ASTANA

Report on sustainable development

Transport input from Tim Pharoah

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CHAPTER 5 SUSTAINABLE URBAN ENVIRONMENT

Contributions as follows:

1. Transport
1.1 What is chapter about
1.2 What do we mean
1.3 Coverage

2. Astana transport today

3. International principles and best practice

4. SWOC analysis

5. Proposed actions, policies and projects

Plus contributions on
- Targets
- Costs
- Budgets

1. Transport

1.1 What this chapter is about

This chapter first gives an appreciation of the present and future transport situation in Astana. Second, we take a look at the consequences of growth and increasing motorisation, and some international examples of responses to such pressures. Third, the chapter includes a brief SWOC analysis, which was informed by the workshop discussions in Astana in June 2005. Fourth, a strategy for sustainable transport is outlined, together with recommended actions, policies and projects.

Reference is also made in other chapters regarding the transport sustainability strategy and how it relates to other aspects of Astana's growth. In particular the proposed pilot project contains important transport elements.

1.2 What do we mean?

Sustainability in transport is relative. Today there is no sustainability in the pure sense, and only the nomadic existence of Kazakh people in former times could be said to be so. All motorised travel relies on non-renewable energy, notably the burning of carbon, and transport activity is very far from being sustainable. Moreover the trend is currently strongly in the opposite direction from that required for sustainability, with demand for car and air travel growing strongly in Kazakhstan as in most other countries.

Globally the demand for oil-reliant transport is expanding rapidly, but this cannot be continued indefinitely. Over the next decades oil will become scarcer and therefore more expensive. It is therefore imprudent to make plans that rely more heavily than today on this diminishing resource. Although Kazakhstan is fortunate in having access to considerable oil reserves, this does not protect the country from the impact of vastly increased global demand. Indeed, it would be economically wasteful to sell oil cheaply at home that could earn valuable export revenue.

Therefore, transport sustainability here is defined as:

1. Minimising the energy consumed by the transport sector (fuel efficiency)
2. Building forms that minimise the need to travel, and which avoid *reliance* on the private car
3. Socially sustainable transport (that provides for those without a car because of age, infirmity, income)
4. Economic sustainability through value for money transport investments and avoidance of risks associated with heavy dependence on oil
5. Environmentally sustainable transport by keeping levels of noxious emissions to levels that do not endanger health or comfort
6. Contributing to the global quest for a reduction in CO2 emissions.

1.3 Coverage

We limit ourselves to personal travel in the city of Astana. Issues of national, regional and freight travel, while important, cannot be adequately dealt with in the context of this strategy. The focus on “internal” personal travel is justified on two grounds:

- The demand for goods transport and infrastructure needed to deal with it is manageable and does not pose as big a challenge as car travel: freight demand will not grow disproportionately to population growth;
- Travel to and from Astana is more readily subject to demand management through price (air and rail fares for example).

Coverage of transport includes all aspects of the city with which transport interacts, including environmental quality, social inclusiveness and accessibility for all.

2. Astana transport today

2.1 How are trips made?

Broadly speaking, the majority of person trips in Astana are made either on foot or by bus. There are no reliable data but our estimate is shown in the table below. This is based on calculations that assume all trips are counted (including short walk trips of over 50 metres) and that car ownership in Astana is around 100 cars per 1000 population.

Table ** Mode Split of all trips by residents 2005

Mode of travel	**% share in Astana (estimate)**	**% share in UK cities of 500,000 people (approximate)**
Walk and cycle	45	29
Bus	35	9
Taxi/other public transport	5	1
Car passenger	5	22
Car driver	10	39
Total	*100*	*100*

The modes are listed in order of their "sustainability" rating

The mode share of distance travelled would be very different, with the car and public transport accounting for a much higher proportion of distance travelled. For example, in comparable size cities in the UK, the car accounts for more than 80% of *distance travelled* compared to 61% of *trips*.

2.2 Explaining mode choice

Speeds are much higher by car than by public transport, even after allowing for peak hour congestion. In addition, conditions on buses are often crowded and uncomfortable. Many people have to walk considerable distances to and from bus stops, sometimes in extreme temperatures, and waiting facilities may also be uncomfortable or non-existent. Parking at present is not a major problem in most parts of the city. Consequently, people with a car have nothing to gain by using public transport.

