Friends are relatively near at hand, and even young children can travel independently down the stairs to the outside world, explore the building yard, or go to neighborhood stores. Older children can travel independently to schools, sports and cultural centers and stores. In a more rural setting, a traditional mixed-use kibbutz, moshav or town also offers a wider range of sites and stimulation than a suburb– be that farm animals and fields or small town business enterprises, parks and cultural centers.

Senior Citizens and Disabled Persons

Relative to western European countries, Israel today is a relatively "young" society, where the elderly make up 9.5 percent of the population -- as compared to 13-16 percent in most of western Europe.[76] Often the highest concentrations of elderly residents may be found in older central city neighborhoods where traffic congestion, pollution and noise may be particularly great.[77]

While children need a transport system that allows them a constantly expanding range of independent movement involving new physical and cognitive challenges, older Israelis find their physical and cognitive powers diminishing and their range of daily mobility shrinking gradually. Therefore, a transport system that eases mobility in neighborhoods and communities helps an elderly person preserve a maximum degree of independence.[78]

Good pedestrian facilities, public transport and mixed use communities that offer a variety of services and activities in close proximity of home are ideal. A good pedestrian network, interspersed with parks and benches, offers the elderly both "vantage points from which to observe and feel part of the fabric of urban life," as well as places to rest along the way which are not too close to noise and pollution, observes Churchman.[79]

In mixed-use, pedestrian-oriented neighborhoods, elderly people can perform basic shopping routines independently.[80] As noted previously, the exercise involved in daily walking is also essential for elderly health -- particularly the maintenance of bone densities that help avoid osteoporosis. Neighborhoods in which contact with people can be made informally on the street reinforces social supports, which also bolster good health.[81] This intuitively apparent link—between social networks and physical well-being—has been supported by a wide range of empirical studies. These demonstrate clear links between social support and decreased mortality and enhanced health.[82]

Outside of the neighborhood, readily-available door-to-door motorized transport (through dial-a-ride schemes, private cars or taxis) is certainly justified at times. But in general, the elderly are far more dependent on public transportation than the general population. In 1995, Israelis over the age of 65 constituted 9.5 percent of the population, but they made up only five percent of drivers' license holders.[83] This relatively greater dependency will remain even as the proportion of elderly with drivers' licenses grows, since there are many elderly drivers who cannot or do not feel comfortable driving, particularly in heavy traffic.

Obstruction of access by fast-moving traffic is particularly stressful for older and disabled persons. Healthwise, the elderly also are at a high risk when exposed to high levels of air pollution generated by excess traffic. The increased rates of premature mortality that occur in cities with high rates of particulate pollution is due mostly to

deaths among the elderly.[84] Increased levels of CO can bring on heart attacks, and fatalities.[85] Among smokers and those in poor health, the extra CO that can trigger a heart attack or even death is relatively small.[86]

For many elderly, driving can be a symbol of independence in old age, yet it also can raise fears and anxiety, as the ability to respond very quickly is diminished. The more car-dependent a society is, the more psychologically and socially difficult it will be for an elderly person to stop driving even when physical limitations dictate the same. Conversely, where pedestrian space is preserved, and public transportation is regarded as a high status form of travel, the loss of driving privileges may be less of a burden. As with women and children, urban light rail, with state of the art "low-floor" platforms, or "tilting" buses can offer special advantages to elderly and disabled persons.

Approximately 600,000 Israelis -- about 10 percent of the population, suffer from some kind of physical disability. [87] Many of the factors that facilitate ease of movement for children and senior citizens also improve the mobility of the disabled. A disabled person who can move about his or her neighborhood freely on a wheelchair will enjoy far more independence than someone who must use a car even for simple errands. On February 23, 1998, the Law for Equal Rights for Handicapped Persons was passed in the Knesset, which should, in principle, guarantee equal rights of access for people with physical disabilities.

Arab Citizens

While Israel's road system and motorization rates approximate those of European countries, the transport system in the Arab sector more closely resembles a third-world model such that found in Central or South America. Per capita, car ownership among Arab citizens is only about 70 percent of the Israeli national average—although over the past two decades it has been growing faster in Arab settlements than in the country as a whole.[88] The public transport system to and from Arab towns and villages is far less developed than that elsewhere in Israel. Roads to Arab communities and within villages, towns and cities are often in poor condition -- reflecting the social marginalization of Arab localities. [89]

In terms of land use, older Arab towns and cities, such as Umm El Fahm, the largest Arab center in the Triangle, or Nazareth in the Galilee, generally developed first

around pedestrian-oriented residential quarters and markets. Thus while the Arab sector may be underdeveloped relative to Israel, it faces similar policy dilemmas; should traditional town centers be degraded and destroyed in order to widen and improve new roads to accommodate the automobile and to thus "catch up" with Israeli motorization rates? Or can a more sustainable transportation model be developed that would be less reliant on the automobile and more compatible with traditional village and town design.

Mobility Patterns

After 1948, Arab villages in the area known as the Triangle region were cut off from the larger Arab towns of the Jordanian-controlled West Bank (Jenin, Tul Karem, Kalkilya, and Nablus). Safed, Tiberias and Beit Shean were emptied of Arab occupants, and Akko, Haifa, Yaffo and Lod were left with diminished Arab populations. With few urban centers as magnets for travel, mobility was low -- except among male workers who traveled outside of villages and towns for employment. Military government, in effect until 1966, reduced mobility considerably, as permits were required for travel.

In the 1990s, most Arab towns lack industrial areas and a significant employment base of their own, and the result is significant commuter traffic from the village every morning to Jewish towns or regional industrial parks located in Jewish areas.

The need to commute to work is most acute in the Bedouin townships of the Negev; many still lack even basic cottage-style industries like metal-works or car garages typically found in Arab towns in the Galilee and the Triangle.[90]

Since the average size of an Arab household is large -- 57 percent of Arab households contain five or more persons, and 25 percent of households contain seven or more members, one car must accommodate the demands of many members.[91]

Usually, women, the elderly and children remain behind when the male members go out to work in the morning. As noted in the section on women and transport, only about one-quarter of women aged 18-34 work in the Arab sector. The percentage of Arab women who continue their studies after age 18 is also lower than that in the Jewish sector.[92]

The long commute to most jobs, combined with the taboos against out-of-town female employment, mean that women may remain socially isolated in the village while male

members are exposed to more of mainstream Israeli society and learn better Hebrew. This differential mobility may also create social strains. Meanwhile, access to a car or the ability to drive may indeed represent a form of liberation for rural Arab women.[93]

Land Use Patterns

Outside of the traditional town or village core, low density single family housing has become the dominant building mode -- in sharp contrast to the apartment blocks that rose up in Jewish towns. This style of building resulted in part from rising affluence and in part from the absence of strong local planning bodies in the Arab sector – where most village land is privately owned, and key "macro" planning decisions are made by "outside" Jewish authorities -- who have failed to provide answers to the development needs of Arab communities. It also reflects the "village" lifestyle still prevalent where large extended families might live in a single compound, alongside their orchards or gardens. Finally, such building also serves a political goal – to re-assert a claim to agricultural land that was constantly under the threat of expropriation from Israeli authorities.

Over time, such building patterns also heighten problems of land scarcity in a society where land is rarely sold outside of families, and in which the birth rate is very high. Political conflicts with Jewish authorities over illegal building on the fringes of cities are exacerbated. Finally, the low-density building also encourages a trend toward automobile dependency as the villages grow larger; per capita car ownership more than tripled from 1970 to 1990.[94]

Transport Infrastructure

Typically a single large road connects the village with the outside world, sometimes passing by the edge of a hilltop community like Umm El Fahm, at other times bisecting it through the middle, as in the case of Baka Al Gharbiya. Smaller windy streets feed into the village or town center, with little hierarchical ordering of size. The roads are often not of standard dimensions, construction, or signage, having begun as pedestrian and animal passages. The low-density building on the perimeter of towns and villages makes the supply of infrastructure and services, including roads and public transportation, less efficient.[95] In congested core areas, the pedestrian injury rate, especially of children, is very high, because cars and pedestrians share the same crowded space.[96]

Public transport is often limited to buses leaving the village in the early morning and returning after the workday. These buses are routed primarily to main roads and

Jewish towns, and there are few radial connections between Arab villages. When a single bus line serves a series of Arab villages along a main road, making a circuit through each, travel can be arduously slow. The bus companies have often relegated the worst buses of their fleet to serve these villages, and these are often overcrowded. Partly because of the poor bus services, many Arab towns are characterized by a high availability of "sherut" taxi services that transport workers to and from work.

