حكـــومـــة أبـــوظـــبي
GOVERNMENT OF ABU DHABI

ABU DHABI SURFACE TRANSPORT MASTER PLAN A VISION FOR CONNECTING ABU DHABI

THE PLAN 2009

TR-501

Surface Transport Master Plan

A Vision for Connecting Abu Dhabi

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List of Abreviations

ADFEC	-	Abu Dhabi Future Energy Company
ADM	-	Abu Dhabi Municipality
ADNEC	-	Abu Dhabi National Exhibition Centre
ADTCo	-	Abu Dhabi Transport Company (proposed)
ADUPC	-	Abu Dhabi Urban Planning Council
AED	-	United Arab Emirates Dirham (currency)
ATC	-	Automatic Traffic Count
AUH	-	Abu Dhabi International Airport
$C0_2$	-	Carbon Dioxide
CBD	-	Central Business District
CCTV	-	Closed Circuit Television
CDM	-	United Nations Clean Development Mechanism
CNG	-	Compressed Natural Gas
DM	-	Demand Management
DoT	-	Department of Transport
EAD	-	Environment Agency Abu Dhabi
EHS	-	Environmental Health and Safety
EHS MS	-	Environmental Health and Safety Management System
EHSIA	-	Environmental Health and Safety Impact Assessment
EIA	-	Environmental Impact Assessment
GCC	-	Gulf Cooperation Council
GDP	-	Gross Domestic Product
GPS	-	Global Positioning System
HRAR	-	Health Risk Assessment Report
ICAD	-	Industrial City of Abu Dhabi
IMO	-	International Maritime Organisation
ISA	-	Independent Speed Adaptation
ITS	-	Intelligent Transport Systems

KPIZ	-	Khalifa Port and Industrial Zone
KSA	-	Kingdom of Saudi Arabia
NILU	-	Norwegian Institute for Air Research
NO_x	-	Nitrogen Oxides
NPV	-	Net Present Value
NTA	-	National Transport Authority
PRT	-	Personal Rapid Transit
PV	-	Present Value
RDC	-	Regional Distribution Centre
RoadCo	-	DoT Roads Company (proposed)
ROGS	-	Rail and Other Guided Transport System
RSA	-	Road Safety Audit
SALIK	-	The Dubai Electronic Toll Collection System
SEF	-	Strategic Evaluation Framework
SO_2	-	Sulphur Dioxide
STMP	-	Surface Transport Master Plan
UAE	-	United Arab Emirates
UTMC	-	Urban Traffic Management and Control
VMS	-	Variable Message Sign

Part A
Context

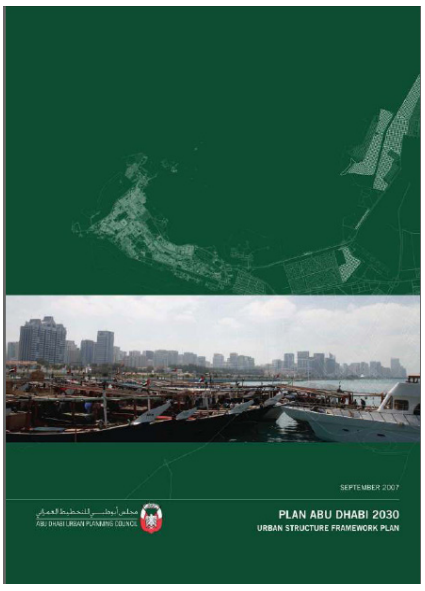
A Context

A1 Introduction

The population of the three regions of the Emirate is forecast to increase to nearly 5 million in 2030.

Abu Dhabi is undergoing an impressive, rapid and visionary transformation designed to establish it as a world-leading city by 2030. The inspiration for this is Plan Abu Dhabi 2030[1], an urban structure framework providing an overarching structure for planning and development efforts over the next quarter of a century, which anticipates a trebling of the city's population to 3.1 million. Further planning for the Al Ain[2] and Al Gharbia[3] regions, which followed the publication of Plan Abu Dhabi 2030, raises the projected population for the Emirate to 5 million by 2030. Plan Abu Dhabi 2030 offers a unified vision for Abu Dhabi's future and provides policy directions in a variety of areas including the natural environment, land use, transport, open space, urban design, housing and the economy.

The Surface Transport Master Plan (the Plan) was commissioned to deliver a world-class transport system for Abu Dhabi that will support the Plan Abu Dhabi 2030 vision. The Plan addresses the regional transport needs of the Emirate as a whole, while focusing particular attention on Metropolitan Abu Dhabi. It is a strategic plan, designed as part of an ongoing process of delivery, whereby the various elements of the Plan will be subject to detailed study, design and refinement but always within the same strategic framework. The Plan will be continuously monitored and updated by the Department of Transport (DoT), remaining a 'live' document, which is vital given the dynamic nature of Abu Dhabi's development.



The main focus of the Plan is the Metropolitan area. The urban structure framework plan for this area was published in September 2007.

This document contains a technical description of the Plan, and is divided into six parts:

A – Context provides the background to the development of the Plan

B – The Challenges outlines the principal issues facing the transport sector up to 2030

C – The Choices describes how alternative transport scenarios were identified and tested

D – The Plan sets out the infrastructure schemes and policies that make up the Plan

E – Delivery describes how the Plan will be implemented

F – Action Plan summarises the phasing of the Plan and the actions needed to deliver it

The six parts are supplemented by a set of appendices, which in turn refer to a series of working papers and reports completed as part of the study process.

A companion document, Surface Transport Master Plan – A Vision for Connecting Abu Dhabi[4], was published in March 2009 to celebrate the official launch of the Plan.

The Plan documentation can be viewed at and downloaded from the project website: www.transportabudhabi.ae.

A2 Role of the Department of Transport

The DoT was established in 2006 under Law 4/2006 to bring under one roof responsibilities for all the main transport modes: civil aviation, maritime transport, highways and road transport, and public transport. Before this, these responsibilities were scattered among several disconnected agencies. Initially only civil aviation and maritime transport – where DoT plays mainly a regulatory role – were transferred. Now, following Law 5/2008, the main highway network, road transport and public transport have also been brought into DoT's areas of responsibility. For these, DoT will be regulator, developer, manager and, where appropriate, operator.

An important reason for bringing all transport modes together is the recognition that, with burgeoning demand, an integrated transport solution is needed, one that combines project planning with broader policy initiatives to bring about preferred outcomes. With Abu Dhabi's metropolitan population expected to triple by 2030, and tourist arrivals currently rising annually by over a third, DoT needs to consider carefully what investments in infrastructure and service capacity are needed, and what supporting

measures are required to ensure that the transport system as a whole operates with efficiency, safety, demand-responsiveness and minimal negative environmental impact. The Plan sets out how this is to be achieved.

The DoT is also the nominated Sector Authority for the transport sector under the Government's 2006 Environmental, Health and Safety (EHS) Policy. Its EHS management framework covers all employees, contractors, stakeholders, local communities and customers – including all those affected by this Plan. Its responsibilities under the Plan encompass all aspects of EHS risk management and their associated processes, practices, procedures and resources.

A3 The Policy Framework

The Plan was developed within the framework set by Plan Abu Dhabi 2030 and also took account of the emerging 2030 Plans for Al Ain and Al Gharbia, as well as the Abu Dhabi Economic Vision 2030[5] and the Abu Dhabi Policy Agenda 2007 - 2008[6].

Plan Abu Dhabi 2030 was created to deliver the vision of His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE and Ruler of Abu Dhabi, for the continued fulfilment of the grand design envisaged by the late Sheikh Zayed bin Sultan Al Nahyan, and to promote the ongoing evolution of Abu Dhabi as a global capital city.

To accommodate a more sustainable pattern of urban development within Abu Dhabi, rather than dispersed developments dictating urban form, Plan Abu Dhabi 2030 acknowledges the need for a systematic approach towards integrating transport and land uses.

Two major themes underpin Plan Abu Dhabi 2030 and have had a significant influence on the Plan as follows:

***'Sustainability** – It is essential to accommodate major new population growth without over development, by conserving and respecting natural and cultural resources and without unnecessarily tearing buildings down. Oil has brought considerable wealth to the city, but it is a finite resource. Abu Dhabi's future lies in its ability to cautiously use existing wealth, to actively explore renewable energy production, to reduce the consumption of nonrenewable resources and to educate future generations. Resource efficiency is vital.'*

The current dependence on the car is not sustainable and can directly impact the UAE's fragile natural environment. European and developed cities with high levels of public transport use have much lower transport-related energy consumption, CO_2 emissions and fatalities than Abu Dhabi.

***'Connectivity** – Abu Dhabi cannot rely solely on the private car when the population reaches three million. The city will need a multi-layered transport network to connect the downtown core with new growth nodes and the developed islands. In the same sense, connectivity should be apparent in a hierarchical system of formal and informal open spaces and biologically significant protected areas.'*

Linkages between future sustainable land use patterns and the impact that the transport network has on the City (and beyond) were emphasised in Plan Abu Dhabi 2030.

***'Transportation** – The best transport plan is a good land use plan. The establishment of two city centres – one in the downtown area of Abu Dhabi Island and the other in the new Capital District – will facilitate a balanced traffic flow in two directions, thus minimizing congestion. The city will also need a layered transport network when the population reaches three million. This will significantly reduce the number of cars on the road, creating a better experience for those who continue to drive. The transport network should include high-speed rail to distant destinations, a local metro railway, freight rail, a surface network of buses, streetcars and light rail, and a fine grain of interconnected streets. The potential for walking must also be enhanced, to increase the tendency for people to walk, especially over short*

distances.'

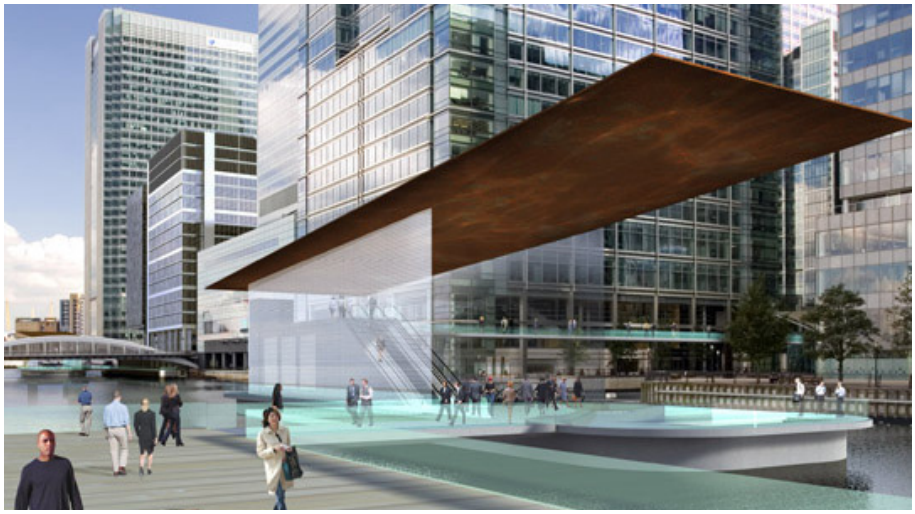
Although Plan Abu Dhabi 2030 can be considered a framework plan – one that deals with the conceptual and broad nature of land use and transport distribution – it made a number of recommendations that helped to facilitate the progress of sustainable transport planning in the Emirate, including Policy T-2 recommending the basis for the Surface Transport Master Plan:

'Complete a City-Wide Comprehensive Transportation Plan as soon as possible for multiple modes, full arrangements for goods movement, and roads with a finely distributed pattern of streets and automobile access.'

A4 Vision for Transport in Abu Dhabi

In aspiring to become one of the world's truly great places, Abu Dhabi has set out to create a truly great transport system. Accordingly, the vision of the Plan is to be a world leader. Although Plan Abu Dhabi 2030 sets out a clear vision for future land use development in the Emirate, the vision for transport in Abu Dhabi is shaped around a cultural shift in the relationship between Abu Dhabi's citizens and the role that transport plays in their lives. Abu Dhabi cannot continue to rely on the private car if it wishes to achieve the sustainable goals of Plan Abu Dhabi 2030. At present, it has more opportunities than most cities to develop a truly world-class system and in doing so to change forever the dependency on private vehicles.

The Plan's vision is to develop 'A world-leading transport system that meets the needs of residents, visitors and businesses in the most efficient, safe, attractive and environmentally sustainable way.'



Cities have recognised the need for large scale investment in transport infrastructure to maintain their global competitiveness. In the United Kingdom, for example, AED 80 Billion will be invested in the Crossrail project to improve mobility across Central London.

Although individual countries and cities have unique transport systems, a number of key attributes of a world-class system have become widely

recognised. They are:

- reduced dependency on the use of private cars
- a high proportion of trips made by public transport
- a high degree of integration within the transport system
- close integration of land use and transport planning/development
- reduced carbon emissions
- promotion of non-motorised movements

These key attributes were all taken into account as the Plan developed. The transport systems of many leading cities were examined to see what lessons, both negative and positive, could be applied to Abu Dhabi.

In Singapore 70% of peak hour trips into the centre are by public transport.

A5 Goals and Objectives

A set of goals and objectives was defined at the start of the study process to guide the Plan's development based on the sustainable planning foundation that underpins Plan Abu Dhabi 2030. More specifically, the three pillars of sustainable development guided the framework as follows:

Goal 1 – Economy: promote economic competitiveness and vitality through efficient, high-quality transport services for passengers and freight

Goal 2 – Society and culture: protect and enrich people's lives by maximising safety and access to opportunities for all

Goal 3 – Environment: deliver world-leading performance in environmental sustainability, through responsible use of resources, minimising pollution, and preserving Abu Dhabi's unique environment.

In order to develop a Transport Plan that can realistically achieve the aims of Plan Abu Dhabi 2030, a clear understanding of the transport goals and objectives was necessary.

A set of objectives and measurable indicators was derived from these goals, designed to ensure that the development of the Plan met more specific needs and so contributions made by the Plan could be quantified. The objectives are:

- Minimise congestion on Abu Dhabi's road network for residents, visitors and businesses
- Reduce reliance on the automobile and encourage alternative modes of travel
- Develop a low carbon economy in Abu Dhabi
- Improve the international connectivity of Abu Dhabi
- Improve the regional connectivity within the Emirate of Abu Dhabi
- Improve connectivity within the Abu Dhabi Metropolitan area
- Encourage sustainable and efficient freight distribution
- Preserve the natural environment that makes Abu Dhabi unique
- Protect and enhance the cultural heritage, landmarks, national symbols and monuments of Abu Dhabi
- Reduce traffic noise and improve local air quality
- Improve safety, particularly for pedestrians
- Enhance the pedestrian realm

A6 The Process

The study was completed in three main phases, which were:

Phase 1 – Assessment

A comprehensive review of existing conditions, policies and plans was undertaken to identify the key issues and options to be addressed and the additional information needed to evaluate future policy and planning scenarios.

Phase 2 – Evaluation

A comprehensive analysis of the probable impacts of alternative scenarios for the management and development of the transport system was made. A range of alternative policy and planning scenarios were formulated, reflecting different ways of achieving the project goals and objectives. The

contribution of these scenarios was assessed against the objectives of the Plan using a wide range of criteria to quantify impacts on the economy, environment, society and other issues. From this phase, a Preferred Scenario was developed.

Phase 3 – Implementation Plan

This final stage involved deriving implementation schedules and action plans, together with recommendations for ensuring that stakeholders have the capability and resources to carry out their assigned tasks effectively, and a financing plan that identifies the sources of funds.

At the completion of this three-phase process, the Plan was produced; it comprises a comprehensive set of policies and plans for the transport network throughout the Emirate, made up of more than 200 different components.

A7 Consultation and Participation

The study process was transparent, with consultation and stakeholder involvement critical to the overall success of the Plan. It was controlled by a high-level steering committee and run by a technical committee made up of representatives of the following key organisations:

- Department of Transport (leading)
- Abu Dhabi Urban Planning Council
- Abu Dhabi Municipality
- Al Ain Municipality
- Al Gharbia Municipality

Regular specialist workshops were held, as well as three major interactive workshops at key points in the process, each attended by up to 200 delegates. The feedback and contributions received provided information about specific schemes and helped to shape and refine numerous initiatives for the Plan.[7]

Local consultation on the Plan itself and its component initiatives was also undertaken. Two major consultation exercises using focus groups were held to gauge the opinion of all demographics on the impact and acceptability of various policies and schemes. Advertisements were placed in local print media, and a text message to all Abu Dhabi mobile telephone numbers elicited over 400 responses.

The study process was driven by effective consultation and coordination with key organisations and stakeholders and members of the public. Major interactive workshops were held during the process that ensured a shared understanding of transport issues and priorities and to coordinate transport infrastructure planning on all levels within the Plan.

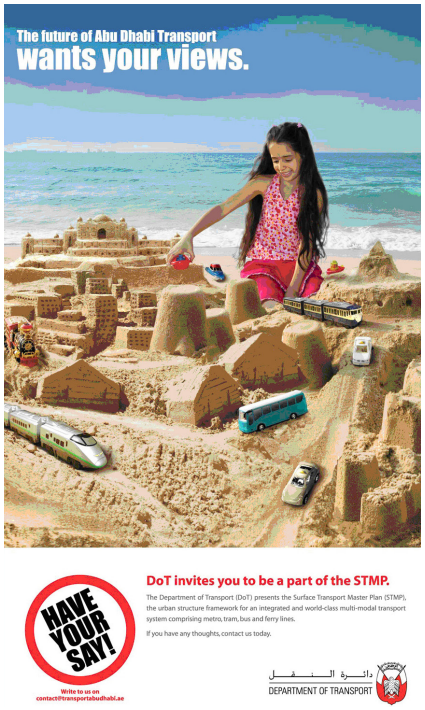
A website for the Plan (www.transportabudhabi.ae) was established and provided information on the study, details of technical papers, and feedback forms where members of the public could respond directly throughout the process. The website remains open as a publicly accessible source of the finished Plan documentation.

At the final major interactive workshop, held in November 2008, a panel of 11 international experts were invited to Abu Dhabi to contribute to the study process. Without exception, this group of transport professionals acknowledged that implementation of Plan 2030 will be a world first. Some highlights from their comments include:

'The vision represents what we all have aspired to but, realistically, have not expected or been able to deliver. The vision is realistic and clearly reflects the best that any community can conceive relative to achieving true balance. Indeed, it is an impressive piece of work, which obviously required a lot of thought, ingenuity and energy to produce.'

'Vision 2030 is challenging but achievable but it is important that the vision, commitment and clarity of objectives that characterise its inception are maintained through its design and development, its implementation and its continuing delivery, maintenance and refinement. Stay true to the Vision - creating it was the easy bit – the test will be the ability and courage to implement it.'

'Implementation will be more than simply converting the plan into reality. Creating and managing positive expectations must be undertaken immediately via a communication strategy and plan but then the implementation will be critical in developing and reinforcing the ongoing communication.'