This is very important in forecasting future trends. Even in cities with good public transport and walking conditions, the level of car traffic is strongly determined by the level of car ownership. (See below)

2.4 Condition of roads

Main roads in the centre of the city appear to be in reasonable structural condition. However, roads serving the poorer residential areas and roads leading away from the city are often in poor condition causing discomfort and danger to users.

2.5 Parking

Most parking in Astana is either on the street or in open areas in front of, beside, or behind buildings. These “off-street” areas often are used informally which can cause discomfort and danger for people walking, or for children playing. This informal parking activity undermines the usability and attractiveness of public and private open spaces. There is very little purpose-built or “structured” parking at present, although we understand more is to be provided in the new city centre.

There are no parking controls (other than for security), and no parking charges, even in the city centre. This is a clear indicator of the present very low level of car ownership. All western cities of 500,000 population have both charges and controls of public parking, both on and off street.

2.6 Walking and cycling

It is estimated that walking accounts for up to half of all trips in Astana. Of course, many of these trips will be very short, to a local shop or stall, or to visit a neighbour. Walking is also an important means of getting to and from public transport, and could account for two thirds of all trip “stages”.

Walking conditions are variable. Tree-lined segregated footways through the Russian grid streets are as good a quality as one could expect, providing amelioration of harsh climatic conditions, as well as visual delight. Moreover, there are many areas served with shops and other activities at ground floor level which makes it feasible to undertake many activities on foot.

The main problem is crossing the street, and the presence of many kerbs. Reasonable safety is provided at intersections with pedestrian traffic signals, but these are not universally provided. It is common to observe people stranded in the middle of a busy street carrying 4 or even 8 lanes of traffic. We would expect to see high pedestrian casualty figures in Astana.

Despite the flat territory, there is very little cycling in Astana.

2.7 Public transport

There is a large local bus system offering transport of variable quality. Investment in modern low-floor climate-control vehicles is under way although there are still many vehicles that are extremely uncomfortable. The system consists of:

- 30 Bus routes

- 19 minibus routes
- 3 trolley bus routes

We have not been able to obtain any data on overall passenger demand. Our estimate of bus mode share would suggest a total of around half a million bus passenger trips each day in the city, an average of about 10,000 per bus route per day. Some corridors in the central city are known to carry four times that daily load.

The street grid structure is favourable for direct and convenient routes, although a denser network of routes might be necessary to minimise walking distances to bus stops in some parts of the city.

Some bus routes in the older parts of the city are “split” with different directions using different streets (trolley bus route for example). This is inconvenient for passengers and is regarded as poor practice.

Although traffic congestion is generally confined at present to peak hours, this is sufficient to delay buses and to disrupt their schedules.

Information on bus routes is generally minimal. There apparently is no map showing the routes operated, and no timetables are displayed at bus stops. Presumably people get to know their routes. People with a car available, however, would not bother. The system is therefore serving a largely “captive” but rapidly diminishing market.