Financing Improvements

Traditionally, the Arab sector ranked very low in national priorities, and the difficulty of local tax collection, combined with the disparity in the government funds available to Jewish and Arab communities, made for constant budget deficits and little investment in transport. This picture changed significantly in 1992. Budgets for roads, for example, ballooned from NIS 870, 000 in 1990-1 to NIS 27.5 million in 1993 and 33 million in 1994.[97] With the increase in budgets, planners sought to relieve the growing transportation stresses in Arab villages through greater investments in the road system) constructing a hierarchical system of straight wide roads according to national standards, multiple road entries into villages, and ring roads around them. "The solution for the transportation problems in these settlements," claims one of the few overviews of the topic, "demands correct planning similar to that done for Israel's large cities."[98]

Such tactics may be technically feasible in areas where the bulk of the development has been recent -- and therefore of low enough density to incorporate a bigger road system. But investment exclusively in roads and car-oriented planning will also spur more sprawl, exacerbate land tensions within Arab communities, and intensify land disputes between Arab communities and Jewish neighbors.[99]

A more innovative approach is apparent in the recent planning of the Nazareth 2000 project, developed by a team of national and local planners to spur tourism in the historic city. The following discussion is devoted to the Nazareth 2000 plan, as an illustration of how sustainable transport principles can be harnessed to create economic and social benefits in the Arab sector -- while also reducing Jewish-Arab political conflict.[100]

Nazareth 2000

The Nazareth 2000 plan represents an attempt to transform a road development "lag" into an advantage. Old City pedestrian and market areas, which are incompatible with road-oriented development, are being **re-pedestrianized** in order to attract business

from among the thousands of pilgrims and tourists who visit the city annually. The Nazareth 2000 plan is expected to add about 3,250 jobs to the Israeli economy over the short term and about 8,000 jobs in the long term, primarily by spurring longer tourist stays in the city.

During the 1970s and 1980s, attempts were made to introduce automobile traffic into parts of former pedestrian alleys that wind through the traditional market -- something that was viewed as a symbol of economic development. Belatedly, policymakers recognized the real results -- traffic congestion, the physical degradation of homes and stores abutting directly onto the road, the loss of pedestrian mobility -- and of tourism and economic value to the neighborhood. [101]

On the edge of the old city area, Nazareth's main street, Paulus VI, became the site of chronic traffic jams. Attempts to widen the road to three and even four lanes failed to keep up with the pace of increasing congestion. As a result of the traffic obstacles and the degraded town center, pilgrims to Nazareth tended to limit their stay in the town to just a brief stop at the town's main religious sites -- while dining and sleeping in resort centers like Tiberias.

Presently, Nazareth's Old City and market area are marked by a very high rate of poverty -- more than 80 percent of families live below the poverty line as compared to 35.4 percent in Nazareth as a whole.[102] The elegant mansions which were built by Nazareth's wealthy Christian bourgeoisie a century ago, and still give the area charm, have fallen into disrepair as affluent Nazarenes fled to the periphery. Most of the Old City's residents are new arrivals from outlying villages in the Galilee. There are no children's playgrounds or community centers -- and as a result the only available play space is in the streets and alleys[103].

The Nazareth 2000 plan has sought to reverse many of these trends -- and create attractions that would prolong the stay of the average tourist in the city. Paulus VI Street is being **narrowed** into a three-lane road of which two lanes will be **bus-only** corridors. The road space thus saved will be used for broader sidewalks, bus alighting zones, and trees. The pedestrian networks which descend from the hills on the city's northern edge into Old City are being renovated and expanded to create a network of promenades around the entire city, linking lookout points and parks on the periphery with the religious sites and market area.

Store fronts and homes are to be renovated both in the marketplace and the central business district, and attention is being paid to **street furniture** that attracts pedestrians – including stores with attractive windows and store fronts, trees, signs and benches, and mid-rise buildings that blend in with the traditional skyline.

The plan also underlines the need to prevent the development of sprawl on the edges of the city -- which would degrade the visual contours of the town, set amidst green space and open agricultural fields.[104]

While the Nazareth 2000 plan is designed primarily to generate economic benefits from increased tourism, the same transport and land use principles that draw tourists also create social, environmental and health boons for local residents who will benefit from the easier access within the city, and a more pedestrian-friendly design..

Still, in its design as a tool for attracting tourists, the plan reflects a *lack of attention to the transport needs of the local population*. Road improvements are designed to facilitate tourist bus traffic and tourist pedestrian flow, rather than promote a more fundamental shift among city residents from private to public modes.

Pedestrian connections between tourist destinations are treated in great detail, but there is no such attempt to create pedestrian connections for the local population – to and from schools, for instance. Improving the local public bus system is absent in a consideration of the transport systems. Without any attention to the creation of a high quality bus and mini bus system that could provide good local access to the center city, it would be difficult to restrain the growth of urban sprawl on the city's periphery. It also will be difficult to retain a broad mix of local services and businesses in center city locations -- or to accommodate traffic growth via the creation of new car parking lots or traffic rerouting, as the Nazareth 2000 strategy envisions.

Regional planning also will have an impact on whether the traditional contours of the town are preserved. New roads being constructed near Nazareth, including the The Trans Israel Highway, are potential sites for road-oriented sprawl, superstore and mall development and business parks, which would destroy the rural Galilee landscape that Nazareth 2000 seeks to preserve.[105] Nazareth's downtown, meanwhile, would then risk becoming a tourist artifact rather than a living commercial area with a mix of businesses drawing local shoppers and visitors.

The Trans Israel Highway and the Arab Sector

In the Galilee, one of the proposed trajectories for the Trans Israel Highway would run from Ha Movil junction, near Bir Al Maksour, and north along the route of the National Water Carrier through the Beit Netofa Valley, which today is largely under Arab cultivation. Besides posing a danger to the national water supply, such a course raises the prospect of massive expropriation of Arab agricultural lands from residents of Sakhnin, Arrabe, and Nazareth, who farm the valley.

It is in the Triangle region, however, where the impact of the road is most apparent and profound. The approved road corridor runs directly adjacent to major Arab towns, like Taibe, Tira, Jaljulia, Kfar Kassem, and Baka Al-Garbiyeh.[106] In many cases, the highway will separate town and village centers from agricultural lands on their fringes, making access possible only via underpasses that are to be built by the road company. Major interchanges are plotted to serve Jewish, not Arab communities. There is, for instance, no interchange at the large Arab town of Taibe; rather, the interchange is located several kilometers to the south, at the tiny Jewish settlement of Tzur Natan.[107]

In cases where a major interchange is located near an Arab town, such as Kfar Kassem, Arab land near the interchange has been expropriated by government authorities for the construction of a new regional industrial park. While such development should be for the benefit of all area residents, it was not coordinated with local leaders, and local entrepreneurs were in fact forced to cancel their own commercial development plans when the land for the industrial park was expropriated from them. In the case of Kfar Kassem, the industrial park sits at close proximity to Arab residential areas along the edge of the village. A formerly open horizon of rolling agricultural fields west and southwest of the village has been transformed into a landscape of concrete and roads, which will generate high traffic volumes, noise and pollution for local residents.

The Trans Israel Highway, as it was first conceived, was clearly intended to serve a strategic purpose -- to wedge Jewish population and employment centers between the growing Arab towns of the Triangle area, thus preventing the gradual merging of the villages of the Triangle and/or the Galilee into more continuous Arab demographic blocs.[108]

However, attempts to contain Arab expansion via the construction of roads and sprawl will only inflame land conflicts over the long term, as well as degrade social environments for both populations and accelerate automobile dependency.

It is striking that an unused rail line travels along much of the Trans Israel Highway corridor in the Triangle region -- (Lod, Rosh Ha Ayin, Kfar Sava, Tira, Taibe, Nizzane Oz, Baka Al Gharbiya and Pardes Hanna, Hadera.) A rail-oriented rather than road-oriented development scheme in that area could have facilitated more compact development of both Arab and Jewish communities, and thus reduced strife over shrinking land resources. Improvements in flexible transport services – i.e., networks of minivans and *sherut* taxi services -- would provide better answers to local Arab needs than still more roads.