A series of newspaper advertisements sought feedback from the general public.

'Besides providing all the physical hardware, it is even more important to set out to change the public mindset with regards to the use of public transport. The public needs to be convinced and won over, not coerced. It will require a massive public education and publicity programme.'

'The 2030 Plan states that land use planning will have the single biggest impact on transportation system performance. This is an unusually enlightened view which provides a very strong foundation assuming that land use planning is closely coordinated with rail planning as quickly as possible.'

A panel of 11 experts from around the world visited Abu Dhabi and reviewed the Plan.

'A good public transport system is reliable, frequent, clean, safe and secure. It is important to set strict regulatory standards to ensure that the services provided comply with the requirements set by the authorities. There needs to be frequent monitoring and enforcement done to ensure that operators perform well.'

'What is required are transit systems of first choice rather than of last resort. One of the most important passenger requirements is a coordinated fare structure for the entire system with one fare media a 'transit smartcard.'

'There is very little urban space and service for pedestrians within the Abu Dhabi CBD when compared with European Cities, be it for the climate, societal or cultural reasons. This should be changed as part of urban renewal providing easy access for pedestrians to hotels, shopping malls, mosques etc., by reducing parking on the public space to the benefit of pedestrians and by at the same time providing access via public transport systems.'

'The problem with the highway network is primarily one of management in the Abu Dhabi metropolitan area. The contrast in service levels between the peak and off-peak hours is enormous, and if the highway network is to perform more effectively in the near- and long-term futures a new approach to its management is required. Concurrently with road expansion, the DoT should look at ways to maximise the existing capacity of the road infrastructure and networks by leveraging on traffic management technologies.'

'Currently parking demand far outpaces supply and enforcement seems to be very minimal. Bringing demand in line with supply is preferable to greatly increasing supply. This cannot be done without a tremendous increase in the availability of travel options.'

A8 References

1. Plan Abu Dhabi 2030: Urban Structure Framework Plan. Urban Planning Council. Sep 2007.

2. Plan Al Ain 2030: Urban Structure Framework Plan. Urban Planning Council. Apr 2009.

3. Plan Al Gharbia 2030: Urban Structure Framework Plan. Urban Planning Council. Under production.

4. Surface Transport Master Plan – A Vision for Connecting Abu Dhabi. Department of Transport. Mar 2009.

5. The Abu Dhabi Economic Vision 2030. The Government of Abu Dhabi. Nov 2008.

6. Abu Dhabi Policy Agenda. Executive Council 2007.

7. Appendix E Consultation. Abu Dhabi Surface Transport Master Plan. Apr 2009.

Part B
The Challenges

B The Challenges

B1 Economic Growth

The population of the Emirate, and of the Metropolitan area in particular, has been increasing rapidly in the last few years. The population of the Metropolitan area rose by over 25% between 2005 and 2008 and the total population of the Emirate is now around 1.6 million. This increase has been accompanied by a major construction boom, with the total developed floor area increasing by 46% over the same period.

Table B1 Population Growth 2005-2008 (million residents).

	2005[1]	2008[2]
Abu Dhabi	0.74	0.94
Al Ain	0.38	0.52
Al Gharbia	0.14	0.14
Total	**1.26**	**1.60**

The Abu Dhabi economy will grow five fold in the next twenty years, putting enormous strain on the Emirate's transport infrastructure.

By 2030 the planned population of Metropolitan Abu Dhabi will exceed 3 million residents.[3] When combined with planned growth in Al Ain and Al Gharbia this will take the population of the whole Emirate to nearly 5 million. The total Gross Domestic Product (GDP) of the Emirate is expected to grow five fold over this period from AED280 billion to AED1,500 billion.[4]

Figure B1: Expected Population Growth 2008-2030

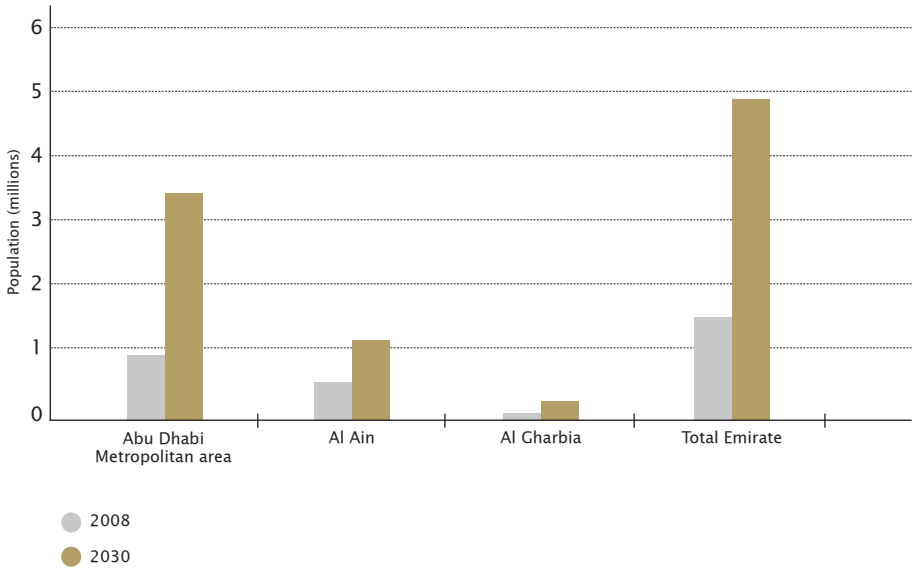
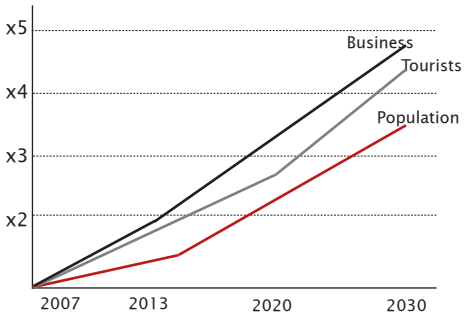


Figure B2: Expected Growth in Business and Tourism



The commercial and tourism sectors will grow four to five fold by 2030.[3]

B2 Economic Diversification

The development plans for the Emirate are designed to reduce the current dependence on the oil sector and to expand the non-oil commercial and industrial sectors together with the retail and tourism sectors. In the Metropolitan area alone Plan Abu Dhabi 2030 predicts a four fold increase in tourist visits and a five fold increase in business activity. The public sector will be developed in parallel to serve this enormous growth.

B3 Spatial Change

The economic development plans require a phenomenal change in the existing distribution of land use. The headline figures in Table B2 illustrate the scale of change in land use required in the Abu Dhabi Metropolitan and Al Ain areas, as set out in their respective 2030 plans. The growth of the city will be delivered primarily through the planning of new mainland neighbourhoods by the government, large-scale urban developments on the islands around Abu Dhabi Island, and redevelopment and infill of existing developed areas.

Table B2: Expected Changes in Land Use 2008-2030

Land Use	Abu Dhabi Metropolitan[3]	Al Ain[5]
Residential Units	506,000	135,012
Retail GFA(*)	3,140,000	640,000
Office GFA (*)	6,100,000	450,000
Industrial GFA (*)	11,000,000	1,175,000
Hotel Rooms	64,500	3,204

(*) Gross Floor Area

The construction of the Capital City District on the mainland will fundamentally alter the urban structure of the Metropolitan area.

The change in land use will be delivered primarily through a number of very large scale developments, either on re-developed sites or (the majority) on previously undeveloped land, particularly the Islands to the east of Abu Dhabi Island.

Some of the key challenges this poses for the Plan are:

- The sheer scale and pace of change throughout the Emirate and hence demand for trip making
- Creation of a second growth pole - the Capital City District - in the Metropolitan area generating significant local and regional travel demand

- Providing access to developments on Islands that have a limited number of access points
- Maximising the opportunity to reduce longer distance trip making and internalise journey to work, educational, social and other trips within developments

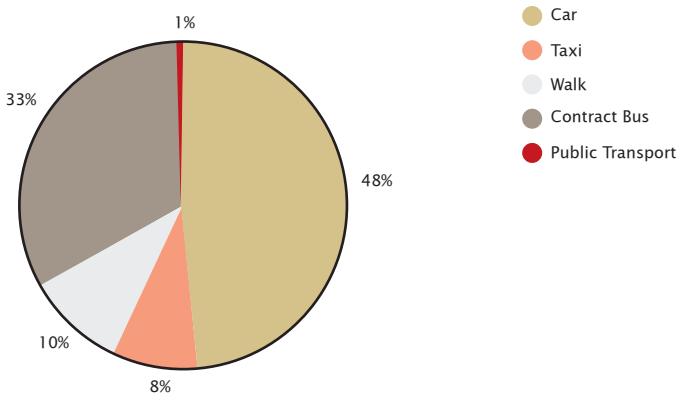
B4 Mobility

B4.1 Car Dominance

Traffic congestion is already a serious issue in the urban areas. The number of vehicles registered in Abu Dhabi increased by 49% between 2006 and 2008 and congestion will get worse as this trend continues.

The majority of surface transport in the Emirate is by private car, taxi or contract bus, with a small but rapidly developing public bus system (there is virtually no maritime public transport).

Figure B3: 2008 Base Year Modal Split [6]



The existing highway network is generally constructed to a high standard but is already reaching its operational capacity at peak times, both within the metropolitan areas of Abu Dhabi and Al Ain and on some inter-city routes.

Traffic modelling has demonstrated that peak hour trips will increase five-fold between 2008 and 2030 and that if no improvements are made to the transport network large scale traffic gridlock will follow, as illustrated in Figure B4.[7]

The DoT introduced an interim fleet of 120 new buses in 2008.

B4.2 Buses

In mid 2008, the provision of bus services in Abu Dhabi was overhauled by the DoT. By the start of 2009 nine new timetabled routes operated by a new fleet of 120 modern air-conditioned buses had been introduced in

the Abu Dhabi Metropolitan area carrying around 50,000 passengers per weekday. The DOT is in the process of purchasing an additional 1360 buses, of which 860 will be in operation by the end of 2009. The service was free until February 2009 when a new fare system, Ojra, was introduced, which charges Dh1 for a single ride, Dh3 for a day pass and Dh40 for a month. Although the new bus services have been successful, it is apparent that they will not be the sole solution to the traffic congestion problems in Abu Dhabi, especially as they share the same space as all other road traffic.

Figure B4: Traffic Congestion in the Metropolitan Area - 2030 Morning Peak

By 2030, with no change to existing plans for highways and public transport, the majority of highways in the Metropolitan area will be over capacity and average journey time will increase up to six fold.

New taxis were introduced in 2007.

B4.3 Taxis

Historically, taxis have provided the only form of mobility for non-car owners, apart from contract worker and school buses. In 2006, a new corporate body -TransAD - was set up by the DoT to develop and introduce a new taxi system and subsequently to regulate and monitor it. TransAD set up a franchise system with initially 7 private franchisee companies licensed to operate approximately 1,000 taxis each. The new operators are slowly phasing out the traditional white and gold taxis with a new fleet of higher specification silver vehicles together with re-trained drivers. The taxi system will always play an important role in Abu Dhabi, as in any country, but the reliance on it as the main form of public transit must clearly change.

Walking and cycling in the urban areas of Abu Dhabi is both unpleasant and unsafe.

B4.4 Walking and Cycling

Both walking and cycling are difficult and dangerous in the car dominated transport system, which only serves to reinforce the use of the private car for many short trips. Although the hot summer climate clearly makes walking and cycling very uncomfortable, improved street design can mitigate this and for over half the year the climate is quite suitable for this type of movement.

B4.5 Parking

The supply of parking space has not been able to keep up with demand and there are serious problems with illegal parking throughout the Metropolitan area in particular. A Parking Management Plan has been prepared for the metropolitan CBD that aims to re-organise on-street parking and introduce parking charges to encourage the use of a number of under-utilised underground car parks (which are charged for). However, even with these measures the demand for car parking will exceed supply.

The availability of car parking is a serious issue in the Abu Dhabi metropolitan area.

B4.6 Freight

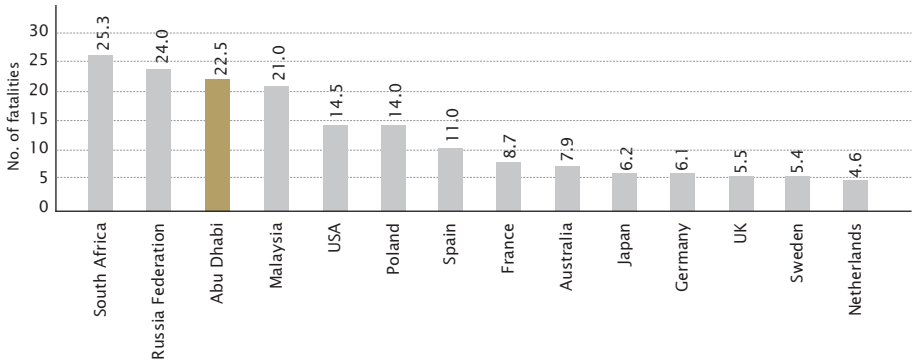
The movement of freight, the majority of which is by road, is a significant challenge to achieving 2030 objectives. Road freight is treated very much as a second priority to the private car and is often restricted to prescribed routes (and time periods in urban areas). These routes nearly always result in longer journey times than the corresponding car routes (in the case of the route to Dubai it is a 50% longer distance) with commensurate increases in operating costs. This creates a barrier to the creation of an efficient freight sector, and hence the realisation of some of the industrial and commercial objectives of the 2030 vision

B4.7 Road Safety

The number of fatalities and injuries resulting from road crashes is unacceptably high in the Emirate. Pedestrians, in particular, are highly vulnerable, accounting for around 40% of all road related fatalities. A number of factors contribute towards this including poor driving standards, excessive speeding and lack of pedestrian crossings. This situation clearly has to change.

Figure B5: International Comparison of Traffic Accident Fatalities [8]

Abu Dhabi has a very high level of traffic accident fatalities per head of population, at 50% greater than recorded in the United States, and four times higher than the United Kingdom.



B5 Environmental Implications

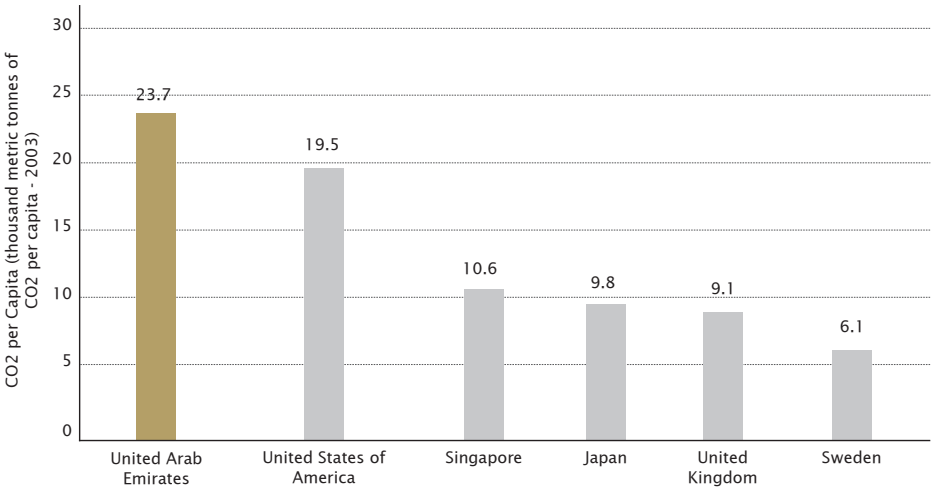
B5.1 Global Climate Implications

The UAE has one of the highest per capita carbon emissions in the world and transport is one of the main contributors to this. The Kyoto Protocol requires industrialised countries to reduce their total emissions of greenhouse gases by about five per cent compared to 1990 levels by 2012. Although the UAE was not required to meet quantitative emission targets, the international community is now working towards a successor agreement to the Kyoto Protocol. It is therefore likely that the UAE will face pressure in the near future to substantially reduce its carbon emissions, including those derived from transport.

Abu Dhabi's future lies in its ability to pursue renewable energy production, and to drastically reduce fossil fuel demand for transport. Resource efficiency and carbon management are vital to the sustainable development of Abu Dhabi.

The UAE has one of the highest per capita carbon emissions in the world - a significant amount of which is transport generated.

Figure B6: Per Capita Carbon Emissions [9]



B5.2 Local Environmental Implications

In addition to carbon emissions, there are more local environmental issues, such as habitat degradation and pollution, to be considered. Increasing traffic levels have led to visual intrusion, air emissions and noise, which impact on human health and quality of life. There are also significant environmental issues related to freight, whether it is by road or sea. National heritage sites provide a link to the Emirate's cultural roots and rich traditions, but are under pressure from expanding development. The current demand placed on the Emirate's finite natural resources is leading to depletion, and without more efficient use the capacity to provide for continued development will be compromised.

B6 Economic Implications

Traffic congestion imposes high economic costs. Recent studies have shown that the cost of traffic congestion in the UK is equivalent to 1.4% of the country's GDP. In Dubai the cost was estimated to be 2.4% of GDP.

Time wasted while delayed on traffic congested roads imposes significant costs on the economy. Many leading cities have recognised that an excellent transport system is vital to maintaining their competitiveness. In a global economy, ease of movement is an important criterion when footloose enterprises, which Abu Dhabi needs to attract, are considering locations.

B7 Social and Cultural Implications

Abu Dhabi's quite unique cultural mix poses its own challenges to the provision of public transport. Only 15% of the population are nationals,

with expatriates making up the majority. The expatriate population consists of several different categories ranging from a professional class to a large number of modestly paid industrial workers. Any system must take account of this wide disparity in incomes and the needs of different gender and social groups for segregation.

It is obvious that the strong car culture needs to change if the traffic gridlock in other similar cities is to be avoided. At first this seems a big obstacle to overcome, but less so when it is considered that much of the expatriate population is accustomed to using public transport in their home countries. Moreover, consultation undertaken at the start of the Plan demonstrated that a wide cross section of society would be willing to use alternative modes to the car.

There is strong evidence of worsening health in Abu Dhabi in the form of increasing levels of obesity, childhood diabetes and heart disease. If healthier options for travelling were introduced, and people were encouraged out of their cars, this could provide a strong boost to health. Walking 20 minutes a day is one way to incorporate exercise into a daily routine to maintain a minimum level of fitness, but if there is no infrastructure to allow this, then car use will be preferred, even for the shortest trips.