2.8 Air and rail transport

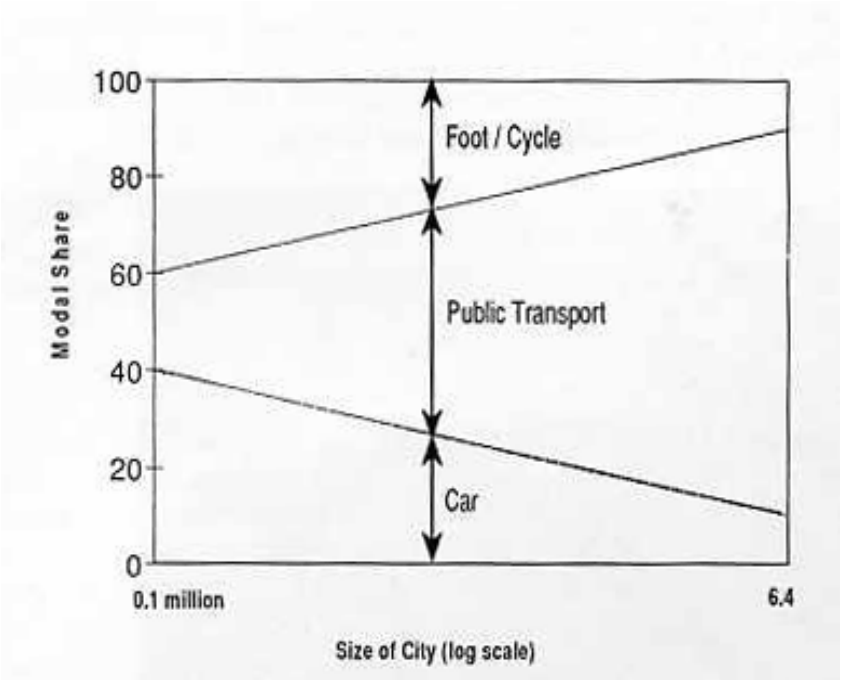
The interchange between the local bus system and the railway station appears to be reasonably convenient. The railway station itself has been recently rebuilt and offers modern facilities. Trains appear to be the main mode of transport in and out of Astana.

The airport has a limited number of international flights, with Almaty continuing to offer better connections. Astana’s airport is modern and is linked to the city with a good road.

3. International principles and best practice

3.1 The universal issue is that of reconciling the space demands of private motorised travel with the requirements of sustainable transport and development. The amount of space required per passenger kilometre is roughly 7 times for car compared to bus or walking. Consequently urban forms that accommodate the car as the main means of travel are exactly the opposite of urban forms that support walking and public transport. It is a case of sprawling or compact city forms. Some cities especially in North America have gone for the sprawl model but most European cities offer some form of compromise. It is important to note, however, that very few cities can claim to have achieved a stable equilibrium. Usually there is an ever-present pressure for more space for cars, and a continuing battle to provide adequate public transport.

3.2 In west European cities the proportion of travel undertaken by "sustainable" modes of travel (walk, cycle, public transport) is fairly closely correlated to city size.



The larger the city, the lower is the proportion of travel by car to the centre that can be accommodated. As Astana grows, so the pressure on city centre space from increasing car use will grow.

Cities that have limited the role of the car in their transport mix have done so by a mixture of providing good quality alternatives and restricting the supply of road and parking space. Such cities of comparable size to Astana include Zürich

(Switzerland), Stockholm (Sweden), Bologna (Italy), and Amsterdam (Netherlands).

What these leading-edge cities have demonstrated is that the amount of traffic in a city is not inevitable. It is not like the rainfall or the temperature – something that has to be accepted – it is a matter of choice.

3.3 The need to limit traffic

Limiting the amount of traffic in a city is essential. There is no possibility of all traffic demands being met when car ownership reaches the levels of western cities. Traffic will either limit itself (inefficiently) as congestion builds up to intolerable levels, or action can be taken to limit traffic to maintain a more efficient transport system. Traffic limitation takes three main forms:

- Traffic restriction, whereby action is taken to physically limit traffic (e.g. road closures, parking restrictions;
- Traffic restraint, whereby action is taken to discourage but not prevent traffic (e.g. parking charges, tolls, bus lanes)
- Traffic avoidance whereby action is taken to avoid traffic arising in the first place (especially through development planning or taxes on vehicle ownership, but also investment in good public transport).

Given the fact that Astana is going to double its population, and car ownership is currently low, the Traffic Avoidance option is of crucial importance.

3.4 Avoiding the build up of traffic

Car use is directly linked to car ownership. If car ownership levels can be kept low (say, to around 250 cars per 1000 population) then traffic levels should be manageable without the need for draconian traffic limitation measures. Car ownership can be limited by providing high quality public transport (e.g. Zürich), by imposing high purchase tax on vehicles (e.g. Denmark), or by imposing ownership quotas (e.g. Singapore).