A more sustainable policy would focus infrastructure improvements not only on road improvements but also on land use. Mixed use development -- the creation of employment centers in Arab towns, which are tailored to meet Arab requirements, and are not exclusively Jewish owned -- would help reduce political tensions, as well as the need to commute. Government subsidy of planning and infrastructure development in new Arab residential neighborhoods would help promote more clustered, compact housing patterns, as it has in Jewish neighborhoods. But such forward-looking changes in policy seem unlikely for the moment, given the unwillingness of government bodies to invest directly in the development of Arab communities and economies, as they have in the Jewish sector

The Jewish Rural Sector

Some 504,000 Israelis live in 944 rural localities, and another one million Israelis live in towns of 2 to 20,000 residents.[109] As noted previously, rural communities constitute the fastest growing population sector – yet most of the development underway there is in the form of low-density suburbs. The rapid pace of low-density development risks transforming most rural parts of Israel into suburban extensions of nearby cities, with grave implications for rural lifestyles, agricultural space and recreational open space.[110] If transport and land use policy in rural areas is not unified with urban policy, automobile-oriented sprawl will replace farmland and open space in many of the Israeli regions that rank as most significant from the point of view of history, landscape, archeology and agriculture.[111]

Mobility

In most developed countries, rural residents are more dependent on cars than urban dwellers, and car ownership rates are correspondingly higher in rural areas. In contrast, Israel's countryside traditionally was a model of transport sustainability. The kibbutz and moshav communities, where workplaces and basic health and educational services were located within walking distance of homes, reduced the unnecessary consumption of travel. Car-sharing was practiced, curbing the unnecessary proliferation of rural car ownership for decades.

However, the situation is changing rapidly due to changes in the structure of the moshav and the kibbutz – in which agriculture plays a diminished role, "outside" work is much more common, and personal automobiles have even become a status "perk" on some kibbutzim. Inside the kibbutz as well, motorized traffic, particularly motorcycles and four-wheel all-terrain vehicles, are increasingly used to travel on internal pedestrian trails. This gradual "incursion" of motorized traffic degrades the safe, pedestrianized environment of the kibbutz.

Land Use - Self Sufficient Communities or Bedroom Suburbs?

In terms of land use, kibbutzim were originally a model of sustainable rural development. The creation of compact, rural communities with well-defined borders between settled communities and open space permitted the preservation of culturally significant rural landscapes in a country of extraordinarily tiny dimensions.

Today, two thirds of rural communities are still kibbutzim or moshavim. But the remaining third of rural communities are primarily suburbs or "residential communities," which generally lack a strong employment or service base, or small towns of fewer than 20,000 residents.[112]

The residential community concept – "yishuv kehilati" in Hebrew -- was developed in order to promote Jewish population dispersal in areas such as the Galilee, Triangle and Negev. In fact, it created the basic ingredient for rural sprawl – a pattern of small, dispersed settlements that failed to develop as genuine communities as they lacked the critical mass of residents necessary to support an employment or service base. More recently, kibbutzim and moshavim are contributing to the now-rapid degradation of rural environments -- by converting former agricultural land into car-dependent, rural suburbs of single family developments and into roadside malls. Some of the development is motivated by financial opportunism and weak land use controls, but it is also driven by government policy, which has encouraged

debt-ridden collectives to convert some of their land to commercial and residential real estate, in order to restore their financial solvency.

Tragically, the physical design of the kibbutz, Israel's unique innovation in the annals of town planning, has failed to be replicated in non-kibbutz locales. The kibbutz is a place where employment, basic services and residential housing coexist in one compact community, where cars are "confined" to the edges of the settlement, and green lawns and pedestrian and bike paths link homes and other destinations.

As well as degrading the rural quality of life, fast-developing sprawl also undermines the long-term viability of Israel's agricultural sector. Sprawl is covering aquifer cachement areas and consuming some of Israel's best farmland forever, while road oils washed away in rainwater runoff pollute underground water supplies.[113] Air pollution generated by traffic has a negative impact on rainfall and crop yields. High concentrations of nitrogen oxides and rural ozone -- increasingly common in Israel -- damage plants and retard plant growth.[114]

Such impacts on agriculture may not receive high priority at present, when many imported crops are less expensive than local produce. Yet soaring world populations and growing worldwide water shortages have given rise to predictions of worldwide crop shortages in the future. Prudence would still dictate that Israel's most fertile farmland should not be buried under concrete.

Infrastructure Development and the Rural Sector

While there is increasing interest in investing in mass transit systems for Israel's large cities, for the periphery recent policy has been shaped around a business-as-usual scenario. The Metropolitan Tel Aviv development plan recommends continued road expansion in the rural sector -- where roads are perceived to have a "relative advantage."[115] Similarly, the Trans Israel Highway is perceived as a tool for developing rural areas on the periphery. Neither the road, nor the small suburban settlements, nor the employment and commercial centers that are planned to be built near the highway, are generally perceived as incompatible or competing with mass transit development in the cities.[116,117]

As noted in Chapter III, a growing body of research in the United States and Europe suggests that this view is erroneous. Road-oriented development on the rural fringes of metropolitan areas DOES compete with efforts to introduce sustainable transport systems closer to city centers. Sprawl induced on the

periphery undermines attempts to create compact, well-defined urban borders.[118-119]

The Lev Ha Sharon Experience

The Lev Ha Sharon area provides an example of the way in which the whole approach to development in the rural sector triggers car-dependent sprawl and degradation. Government and local authorities are currently examining proposals to develop a local commercial area in the region. The goal is to create local shopping, educational and leisure opportunities for the growing population of rural bedroom suburbs and moshavim -- thereby reducing traffic and congestion into Netanya. New commercial, office, and educational facilities would be consolidated into coordinated, planned centers, so as to avoid development in unplanned, and scattered sites.[120]

The plan would indeed be an innovation if an existing rural town or settlement was developed as a regional center that concentrated future population growth on one site, where an enhanced range of shopping, employment, educational and sports facilities were also available.

The focusing of rural growth in population and services into fewer locations would, over time, reduce the projected increases in rural traffic. High-frequency bus, *sherut*-taxi or mini-bus services could be created to and from neighboring settlements that use the commercial, educational and employment services of the enhanced town center.

Instead, the new Lev Ha Sharon commercial area is being planned as an isolated bloc of commercial development sited along a new access road running north-south between Tel Mond, Kadima and Kfar Yona. As such, it will be entirely car-dependent and, as such, a trigger for further sprawl.

Motor Vehicles and Recreational Sites

Israel's rural space and coastal areas also serve an important leisure time function for urban residents and their children, particularly for families who cannot afford to travel abroad for vacations. The transformation of rural locales and beaches in close proximity to cities into a series of car-oriented, suburban tract townships deprives city dwellers of an important source of leisure outlets close to their homes. It also diminishes, over time, appreciation for Israel's unique history, landscape and heritage.

Much of this degradation, however, is due not only to poor planning but also to the **increased intrusion of recreational motor vehicles** into sites that previously were used primarily by pedestrians or cyclists -- in a process parallel to that underway in more urbanized areas.

Marinas -- essentially **"parking lots-in-the-sea"** -- are given preference over beaches, which serve in essence, pedestrian users. Offshore, motor boats and motorized ski jets often usurp the space of swimmers – endangering their safety while dumping oil and exhaust fumes back onto the beach.[121] In parks and nature areas, all-terrain vehicles are increasingly popular -- degrading the site for the non-motorized user. Even on the pedestrian paths of kibbutzim and kibbutz resorts, cars and motorcycles are increasingly intrusive, and "club cars" are used for very short trips by staff, where bicycles or walking would suffice.