B8 References

1. UAE Census 2005.

2. Department of Planning and Economy, Abu Dhabi.

3. Plan Abu Dhabi 2030: Urban Structure Framework Plan. Urban Planning Council. Sep 2007.

4. Abu Dhabi Policy Agenda. Executive Council 2007.

5. Plan Al Ain 2030: Urban Structure Framework Plan. Urban Planning Council. Apr 2009.

6. Validated 2008 Abu Dhabi Enhanced Transport Model

7. Appendix B Traffic Modelling. Abu Dhabi Surface Transport Master Plan. May 2009.

8. Various sources.

9. International Energy Agency (IEA) Statistics Division 2006.

Part C
The Choices

Part C – The Choices

C1 Overview

In order to determine the best transport system for Abu Dhabi in 2030, it was necessary to evaluate a wide range of choices. A rigorous technical process was applied, based on international best practice whereby alternative scenarios were identified, modelled, evaluated and further developed by an iterative process in order to define a preferred scenario. The preferred scenario was in turn refined through a further set of modelling and evaluation exercises to reach the final Plan.

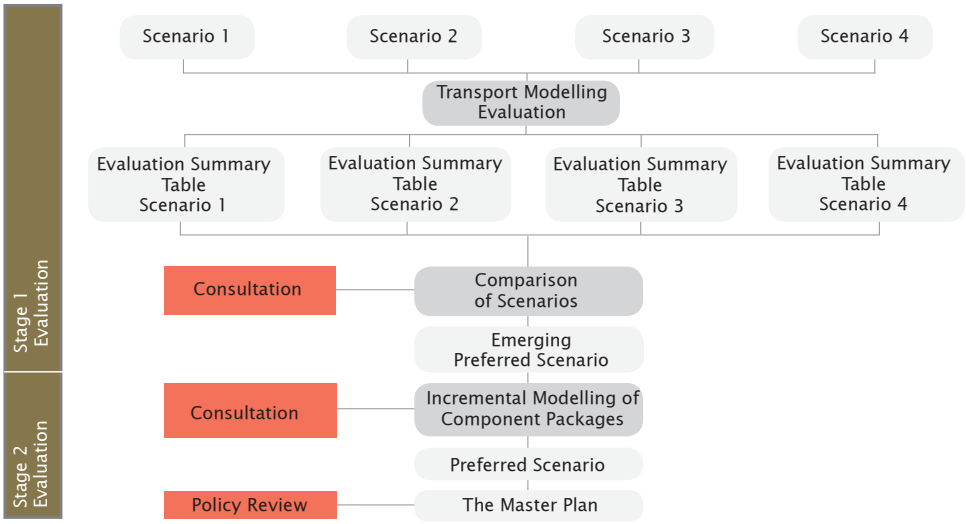
C2 The Evaluation Process

C2.1 Overview

The evaluation was based on a two stage process (Figure C1). In the first stage, four alternative scenarios were defined and subject to a broad evaluation against the project objectives. In parallel to this, a first sift of policy and physical components was made to identify priorities and to reject components that were considered to be undeliverable. A comparison of the scenarios was then made in order to identify an emerging preferred scenario.

In the second stage, this emerging preferred scenario was subject to iterative testing of packages of components and policies. The results enabled an overview to be taken of the performance of each package against each objective. Concurrently, a qualitative evaluation of each scenario component was made against the key Plan objectives. This analysis of individual components provided an understanding of which components contribute best to the achievement of objectives and informed the choice of components to be included in the preferred scenario; it also acted as a mechanism to screen out components that made little contribution to the objectives. Stakeholders were involved at key decision points in the process, contributing to the selection of the alternatives, the identification of the emerging preferred scenario and the selection of the preferred scenario.

Figure C1: The Evaluation Process



C2.2 Setting Goals, Objectives and Indicators

As discussed in Part A, the Plan has a vision, a set of goals and a set of objectives. The vision is to develop:

A world-leading transport system that meets the needs of residents, visitors and businesses in the most efficient, safe, attractive and environmentally sustainable way.

The goals are:

Goal 1: Economy – Promoting economic competitiveness and vitality through efficient, high quality transport services for passengers and freight.

Goal 2: Society and Culture - Protecting and enriching people's lives by maximising safety and access to opportunities for all.

Goal 3: Environment - Delivering world leading performance in environmental sustainability, through responsible use of resources, minimising pollution, and preserving Abu Dhabi's unique environment.

In order to measure the contribution of the alternative scenarios to the goals, ten objectives were set to provide more direction to the design of the Plan (Table C1). Each of these objectives has one or more measurable indicators that were used to assess the contribution of the alternatives to the objective.

C2.3 The Strategic Evaluation Framework

In order to evaluate the alternative scenarios and the individual schemes, a Strategic Evaluation Framework (SEF) was developed. The SEF was developed

using international best practice and existing elements of guidance already used in Abu Dhabi. The multi-criteria framework approach used provides decision makers with a more comprehensive understanding of the main beneficial and adverse impacts of each scenario measured using common criteria (economic, environmental and social). It aims to ensure that all relevant impacts are captured in some way, even if they cannot be quantified and valued in the same way as the components of a conventional cost-benefit analysis (see Appendix D).

Table C1: Objectives and Indicators

Objective	Indicators
ENVIRONMENT GOAL	
Develop a low carbon economy in Abu Dhabi by 2030	CO_2 emissions Qualitative assessment of impact on fuel and energy use
Preserve the critical natural environment that makes Abu Dhabi unique	Qualitative assessment of impact on natural environment (biodiversity, water, soil)
Protect and enhance the cultural heritage, landmarks, national symbols and monuments of Abu Dhabi	Qualitative assessment of impact on townscape character, landscape & heritage
Other Environment (noise and local air quality)	Qualitative assessment of impact on noise and local air quality
SOCIETY & CULTURE GOAL	
Improve the international connectivity of Abu Dhabi	Qualitative assessment of access to neighbouring Emirates & countries and airports
Improve regional connectivity within the Emirate of Abu Dhabi	Qualitative assessment of access between Abu Dhabi metropolitan area, Al Ain and Al Gharbia
Improve connectivity within the Abu Dhabi Metropolitan area	Qualitative assessment of access to key employment, business and tourist destinations within Abu Dhabi Metropolitan area, including Suwa Island, Saadiyat Island, Marina Mall, Capital District, Central Market Station
Encourage sustainable and efficient freight distribution	Qualitative evaluation of sustainability of multi-modal access to Mussafah and KPIZ
Improve health and safety for the workforce passengers and communities	Qualitative assessment of impact on number of road traffic accidents
Enhance the pedestrian realm	Qualitative assessment of impact on pedestrian realm
ECONOMY GOAL	
Minimise congestion on Abu Dhabi's road network for residents, visitors and businesses	Vehicle hours delay per vehicle
Reduce reliance on the automobile and encourage alternative modes of travel	Percent mode share of public transport

C2.4 The Enhanced Transport Model

In order to develop, test and evaluate the alternative scenarios, a transport model is an essential tool. The existing Abu Dhabi Municipality model (ADM) was not suitable for this purpose as it could only simulate road traffic. Within the timeframe available for the study, the new model was developed from the ADM and is based on the same trip generation relationships that were calibrated and validated using data that is now some eight years old. Although Abu Dhabi has changed significantly in the interim period, the ADM and the Enhanced models are both based on the trip making characteristics of representative individuals and households.

Most other aspects of the model, from distribution to mode choice and assignment have been significantly enhanced. The most significant change was for mode choice where the network of services and the level of service of each mode of transport was incorporated into the mode choice model. This was required to enable the testing and evaluation of regional rail, metro, tram, bus and ferry alternatives as components of the Plan.

To calibrate the enhanced model, the 2008 base year land use and socio-economic data was developed, based on detailed information from the 2005 Census adjusted to 2008 conditions based on the best available data on population changes and information on newly completed buildings. To complement available traffic data for Abu Dhabi Metropolitan area, and the rest of the Emirate, traffic counts, vehicle occupancy surveys and journey time surveys were also undertaken in May 2008 covering each of the model time periods:

- Morning (AM) peak 07:00 – 08:00
- Afternoon (PM) peak 14:00 – 15:00
- Evening (EV) peak 19:00 – 20:00

The Enhanced Model has been validated against these traffic counts and journey time surveys for each of the model time periods (see Appendix B). The comparison of observed and modelled journey times and flows on links, as illustrated by the examples presented in Figures C2 and C3, was found to be acceptable giving confidence in the application of the model under different scenarios.

Figure C2 Example of Journey Time Validation
Observed v Modelled Morning Peak Journey Times for Route 3 Southbound

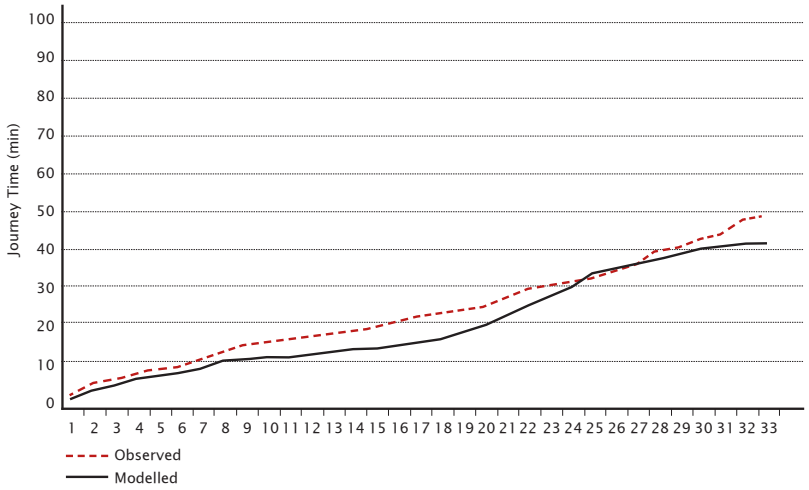
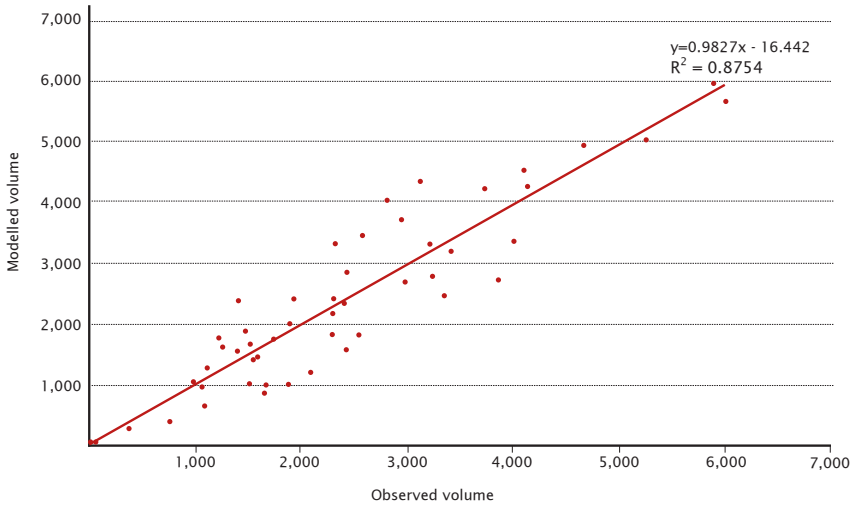


Figure C3 Example of Traffic Count Validation
Observed v Modelled Morning Peak Car Volumes by Link



Based on close coordination with ADUPC, the expected 2030 land use and socio economic scenario, as described in Part B, was distributed across the 931 traffic zones used within the model, based largely on planned development changes from the 2008 base year. The 2030 scenario reflects the Plan Abu Dhabi 2030 vision for development. On the basis of indicative phasing of developments, a process of interpolation was adopted to generate corresponding land use and socio economic scenarios for the intermediate years of 2015, 2020 and 2025 (for details see Appendix C).

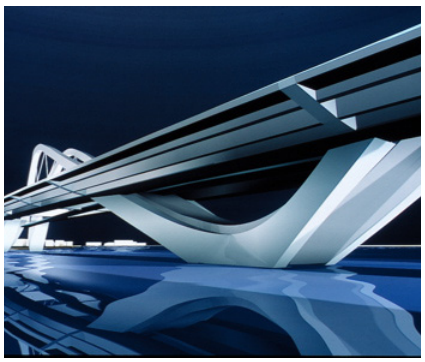
The Enhanced model was then used as a tool for developing, testing and evaluating the alternative scenarios, described in subsequent sections. In each case, model runs were carried out for all three model time periods although for simplicity only the morning peak results are presented since these represent the time with the greatest travel demand. The model has also been used to test the phasing of components and to determine when major elements of the Plan need to be in operation.

C3 Identification of Alternative Scenarios

C3.1 Overview

The future scenarios had to represent a variety of different ways in which transport could meet the Plan goals and objectives. The scenarios needed to be challenging and wide ranging in order that all possible solutions were considered in reaching the final Plan. The scenarios were put together in a strategic workshop in which key stakeholders and the project team brain-stormed a wide range of potential solutions, for which four broad scenarios, in addition to a reference (baseline) case, were developed. These scenarios included both physical infrastructure components as well as policy measures, as follows:

- **Scenario 1:** A highways based scenario designed to facilitate road based transport.
- **Scenario 2:** A public transport and car alternatives scenario designed to encourage use of non-car modes.
- **Scenario 3:** A demand management scenario designed to influence the mode of travel through mechanisms such as pricing.
- **Scenario 4:** A low carbon scenario designed to reduce carbon emissions.



The Reference Case includes committed schemes and is the basis for comparison with the alternative scenarios.

C3.2 The Reference Case

The Reference Case comprises the existing highway network plus already committed highway schemes and the planned improvements to bus services, and forms the basis for comparison with the alternative scenarios.

The key committed schemes included in the Reference Case are:

- Sheikh Zayed Bridge
- Saadiyat - Shahama Freeway

- Shahama Freeway Extension to E11
- Mafraq – Ghwaifat Upgrading (E11)
- Gayathi - Madinat Zayed Road
- Salaam Street Tunnel with 4 grade separated junctions
- Saadiyat Bridge to Al Meena Street Tunnel
- Bridges connecting CBD to Suwa Island
- Bridges connecting Suwa Island to Reem Island
- Al Ain to Dubai Highway (E66) Upgrading
- Lulu Highway
- Al Ain Northern Bypass
- Implementation of the Parking Management Strategy within the Abu Dhabi CBD

The following projects were also included as committed, but are subject to final ratification:

- Lulu Island tunnel links and associated junction improvements
- Electra Street underpasses at Junctions 6 and 4
- Bainuna Street widening

In terms of public transport, the Reference Case is limited to the roll-out of the planned DoT bus fleet of 1,360 buses.

C3.3 The Highways Scenario

The highways based scenario was designed to meet the Plan objectives through the provision of a highway system alone, which would cater for private vehicle movements as well as road-based public transport and a road-based freight network. This would involve expansion of the existing road network including the development of some additional routes for both general traffic and freight traffic. It would require significant land take for new highways infrastructure and also involve provision of extensive parking within key locations such as the CBD and Capital City.

The Highways Scenario was designed to test if increased highway capacity could solve 2030 transport needs.

This scenario includes the following components in addition to those in the Reference Case:

- An increase in the road network capacity through widening of existing

freeways including the E10, E11, E20 and E22, upgrading selected key routes within Abu Dhabi to freeways with provision of grade separated junctions, upgrading existing distributor roads and provision of some new roads

- Development of some additional strategic links including the Mid Island Parkway, Desert Highway extension and a new link from Capital City to Abu Dhabi Island to provide additional capacity from the mainland to Abu Dhabi Island
- Upgrading the E15, E65 and E90 to two lanes in each direction to improve safety
- Definition of a road hierarchy that would assist in imposing controls over the network
- Introducing traffic management measures to improve traffic flows and capacity, traffic calming and a comprehensive system for real-time traffic management
- Improving safety on the road network through improved driver education and training, greater enforcement of traffic violations, increased vehicle safety checks and regulations for freight vehicles
- Introduction and enforcement of a Highway Code to regulate driving conditions in the Emirate and allow for increased enforcement of violations
- Development of a rapid bus-based transit system that would follow key corridors and freeways
- Introduction of a network of local bus services to link in with the rapid bus services
- Transfer of some road space to high-volume public transit and high occupancy vehicle lanes and provision of some private toll lanes on freeways to accommodate drivers prepared to pay a fee to bypass traffic congestion
- Increased provision of taxis including formalised shared taxis, with improved taxi infrastructure such as additional taxi ranks at locations outside of those already provided at hotels and malls, a centralised taxi booking service and use of a GPS booking system for taxis
- Encouraging greater use of school buses and bus services for key employment and educational facilities

- Provision of new highway capacity for freight, including a dedicated truck route from Mussafah to Khalifa Port via an alignment parallel to the E11, extension of existing freight routes, improved signage and strategic location of distribution centres and new truck stops and parking
- Extensive event management strategy for concerts, sporting and religious events to manage the impact on the highway network
- Extensive parking strategy, which includes both on and off-street parking management, extension of controlled parking zones and standards for new developments
- Extensive provision of new on and off-street parking within developments in Abu Dhabi.

In this scenario, management of the highway network would be critical in maintaining the flow of traffic around the network and traffic enforcement would be an important component in managing the demand for parking space and the efficient movement of freight.

C3.4 The Public Transport Scenario

A very comprehensive public transport system was identified for the Public Transport Scenario.

The public transport scenario was designed to meet the Plan objectives by maximising the quality and availability of public transport to provide an effective, easy to use and popular alternative to the private car and to encourage non-car modes. This scenario proposed a substantial expansion of the public transport network compared to the Reference Case, including regional rail, metro, tram, bus, passenger ferries and personal rapid transit. The public transport network would be fully integrated to ensure entire trips can be made from “door to door”. In addition, there would be wholesale provision of segregated pedestrian and cycling facilities and use of water transport for passenger services.

This scenario includes the following components in addition to those in the Reference Case:

- Introducing traffic management measures to improve traffic flows and capacity, traffic calming and a comprehensive system for real-time traffic management
- Upgrading the E15, E65 and E90 to two lanes in each direction to improve safety
- Development of a regional rail network throughout the Emirate including

high speed rail links to Dubai, Al Ain and potentially Qatar with regional stopping services where appropriate, including potential stops at Ruwais, KPIZ, Shahama and Mafraq

- Development of an extensive Metro network, which would provide high quality mass transit around Abu Dhabi and the Capital City, with direct links to the Abu Dhabi International Airport and key locations around the metropolitan area
- Development of an extensive network of trams, light rail transit and bus rapid transit throughout the Abu Dhabi metropolitan area to link Metro stations with education and health facilities, commercial developments and other key development areas around the city. The development of this network would provide a high capacity public transport alternative where Metro services could not be developed or justified
- A fine grained network of local bus services to link residential areas, commercial districts, and other key developments with tram and metro stops in order to provide an integrated public transport network
- An enhanced inter-regional long distance coach network between key locations in the Emirate
- Development of relevant support infrastructure for the public transport network including smartcard technology to facilitate integrated ticketing for the whole network and real time travel information for passengers
- Development of key multi-modal interchanges to allow passengers to easily transfer between the Metro, tram and bus services. The development of interchanges is imperative as it would focus the network on key points and make it easier to navigate around the public transport network
- Improvements around Metro stations and key interchanges to improve conditions for pedestrians including air-conditioned walkways, quality signage and on-street pedestrian improvements
- Provision of park and ride sites at key locations to encourage transfer of trips on to the public transport network. To support interchange, controlled parking measures could be introduced around Metro stations
- Development of a water-based public transport passenger network including a mix of scheduled ferry services around Abu Dhabi, water taxis, long-distance services to Dubai and other regional locations and improved regulation of use of waterways in Abu Dhabi to improve safety

A full range of demand management tools was incorporated in the Demand Management Scenario to assess the scale of complementary measures that might be required to meet 2030 needs.