As Astana joins the club of cities that are growing rapidly, it faces a stark choice. Either it tries to adapt to high levels of motorised personal mobility by building large roads and car parks, or it attempts to avoid the mistakes made by most western cities. In terms of environmentally this is not really a choice at all. Providing for high levels of traffic growth is quite simply irreconcilable with growth of the city in a way that will meet sustainability targets. The growing problems in Moscow as car ownership levels increase provides a salutary lesson in what needs to be avoided.

3.5 The New Urbanism

Even highly motorised cities, for example in California, are now trying to limit car growth. This is not just to reduce environmental impacts but for economic reasons. Car-based development uses a lot of land and increases distance, and imposes high costs for infrastructure construction and maintenance. However, trying to provide high quality public transport in urban areas that were laid out for the car has proved extremely expensive and has had limited success in keeping traffic levels manageable.

The New Urbanism described elsewhere in this report is based on limiting reliance on cars in order to pursue urban structures that are socially and environmentally more attractive. It must be said that the areas planned with the New Urbanism principles are miniscule by comparison with the vast swathes of car-based suburban development throughout North America, Australia, and elsewhere.

3.6 Some traffic limitation techniques

- Limited road building (Copenhagen, London)
- Avoidance of high speed roads
- Management of road system to prioritise public transport, walking and cycling
- Creation of public transport systems that are unaffected by traffic congestion (mostly rail systems, but increasingly segregated bus lanes and busways
- Integration of transport modes to limit car reliance (information, tickets, interchanges, Park and Ride etc.)
- Parking controls and charges to limit demand and to distribute opportunities to the most valuable users

3.7 Light rapid transit

Light rapid transit, especially rail-based, have been used both as a toll to assist regeneration and redevelopment (e.g. Lyon, Montpelier, Manchester, Sheffield) and as a way of providing for city growth (e.g. Freiburg in Germany, and The Netherlands capital at The Hague).

3.7 Encouragement of walking

It is commonly assumed that walking and cycling cannot compete with cars because the comfortable distances are short. But it is increasingly now recognised that cities can be shaped to ensure that many distances are kept short. This can be achieved by ensuring mixed-use development and high building densities. Thus in Europe we now speak of the “city of short ways”. This model does not deny a role for the car, but is based on the sensible assumption that the car should not be used habitually but for those journeys and those circumstances where it brings maximum benefit to the individual but minimum disbenefit to the wider community.

In Europe, even car manufacturers accept that car use has to be limited in cities. An advert for Mercedes cars shows the driver catching a tram, with the phrase “A man intelligent enough to own a Mercedes is intelligent enough to know when to use it”.

The key point is that through good planning we can ensure that a high proportion of people’s needs can be met without the need to use a car. Conversely, bad planning can lead to high levels of car dependence and transport inefficiency. In city transport planning the highest achievement is a short walk. Unfortunately this is rarely the main motivation of transport planning practice.