At archeological and historical sites around the country, tourist buses typically leave their diesel bus engines idling for hours, while awaiting tour groups to reboard the vehicle -- generating unnecessary pollution and noise. The design of many beaches, nature and historical sites tends to sanction the pre-eminence of the motorized vehicle -- in that parking is usually made available directly adjacent to the site -- rather than behind dunes, trees or other landscaping. Admittedly, it is important to provide easy motorized access to the disabled in such sites, but the fact is that access is usually abused by the able-bodied public. In fact, it could be said that recreational design recognizes and condones the fact that the average Israeli has become so physically unfit that he or she is unable to walk more than a few meters for a recreational event! Official authorities even set the pace for the pre-eminence of motorized vehicles in recreational settings – using cars, jeeps and trucks to patrol beaches or collect trash, when foot or bicycle patrols could be effective. The perverse consequences of such practices are evident in the directional road signs and barbed wire that deface the country's upscale Herzliya beach, signing that bars unauthorized traffic on the beach, even though garbage trucks and beach patrol vehicles travel at regular intervals, posing a danger to children and sunbathers.

Ultra-Orthodox Communities

Approximately 21 percent of Jewish Israelis identify themselves as Orthodox, and an additional five percent identify themselves as ultra-Orthodox. [122] Orthodox households, and particularly the ultra-Orthodox ones, tend to be urban, lower income households with a higher-than average number of children. As a result, the Orthodox population is both highly dependent on public transportation – and negatively affected by the trend towards car dependency.

Mobility - Why Car Dependency Harms Religious Families

Nationally, the level of motorization among the ultra-Orthodox population is lower than that of the rest of the population.[123] A recent Jerusalem survey revealed that the

use of public transport divides almost as sharply along the line of religious observance as it does along income lines. Eighty-four percent of Orthodox and ultra-Orthodox residents use buses at least once a week, as compared to only 66 percent of those identifying themselves as "traditional." In the case of secular Jerusalemites, just 62 percent use buses regularly.[124] Male yeshiva students are discouraged from purchasing cars until they marry. Some use bicycles as an alternative mode. Since families are often large -- i.e. more than five persons -- many families cannot fit into a standard size car. As a result, not only work trips, but also leisure travel may be more common by taxi or public transport.

Religious communities traditionally have had a certain pedestrian orientation -- due to the centrality of the synagogue and study houses in ritual life. For instance, observant families almost always seek homes within walking distance of a synagogue and an extended community of friends or family that they can visit on the Sabbath by foot; such proximity to friends and family is less of a problem for the secular, who can drive.

Special Land Use Needs of Religious Communities

Housing densities are often high in ultra-Orthodox religious neighborhoods. While that may be due to their lower average income, it also serves religious needs. A compact and more densely populated neighborhood can, for instance, more easily provide access to a range of daily synagogue services, study sessions and Sabbath activities. At the same time, however, many religious communities are sited in urban areas where the demands for roads and parking space on the part of the general public compete with the need for pedestrian space and children's play space for the religious community itself. In Jerusalem, illegally parked cars impede the pedestrian travel of religious parents and children in and around many central city religious neighborhoods.

Traffic pollution may also be extraordinarily high, posing severe health consequences. For instance, a 1995 report commissioned by the Israel Ministry of the Environment found that on average, particulate concentrations in Jerusalem's ultra-Orthodox Mea Shaarim Quarter were three to seven times above the Israeli standard. [125]

As documented previously, much of the urban automobile congestion is due to the transit of more affluent commuters living in new suburbs built on the periphery. Planning policies which facilitate the growth of dispersed, road-oriented bedroom suburbs on the periphery of Israel's urban areas -- which tend to be more secular in

character – thus indirectly spur the increase in commuter lifestyles, and in turn contribute to the degradation of urban neighborhoods where poor, ultra-Orthodox families may reside.

Even in newer, planned ultra-Orthodox neighborhoods, however, conflicts between needs for road space and needs for green space and play space are often acute. They are compounded by the fact that a larger than average percent of the available land must be set aside for public buildings -- i.e. separate schools for boys and girls, ritual baths, and different kinds of synagogues for different social groups, which often are fragmented along lines of ethnicity or religious practice (i.e., Hassidic versus Lithuanian communities).[126] Again, to the extent that car dependency is minimized, and there are good pedestrian, rail and bus links to nearby shopping and employment centers, the micro-design of such neighborhoods can be oriented more towards the multiple needs of pedestrians (children, women, yeshiva students) -- and less towards the needs of car commuters who need to enter and leave the neighborhood daily for work.

Neither car-oriented suburban development nor hyper-dense urban high-rise development is ideal for religious lifestyles. Ultra-high-rise housing, as noted before, limits the mobility of young children, and at street level requires large road infrastructures which degrade the pedestrian environment that children thrive upon.

In Israel, heavily car-oriented, low density suburban development may lack the concentration of population necessary for a diverse array of synagogue activities, study activities and children's play. It should be noted that in the United States, suburbanization was one of the key factors in forcing religious leaders to accept de facto the use of cars on the Sabbath. The fact that the American Conservative Movement in 1950 specifically permitted car travel to and from synagogue only, dramatically illustrates how Jewish communities became more dispersed as families moved from compact cities to the suburbs, and how this dispersal dramatically changed everyday life.[127] Conversely in Israel, Conservative Movement leaders have refused to sanction driving on the Sabbath, contending that virtually every Jew who wants to can live within walking distance of a synagogue.[128]

A unique type of suburban community has developed to answer ritual needs, in which admittance is restricted only to ultra-Orthodox families. However, these suburbs still suffer from other problems similar to those found in secular suburbs. They lack employment and shopping opportunities; car dependency is high, creating a heavy

financial burden on large families forced to maintain two cars; bus service is poor; women's work options become limited by the long commute required to employment centers; and there is little socio-economic diversity. The social isolation of these suburbs also contributes to social polarization – between secular and religious groups, and even between various ultra-Orthodox streams.

Sabbath Transport and Religious Legislation
Towards a Better Definition of Priorities

Religious leaders who set policy and priorities for the religious community have displayed little understanding of the ways in which transport policy shapes lifestyles, social interactions and ethical values. Gershom Gorenberg, a religious commentator, observes:

> "The religious population should have an interest in creating communities, which share celebrations, and look beyond the individual nuclear family to the larger group, in preventing the atomization of society and alienation of the individual. The way you build a cityscape will affect what kind of community you produce. Public transportation encourages towns to have a center -- and that is also a physical statement of community. Road dependency creates the exact opposite effect, it discourages the creation of community centers."[129]

Unfortunately, popular religious concerns about car travel have focused narrowly on the limiting of automobile traffic on the Sabbath -- i.e. the ultra-Orthodox demands to close the Bar Ilan Road in Jerusalem. Too little attention has been given to the way urban congestion -- spurred on by the growth in commuter suburbs on the periphery -- degrades inner-city ultra-Orthodox communities seven days a week -- fostering social tensions between more affluent, secular car users and a generally poorer, religious public.

Often ultra-Orthodox-inspired efforts to prevent Sabbath travel actually generate **MORE** travel. The complete shutdown of public transport on the Sabbath fosters even greater car dependency than on weekdays. Efforts to shut down businesses in town and city center locations on the Sabbath have forced the locus of much Sabbath day activity to move to car-dependent shopping mall sites -- a trend that spurs commercial flight from cities and ultimately creates more travel demands on the Sabbath -- as well as on weekdays.

Due in part to religious legislation, shopping malls have now become major Sabbath leisure centers for secular Israelis.

Despite the lip service paid to the sanctity of the Land of Israel, religious leaders seem to be unaware of the ways in which auto-dependent development is irrevocably destroying Israel's Biblical landscape -- a heritage that religious Jews, Christians and Muslims have viewed as a source of spiritual inspiration for centuries.