- Development of a freight distribution network that reduces the demand on movements of goods on the highway network including new rail lines to Dubai and Al Ain from KPIZ and a network of distribution centres in key locations
- Provision of improved cycle facilities around interchanges, development of pedestrian-only streets in key locations, provision of pedestrian-only phases at traffic signal junctions and new mid-block pedestrian-only traffic signals in the CBD.

C3.5 The Demand Management Scenario

International experience has demonstrated that a public transport system has to be complemented by demand management measures if it is to be fully effective. The Demand Management Scenario, therefore, was designed to meet the Plan objectives by introducing a variety of measures to control highway traffic demand combined with provision of an extensive public transport network.

The Demand Management Scenario contains the following components in addition to those in the Public Transport Scenario:

- Introduction of congestion charging as well as cordon pricing for entering the Abu Dhabi metropolitan area
- Free public transport fares and park-and-ride fares in the Metropolitan area
- Improved management of parking, including on and off-street parking charges and extension of controlled parking zones
- Removal of fuel subsidies, introduction of a tax on fuel and annual vehicle registration fees and safety tests
- Provision of information services including improved communication and marketing of public transport services and initiatives, travel planning for individuals, workplaces and education facilities and improved event management strategies
- Encouragement of car-clubs in the metropolitan area to reduce vehicle usage and development of extensive network of Variable Message Signs (VMS) to improve network management and inform drivers of road conditions.

C3.6 The Low Carbon Scenario

The Low Carbon Scenario was identified in order to test the impact of a wide range of carbon reduction measures.

The Low Carbon Scenario was designed to meet the environmental objectives of the Plan through the reduction of carbon emissions arising from transport by encouraging environmentally friendly forms of transport and introducing alternative energy and fuels. This could be viewed as extending the carbon neutral, zero waste principles adopted for Masdar to the whole Emirate to achieve One Planet Living.

This scenario sought to complement public transport by encouraging a shift to alternative fuels in order to reduce carbon emissions. It also included a range of measures to encourage non-polluting forms of transport through provision of sustainable infrastructure for walking and cycling and measures, both voluntary and mandatory, for reducing car use.

The Low Carbon Scenario contains the following components in addition to those in the Public Transport Scenario:

- Use of alternative fuels (such as hydrogen) and low-emission buses on the public transport network in Abu Dhabi together with some routes operating on a “demand responsive” system where buses serve stops when required
- Provision of passive cooling and shading rather than air-conditioning, where feasible
- Introduction of a low emission zone for Abu Dhabi, Suwa, Al Reem and Saadiyat Islands, which would charge vehicles for entering the zone depending on their carbon emissions
- Introduction of a low emission zone for Capital City District, which would charge vehicles for entering the zone depending on their carbon emissions
- Introduction of a vehicle tax depending on emission levels
- Introduction of subsidies for alternative fuels and parking charges according to the fuel efficiency of vehicles
- Improved management of parking including extension of controlled parking zones
- Transhipment of freight and deliveries from distribution locations by electric, low pollution vehicles or freight trams
- Provision of improved cycle facilities around interchanges and cycle hire schemes

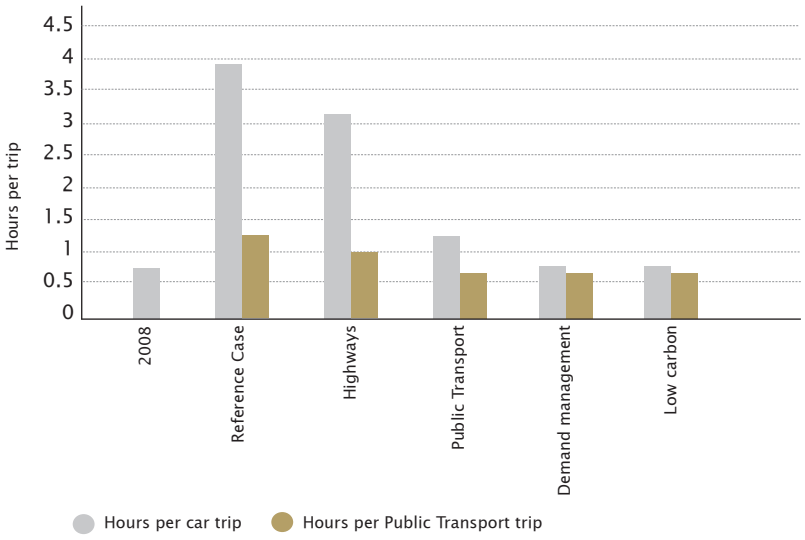
- Development of Personal Rapid Transit (PRT) networks.

Many of the measures proposed were complementary to the provision of a public transport network and reflected the desire to manage growth through pricing, policy and physical measures that reduce the level of carbon emissions.

C4 First Stage Evaluation

The Enhanced Transport Model was used to test the Reference Case and each of the alternative scenarios. The model results indicated that the Reference Case and the Highways Scenario, in particular, would result in severe overloading of the highway network and unacceptable journey times. The results are presented in Figure C4. However, these are only indicative for the Reference and Highway Cases as the model was unable to converge satisfactorily to balance the traffic demand with the available supply of road space due to the large growth in overall travel demand and the lack of alternatives.

Figure C4: Results of First Phase Transport Modelling - 2030 morning peak



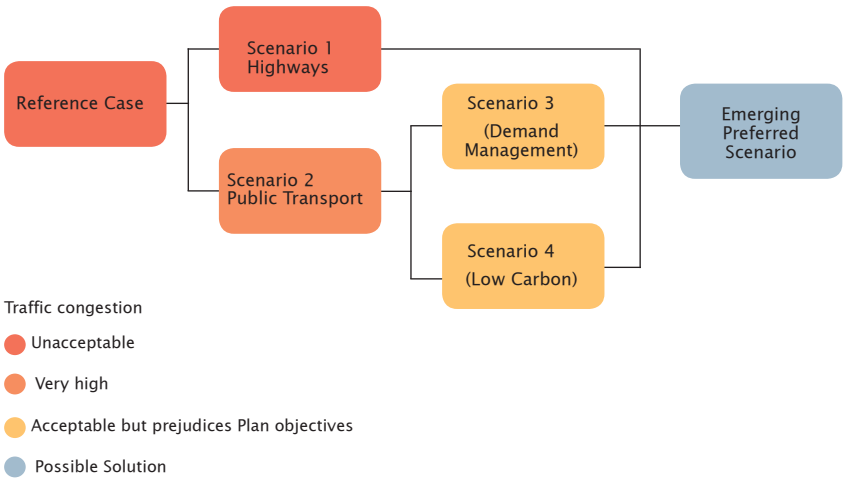
The initial assessment indicated that the Reference Case and Highways Scenario had significant environmental, economic and social impacts that would be detrimental to Abu Dhabi and would not support the Plan goals.

Whilst the initial environmental, economic and social assessment of the Demand Management and Low Carbon Scenarios indicated that their impacts

would be far less than the other scenarios, it became clear from the Strategic Evaluation Framework (SEF) that no single scenario as initially presented would ultimately satisfy the requirements of Plan Abu Dhabi 2030.

As a result of the initial modelling and the corresponding environmental, economic and social assessment, it became apparent that a hybrid of all the scenarios would be required to achieve the Plan vision.

Figure C5: The Evaluation of Scenarios



The first stage of evaluation demonstrated that elements of all the scenarios would be needed to achieve the Plan Goals.

C5 Second Stage Evaluation

C5.1 Identifying the Emerging Preferred Scenario

An Emerging Preferred Scenario was developed from the results of the initial testing and evaluation. The components and policies that were combined to make up the Emerging Preferred Scenario included infrastructure and policy elements from all scenarios developed throughout the study process.

The infrastructure components included in the Emerging Preferred Scenario were those with positive environmental, economic and social impacts as well as those contributing positively to meeting the overall travel demand on the transport network. The combination of these measures provided a base from which to test further elements and specifically different levels of demand management policy interventions.

The development of the Emerging Preferred Scenario also provided the opportunity to remove those components that were not to be taken through for more detailed evaluation, such as those with severe adverse environmental impacts.

Key stakeholders were consulted at each stage of the evaluation.

The Emerging Preferred Scenario was discussed at a workshop with over 200 key stakeholders in November 2008, with feedback used in the evaluation of scenario components. A review by a panel of eleven international experts was a key component of this process.

The Enhanced Transport Model was used to run a significant number of different iterations over varying time periods, testing alternative levels of demand management measures, policies and the location or composition of different schemes. At the same time, individual assessments of each component were completed using the SEF. As a result of this, and the consultation, a number of schemes were dropped and a number of policies were strengthened or removed and the Preferred Scenario was identified.

C5.2 Testing the Preferred Scenario

C5.2.1 Overview

In order to ensure that the modelling tools being used during the evaluation of the Preferred Scenario were suitable, a number of alterations were made to the model matrices and networks. A number of presentations were made on the interim results of the network alterations and guidance provided by the DoT, ADUPC and other stakeholders on where aspects of the model needed to be addressed. Upon completion of these base runs and strengthening of the model network, further model runs were carried out to assess the impacts of alterations, such as inclusion of a new scheme or stronger demand management measures. A significant number of tests were conducted that examined proposed changes which had come from:

- Stakeholder Workshops
- Experts' feedback
- Feedback from Public Consultation exercise
- Individual sessions with stakeholders
- Technical sessions with DoT and ADUPC.

C5.2.2 Modelling of Demand Management

The inclusion of demand management measures within the Preferred Scenario has been subject to extensive evaluation throughout the study process. In the assessment of the Preferred Scenario a range of demand management measures was tested in combination with different packages of infrastructure in order to identify the optimal balance of infrastructure

provision and demand management. The principal measures tested were parking charges, fuel taxes and congestion charges. These were broad measures designed to ascertain the order of magnitude of intervention that will be needed to achieve good future levels of transport service. The exact form of the measures and the level of charges needed will be determined following further assessment (see Section D1.4). The measures tested for 2030 (with all prices in 2008 values) were:

- Parking charges between AED5 and 10 per hour in the CBD and Capital City District
- Global fuel tax between AED0.25 and 1.0 per km on all vehicles
- Congestion charge on inner cordon (bridges to Abu Dhabi Island) between AED10 and 20 per vehicle
- Congestion charge on outer cordon (Shahama Freeway and Mid Island Parkway) between AED5 and 10 per vehicle

The modelling assumed that public transport fares will be maintained at low levels to maximise patronage with a flat fare on Metro, tram and bus services of AED 3 per trip, with a supplement of AED 0.7 per km on long distance regional rail trips.

C5.2.3 Results of the Modelling

The modelling of the various combinations of infrastructure improvements and demand management measures demonstrated that all of the schemes identified in the Public Transport Scenario together with a large number of highway components will be needed, in addition to significant demand management measures, if acceptable levels of transport service are to be achieved in 2030. A summary of the infrastructure components and key demand management elements which were shown to be needed in the modelling is set out in Table C2.

The results of the modelling are summarised in Figures C6 – C11, which present separate comparisons for each model time period, ie morning, lunchtime and evening peaks respectively. The top figure of each pair illustrates that without the Plan the highway network in the Metropolitan area will be largely over–capacity (and in many areas extremely so) in 2030. The lower figure of each pair illustrates that with the Plan infrastructure components and a full range of demand management measures, as set out in Table C2, congestion can be managed and the majority of the

transport network will be within capacity, with the public transport network accommodating around 40% of peak hour trips.

Table C2 Key Elements of the Preferred Scenario

Element	Description
Regional Passenger Rail	590km system of inter-regional rail forming part of a future UAE and GCC-wide passenger rail system
Freight Rail (Union Railway)	1300km system of inter-regional rail forming part of a future UAE and GCC-wide freight rail system
Metro	130km of segregated railway in Abu Dhabi Metropolitan area
Tram	340km of street running tram in Abu Dhabi Metropolitan area
Personal Rapid Transit	Demand-responsive system planned for Masdar, and potentially Lulu
Bus	A fine grained bus network will be provided in all urban areas not served by tram or metro
Water Transport	A system of scheduled ferry services along both sides of Abu Dhabi island
Highways	1500km of new or upgraded highways
Parking charges	Charge of AED10 per hour in the CBD and Capital City District
Global fuel tax	Tax equivalent to AED1 per km on all vehicles
Congestion charge on inner cordon (bridges to Abu Dhabi Island)	Charge of AED20 per cordon crossing
Congestion charge on outer cordon (Shahama Freeway and Mid Island Parkway)	Charge of AED10 per cordon crossing