3.8 The importance of good data

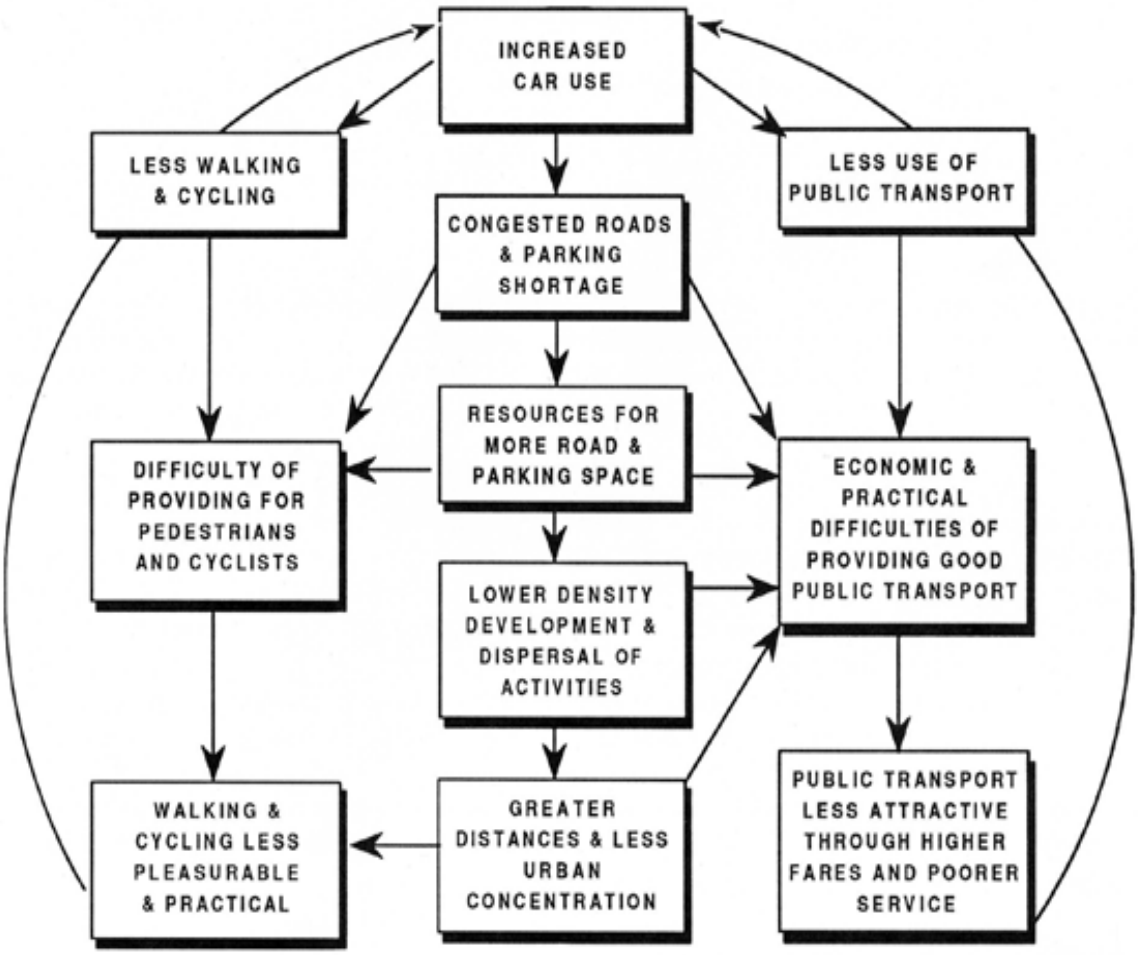
The most advanced cities have not only achieved good results but can demonstrate their achievements with good data. Data not only measures success but also helps to set the direction policy should take. Walking is often ignored because there are no data. Best practice data includes trips by all modes, including short walks. In Astana, we are assuming that walking accounts for up to 50% of all trips, and that the car accounts for less than 15%. If this is correct then it suggests that transport investment aimed at car users will show distorted and misguided priorities.

To compare progress with best practice cities, Astana will need to institute a research programme to collect comprehensive data on the demand side. This should comprise household travel data. A cheaper but less good option would be manual counts of traffic supplemented by walking surveys and bus passenger data.

3.9 The vicious circle of motorisation

The potential demand for car use is for all practical planning purposes unlimited. This is because of the dynamic of motorisation. As more provision is made for car traffic, so the city becomes less able to sustain the alternatives, thus further fuelling the demand for car travel. This is a vicious circle which has to be broken to achieve sustainable outcomes. It is shown diagrammatically below.

The vicious circle of motorisation



4. SWOC analysis

For transport, strengths and weaknesses have to be placed in a policy context. What are seen as strengths form one point of view can be weaknesses from another. This difficulty became very clear at the workshop held in Astana in June. The key issues are briefly mentioned under each sub heading.