There also is little awareness in the religious community of the benefits of sustainable transport systems. Development of urban pedestrian networks, car-free zones and "traffic calming" can reduce Sabbath tensions over traffic and improve quality of life in poor neighborhoods, both religious and secular. Urban train or tram services that operated on the Sabbath could help ease conflicts over Sabbath road closures in religious neighborhoods. Trains can potentially be routed underground through center city religious quarters so that unimpeded passage is assured on the Sabbath with no disturbance whatsoever to the neighborhood -- a scheme being considered for parts of Jerusalem's light rail development plan. [130] Although train travel, per se, might be unacceptable to religious Jews personally, automated electric trains, trams or people movers which could be operated automatically, opening at every stop, should be "less objectionable" than gasoline-driven vehicles, which require human guidance and rely on gasoline combustion. Sabbath elevators, operating on similar principles, are in fact used widely by the religious public. In the early part of the century, certain ultra-Orthodox rabbis even permitted the use of trolley buses and trams by Jews on the Sabbath under limited conditions, mostly in North African and Egyptian communities.[131]

While most of the discussion here focuses on the religious public, secular leaders, too, play a role in fueling controversies over Sabbath transport. Secular Israelis -- and even transport planners -- often exaggerate the innate importance of the automobile—and perceive car travel exclusively as a symbol of independence and freedom. Secular politicians generally relate to the tensions triggered by the controversy over Sabbath street closings as a religious issue rather than as a genuine **transport** issue. They therefore fail to acknowledge the very high price urban-bound religious communities pay in traffic-generated noise and air pollution. The secular, as well as the religious public, can in fact reap benefits from reasonably designed limits on car travel in the cities which accommodate religious sensibilities -- witness, for instance, the explosion of bicycles and skateboards on empty city streets on Yom Kippur.

CONCLUSION

Transport policy is not a zero-sum game that necessarily pits the affluent against the poor, or urban dwellers against their rural counterparts. While certain groups such as women, children and the elderly may suffer more from car-dependent development -- in the end almost all levels of society are impacted. Israel is too small a country for any social group to escape the implications of car-oriented development.

While less visible at times, air pollution erodes quality of life in affluent suburbs, just as it does in urban areas. Car dependency traps affluent Israelis, as well as the poor, in an unending cycle of congestion, urban degradation and flight. Sprawl, which tends to develop as isolated blocs of housing, commercial and entertainment centers, connected only by automobile access, leaves commercial areas abandoned at night -- and prone to vandalism and break-ins, while residential areas are emptied during the day, also inviting crime. While many middle-class Israelis see the automobile as a symbol of personal freedom -- they too lose out from an automobile-dependent society, which is both insular and fragmented.

Conversely, when poor sectors of society enjoy good public transport services and a high urban quality of life -- affluent sectors also benefit, not only from the added transport options but also from less traffic congestion, revitalized cities and neighborhoods and safer streets. Pedestrian systems that minimize the intrusion of traffic into poor religious communities also can improve urban quality of life overall for secular residents, both rich and poor. Ultimately, both the affluent and the poor reap social benefits from a sustainable transport model in which community residential, commercial and leisure elements are integrated.

The Urban Village

Evidence from around the world suggests that the critical threshold level needed for some form of public transport is only about 30 to 50 persons per hectare or about three to five persons per dunam (1/4 acre). That translates to about six to ten persons per dunam in the built space. [132] These numbers are hardly high, by Israeli standards. With growth channeled into existing rural and urban population centers, with compact, mixed-use designs with a strong pedestrian orientation, both urban and rural communities could achieve the higher overall (gross densities) needed to support public transport. They could preserve moderate densities in the built space by saving on the excess development of roads and residential and commercial parking.[133]

An emphasis on high quality urban and interurban public transport can be used synergistically with land use policies to shape cities, towns and communities where people can live, work and play in more "integral" neighborhoods, and where basic needs can be met without unnecessary commutes and car travel. Encouraging viable urban rail systems and vibrant pedestrian networks can foster economic patterns that give small, neighborhood and traditional stores in central business areas a fighting chance to compete against incursion by car-dependent superstores and shopping malls.

Development of new retail/office space complexes along highway corridors should be banned – and future commercial development channeled into new or existing town and city centers, linked by high quality pedestrian and public transport networks to a larger framework of homes and services.

Such systems can foster travel patterns that give disadvantaged groups high quality mobility—along with the affluent. It can foster equal access to quality transport for all social sectors. And it can create patterns of travel that reduce social tensions rather than exacerbate them; where Israelis are not just anonymous (and often hostile) competitors for road space behind the wheel of a private car, but part of a larger social framework in which different social, economic and religious groups meet and rub shoulders on the street; and in which society's weakest sectors, like children and senior citizens, enjoy the maximum mobility.

Ultimately, the goal is to create, or maintain, what planners today call the "urban village" -- community-oriented units that replicate some of the social networks prevalent in traditional towns and villages. Some may regard such a vision as quaint or outmoded -- even though it is being realized today in many parts of Europe -- and aspire to an alternative, American model. Before rushing towards the American dream, however, they should take heed of the critics, among them architect James Howard Knustler, who describe the ruin wrecked by the car on the American social landscape:

> "Americans sense that something is wrong with the places where we live and work and go about our daily business. We hear this unhappiness expressed in phrases like "no sense of place" and the "loss of community." We drive up and down the gruesome, tragic suburban boulevards of commerce and we're overwhelmed at the fantastic, awesome, stupefying ugliness of absolutely everything in sight -- the fry pits, the big box stores, the office units, the lube joints, the carpet warehouses, the parking lagoons, the jive plastic townhouse

clusters, the uproar of signs, the highway itself clogged with cars -- as though the whole thing had been designed by some diabolical force bent on making human beings miserable.

"The highway strip is not just a sequence of eyesores. The pattern it represents is also economically catastrophic, an environmental calamity, socially devastating and spiritually degrading." [134]

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[1] Central Bureau of Statistics, Special Publication #975. Table 27. "Ownership of Durable Goods According to Family Size:"

Households Owing One Car or More- 1992	
(By Number of Family Members)	
1 member	23.2%
2 members	42.3%
3 members	55.4%
4 members	67.2%
5 members	68.4%
6 or more members	51.8%
Average – 50.4%	

[2] Jerusalem Transport Master Plan, Transport in Jerusalem, Selected Statistics, , Publication Number 1. Report of the Master Plan's Travel Habits Survey, 1994-1996. Jerusalem Institute for Israel Studies p. 23. (in Hebrew)

[3] The Trans Israel Highway Company, Traffic Analysis and Economic Evaluation, Final Report, November 1994, (in Hebrew), Page 3-35.

[4] Central Bureau of Statistics, Motor Vehicles 31-12-1997, Current Briefings in Statistics, No. 12, Jerusalem, 1998. Included in the calculation of car ownership were 2/3 of the fleet of light commercial vehicles. Rates for Tel Aviv-Jaffo also were adjusted downwards, while ownership in the Tel Aviv metropolitan area was adjusted upwards -- according to the formula used by the Trans Israel Highway Co. in its Traffic Analysis and Economic Evaluation, (see Chapter II, footnote 19.)

[5] Todd Litman, Transportation Cost Analysis, Techniques, Estimates and Implications. Victoria Transport Policy Institute. December 6, 1996. p. 7-2.

[6] Hu and Young, 1990 NPTS Data book, Vol. 1, Federal Highway Works Agency, Washington, D.C. Nov. 1993, Table 3-14. as cited in Todd Litman, Transportation Cost Analysis, Techniques, Estimates and Implications.

[7] Ibid, Trans Israel Highway Co. "National Travel Habits Survey-1993" Traffic Analysis and Economic Evaluation, November, 1994, (Hebrew version). p. 23.

[8] Ibid. Page 3-48.

[9] Ibid. Motorization projections are calculated from Table 3.22, which projects the total car fleet per subdistrict until 2020 & Table 3.7, which projects population per sub-district until 2020.

[10] The Royal Commission on Environmental Pollution: Transport and the Environment, HMSO, London, 1994. p. 17.

[11] Ibid. Todd Litman, Transportation Cost Analysis: Techniques, Estimates and Implications.. p. 7-4.

[12] Conrad Wagner, Balance Inc., Switzerland, Personal Communication.

[13] Rafael Lehrman, "The Metropolitan Space. Identification of Trends and Development Directions," in Principles for the Development Policy of Metropolitan Tel Aviv, Stage Aleph, Definition of the Metropolitan Space, Interim Report The Ministry of Interior, No. 1, March 14, 1996. p. 15. (in Hebrew) & Maya Choshen and Na'ama Shahar, eds. "The Internal Migration Balance of Jews in

Tel Aviv, Jaffa and Haifa in Selected Years," The Jerusalem Statistical Yearbook, 1996. of Jerusalem, The Jerusalem Institute for Israel Studies, p. 77.

The Jerusalem Statistical Yearbook, "Migration to and from Jerusalem in Selected 96. p. 80.