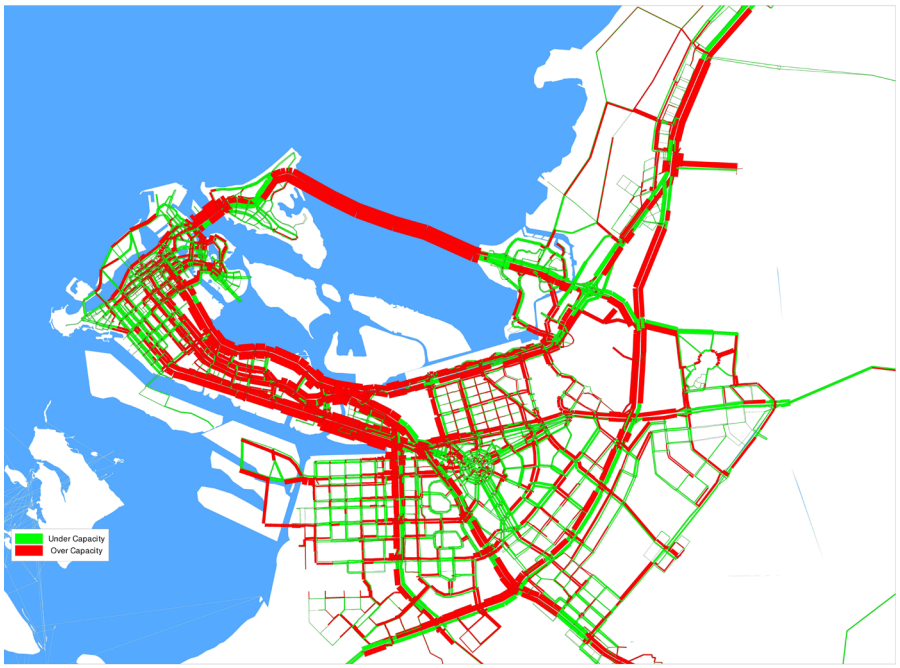


Figure C6: Traffic congestion in the 2030 morning peak without the Plan

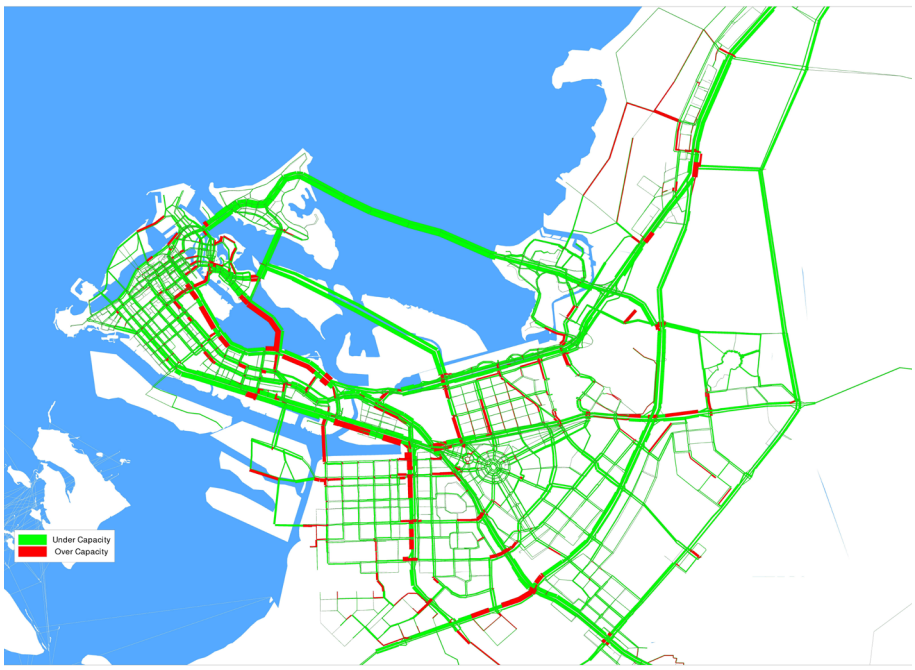


Figure C7: Traffic congestion in the 2030 morning peak with the Plan

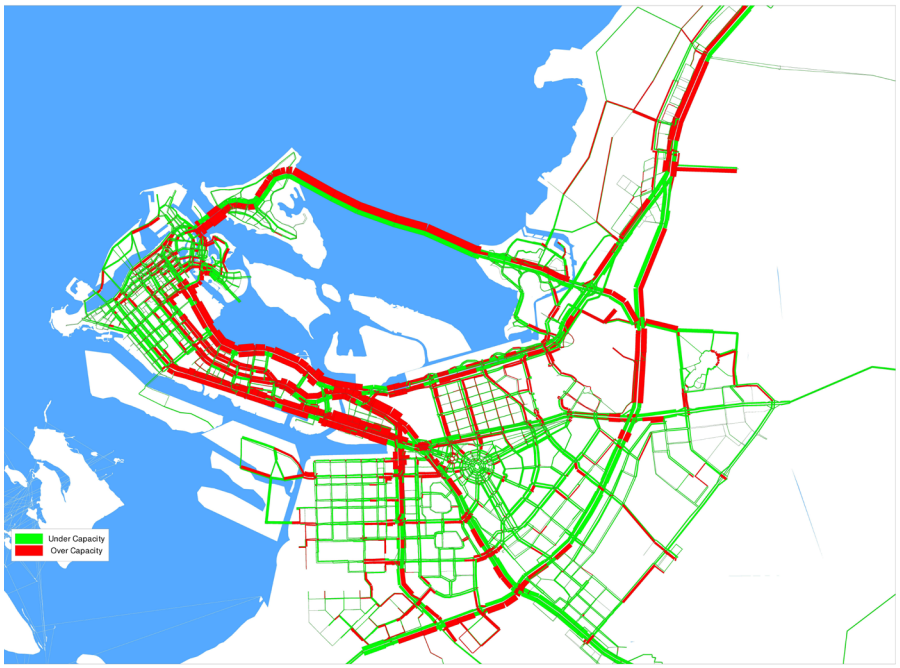


Figure C8: Traffic congestion in the 2030 lunchtime peak without the Plan

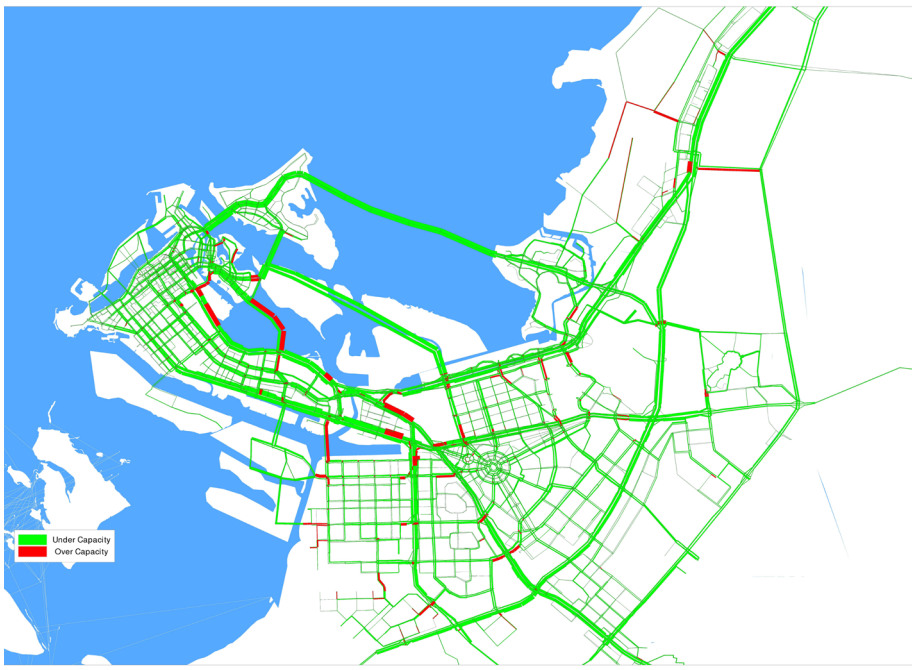


Figure C9: Traffic congestion in the 2030 lunchtime peak with the Plan

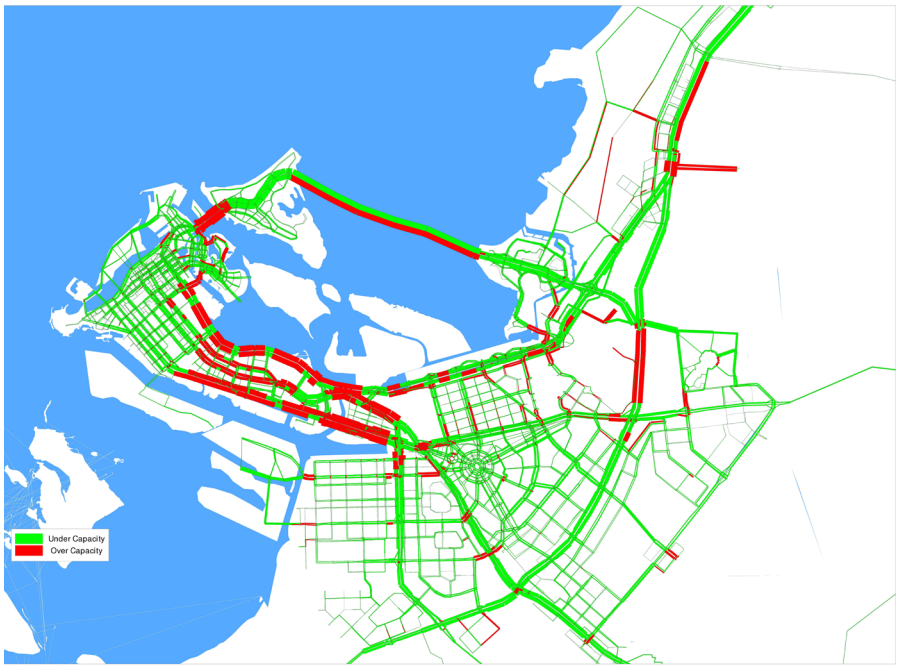


Figure C10: Traffic congestion in the 2030 evening peak without the Plan

Figure C11: Traffic congestion in the 2030 evening peak with the Plan

C5.2.4 Environmental Evaluation

The environmental evaluation measured the contribution of the Preferred Scenario towards the environmental goal of:

'Delivering world leading performance in environmental sustainability, through responsible use of resources, minimising pollution, and preserving Abu Dhabi's unique environment.'

This goal has the following second level objectives:

- Develop a low carbon economy in Abu Dhabi by 2030
- Preserve the critical natural environment in Abu Dhabi
- Protect and enhance cultural heritage, landmarks, symbols and monuments
- Other environmental evaluation criteria including:
  - Local air quality
  - Noise

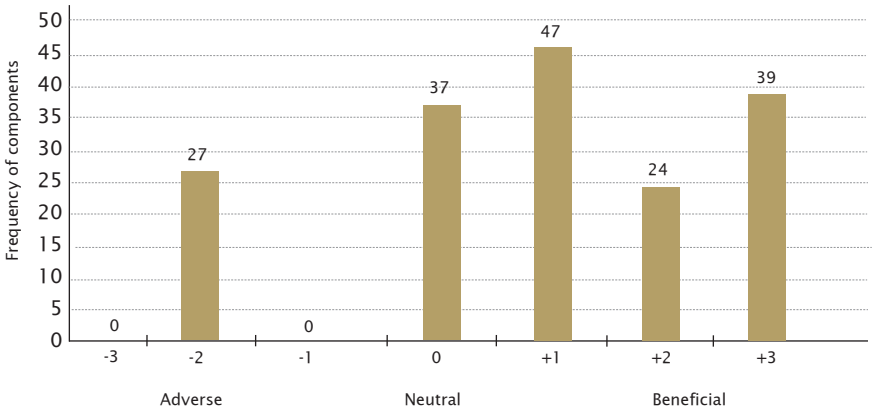
The reduction of Carbon Emissions is central to the Plan and to reducing the impacts of climate change on Abu Dhabi's unique environment.

Develop a Low Carbon Economy in Abu Dhabi by 2030

Reduction in carbon use and CO_2 emissions is a key requirement for the Plan to strive towards sustainability. The Preferred Scenario contained extensive public transport components as part of a low carbon approach, alongside world leading sustainable transport components such as PRT systems, low emissions zones, alternative fuel initiatives, passive cooling of public transport facilities, cycling schemes, freight movements transferred to rail, multimodal distribution centres and car free areas.

The Preferred Scenario showed an overall beneficial impact in achieving a low carbon economy in Abu Dhabi by 2030 in comparison to the Reference Case. However, a large number of highways components required to provide sufficient transport capacity remained in the Preferred Scenario after the secondary evaluation. Figure C12 illustrates the number of scenario components according to their SEF score. The highways components resulted in the remaining adverse scores towards achieving the low carbon objective.

Figure C12: Contribution of Plan Components to Low Carbon Objective



In comparison with the 2030 Reference Case, the Preferred Scenario showed a 35% reduction in CO_2 emissions. This reduction in CO_2 emissions significantly reduces Abu Dhabi's contribution to global greenhouse gases and thus impact on global warming and climate change. However, it should be emphasised that real reductions from today's emission levels are urgently required to stabilise global emissions and to counteract climate change.

The magnitude of reduction required to fulfil international obligations of a reduction of 80% in CO_2 emissions by 2050 will only be achieved by far greater effort. To this end, any policies to encourage greater use of renewable energy for transport are strongly encouraged. This may be better achieved with a largely electrically powered public transport system, which could include trolley buses in place of diesel buses.

These emissions calculations did not consider reduction of CO_2 produced at the power station by electricity generation for the electrified regional rail, metro, trams and PRT. If this electricity was provided by a low carbon source such as renewables, this would further reduce CO_2 emissions.

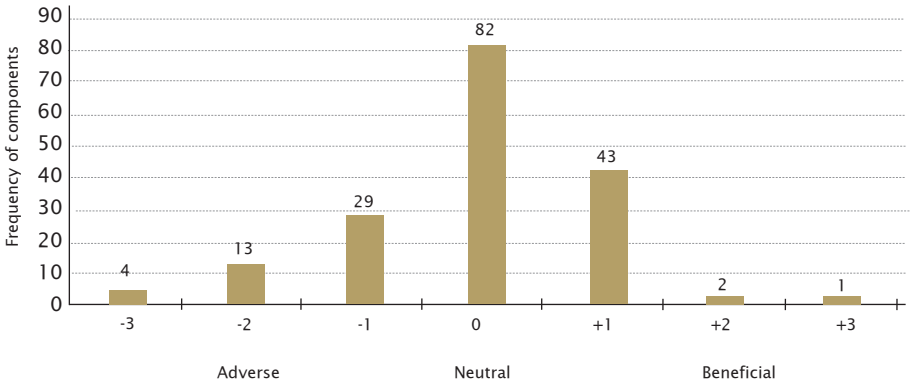
This evaluation of the Preferred Scenario revealed that for a truly world leading effort in carbon emissions reduction, the Preferred Scenario should be operated with all electrical energy generated from renewables and low carbon sources. A commitment in energy and carbon policy will be required calling on collaboration between the Abu Dhabi government and energy industry stakeholders.

The Plan aims to protect sensitive aspects of Abu Dhabi's natural environment.

Preserve the Natural Environment in Abu Dhabi

Abu Dhabi's islands, sand dunes, sea, coastlines and native wildlife all blend to create Abu Dhabi's incredibly intricate, sensitive and unique natural environment. As shown in Figure C13 the evaluation showed there were components in the Preferred Scenario with potentially significant negative impact on the critical natural environment of Abu Dhabi. The potential impacts of these remaining components were therefore studied in more detail.

Figure C13: Contribution of Preferred Scenario Components to Natural Environment Objective



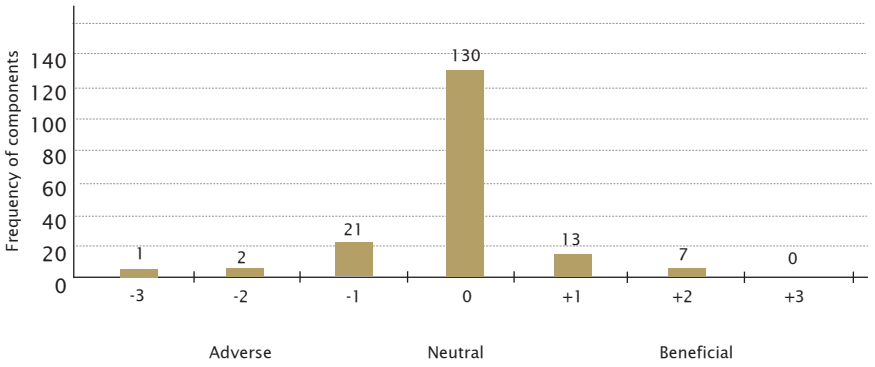
The Plan seeks to minimize the impact on Abu Dhabi's cultural heritage

Protect and Enhance Cultural Heritage, Landmarks, Symbols and Monuments

The Plan makes a commitment to protect key heritage sites, landmarks, national monuments and key townscapes of the urban environment. Overall, the Preferred Scenario was shown to have a neutral impact on cultural heritage landmarks and symbols of Abu Dhabi, as seen in Figure C14. Effort will be made to ensure the design of all infrastructure and associated buildings of the Plan act to provide a positive enhancement of the cultural heritage of the Emirate.

The Preferred Scenario will improve air quality compared to the Reference Case.

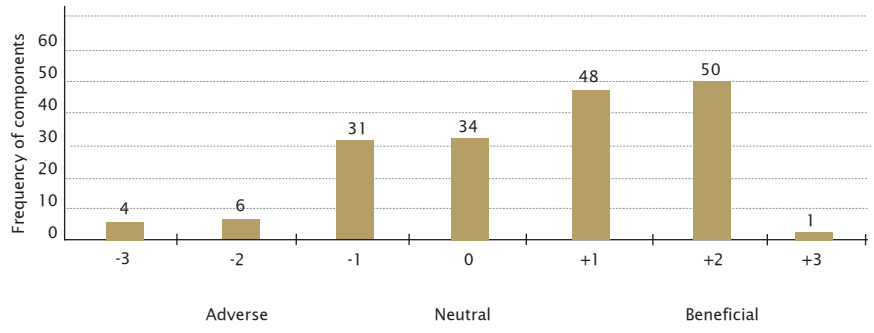
Figure C14: Contribution of Preferred Scenario Components to Cultural Heritage, Landmarks, Symbols and Monuments Objecive



Other Environmental Evaluation Criteria (Noise and Local Air Quality)

Noise nuisance from transport can adversely affect the quality of living in local communities. Exhaust emissions from transport currently reduce local air quality leading to damage to human health and impacts on the urban environment. The Preferred Scenario was shown to have a positive impact on local air quality and noise in comparison to the Reference Case, as shown in Figure C15. Noise and local air quality are already close to statutory limits in some parts of the Emirate. This evaluation has highlighted a potential for negative impacts and every effort will need to be made to avoid, minimise and mitigate these, especially in these areas already close to statutory limits.

Figure C15: Contribution of Preferred Scenario Components to Noise and



Local Air Quality Objective

C5.2.5 Social Evaluation

The contribution of the Preferred Scenario to the society and culture goal of *"Protecting and enriching people's lives by maximising safety and access to*

opportunities" has five second level objectives:

- Improve international connectivity
- Improve regional connectivity
- Improve connectivity within the Abu Dhabi Metropolitan area
- Improve health and safety
- Enhance the pedestrian realm

Improve International Connectivity

International connectivity is vital to the economic development of Abu Dhabi and is reflected in the objectives of Plan Abu Dhabi 2030. Changes in international accessibility have been evaluated using public transport journey times to Dubai and Abu Dhabi International Airport (AUH) as proxies for journeys outside Abu Dhabi. Table C3 shows that the Preferred Scenario results in a 46% reduction compared to the Reference Case.

Journey times to and from Abu Dhabi International Airport from the CBD will be reduced by 50% compared to the Reference Case.

Table C3: Indicators for Improvement of International Connectivity
(Public Transport Journey Time - mins)

Selected Journeys	Reference Case	Preferred Scenario	Percentage Improvement
To AUH from CBD	82	36	56%
To AUH from Capital District	40	14	65%
To Dubai from CBD	135	84	38%
To Dubai from Capital District	106	63	41%
Overall			46%

Note: journey times are for the AM peak in 2030

Improve Regional Connectivity

Regional connectivity is essential for a more cohesive and inclusive Abu Dhabi, particularly because of the differences (in terms of infrastructure and opportunities) between the capital and the other regions. Changes in regional accessibility have been evaluated on the basis of a reduction in public transport journey times to Al Ain and Al Gharbia from the Metropolitan area. Table C4 shows that the Preferred Scenario results in a 42% travel time saving

compared to the Reference Case.

Journey times from Abu Dhabi CBD to Al Gharbia will be reduced by over 50% compared to the Reference Case.

Table C4: Indicators for Improvement of Regional Connectivity (Public Transport Journey Time - mins)

Selected Journeys	Reference Case	Preferred Scenario	Percentage Improvement
To Al Ain from CBD	136	97	29%
To Al Ain from Capital District	108	76	30%
To Al Gharbia from CBD	221	113	49%
To Al Gharbia from Capital District	192	97	50%
Overall			42%

Note: journey times are for the AM peak in 2030

Improve Connectivity within the Abu Dhabi Metropolitan Area

Local connectivity is essential for daily mobility requirements, such as access to jobs, education, shopping and leisure activities. Changes in local accessibility have been evaluated on the basis of a reduction in the public transport journey times within the Metropolitan area. Table C5 shows that the Preferred Scenario results in a time saving of 56% compared to the Reference Case.

Journey times from the CBD to the Grand Mosque will be reduced by over 70% compared to the Reference Case.

Table C5: Indicators for Improvement of Local Connectivity (Public Transport Journey Time - mins)

Selected Journeys	Reference Case	Preferred Scenario	Percentage Improvement
CBD to Saadiyat Island	34	11	68%
CBD to Central Market Station	8	3	62%
CBD to Masdar	76	41	46%
CBD to Grand Mosque	83	33	60%
Overall			56%

Note: journey times are for the AM peak in 2030

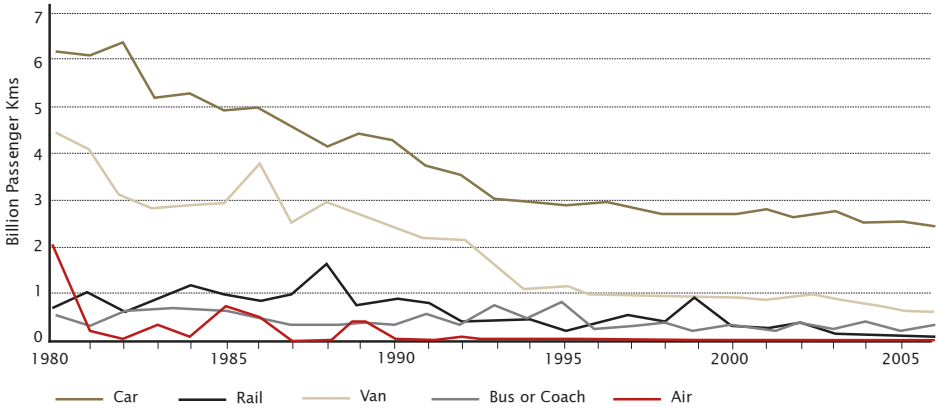
Improve Health and Safety

The transfer of trips from car to public transport within the Preferred Scenario will result in a reduction in the number of personal injury accidents as accident rates for public transport are generally substantially lower than accident rates for private cars, as illustrated in Figure C16.

The Preferred Scenario will generate significant benefits for the Pedestrian Realm.

This trend will be reinforced by Plan measures to reduce speeds, improve driver behavior and, very importantly, to reduce the number of accidents involving pedestrians and cyclists through improving street design and other measures.

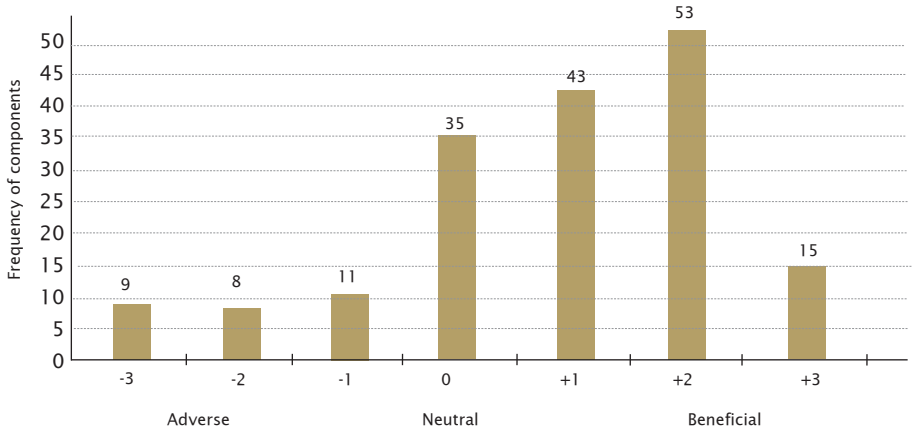
Figure C16: Example Accident Rates from the United Kingdom[1]



Enhance the Pedestrian Realm

The enhancement of the pedestrian realm is one of the key transport objectives of the Plan. Pedestrian improvements, which are often synonymous with enhancement of the public realm, are a constant theme throughout Plan Abu Dhabi 2030. In the comparative assessment carried out, the Preferred Scenario has the highest frequency of positive impacts and the lowest number of negative impacts as shown in Figure C17.