4.1 STRENGTHS

1. Relatively high density and compact built form of older parts of city
2. A large bus system that is being upgraded
3. Relatively low bus fares
4. Money is available for transport investment
5. Political will to invest in high quality public transport
6. Broad streets capable of handling all future person movement demands (but also a weakness if allowed to attract more and more traffic)
7. Many attractive tree-lined streets offering relatively comfortable walking conditions for much of the year
8. Concentration of new employment in the centre, allowing access by public transport

4.2 WEAKNESSES

1. Traffic danger, especially for pedestrians
2. Uncomfortable walking conditions in newer areas (no trees, bleak spaces)
3. Overcrowding on buses at peak times
4. Pollution, noise and dirt from motor traffic, including older buses
5. Very poor public transport routing and public information
6. Little apparent awareness of transport sustainability issues amongst professionals
7. Extremes of climate that limits the comfort and practicality of cycling, and also walking and waiting (for public transport)

4.3 OPPORTUNITIES

1. Still time (just) to avoid mistakes of western cities
2. Public transport lanes routes can be reserved on the streets, to ensure protection from congestion
3. High quality public transport can be created to reduce people's desire to switch to cars
4. The successful grid street structure can be adapted and managed to provide good conditions for all road users
5. The topography (but the climate less so) provides an opportunity to foster cycling
6. Problems of city growth can be avoided through planning actions taken now

4.4 CHALLENGES (THREATS)

1. Speed of economic and population growth exceeding the ability to plan
2. Rapidly rising car ownership and use
3. Pressures to disperse land use development and activities in response to rising traffic congestion and lack of parking space
4. Attitudes of citizens and decision takers based on unrealistic expectations for individual mobility
5. Availability of money could lead to imprudent transport investment, especially damaging and unnecessary major highways
6. Insufficient professional staff to plan in a sustainable way (this is a threat even in countries further advanced in tackling the issue)
7. Pressure to provide parking spaces will undermine the required compact spatial structures

5. Proposed actions, policies and projects

This section sets out basic principles, and actions that are compatible with these principles.

5.3 Basic rules governing transport policy development

There are a number of important “home truths” that can be determined from the experience of cities round the world. It is important that policies and projects are devised with a full understanding of these basic rules.

- The number of trips per person per day is a constant (usually 3 per day average of whole population). An increase in car trips will therefore be matched by a corresponding decrease in trips by other modes.
- The time spent travelling per person per day is constant (usually 50-60 minutes per person per day). Consequently any increases in journey speeds facilitated by new roads will be counteracted (in the long run) by longer journey distances.
- Increases in car ownership will be accompanied by a corresponding shift from walking and public transport to car travel unless countervailing measures are taken.
- Mode shift from public transport and walking to the car will produce a corresponding increase in *average* journey speeds overall, even if average car journey speeds fall because of increasing congestion.
- The potential demand for travel by car virtually infinite, and can never be provided for in full, however many roads and parking spaces are built.
- The greater the provision for cars (roads and parking) the greater the long run problems for people travelling on foot or by public transport.
- The quality of the urban environment (environmental and social sustainability) is inversely proportional to the proportion of trips undertaken by private car.

5.2 Principles for sustainable transport in Astana

- Spatial development patterns designed to minimise or avoid the need for travel by car.
- “City of short ways” by planning for high density mixed use development
- Maintain and intensify the city centre
- Ensure transport provision is socially inclusive
- Adopt a “traffic avoidance” strategy
- Avoid excessive growth in car ownership
- Measure the efficiency of corridors of movement (road, pedestrian, bus, cycle) in terms of people volumes, not in terms of vehicle volumes.
- Street design should be integrated with design for transport, traffic and parking, and should reflect streets as living space, not just as movement corridors.

5.3 Policies for Astana

- Protect buses from growing traffic congestion by reserving lanes on the existing streets. This is an urgent requirement.
- Invest heavily and urgently in public transport to keep ahead of the demand for people to switch to private car. This should include investment in a light rail system, such as previously studied.
- Plan the public transport system on the basis of a city of 1 million plus people, with high capacity provision on key corridors.
- No high-speed, free-flow roads.
- Communal provision of parking only
- No private commercial parking (all parking subject to control)
- Parking controls, permits and charges to allocate space
- Introduce appropriate pricing and control to manage demand for roads, parking and public transport.
- Continue the policy of intensification of the city centre.
- Invest primarily in transport links to the city centre
- Intensify density and activity along public transport corridors and at public transport nodes (interchanges). A poly-centric solution is appropriate with a range of activities as well as high density housing at public transport “nodes”.