Maya Choshen, The Jerusalem Institute for Israel Studies, 1996. Press communication. notes that her preliminary findings from a survey of Jerusalem residents who left identified housing, employment and religious-secular relations as the three primary for emigrating. However, fourth on the list is "deteriorating quality of life in the city" which can be ascribed in large part to the substantial increase in traffic congestion, noise, and traffic pollution in Jerusalem in the past decade. Deterioration in city quality notably, is cited more frequently than educational quality, Arab-Jewish tensions, or the of entertainment options, as the primary reason for leaving the city.

Ibid. The Jerusalem Statistical Yearbook, 1996. "Population Movement Balance in alem by Subquarter, 1995." Map. p. 89.

Ibid. Ministry of Interior, Principles for the Development Policy of Metropolitan Tel Aviv, (in ew) Note: The impacts of traffic congestion on urban decline are noted and dealt with at th in the series of Ministry of Interior documents on development trends in metropolitan Aviv. However, press articles and public statements have tended to focus more on housing and ployment in the shaping of overall urban policy.

[18] OCDE-OECD Environmental Policy Benefits: Monetary Valuation, Paris, 1989. p. 30: he following table from this document illustrates how urban air pollution is quantifiably ated to housing value depreciation.

CITY	YEAR OF DATA	POLLUTANT	POLLUTION	PROPERTY VALUE
St. Louis	1960	Sulfates (from SOX)	+.10%	-.6 %
St. Louis	1963	Particulates	+.14 %	-.12 %
Chicago	1964-1967	TSP & Sulphates	+.50 %	-. 20%
Toronto-Hamilton	1961	Sulfates	+.12 %	-.6 %
Washington	1970	Particulates	+.12 %	- .5%
Pittsburgh	1969-70	Dust and Sulpates	+.15	-.9%

[19] Ibid. OCDE-OECD, Environmental Policy Benefits: Monetary Valuation, p. 30. The following findings are cited linking traffic noise to housing value depreciation.

TRAFFIC NOISE AND HOUSE PRICES: SUMMARY OF FIELD STUDIES

LOCATION	IMPACT OF ONE UNIT CHANGE IN EQUIVALENT CONTINUOUS SOUND LEVEL*
Washington D.C.	-.88 %
Spokane, Washington	- .8 %
North Virginia	- .14%
Chicago	-.65 %
Toronto, Canada	-1.05%
Basel, Switzerland	-1.26 %

*Equivalent Continuous Sound Level is a level of constant sound in dBA which would have the same sound energy over a given period as the measured flunctuating sound under consideration.

[20] Shimon Gulan, "A Survey of Public Environmental Awareness," The Haifa District Environmental Town Association, 1990. p. 9. (in Hebrew)

[21] Ibid. p. 7.

[22] Sagi Nevo and Dorit Ben Or, The Center for Research into Natural and Environmental Resources, Haifa University, "The Impact of Noise on Apartment Prices," Ha Biosphera, March-April, 1994. pp.3-7. הביוספירה כ"ה 3

[23] The Royal Commission on Environmental Pollution, Transport and the Environment, HMSO, London, October, 1994. pp. 47-50.

[24] The University of Cornwall, England, Study on Children near Airport in Munich.

[25] The Netherlands, Ministry of Transport, Annual Report on Transport in The Netherlands, 1995. p. 36. The Report states: "The train is also more attractive than driving as far as noise pollution is concerned. This was proven in a recent TNO study of perceived nuisance from environmental pollution in The Netherlands. With an approximately 50 percent growth in train traffic, the amount of people experiencing noise pollution still decreased over the past 10 years."

[26] Arza Churchman, "Differentiated Perspective on Urban Quality of Life, Women, Children and the Elderly," in Perception and Evaluation of Urban Environment Quality. ed. Mirilia Bonnes, UNESCO Programme on Man and Biosphere, Proceedings of International Symposium, Rome November 28-30, 1993. p. 169.

[27] John Whitelegg, Transport for a Sustainaable Future:The Case for Europe, John Wiley Press, Great Britain, p. 100-1. Derived from Appleyard (1981)

[28] Ibid. Transport For a Sustainable Future

[29] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment. p. 51.

[30] Central Bureau of Statistics, Statistical Abstract of Israel 1996, Tables 2.9, 2-6.

[31] Yehuda Gur & Shuki Cohen, "Transport in Israeli Cities at the Outset of the 21st Century," Israel 2020 Plan, Haifa Technion, Stage Three (Gimmel), Report No. 18. (in Hebrew).

[32] The estimate of bus patronage in the Tel Aviv area is from Pioter Vopshaw, Israel Institute for Transport Planning and Research, May, 1997.

[33] The government's 1996 Budget Summary, p. 157, noted that about 40 percent of the annual bus operating subsidy is designated for ticket reductions precisely to those groups along the following scale: elderly and low income- 33 % reduction; youth-50 % reduction; soldiers- 70% reduction.

[34] The Trans Israel Highway Co. Traffic Analysis and Economic Evaluation, Final Report, November, 1994. Travel Habits Survey. pp. 12,38. (in Hebrew)

[35] In addition, there is a fundamental subjective distortion in the way that travel costs are paid by public transport users as compared with private car owners that contributes to overuse of the roads and underuse of the public transport system. Whereas transit costs are distributed more or less evenly over every trip, travel by car is actually cheaper than by public transport in many cases, once the initial investment in an automobile, and yearly license and maintenance fees are made, creating an incentive to added use.

[36] Central Bureau of Statistics & Ministry of Transport, "Transport Statistics Quarterly: The Consumer Price Index of Transport and Communication," Jerusalem, 1994. Summary Tables 8&9. (in Hebrew)

[37] Bank Ha Poalim, Economics Department, Consumer Price Index Survey, June, 1996.

[38] Central Bureau of Statistics, Statistical Abstract of Israel, 1996. Tables 18.5 and 2.1; Population, 1985=4,266,200; 1995=5,619,000; bus kilometrage; 1985=371 million kilometers; 1995=391 million kilometers.

[39] Ibid. Trans Israel Highway, Traffic Analysis and Economic Evaluation, Travel Habits Survey, p. 19. (in Hebrew)

[40] Baruch Yona, Director of Economics and Finance, Ministry of Transport, personal communication. May 11, 1997.

[41] The Royal Commission on Environmental Pollution, Transport and the Environment, 1994. London, p. 117.

[42] AASHTO International Transportation Observer ,"German Environment Pass: Success Story," American Association of State Highway and Transportation Officials. Washington, D.C. January, 1991. p. 1.

[43] The dispute is recorded in letters to Dr. Gilberg from Gideon Geva, Environment Ministry Comptroller, December 25, 1995, and Shalom Sari, Deputy Minister of Administration, January 9, 1996.

[44] Ibid. Arza Churchman, UNESCO Programme on Man and Biosphere. p. 169.

[45] Kerry Hamilton and Linda Jenkins, "Women and Transport," in M. Grieco, L. Pickup, and R. Whipp. Gender, Transport, and Employment. Great Britain.

[46] Ibid. Arza Churchman, UNESCO Programme on Man and Biosphere. pp. 165-178. & The Israel Women's Network, "The Urban Environment and Women in Israel," & "Peripheral Areas and Women in Israel" in Habitat II Shadow Report, June, 1996. pp. 25-53.

[47] Central Bureau of Statistics, Statistical Abstract of Israel, 1997. Jerusalem, Tables 12.2 and 12.6

[48] Central Bureau of Statistics, Statistical Abstract of Israel, 1997. Jerusalem, Tables 12.7 & 2.18. Note: There are 37,100 Arab women (including Druze, Bedouin, Christians and Muslims) between the ages of 18-34 in the labor force among a population of 155,200 in the same age bracket.

[49] Adva Center, "A Breakdown of Personal Income, Employees and Self-Employed, by Decile and Gender, January 1996" in Looking at the 1997 Budget, November, 1996. (in Hebrew)

[50] Central Bureau of Statistics, Statistical Abstract Israel 1997, Jerusalem, Table 12.2 & 12.16.

[51] Central Bureau of Statistics, Statistical Abstract of Israel 1997. Jerusalem, Table 12.16.

[52] Ibid. The Trans Israel Highway Co. Traffic Analysis and Economic Evaluation, Travel Habits Survey, p. 7. (in Hebrew)

[53] Ibid. p. 17.