Figure C17: Contribution to Pedestrian Realm Objective



Overall journey times by car will improve by 50% compared to the Reference Case.

C5.2.4 Economic Evaluation

The economic evaluation is designed to measure the contribution of the preferred scenario to the economy goal of:

'Promoting economic competitiveness and vitality through efficient, high-quality transport services for passengers and freight.'

This goal has three second level objectives as follows:

- Minimise congestion on the road network
- Reduce reliance on cars and encourage alternative modes
- Encourage sustainable and efficient freight distribution

Further economic evaluation criteria include:

- Economic efficiency
- Economic activity

Minimise Congestion on Abu Dhabi's Road Network

Changes in congestion have been measured using average travel time per car trip to reflect congestion, and the travel time per passenger on public transport using direct output from the Enhanced Transport Model. The number of hours per vehicle (car) per trip and the hours per passenger on public transport (in vehicle time) are shown in Table C6. The results clearly demonstrate that the Preferred Scenario shows a substantial improvement as compared to the Reference Case.

Table C6: Indicators for the Impact on Minimising Congestion

Selected Journeys	Reference Case	Preferred Scenario	Percentage Improvement
Car Trip	85	40	53%
Public Transport Trip	26	21	18%

Note: journey times are for the AM peak in 2030

Reduce Reliance on Cars and Encourage Alternative Modes

Changes in the level of reliance on cars and the use of alternative modes have been evaluated on the basis of the changes in mode share of car, taxi, private transport and public transport using direct output from the study

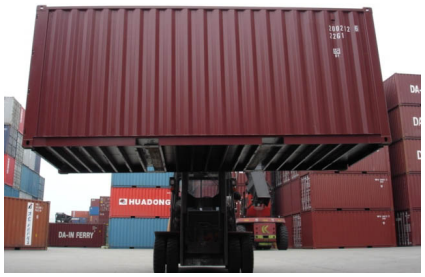
Enhanced Model. The mode share of car, taxi, private transport and public transport is shown in Table C7. A key objective of the Plan is to increase the public transport mode share, and this has clearly been achieved. It should be noted that the modelled Reference Case mode share for public transport (buses) is very optimistic and that the shift in use of Public Transport between the Reference Case and the Preferred Scenario is likely to be higher than that indicated.

Table C7: Indicators for the Impacts on Mode Share

Selected Journeys	Reference Case	Preferred Scenario	Percentage Change
Car Mode Share	59%	43%	-16%
Taxi Mode Share	11%	8%	-3%
Private Transport Mode Share	10%	7%	-3%
Public Transport Mode Share	20%	41%	22%

Note: Mode shares are for the AM peak in 2030

Encourage Sustainable and Efficient Freight Distribution



Reductions in traffic congestion will generate benefits for freight tranport.

Freight and passengers share a significant proportion of common infrastructure and consequently many of the transport objectives also have implications for the freight distribution system. The associated benefits are included within the overall evaluation.

In order to develop efficient freight distribution, the Preferred Scenario proposes a number of regional distribution centres within Abu Dhabi. The beneficial impacts of these include:

- Increased consolidation supports higher vehicle utilisation, thereby raising the efficiency of the freight transport system through reducing vehicle movements and lowers unit costs
- Promotion of multi-modal distribution centres (road, rail or water) provides scope for shifting of distribution away from road-based haulage
- Multi-modal distribution centres outside the urban centres offer the scope for re-consolidating inbound and return retail deliveries for single drop, rather than multiple delivery
- Central consolidation centres provide greater scope for the establishment and regulation of enhancements to safety and environment standards.

C5.2.5 Economic Efficiency

The impacts of the Preferred Scenario on the economic efficiency of the transport system were analysed on the basis of outputs from the transport model. The assessment quantified how reductions in congestion resulting from the provision of new transport infrastructure and modal shift from highways to public transport will generate savings in the costs of operating vehicles (the most important of which is fuel) and in terms of travel time saved by transport users.

By comparing the total monetary value of the transport benefits generated by the Preferred Scenario over its lifecycle, with the costs of constructing, operating and maintaining the system it is possible to establish the economic return of the investment. It is important to note that the economic return measures the contribution of the investment to overall society and reflects how efficiently resources are being used which is quite distinct from a financial assessment where the direct cash receipts from the investment are compared to its costs.

A standard discounted cashflow analysis methodology was used to calculate economic performance whereby all costs and benefits were projected for a 45 year assessment period (20 years construction to 2030 and 25 years operation) and discounted back to present year values for comparison using a range of discount rates from 3.1% to 5.0% to reflect different assumptions regarding the opportunity cost of capital in Abu Dhabi. The results are shown in Table C8.

The majority of benefits from the Preferred Scenario accrue from savings in travel time to transport users due to the significant congestion alleviation, which (as shown in C5.2.3) will reduce travel times by around 50% compared to the Reference Case.

Table C8 Economic Efficiency Benefits Generated by the Preferred Scenario (Present Values AED 1000 million in 2008 prices)

Benefit	3.1% Discount Rate	5.0% Discount Rate
Travel time savings	1,394	1,404
Vehicle operating cost savings	178	116
Total	1,572	1,520

When compared to the present value of the costs of constructing, operating and maintaining the system (Table C9) it is apparent that the benefits of the Preferred Scenario are significantly greater than its costs, with Benefit to Cost ratios in the order of 5:1 to 6:1, indicating that the investment is economically justified and indeed will contribute significantly to the economic efficiency of transport operations in Abu Dhabi.

Table C9 Summary of Results of the Economic Evaluation of the Preferred Scenario (Present Values AED 1000 million in 2008 prices)

Benefit/Cost	3.1% Discount Rate	5.0% Discount Rate
Present Value Benefits	1,572	1,520
Present Value Costs	333	249
Net Present Value	1,239	1,271
Benefit cost ratio	4.7	6.1

Economic Activity

The wider economic impacts of the different scenarios are wide ranging in terms of their nature and geographical coverage. Wider economic benefits arise as businesses and employees take advantage of increased accessibility from improved transport links – accessibility to jobs, markets, suppliers and other organisations resulting in productivity gains outside of conventional transport appraisal. At the same time, there are direct socio-economic impacts, predominately arising from effects on the labour market and the construction industry during the time of construction.

The scale of such benefits tends to be greater with public transport systems in densely populated urban areas. Certainly, highway improvements along transport corridors tend to generate lesser - though usually positive - improvements in the efficient working of the labour market, the promotion of agglomeration impacts, and tackling imperfect competition.

Analysis based upon schemes in other countries suggests that schemes with the characteristics of the Preferred Scenario will typically deliver agglomeration benefits that may add 25-35% to conventionally measured user benefits. Agglomeration benefits are more associated with public transport schemes than highway schemes, particularly where there are dramatic improvements in accessibility as with mass rapid rail schemes.

Other benefits arising from labour market impacts and other mechanisms

The Plan will support the wider economic objectives of the 2030 vision, including stimulation of the tourism sector.

noted above can add a further 10-15% to conventionally measured benefits. Again such benefits tend to be higher with public transport schemes with exceptions in cases where the highway scheme is a 'missing link' in terms of road infrastructure.

The construction workforce required to implement the Preferred Scenario will be substantial. It is estimated that the Preferred Scenario will require an average workforce of some 30,000-40,000 per annum over the 20 years to 2030. Operating and maintaining the transport system will then involve a continuing requirement of 20,000-30,000 employees per annum.

The inclusion of the impacts on the wider economy has the potential to add 35-50% to the transport benefits of the Preferred Scenario, given its inclusion of significant elements of major public transport improvement. This could contribute a boost to the local economy in the order of AED 20 billion/year at 2008 prices when the schemes are fully implemented.

C6 Summary

On the basis of a rigorous evaluation process, a robust Preferred Scenario was identified and tested. This Preferred Scenario will significantly reduce traffic congestion and generate sustainable use of public transport, as illustrated in Figures C18 and C19 overleaf.

The Preferred Scenario was subject to consultation at key stages, including a review by a panel of international experts, and sought to accommodate, as far as possible, the needs of all stakeholders. This approved Preferred Scenario is presented as the Plan, which is set out in Section D.

C7 References

Road Casualties Great Britain' Annual Report 2007

Figure C18: Traffic congestion in the 2030 morning peak without the Plan

Figure C19: Traffic congestion in the 2030 morning peak with the Plan

Part D
The Plan

D The Plan

The Plan is a well-coordinated and integrated multi-modal transport solution that will provide users with seamless travel throughout the network. The Plan will be implemented through a series of seven strategies, each of which has a number of sub-strategies and polices that are described in this section. The strategies are:

- Congestion Management
- Accessibility
- Health, Safety and Security
- Pedestrian Realm Improvement
- Freight Management
- Low Carbon
- Environmental Protection

All aspects of the Plan and listed strategies will be governed by the Transport Sector EHS MS framework. The aims and outcomes of the strategies will be implemented on a project by project basis through this framework. This consists of Environmental Impact Assessment (EIA), Health Risk Assessment Reports (HRARs) and Safety Case development making up the Environmental, Health and Safety Impact Assessment (EHSIA). The framework will be applied across the full life cycle of the Plan (including projects, operational facilities and decommissioning).

The Plan presents each strategy and policy in turn and concludes with a detailed schedule of the physical infrastructure components.

The vision of the Plan is to create a world-leading transport system.

D1 Congestion Management Strategy

The congestion management strategy underpins the successful delivery of the Plan. The concept of a layered hierarchy of public transport was proposed in Plan Abu Dhabi 2030[1] and has been developed into an extremely comprehensive and integrated system. When combined with other measures this system will carry between 30 and 40% of peak period passenger trips and will create an efficient transport system for 2030 and beyond.

The Plan incorporates the ongoing DoT initiative to purchase 1360 buses.

D1.1 Provide High Quality Alternatives to the Car

D1.1.1 Provide a New Public Transport Hierarchy

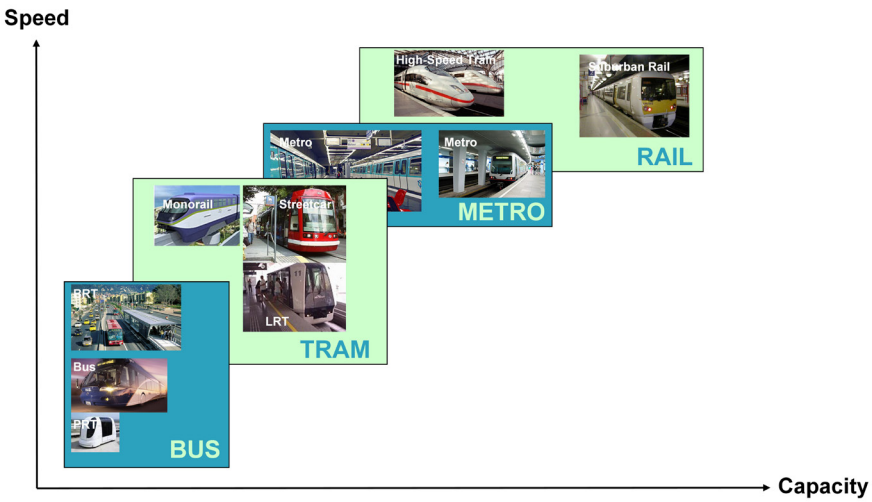
A key component of the Plan is the provision of a comprehensive, fine-grained and integrated public transport system that provides regular and reliable services accessible to all and offers an attractive, high quality alternative to the private car. In urban areas, the Plan aims to ensure that no-one will need to walk more than 300 metres to their nearest public transport stop.

Regional rail and metro will provide high capacity and frequent services for longer journeys.

Safe and convenient pedestrian access will be a key feature.

For longer journeys, regional rail and metro stations will be at key locations so travellers will be able to transfer directly from local services to fast long-distance services. Parking will be provided at key interchanges to enable travellers to park-and-ride.

The complete public transport network will be designed and operated as a single integrated system so that a high level of accessibility is maintained irrespective of location or service. There will be a single fare system that does not impose extra transfer costs, a timetable that minimises waiting times and real-time information for all potential travellers, including updates in the event of delays or disruptions. Provision will also be made for convenient and safe walking and cycling to access the public transport system and to serve more local journeys.



The layered hierarchy of public transport will cater for a wide range of travel needs from short distance trips by bus or tram to longer distance trips by metro and rail.

The new transport system will be integrated with existing and proposed developments.

The full hierarchy of modes is as follows:

- **Regional rail** will provide high-speed intercity trains from Abu Dhabi to Dubai, Al Ain and Al Gharbia, with potential extensions to Oman, Saudi Arabia and Qatar (Figures D1 and D2). These services will interchange with the Metro and other modes at the CBD, Capital City, Abu Dhabi International Airport and Al Ain. Suburban trains will provide services to key suburbs or towns within the Emirate, including Shahama, KPIZ, Mirfa and Ruwais.
- **Metro** will provide fast, high-capacity services throughout the Abu Dhabi Metropolitan areas, that are fully segregated from traffic (Figure D3). The main metro loop will connect the Abu Dhabi CBD via Suwa, Reem, Saadiyat and Yas Islands, the Airport, Masdar, Capital City, Emerald Gateway, Grand Mosque, Zayed Sports City, ADNEC and then via Airport Road and Hamdan Street back to the CBD. A spur will connect from Airport Road to Marina Mall via Zayed Street. A second loop will link Capital City and Mohammed bin Zayed City with a separate spur to serve Shamkah.
- **Trams** will provide frequent and reliable services covering the more densely developed areas where the higher capacity can be justified, with a fine-grained network providing excellent accessibility (Figure D3). The tram network will be concentrated in the CBD with links to Suwa, Reem and Saadiyat Islandsand also in Capital City with links to adjacent developments, including Khalifa A, Khalifa B, Mohammed bin Zayed City and Al Raha Beach. A smaller tram system is proposed for Al Ain. Its feasibility will be tested as part of the Al Ain Transport Master Plan to be prepared in 2009.
- **Buses** will provide reliable services in those areas where trams cannot be justified, with peak period frequencies of at least 4 buses per hour on a fine-grained network providing excellent accessibility. School and contractors' buses will be provided where appropriate. Demand-responsive buses/minibuses will serve those areas where conventional buses at a peak-period frequency of 4 buses per hour cannot be justified. The Al Ain bus network will be developed and extended into a comprehensive system. As Al Gharbia towns are developed in accordance with Plan Al Gharbia 2030 (forthcoming), bus services will be planned for each town. The network of high-quality long-distance bus services will be expanded in parallel with new regional development.

- **Taxis** will continue to provide a door-to-door service for those willing to pay the higher fares.
- **Ferry services** will provide connections along the coastline, and between islands. These services will be complemented by water taxis where appropriate.

In order to address short-term issues, to support provision of park and ride, and to enhance the existing bus services there is a need for bus priority measures to be introduced.

To ensure that the transport infrastructure projects contribute towards the strategy of providing high quality alternatives to the private car; the following initiatives will also be developed.

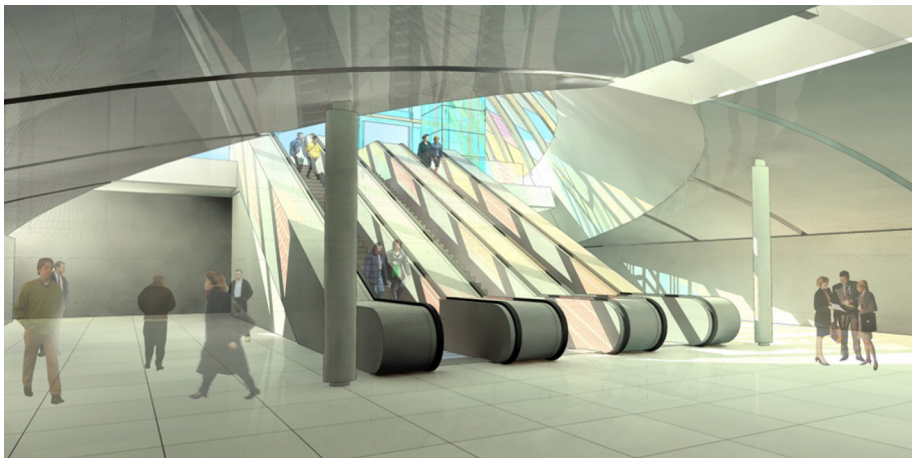
D1.1.2 Provide Cycle Routes and Facilities

For much of the year, temperatures allow cycling as a mode of transport. The Plan supports the development of a network of safe cycle routes serving new and existing developments, short-term hire of cycles (which could be encouraged in workplaces, through clubs or at major passenger interchanges), cycle parking and storage facilities and the promotion of cycling as a healthy alternative to the car.

One of the first self-service rental bike schemes has been set up in Paris. The scheme has been hugely successful and the idea is now being exported around the world.

D1.1.3 Provide High Quality Passenger Interchanges and Stations

Interchanges will be required to facilitate some of the more complex travel patterns in Abu Dhabi. Their design will reflect international best practice in ensuring easy and convenient climate controlled transfer between modes, including catering for the needs of women and children. Climate-controlled shelters will also be provided at all bus, tram and ferry stops. Where appropriate, well-shaded and passively-cooled waiting areas will be provided as a more environmentally sustainable alternative to air-conditioning. Stations will be located to provide convenient, secure and sheltered access to adjacent developments and public areas. Comprehensive Station Precinct



Best international practice will be used in the design of passenger interchange.

Plans will be prepared for the Capital City District Central Station, the CBD Central Station and other landmark stations to create high quality public places around them.

D1.1.4 Provide a High Quality Passenger Experience

All public transport vehicles will be air conditioned and fitted to a high level of comfort. Health Risk Assessment Reports as part of the Environmental Health and Safety Impact Assessment will be used to maximise passenger health benefits. Where practicable, provision will also be made for separate facilities for women and children. All vehicles will also be designed to cater for the mobility-impaired and those with luggage, shopping, or pushchairs with young children.

Hong Kong's Octupus Card is used on all public transport modes.

D1.1.5 Simple and Integrated Ticketing

A single smart card ticketing system will be provided for all public transport services (similar to the Octopus card in Hong Kong and the Oyster card in London). The aim is to make it as easy as possible for anyone to use public transport without any concerns about how to pay, having the correct fare, paying the correct fare for their actual journey or having to pay again for changes of mode or unexpected changes of plan during a trip. The use of the card to pay for parking, tolls and even for small retail purchases may be extended.