5.4 Project criteria

All transport projects should meet minimum criteria

- Must be compatible with the sustainable development objectives
- Must meet a clearly defined purpose
    - What type of journeys does it provide for?
    - What groups of people will it serve?
- Must demonstrate which transport-related problems will be addressed:
    1. Walking difficulties and dangers
    2. Street quality
    3. Peak hour congestion
    4. Public transport overcrowding or discomfort
    5. Noise, pollution, CO2 emissions
    6. Parking difficulties
    7. Danger and casualties
- Must provide value for money, compared to the alternatives

(See table at end of paper for projects)

Contributions on

a) Targets

National targets are required in relation to pollutants from transport, including concentrations of noxious emissions in urban areas, and CO2 emissions overall.

CO2 emissions targets for new development should be set in relation to emission levels from domestic and industrial sources. A per-capita figure for each sector is likely to be the most appropriate way forward. However, the base year should probably be set around 2005 rather than the 1992 Kyoto base. This is because per capita CO2 emissions in 1992 are likely to have been high on account of inefficient coal burning heat and power generation.

Noise standards should also be adopted for transport infrastructure.

Targets in relation to transport specifically are of little use until there are comprehensive data on transport mode and distance travelled.

b) Transport and Planning objectives

1. Accommodate and support growth, and rapid growth
2. Constrain immediate and long term infrastructure costs for transport and utilities (compact city)
3. Ensure short-medium term investment is good value and serves majority of people
4. Plan accessibility to a range of employment and services for everyone. No significant employment should be planned in locations that accessible only by car
5. Public transport should be planned to provide “seamless” journeys between any two points in Astana (i.e. no more than one change of bus required, and no multiple fares)
6. Achieve a high quality travel experience (comfort, convenience, safety, cost). This should be measured with “satisfaction” surveys
7. Similarly achieve high quality public realm.
8. Plan the urban structure and transport facilities in ways that make a low call on non-renewable energy sources
9. Similarly plan so that transport makes a small ecological “footprint” in terms of noise and pollution
10. Achieve a steady reduction in road casualties, especially fatalities, serious injuries, and injuries to children.

c) Community objectives

An alternative to targets is to ensure that all plans and projects meet specified objectives. The following are recommended in relation to accessibility and transport and are construed in terms of personal and community aspirations.

1. Everyone in Astana should be able to meet their normal daily requirements comfortably without needing a car. (This is not to say that people should not be able to use a car. The issue is avoiding dependence, not removing choice.)
2. People should be able to go about their business without danger from traffic or pollution.
3. People should be able to complete their journeys on public transport reliably, without undue delays, and at reasonable cost.
4. Getting around Astana should be sufficiently comfortable and convenient for people to regard this as a generally positive experience.
5. People living in Astana should not be subjected to excessive noise, danger or pollution in their homes and communities.
6. People should be offered a choice of means of travel to suit the range of circumstances in which they travel (bad weather, with children, accompanying elderly or disabled people, carrying bags and so on).
7. People should be able to reach their work and other essential destinations at reasonable cost.

d) Costs and budgets

Item	Actions	Cost implications	When needed
1	Cancel plans for high-speed free-flow roads	No cost	Now
2	Reserve bus lanes on street network	Low cost	Now
3	Reserve rapid transit (LRT) route from railway station to the new centre	Low cost	Now
4	Produce “Transit Oriented Development” strategy, and create planning control mechanism to implement	Low cost	Short term
5	Produce street design code favouring sustainable modes of travel	Low cost	Short term
6	Plan restructuring and upgrading of public transport system	High cost	Short term
7	Implement public transport upgrade	High cost	Medium term
8	Traffic management to provide pedestrian and bus priority	Moderate cost	Medium term
9	Build LRT system in phases	High cost	Medium term
Ongoing projects			
10	Dropped kerbs and grading of carriageways at side streets to improve walking conditions	Medium cost	Over time
11	Tree planting throughout network	Low cost	Over time
12	New streets programme – boulevards and possible “northern arc” distributor road	High cost	Over time
13	Parking control and charging system	No net cost	Over time
14	Planning control including accessibility assessment	Low cost	Over time

Note: “Low cost” is taken to mean less than $10million; moderate cost $10-100million; high cost over $100million