[54] The Israel Women's Network, "Report on Women in Work and the Economy," 1995 p. 12. (In Hebrew)

[55] Ibid. The Trans-Israel Higway Co. ,Traffic Analysis and Economic Evaluation, Travel Habits Survey, p. 54. (in Hebrew)

[56] Ibid. p. 21..

[57] Ibid. Arza Churchman, UNESCO Programme on Man and Biosphere, p. 169.

[58] Ibid. The Israel Women's Network, Habitat II Shadow Report, p. 12.

[59] Ibid. Arza Churchman, UNESCO Programme on Man and Biosphere, p. 171.

[60] Arza Churchman, "Study of Factors in Sense of Safety, Physical Problems in Order of Frequency," Presented at the Society for the Protection of Nature Annual Meeting, Tel Aviv, January, 1997.

[61] Ibid. Arza Churchman, UNESCO Programme on Man and Biosphere. p. 169.

[62] Central Bureau of Statistics, Statistical Abstract of Israel 1996, Table 2:18. Numbers of Israelis Ages 0-4: 567,100;Ages 5-9: 545,400; Ages10-14: 526,000.

[63] Central Bureau of Statistics, Statistical Abstract of Israel 1996, Tables 11.1; 12.6; 12:10 ; There are 551,200 Jewish households, 42 percent of the total, with children under the age of 14.

[64] Mayer Hillman et al. (1991) cited in D. Appleyard, Liveable Streets, University of California Press, Berkeley, 1991. p. 104-107

[65] Dr. Thomas Platts Mills, University of Virginia's Asthma and Allergic Diseases Center as cited in Geoffrey Cowley and Anne Underwood, "Why Ebonie Can't Breathe," Newsweek, May 26, 1997. p. 47.

[66] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment, p. 27.

[67] Fiona Godlee, "Air Pollution: II- Road Traffic and Modern Industry," in Health and the Environment, eds. Fiona Godlee and Alison Walker, British Medical Journal, 1992.

[68] John R. Goldsmith, M.D. "Health Risk from Vehicle Emissions" in Preservation of Our World in the Wake of Change, Vol. VI B, ISEQS Publications, Jerusalem, Israel,l 1996. Editor, Y. Steinberger. p. 881.

[69] Dr. Elihu Richter, M.D., Unit of Occupational and Environmental Health, Hadassah Hebrew University Medical School, personal communication. May, 1997.

[70] Arza Churchman, "Children in Urban Environments, the Israeli Experience," from Managing Urban Space in the Interest of Children, eds. W. Michelson and E. Michelson, Canada/MAP Committee, 1980. p.51.

[71] Ibid. p.50.

[72] Ibid. pp. 46-50.

[73] Haim Avnaim, of Dunhill Bike Manufacturers, Beersheva. Personal Communication. Avnaim estimates that 170,000 bicycles are sold in Israel every year, of which 50,000 are mountain bikes designated for ages 14 and upwards. The remainder, 120,000, are children's bicycles.

[74] Central Bureau of Statistics, Statistical Abstract of Israel 1996, Jerusalem, Table 2.28.

[75] Ibid. Arza Churchman, UNESCO Programme on Man and Biosphere, p. 171 and Arza Churchman, "Children in Urban Environments: The Israeli Experience," p. 54.

[76] WHO World Health Statistics Annual, Geneva, 1994-1995. & Central Bureau of Statistics, Statistical Abstract of Israel, 1996, Table 2.21.

[77] Ibid. Jerusalem Statistical Yearbook, "Median Age of Jerusalem Population, by Subquarter," 1995. p. 54.

[78] Arza Churchman, "The Planning of Residential Neighborhoods With A Special Emphasis on the Elderly," Gerontology, Winter-Spring, 1981. (Hebrew)

[79] Ibid. Arza Churchman, UNESCO Programme on Man and Biosphere p. 172.

[80] Ibid. Arza Churchman, Gerontology

[81] Ibid. John Whitelegg, Transport for a Sustainable Future: The Case for Europe. pp. 98-9. Transport and Health Study Group. Health on the Move: Policies for Health Promoting Transport. Public Health Alliance, Birmingham, Great Britain, 1991, p. 3.

[82] Berkman, L. F., and S. L. Syme. "Social Networks, Host Resistance, and Mortality: A Nine Year Follow Up of Alameda County Residents." American Journal of Epidemiology 109 (1979): 186-204. Blazer, D. G. "Social Support and Mortality in an Elderly Community Population." American Journal of Epidemiology 115 (1982): 686-94.

[83] For breakdown on drivers' license holders by age see: Ministry of Transport, Representative Statistics of the Transport Branch, May, 1996. p. 18. (in Hebrew) & Central Bureau of Statistics, Statistical Abstract of Israel 1996. Table 2.21.

[84] Dr. Gary Ginsberg, Aharon Serry, Elaine Fletcher, Dani Koutik Phd, et al. "Mortality From Vehicular Particulate Emissions in Tel Aviv-Jaffo." 1998, & personal communication.

[85] RD Morris, EN Naumova, RL Munasinghe, "Ambient air pollution and hospitalization for Congestive Heart Failure among the Elderly in Seven Large American Cities" (ABST) Sixth Conference of the International Society for Environmental Epidemiology, Research Triangle Park, NC, Sept 18-21, 1994.

[86] John R. Goldsmith, M.D., "Health Risk from Vehicle Emissions," in Preservation of Our World in the Wake of Change, ed. Y. Steinberger, Vol VIB, ISEQS Pub. Jerusalem, , page 880.

[87] This is an estimate of the Umbrella Organization of Associations for the Disabled, P.O.B. 57146 Tel Aviv, 61570. It is comparable to estimates from Europe. According to the Central Bureau of Statistics, 272,794 Israelis, about 4.5 % of the population, received disability funds in 1996.

[88] Portions of this section are derived from Yaakov Garb, "Sustainable Transport: Some Challenges for Israel and Palestine," in World Transport Policy and Practice, Volume 4, No. 1, 1998, pp. 21-28. He compares Arab motorization rates to those in Argentina (133), Costa Rica (106) and Mexico (131).

[89] Rassem Khamaisi, The Development of Transportation Infrastructure in Arab Localities in Israel. The Floersheimer Institute for Policy Studies (Jerusalem), 1995. (in Hebrew)

[90] Complaints by Arab residents and municipal officials regarding the absence of employment zones in Arab & Bedouin towns, have been noted in repeated visits by the author between 1987 and 1996 to Bedouin townships of the Negev, and the Arab towns and cities of the Triangle and the Galilee.

[91] Central Bureau of Statistics, Statistical Abstract of Israel 1997, Jerusalem, Table, 2.28.

[92] Ibid. Central Bureau of Statistics, Statistical Abstract of Israel 1997. Table 12.17. The Percent of Arab women who do not work, but study, ages 18-24 is 15.1 %; Among Jewish

...e percent who study full-time is 18 percent, while another 10 percent of Jewish ...combine work with study.

...observation was made by the author during interviews with women residents of ...Rahat in the early 1990s.

...International Road Federation, World Road Statistics, 1989-1993, 1994. Geneva.

...Amiram Gonen and Rassem Khamaisi. Towards a Policy of Urbanization Poles for the Arab ...tor in Israel. The Floersheimer Institute for Policy Studies, Jerusalem, 1993.

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...Ibid. Rassem Khamaisi, The Development of Transportation Infrastructure in Arab Localities ...el.

...Ibid. p. 6.

[99] The observations vis a vis Kafr Kara are from a visit to the village by the ...hor in 1996.

...Aryeh Rahamimoff, Architects and Urban Planners, Nazareth 2000, A Plan for the ...velopment of Tourist Infrastructures for the Years 1995-1999. A joint project of the City of ...Nazareth, Israel Government Tourist Corporation, and the Ministry of Tourism, July 1995. (in ...Hebrew) Note: These observations also are drawn from visits by the author to the city of ...Nazareth and its environs in 1996 and 1997.

[101] The observation that road-widening in pedestrian areas was viewed as a sign of progress in the 1970s and 1980s is made by Adib Daoud, Nazareth-based architect and member of the Nazareth 2000 planning team.