D1.1.6 Provide integrated public transport service information

To make the public transport system as easy to use as possible, it is important that up-to-date route and real-time operational information is easily available at all times for all services. Some of the required data can

be easily collected from the operators, but this must then be disseminated to potential travellers by means of displays at stations and stops, within developments, on personal communication devices or displays in individual residences or offices and through a journey planning website. This system will be integrated with the traffic information system [D1.2.3] to encourage modal transfer.

State of the art traffic management and control systems will be used

D1.2 Provide an Appropriate and Well Managed Highway Network

Abu Dhabi already has an extensive highway network that will be adapted, managed, and in some areas expanded to meet the Plan's objectives. The design of urban roads and the whole urban streetscape is under review by the ADUPC in line with Plan 2030[1] to create a more liveable environment. This initiative is strongly supported by the Plan.

D1.2.1 Implement and Enforce an Effective Road Hierarchy

The road network will be managed and controlled according to the following hierarchy:

- Freeway – high capacity, higher speed as determined by the urban or rural context, controlled access, with grade-separated junctions and no building plot frontages
- Highway – high capacity, higher speed as determined by the urban or rural context, some controlled access and some grade separated junctions, with frontages on controlled access points
- Rural Road – speed varies with the context, at-grade with no controlled access.
- Urban Streets – a hierarchy of streets, as defined in the "Abu Dhabi Urban Street Design and Mobility Standards Manual" (see D4.1.1), covering all streets in the urban areas of the Emirate, except for urban freeways, and are characterised by lower vehicle speeds, public transport priority and pedestrian and bicycle convenience and safety.

The Plan is focused on the main road network in the Metropolitan area and does not address the re-design of roads within city blocks or the opening of additional roads through city blocks to provide a fine grained road network. This issue will be subject to the findings of the ongoing ADUPC work which will be summarised in the Abu Dhabi Urban Street Design and Mobility Standards Manual.

D1.2.2 Urban Traffic Management and Control

The existing Traffic Control Centre will be upgraded with a modern Urban Traffic Management and Control (UTMC) system to allow the efficient coordination of traffic signals at all times to match traffic patterns as they vary through the day. This will require the regular review and updating of traffic operations plans, and regular preventative maintenance of traffic signals and traffic detectors so that the system is always able to react to varying traffic conditions. The UTMC will also have provisions for air quality and noise level monitoring as part of the integrated system.

To support management and control of the strategic road network throughout the Emirate, an extension of the existing traffic control system will also be implemented. A new regional traffic control centre will be designed to manage the network where control of high-speed, long-distance and truck traffic is the major concern and the ability to identify and respond promptly to crashes anywhere on the network is a key requirement. Throughout the highway network, modern systems to monitor traffic flows and average traffic speeds will be implemented by means of Intelligent Transport Systems (ITS) to guarantee the quality, safety and efficiency of the highway network for all users at all times.

Variable Message Signs warn of traffic congestion, accidents, incidents, roadwork zones or speed limits on a specific highway segment or provide general traffic information. In urban areas, VMS are used to guide drivers to available car parking spaces.

D1.2.3 Provide Reliable Journey Time Information

To improve the reliability of all journeys, information will be made available to drivers via in-car satellite navigation systems, Variable Message Signs (VMS), personal communication devices and a journey planning website. An important extension to this system will be the provision of up-to-date information on car parking space availability, with the possibility of introducing a booking system to guarantee the availability of a convenient space. Based on the data collected by this system, drivers could be advised

to use park-and-ride and public transport if, for example, there was severe congestion on Abu Dhabi Island.

D1.2.4 Event and Incident Management

Management systems will be put in place to proactively manage the traffic impacts of construction, incidents and major events, such as the F1 Grand Prix and exhibitions at ADNEC and the new cultural district. This management system will be integrated with Emirate-wide emergency response and preparedness planning.

D1.3 Transit and Pedestrian Oriented Development

A transport system should not simply meet the travel demands generated by current and planned developments; it is also important that the location, magnitude and nature of new developments recognise their impact on the transport system and that both land-use development patterns and transport networks are planned together. This will require continued close coordination between the DoT, ADUPC, Municipalities and developers.

D1.3.1 Establish Effective Land-use Planning Controls

The ADUPC's Development Management Program will provide more detailed planning direction in the context of the Abu Dhabi, Al Ain and Al Gharbia 2030 Framework Plans. It will ensure that developments are planned to minimise traffic impacts by strongly encouraging the use of public transport, cycling and walking. As part of this process, the current approach to traffic impact assessment will be overhauled and extended to become a multi-modal transport impact assessment, incorporating consideration of provision for pedestrians, access to public transport and the preparation of Travel Plans (D1.3.3).

The Development Management Program will provide more specific direction on the distribution of development, within the context of the 2030 Framework Plans, so that more intensive development is located where it can be well serviced by the public transport network, and will not aggravate congestion on the designated street network.

D1.3.2 Regulate Parking Standards

In association with the , new parking standards that are consistent with the Plan will be applied to all new developments as part of the Development Management Program. The level of parking permitted will depend on the type of development, its location and its accessibility to public transport.

Parking standards will also specify the capacity to be provided for visitor parking to make most effective use of the on-street parking capacity. As described below under Demand Management, policies to manage parking supply and demand will also be introduced.

D1.3.3 Introduce Travel Plans

Travel Plans will be introduced to encourage the use of sustainable transportation

Travel Plans will include a range of additional measures that can be provided within a development to reduce the need for motor vehicle travel, and will be linked to the Estidama Communities Pearl Rating System.

In order to encourage efficient use of the transport system, developers will be required to provide travel plans for all new developments as part of the enhanced process for transport assessments. A travel plan is a package of measures developed to encourage alternative travel modes rather than single-occupancy car use. A travel plan can include car sharing schemes, cycle improvements, changes to bus services and car parking management. It may also review and promote changes to working practices.

Travel plans have been used successfully in other countries for many years and are an important tool for promoting sustainable travel, e.g. walking, cycling and public transport, and help to reduce single occupancy car use. Travel plans also encourage effective use of current transport networks and can be used to secure the provision of sustainable travel choices, both to new developments and to extensions of existing sites.

D1.4 Demand Management

Demand management is a toolkit of techniques to influence the demand for travel – mainly to encourage people to utilise non-car modes or to make fewer trips. They can include pricing and other measures to alter people's travel choices. The Plan includes a mixture of measures, all of which were demonstrated as being necessary in the transport modelling carried out for the study (section C5.2), consisting of parking charges, fuel taxation and congestion charging. The phasing of the measures, and their design, will be subject to further study. However, it is clear that most of the measures will only be introduced after public transport, walking and cycling alternatives to the car have been improved.

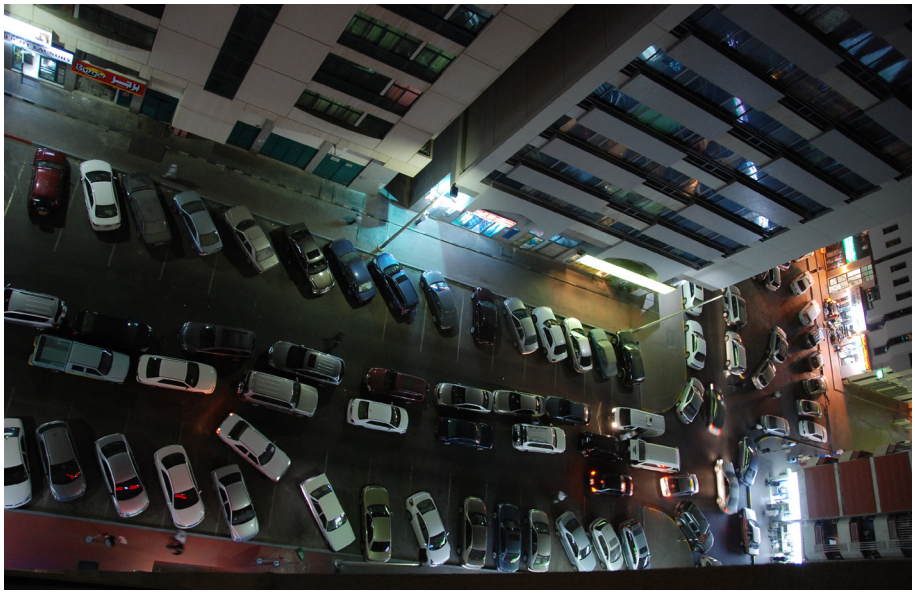
D1.4.1 Implement Parking Management

The introduction of parking management areas in the CBD, which were planned prior to study, will begin the process of bringing parking supply

and demand into balance and will require a strong policy of enforcement of parking violations. At the same time, the re-organisation of parking spaces and improvements to the pedestrian realm will be implemented in a staged programme.

In many areas it is not practicable to provide additional parking spaces at ground level, and indeed in many areas it will be appropriate to reduce parking spaces in order to improve facilities for pedestrians and public transport and to improve the urban streetscape and the safety of residents and visitors. Further studies will be carried out to determine whether, where and when to provide new underground or multi-storey parking structures, a schedule for their construction will be developed by the ADUPC and DOT as part of the City Centre Block Revitalisation Programme.

A vital component of the parking management strategy will be to balance the proportion of long-term and short-term parking spaces. Parking charges will be reviewed on a regular basis for both on-street and off-street parking to help address the congestion caused by unrestrained long-term parking in the CBD by residents and commuters and to address the changing balance between demand and supply.



The limited availability of car parking space is currently a major problem in the city centre. Rigorous measures are supported to address this.

D1.4.2 Improve Public Information

The change from a car-based culture to one in which public transport is the mode of choice will require significant changes in public perceptions and

behaviour. Publicity campaigns will be an important element in influencing local attitudes and changing such behaviour; these will need to be introduced as soon as bus services provide a satisfactory alternative to the private car and will require strong reinforcement once metro and tram services begin operation.

D1.4.3 Implement Road User Charges

The evaluation of alternative scenarios demonstrated that a form of road user charging and potentially fuel taxation will need to be introduced to manage congestion directly. Congestion charging is in operation in major cities such as Singapore, London and Stockholm, where the impacts on successfully managing congestion have been demonstrated. A range of approaches and technologies could be employed and these will develop as the technology options improve over time. The most equitable method of charging for road use would be based on the distance travelled within a zone, or the time spent travelling, or indeed some combination to reflect local traffic conditions at the time. Alternatively, a fee may be charged for crossing a cordon (as in London and Singapore). The method to be introduced in Abu Dhabi will be assessed by a Pricing Strategy Study.

The Singapore Electronic Road Pricing (ERP) system has been successful in managing traffic congestion.

D1.4.4 Provide Park and Ride Schemes

Park and Ride schemes will provide a more reliable and convenient alternative to driving in to the metropolitan area of Abu Dhabi. To facilitate this, Park and Ride sites are planned at key locations on the mainland to intercept traffic approaching the Islands and Capital City.

D1.4.5 Provide Measures to Encourage Teleworking and Car Sharing

Measures to encourage working at home, the use of information technology and car sharing to reduce the demand for travel are supported by the Plan.

By replacing the daily commute to a central place of work, telecommuting can reduce an individual's carbon footprint and provide additional flexibility to employees.

D2 Accessibility Strategy

This strategy seeks to develop a high level of accessibility to transport throughout the Emirate so that all segments of society, irrespective of where they live and work, are able to fully contribute to the community and, where appropriate, to the economic development of Abu Dhabi. Ease of access will also encourage the use of public transport by those members of society who suffer from impaired mobility and require convenient and easy travel arrangements.

Public transport will be fully accessible to the mobility impaired.

D2.1 Minimise Access Time to Public Transport

D2.1.1 Provide Public Transport within a 300m walk

The underlying philosophy that no one within developed areas will need to walk more than 300m to access public transport (see D1.1.1) is, of course, fundamental to the accessibility strategy. The number and location of existing bus stops will be reviewed as part of a Mobility Management Study with the aim of optimising coverage of the areas served. Bus stop locations for new routes will be carefully designed prior to start of operation of bus services along new roads. The provision of passively cooled and shaded bus shelters at stops, and the issue of mis-use of bus lay-bys by other vehicles will also be addressed with the aim of improving the efficiency and safety of the bus network. Guidelines on where demand-responsive bus or minibus

services should be operated will also be prepared.

The location of tram stops will also be carefully planned to provide a similar high quality coverage, especially within the CBD and Capital City where trams are intended to form the backbone of the local transit network.

D2.2 Providing Access for All

D2.2.1 Provide Access for the Mobility Impaired

All public transport will be fully accessible to the mobility impaired. Vehicles will be designed according to best international practice and lifts will be provided at interchanges and stations. The pedestrian environment will be made more accessible through the provision of tactile paving at crossing points (for the visually impaired) and so that all areas can be accessed by wheelchair users.

D2.2.2 Implement Inclusive Fare Policies

Fares will be set at a level to ensure that users on lower incomes are not prevented from accessing the public transport system, as well as to achieve the broader objectives of the Plan.

D2.2.3 Provide for Women and Children using Public Transport

Where and when practicable, segregated facilities will be provided for women and children, including separate compartments on rail and metro trains and on trams.

Facilities for women and children will be provided.

D2.2.4 Taxis and Minibuses

The current gradual switch from the old white and gold taxis to the new silver franchised taxi operators is supported. It will however be important that TransAD carefully monitors the service level provided and increases the taxi fleet to match supply to demand on a regular basis.

The existing white and gold taxis are complemented by a fleet of minibuses that together provide a service for shared transport, which in terms of cost lies between that of a taxi and the new bus service. In theory these shared services would be unnecessary if and when the full transport network provided by the Plan is completed, however in practice there may be a need to continue these services in limited areas for certain purposes, eg to serve construction workers and labour camp residents. A Taxi and Minibus Study will be commissioned to consider the future role for this type of service and will also review the scale of provision appropriate for school and contract

buses, and what new policies may become appropriate as the Plan's public transport network emerges.

D3 Health, Safety & Security Strategy

The objective of this strategy is to create an integrated transport system of road and rail options that is safe and secure. In particular, the integrated systems will be designed to encourage a switch from the current high use of cars and thereby reduce the current unacceptably high level of fatalities and injuries on the road network. All future transport projects and operations will need to be subjected to a formal process of health and safety assessment through a Safety Case regime and Health Risk Assessment Report (HRAR) respectively.

D3.1 Road Safety

A key component of the strategy is the development of a series of road safety measures to reduce the existing accident rate. The introduction of effective road safety mitigation measures, based on international experience and best practice, is likely to include a combination of engineering, enforcement and educational solutions. The Strategic Road Safety Plan commissioned by the DoT in 2009 will address these issues (Part F).

The reduction of fatalities and injuries due to transport is a key part of the Plan. This includes the general public and all those involved in operating and building the system.

D3.1.1 Speed Management

Existing speed limits will be reviewed and amended as necessary to ensure that appropriate posted speed limits are in place on all sections of the highway network. A speed management strategy will then be introduced including the use of static cameras. The speed management policy will set limits that achieve good speed compliance through education and enforcement and help to contribute to the overall target of reducing the numbers of casualties. Independent speed adaptation of vehicles could also be introduced in the longer term, once this capability becomes generally available.

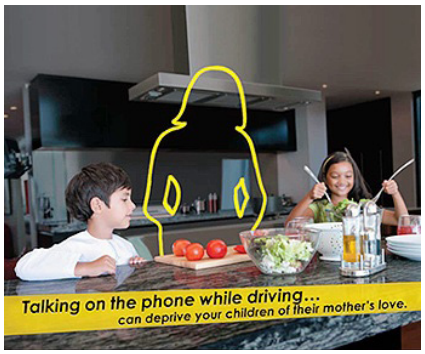
D3.1.2 Pedestrian Safety

There is a high rate of pedestrian casualties in road accidents, exacerbated by the relatively poor provision of pedestrian crossings. As part of the Pedestrian Realm Improvement Strategy (see D4) a comprehensive programme of improvements to pedestrian infrastructure will be delivered. This will be prioritised according to available accident investigations and will reflect those locations with significant pedestrian demand to cross busy roads.

Key elements will include, where needed, pedestrian phases at traffic-signal controlled junctions and mid-block locations and grade-separated crossings on high-speed highways. Specific measures will also be introduced at locations such as schools, hospitals and transport interchanges. The delivery of the physical improvement measures will be supported by an educational programme targeted towards vulnerable groups.

D3.1.3 Driver Training and Education

In order to improve the current standard of driving behaviour, the existing driving test will be reviewed and compared to the standards set for other countries. The development of a more stringent driving test will be supported by the introduction of a Highway Code, the development of which will be based on local needs and international best practice. The new Highway Code will eventually form part of the revised driving test and a policy of mandatory re-training and re-testing will be considered for current drivers who are identified though accidents or an accumulation of penalty points.



Education will be one of several initiatives to improve road safety.

D3.1.4 Road Safety Education

It is not only drivers who need to learn about road safety; everyone who ventures outside their home needs to be aware of the possible dangers. The planned Highway Code will cover all types of street activity including the needs of pedestrians, cyclists and the mobility impaired and the priority to be afforded to each, on all types of road and shared space.

International experience shows clearly that teaching children about road safety is a good investment, and can substantially reduce the numbers of children killed or injured on the roads. A policy whereby all schoolchildren are given at least one full day of road safety training each year will be introduced as soon as the necessary facilities can be provided.

D3.1.5 Accident Investigation

A crash database will be established to enable the identification of multiple crash sites and causes and so that remedial measures can be developed and introduced to address the identified road safety issues. Prior to the development of the database, accident investigation will be completed using existing crash data collected from the police.

D3.1.6 Road Safety Audits

In order to reduce crash rates, Road Safety Audits (RSAs) will be completed to identify and mitigate against road safety hazards. The RSA qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety. The introduction of a programme of RSAs will require the development of road safety audit guidelines for Abu Dhabi, based on international best practice. RSAs will also need to be completed by a suitably qualified road safety audit team at all stages of design from preliminary design to completed scheme so that all new roads meet the highest standards for all road users.

D3.1.7 Traffic and Vehicle Regulations

To support the overall road safety strategy, new traffic and vehicle regulations will be required. To meet this requirement the following will be introduced:

- The scope of vehicle inspections for both commercial and private vehicles will be enhanced to improve the condition of all vehicles by enforcing an annual test on key maintenance issues and by introducing emission tests to assist in reducing CO_2 emissions.

- A tachograph system to monitor the hours driven by professional drivers will be introduced, and guidance on the enforcement of maximum loaded vehicle weights will be developed centrally through the National Transport Authority (NTA).
- The compulsory wearing of rear seat belts and the introduction of child safety restraint systems will be introduced.

At present child restraints are not widely used in Abu Dhabi.