[102] Aryeh Rahamimoff, Architects and Planners, Nazareth 2000. July, 1995. p. 62.

[103] Ibid. p. 64.

[104] Ibid. p. 114.

[105] This observation is informed by a visit to the Tzippori area in April, 1997, and interviews with residents of Moshav Tzippori regarding regional development plans.

[106] This section is informed by discussions with Yehonaton Golani, former Interior Ministry official in charge of the plans for the original "Seven Stars" project along the Trans Israel Highway corridor in January, 1991, as well as by visits to the villages of Kfar Kassem and Kfar Kara in 1996, and interviews with Kfar Kassem city officials.

[107] Trans Israel Highway Company, Route 6 map.

[108] The Jewish fears vis a vis the demographic and land use implications of illegal Arab building, and the gradual merging of Arab towns and cities into one block were described comprehensively in the Markovitch Report, an inter-ministerial report on illegal building in the Arab sector in the late 1980s.

[109] Ibid. Central Bureau of Statistics, Statistical Abstract of Israel 1996, Jerusalem, Table 2.9.

[110] Ibid. The Metropolitan Planning Team: A Document of Principles for the Development Policy of the Metropolitan Tel Aviv Area, Stage Aleph, Report No. 1. pp. 37-38. (in Hebrew): See the discussion by Shlomo Hasson and Maya Hoshen about the dangers of the metropolitan area extending beyond its presently defined "borders" to the entire area between Modi'in, Ashdod and Netanya, and the creation of an unbroken chain of suburban development linking existing urban areas together from the Mediterranean coast to Israel's international borders.

[111] Motti Kaplan & Oren Dayan, A Master Plan for Israel in the 21st Century, Special Subjects in Planning Policy, "The Open Space Network," Haifa Technion & The Office of Engineers, Architects, and Academics-Society of Architects and City Planners in Israel, 1996. (in Hebrew)

[112] Ibid. Central Bureau of Statistics, Statistical Abstract of Israel 1996, Jerusalem, Table 2.9.

[113] The increased presence of gasoline oils in rainwater runoff is noted in Elaine Fletcher, The Jerusalem Report. "Poisoning the Land of Milk and Honey," May 16, 1991.

[114] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment p. 36. The report notes that high levels of nitrogen oxides and ozone can damage plants and retard plant growth, as well as damage trees: "In experimental studies UK ozone episodes have significantly reduced growth in several crop species."

[115] Ibid. The Metropolitan Planning Team, A Document of Principles for Development Policy in Metropolitan Tel Aviv, March 27, 1997, p. 11.

[116] Ibid. p. 11. These twin goals are articulated in the document.

[117] Ibid. The Trans Israel Highway Company, Traffic Analysis and Economic Evaluation. "Primary Sites for Possible Development Along the Trans Israel Highway Route." Annex 3.2. (in Hebrew) Note: An analysis of the projects proposed reveals that most are single use developments of homes or commercial development unconnected to existing urban entities, and thus will promote unsustainable patterns of sprawl, as well as excessive dependence on automobile transport -- generating toll road revenues.

[118] Daniel Carlson and Don Billen, Transportation Corridor Management: Are We Linking Transportation and Land Use Yet? University of Washington, Institute for Public Policy and Management, October, 1996.

[119] Ibid. The Royal Commission on Environmental Pollution, Transport and the Environment. London, pp. 147 & 181. Notes: A study in Great Britain of development along the M40 highway between London and Oxford notes how developers also pressure for zoning changes along a new highway. The M40's development, the report notes, was built through previously open country, and spurred development that was not in accordance with approved plans -- superstores, multi-screen cinemas, office blocks, etc. Traffic generated by the low-density development created new highway problems and the need for further road improvements. Concludes the Commission:

"Development pressures may be difficult to resist even when they run counter to existing planning policies. New roads around urban areas create particularly strong development pressures. Modeling carried out by the International Study Group on Land Use/Transport Interaction suggests that provision of a fast outer ring road encourages more decentralization of employment, particularly service and retail.... Perhaps the most intractable problems arise in the less isolated rural areas, especially in the vicinity of large conurbations."

[120] Eren Razin and Anna Hazan, "Steps for Countering Dispersed Suburbanization" (in Hebrew) Flourshеimer Institute for Policy Research. December 1996, Jerusalem.

[121] In November 1996, four-year-old Yarden Freidman of Moshav Ein Iron near Hadera was struck and killed by an ATV on a beach. (Joel Gordin, "The Fatal Shore" Jerusalem Post Magazine, June 20, 1997) prompting a police crackdown on some, but not all motorized traffic in leisure and beach sites.

[122] Dr. Tamar Herman, Tami Steinmetz Center for Peace Research, Tel Aviv University. The estimates on religious identification are derived from a monthly public opinion survey of 500 Jewish Israelis conducted by the Steinmetz Center for Peace Research. According to the results of the August 1997 survey, which also are consistent with previous surveys, Jewish Israelis identify themselves in the following way: Haredi- 5 %; Religious- 21%; Traditional-31 %; Secular-39%; Secular "believers" - 3.5 %; No Jewish identification .5 %.

[123] Ibid. The Trans Israel Highway Company, Economic and Traffic Analysis, p. 3-33. (in Hebrew)

[124] Ibid. The Jerusalem Transport Master Plan, Travel Habits Survey, 1996, pp. 28-30. (in Hebrew.

[125] Alf Fishbein et al, "Lead in Environmental Dust," Final Report to the Chief Scientist of the Israel Ministry of the Environment, 1995,Table 1. Measurements of lead, manganese and total suspended particulates were made in a series of 31, 24-hour readings, performed over a three-month period. The readings were taken at two sites in the Mea Shaarim area - at the Geological Survey Institute and at Kikar Shabbat. The average at the GSI site was 544 micrgrams per cubic meter, and at the Kikar Shabbat site, 1362.

[126] This observation is from Israel Kimche, former Jerusalem city engineer. The Jerusalem Center for Israel Studies, Jerusalem. He notes that while the law permits up to 40 percent of available land in any new development to be expropriated for public needs – ultra-Orthodox communities may need 50 percent or more of the available space to accommodate all of the public buildings their lifestyle demands.

[127] The Rabbinical Assembly of Israel, "Responsa of the Va'ad Ha Halacha of the Rabbinical Assembly in Israel, ed. Rabbi David Golinken. Volume 4, The Masoreti [Conservative] Movement, 1992. (in Hebrew) & Rabbi Ben Zion Bokser, "The Halacha of Travel on the Sabbath." in Tradition and Change, The Development of Conservative Judaism, ed. Mordechai Waxman, New York, The Burning Bush Press, 1958.

...binical Assembly of Israel, "Responsa of the Va'ad Ha Halacha of the Rabbinical ...l, ed David Golinken, Volume 4, The Masoreti Movement, Jerusalem, 1992. pp. ...)

...inion was expressed by Gershom Gorenberg, who writes on religious affairs for The ... and The New Republic, June 18, 1996, personal communication.

...the alternatives for the proposed Jerusalem light-rail system contains a proposed ... link through the downtown Jerusalem neighborhoods near the ultra-Orthodox ...od of Mea Shearim. See Map of Proposed Light Rail System, Chapter 4.

...ponsas of the Va'ad Ha Halacha, of the Rabbinical Assembly of Israel, Volume 4, ...vid Golinken, The Masoreti Movement, 1992, Jerusalem. While presently, Orthodox ...rbid travel by public transport, those who permitted such travel under certain ...conditions earlier in the century are said to include, Rabbi Leo Ginsburg, Rabbi Yosef ..., Rabbi Nissim Binyamin Ohana, Rabbi Somekh; & Rabbi Yosef Entibi.

...id. Peter Newman, "Reducing Travel Through Land Use Planning" in Travel in the ...Making it Sustainable, International Conference, p. 106: Newman speaks here about the ...l density necessary to support of a good public transport system as 30 persons per ...re. The Royal Commission on Environmental Pollution, Transport and Environment, p. ...reports that travel demand falls sharply as densities increase about 50 persons per ...re.

Ibid. The Royal Commission on Environmental Pollution, Transport and the ...vironment: The report recommends the development of "key villages" large enough to ...pport essential services. London, 1994, pp. 181.

Howard Knustler, Home from Nowhere.