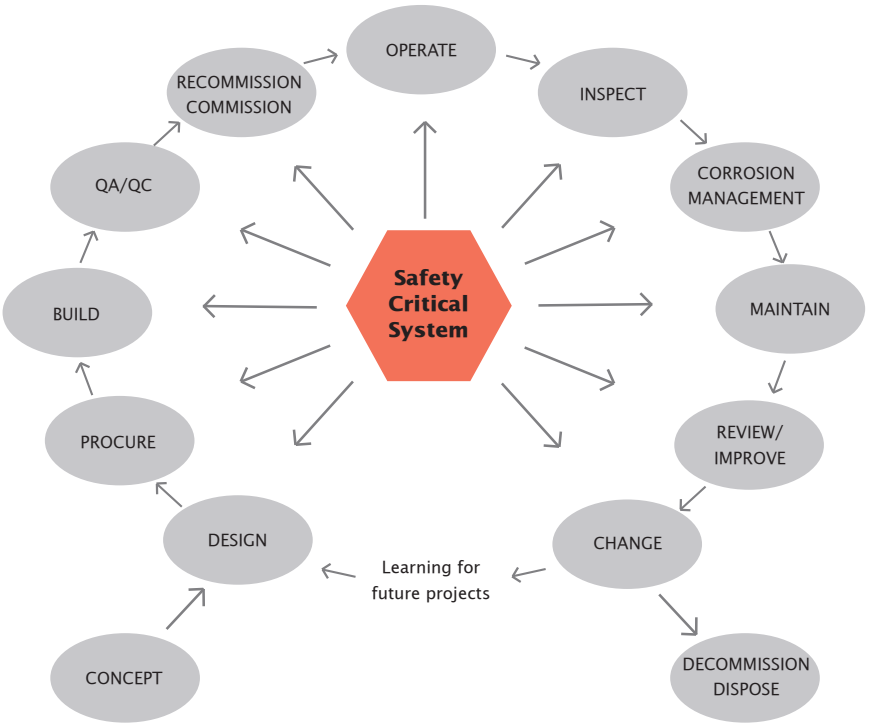
D3.2 Public Transport Safety

Abu Dhabi will be introducing new modes of transport that will be unfamiliar to many of its residents, including trams and metros, which have regulatory, public education and safety requirements that have not been considered to date. The regulatory element will need to be addressed by the system developers and operators, while the education category will need to be addressed within the operator's organisation, with a view to educating the public on some of the safety interfaces that will characterise the systems they operate.

D3.2.1 Safety Assurance

The safety of transport workers, passengers and communities is of paramount importance. A Safety Case will be used to identify and demonstrate to regulatory authorities and key stakeholders that safety critical systems are in place and are effective. A safety critical system is defined as a system required for the prevention, detection, mitigation or emergency response to catastrophic events that may lead to loss of life, asset and reputation.

Technical Integrity Life Cycle of Safety Critical Systems



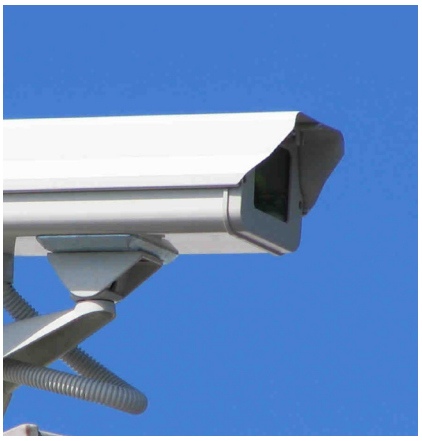
A comprehensive safety assurance process will be deployed to ensure that the technical integrity of all safety critical systems associated with public transport activities are maintained to within agreed goals or performance standards. Performance standards are parameters that will be measured or assessed so the suitability and effectiveness of each safety critical system can be assured and verified. Safety assurance will be regulated by DoT and will include Independent Safety Assessments from third party companies.

D3.2.2 Public Safety Education

A public awareness campaign will be needed regarding safety risks associated with their new transport system. This is particularly critical for the street running tram system where both car users and pedestrians have to interact with the new transport mode. Extensive experience of these issues has been gained in other cities around the world where trams have been introduced to predominantly car-based societies and these could be adapted to the situation in Abu Dhabi.

D3.3 Transport Security

The provision of effective door-to-door security is an important element in



CCTV cameras will be used to increase personal security at interchanges or inside metros, trams or buses as necessary

a successful public transport system. This includes a combination of safety measures to make pedestrians and public transport users feel safer using the public realm and associated infrastructure. The introduction of security measures may include passive surveillance from adjacent land uses, CCTV, good lighting and the application of safe urban design principles.

D3.3.1 Increase Security for Transport Users

The implementation of improved pedestrian infrastructure as outlined in D2 and D4 is likely to contribute towards a sense of well-being and personal security. The existing poor pedestrian infrastructure and accessibility to public transport may discourage trips on foot and using public transport due to a fear of conflicts with other vehicles. In addition, pedestrians, and those waiting at public transport facilities and using public transport services, may fear for their security due to their sex, ethnic group or age. Improvements to the pedestrian realm, with a degree of priority over traffic, will act as a strong counter to any feelings of insecurity. This will be amplified by encouraging adjacent land uses to overlook the street (passive surveillance) and through creation of an active street life, which is also an aim of Plan Abu Dhabi 2030.

D3.4 Transport and Health

All future transport projects and operations will be subjected to the formal Health Risk Assessment (HRA) process. HRA addresses the life cycle of any operation and takes account of all employees, contractors, third parties and the public. All health hazards will be identified, their risk assessed and mitigation measures defined for all activities, operations and products, including chemical, biological, physical, psychological, ergonomics, etc.

In addition, health benefits will be realised from other Plan strategies, which will include:

- Promoting walking and cycling (see D1.3.2, D1.3.4, D4.1.1, D4.2.1)
- Improving access to public transport (see D2.1.1, D2.2.1, D2.2.3)
- Improving the waiting environment and accessibility of streets for all, especially those with impaired mobility, to reduce social isolation. (D4.1.1)
- Improving the ability to access services (e.g. retail, health, leisure and education) (D1.1.1, D2.1.1)

D4 Pedestrian Realm Improvement Strategy

Areas where pedestrians have priority over cars are a feature of many world class cities and is one of the key factors in attracting tourists. The enhancement of the pedestrian realm is therefore a constant theme throughout Plan Abu Dhabi 2030 and a key objective of the Plan. In addition to promoting walking as an alternative mode of travel in its own right, a high-quality public realm also makes the use of public transport more attractive by improving passenger experience and accessibility.

D4.1 Improved Pedestrian Environments

The existing pedestrian realm in Abu Dhabi provides a poor level of accessibility and safety and actively discourages pedestrian activity at street level. Indeed, it seems that the private car takes absolute priority and pedestrians are frequently expected to take whatever space is not dominated by traffic and parked cars. To achieve a world class city will require a high quality public realm where pedestrian activity is convenient and comfortable, and where priority is more equitably allocated to suit the particular situation.

D4.1.1 Adoption of Abu Dhabi Urban Street Design and Mobility Standards Manual

The "Abu Dhabi Urban Street Design and Mobility Standards Manual" will be issued by the ADUPC in the third quarter of 2009. In addition to the ADUPC and DoT, the Technical Advisory Committee formed for this project includes representatives from the Municipalities, the Traffic Police, Civil Defence agencies (fire protection), the Health Authority, and from developers and utility providers. A programme for implementing its recommendations will be developed so that over the period to 2030 the public realm in all new developments and a majority of existing developments is upgraded to the latest pedestrian-friendly standards.

The re-design of streets to create a more pedestrian friendly environment is an important part of the Plan.

D4.2 Pedestrian Routes

In order to encourage use of public transport, and indeed walking for shorter trips, it is strongly recommended that a comprehensive network of walkways is provided throughout developed areas of the Emirate. A critical aspect in achieving an active street life is the provision of extensive shading, and even cooled links in the busiest locations.

D4.2.1 Effective Walkway Provision

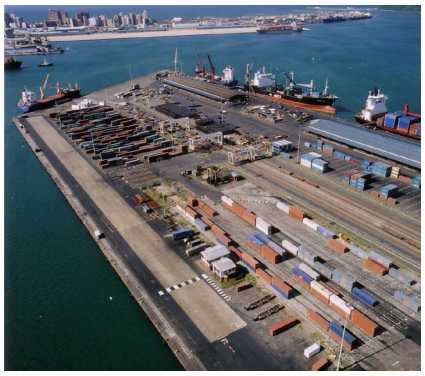
Walkways for pedestrians will be provided in locations where there are high volumes of pedestrian movements and along links between transport interchanges and key developments. Inevitably pedestrians will need to cross busy roads and the design of the public realm will guide this towards convenient and safe locations where subways or pedestrian-controlled traffic signals will be provided. In busy areas, the updating of existing junction controls will include signals for traffic turning right that provide an opportunity for pedestrians to cross.

To ensure that a comprehensive and inter-connected pedestrian network can be achieved over the Plan period, a Pedestrian Master Plan will be developed. A similar Bikeway Master Plan will also be commissioned to develop a comprehensive cycle network for cycle travel throughout the urban areas, to complement walking and public transport as well as for leisure activities.

D5 Freight Management Strategy

This strategy seeks to enhance the effectiveness and efficiency of freight movement within Abu Dhabi. The aim is to support the development of a sustainable freight distribution system that provides an appropriate balance between alternative transport modes, improves the utilisation of the transport resources deployed, and lowers the unit cost of freight based services.

A strategy will comprise elements that are directly related to the freight sector, plus many initiatives that are common to both passenger and freight transport. This includes aspects related to noise, air quality, safety and the impacts upon the natural and built environment.



Regional Freight Distribution Centres will be set up at key locations.

D5.1 Support Freight Transhipment and Modal Shift

D5.1.1 Develop Regional Distribution Centres

The Plan promotes the development of key Regional Distribution Centres (RDC's) in KPIZ, Mussafah/ICAD, Abu Dhabi International Airport, Al Ain, and within Mina Zayed. RDC's provide effective transhipment locations for consolidation, processing and onward transfer of freight between primary and secondary distribution flows, thereby improving the overall efficiency and effectiveness of Abu Dhabi's freight transport system.

The multimodal aspects of selective RDC's will also promote the case for the interchange of freight between alternative road, rail or coastal shipping services, promoting broader freight transport connectivity across the Emirate. This may encourage a gradual shift from road based haulage to alternative rail and shipping services on key routes. Consolidation of freight at the RDC will benefit from the promotion of freight market information services, providing transport operators with the opportunity to minimise empty backhaul movements or sub-optimum loading, and improving the co-ordination between road, rail, and shipping services. Concentration of freight road haulage interchange at the RDC also provides scope for enhanced vehicle regulation, thereby addressing related safety issues and the opportunity for driver training and education.

D5.1.2 Facilitate the Freight Rail Line

The Plan promotes alternative rail and shipping based transport options for those types of cargo where such modes are viable. This will require implementation of Union Rail's planned GCC-wide freight line from KPIZ to Mussafah/ICAD, and links to Al Ain, Ruwais, Dubai, KSA and beyond. This could result in substantial increases in freight movement coming by rail into Abu Dhabi rather than being unloaded directly at a local port or travelling overland by road. Further consideration will need to be given to the most

The freight rail line is an integral part of the Plan.

appropriate means to promote coastal shipments from Khalifa Port through the Mina Zayed RDC and Mussafah Port. This will be addressed as part of a Freight Logistics Study to be commissioned by the DoT.

D5.2 Freight Traffic Management

In order to enhance the efficiency of freight haulage services and to reduce their adverse impacts on developments adjacent to major highways, it has become clear that substantial improvements to the quality of the freight haulage industry are required. These issues will be addressed through a combination of regulations to raise the technical quality of vehicles deployed, to define and enforce restrictions in vehicle loading and through improvements in operator and driver training and education. Many of these issues are closely related to road safety and are described further under safety and security (Part D3).

D5.2.1Rationalise Truck Routes

The current policy forcing trucks to use truck routes that often result in considerably extended journey times and distances, and hence economic costs, will be reviewed as part of the Freight Logistics Study.

D5.2.2 Promote Alternative Routes

The current policy of goods vehicle restrictions by route and time of day should be continued; however a policy to encourage use of alternative methods of delivery, e.g. by water, should also be encouraged where appropriate. To complement these restrictions, it is also proposed that a system of truck signage and real-time traffic information be introduced to provide an improved service to truck operators and drivers and to make most efficient use of the available road network at all times.

D5.2.3 Use Real Time Journey Information

The provision of real-time journey information can result in significant efficiency gains by truck operators, and demand for this service may act as an encouragement to a private sector provider to enter the market with a commercial product. This will also enable limited use of certain routes within Abu Dhabi Island by trucks during the day to improve the efficiency of construction and redevelopment activity.

D.6 Low Carbon Strategy

The Low Carbon Strategy guides and steers the Abu Dhabi transport network towards a more sustainable future, predominantly by reducing the carbon footprint. Key low carbon objectives in the Plan will be carried forward, ambitious targets established, and the implementation of measures to achieve such targets initiated in collaboration with a Sustainable Transport Taskforce.

A sustainable transport taskforce will be chaired by the DoT to coordinate cross-agency initiatives to reduce the carbon footprint.

D6.1 Sustainable Transport Taskforce

The Sustainable Transport Taskforce will comprise high-level representatives from DoT, Masdar, EAD and ADUPC, and will be responsible for implementing the concept of sustainable transport in Abu Dhabi. A framework of sustainability policies and codes of practice will be developed and applied to transport planning across the Emirate.

The establishment of a Sustainable Transport Taskforce recognises that environmental and sustainability issues in transport have many interfaces, and therefore robust management will require close collaboration between key government and regulatory bodies.

D6.1.1 Life Cycle Sustainability Management

Sustainability will be integrated into management of transport in Abu Dhabi across the full life cycle from design, through procurement, construction, operation and decommissioning.

The Plan has been derived with sustainability (environmental, social and economic) embedded into its development and decision making from the outset (Section A3). A continued focus on sustainability will be necessary to ensure that the overall vision and goals of the Plan are realised.

A sustainability framework will be developed in consultation with the Sustainable Transport Taskforce. In developing the framework, the key requirements of Estidama (under development) and international sustainability standards and systems, will be combined to create a locally appropriate and robust approach for ongoing management of sustainability in Abu Dhabi's surface transport.

D6.2 Low Carbon Commitment

Strong commitment to a low carbon, sustainable transport system is essential, from inception through to implementation. DoT's lead on this commitment, through the Sustainable Transport Taskforce, will carry forward the sustainable transport agenda in Abu Dhabi.

D6.3 Regulatory Framework

The Sustainable Transport Taskforce will oversee a comprehensive suite of new policy and regulation to embed low-carbon policy into decision- making.

The following Strategies are complementary to the Low Carbon Strategy:

- Congestion Management (D1)
- Freight Management (D5)
- Pedestrian Realm (D4)
- Environmental Protection (D7)

In addition to the above strategies, implementation of the following energy policy strategy component will provide a further and significant push towards a Low Carbon Economy as envisioned by Plan Abu Dhabi 2030.[1]

D6.3.1 Energy policy for mass transit

The use of Renewable and low-carbon sourses for mass transit is supported by the Plan.

The Plan provides a unique opportunity to make an aggressive move towards renewable and low-carbon sources of energy for transport in Abu Dhabi. The power demands of the electrically-powered public transport system of regional road, metro and tram, and potentially trolleybuses, could reach 1GW in 2030, the output of a large power station. This demand should be used to drive investment and development into low-carbon energy generation from renewable sources. DoT, working with the Abu Dhabi government and energy industry stakeholders, will initiate the development of this new power generation capacity.

Strategic objectives for low carbon and low energy use within the Plan,

defined by the Sustainable Transport Taskforce, will provide support in the development of the Low Carbon Strategy and energy policy.

This strategy component complements the Masdar Initiative and actions stemming from it may constitute eligibility for carbon credits under the United Nations Clean Development Mechanism (CDM), although further investigation would be required in order to confirm and plan for such eligibility.

D6.3.2 Environmentally-friendly Public Transport Fleets

The development of a completely new public transport system presents a unique opportunity to adopt world leading environmentally-friendly public transport vehicle fleets system-wide throughout Abu Dhabi. This opportunity will also bring about benefits to various sustainability aspects such as carbon and local pollutant emissions reduction, passenger safety and environmental protection.

D6.3.3 Vehicle Registration Schemes

A reduction in total air and noise pollution in the Emirate will be achieved by developing a vehicle registration fee scheme, preferably Federal, that takes into consideration the emissions level and fuel type of vehicles. Broader Plan cost recovery and demand management objectives will also be factored in the strategy development. Significant discounts, up to 100%, from standard fees for low emission vehicles and those utilising low carbon fuels or Compressed Natural Gas (CNG) should be available. The fee scheme should especially cover freight vehicles.

D6.3.4 Low Emission Zones

Reduction of air pollution in areas where local pollutant levels would otherwise be unacceptable will be achieved and air quality targets established for defined low emission zones. A method of applying an emissions charge/fine for entering the zone should be developed in consultation with NTA to encourage cross-Emirate co-operation and the utilisation of common technology standards such as the SALIK tag system.

Co-ordination will be required with any congestion charging mechanism. The low emissions zone strategy could be tied in with the Vehicle Registration Scheme in order for all vehicles to be classified by level of emissions, the data for which could be stored on an electronic tag such as used by SALIK.

Low Emission Zones will be implemented to improve air quality.

D6.3.5 Priority Parking for Low Emission Vehicles

Prioritised and/or subsidised parking rates for low emissions vehicles within the overarching parking surcharge will be introduced in support of the Congestion Management Strategy. Designs of parking areas for developments, such as new stations and park and ride sites, would include the low emission parking schemes.

D6.3.6 Awareness Raising Campaigns

Promotion and awareness raising on the Environmental Protection and Low Carbon Strategies by means of appropriately targeted campaigns will be essential in maximising the success of these strategies. Campaigns will focus on the reasons for change in Abu Dhabi transport and will celebrate the resulting economic, social and environmental benefits. Increased awareness and understanding aims to promote the modal shift to new public transport systems available and catalyse a change towards low carbon and sustainable practices in all aspects of life in Abu Dhabi.

Educational messages on issues relating to sustainability, carbon footprint and environmental stewardship will be incorporated in all future programmes. Promotion through a variety of media, alongside potential collaboration with the EAD education and awareness raising department, will maximise coverage and impact of campaigns.

D7 Environmental Protection Strategy

Stewardship of Abu Dhabi's unique natural and built environment will aim to protect and highlight their long-term value and connections with human health, economic prosperity, quality of life and cultural heritage.

Environmental protection has been embedded into the process from the outset. Implementation of the Plan continues to focus on environmental aspects in order to protect and enhance the very attributes that attract people to live, work and invest in Abu Dhabi.

Key environmental objectives identified as part of the Plan will be carried forward, ambitious targets established, and implementation of such targets achieved through the Sustainable Transport Taskforce.

The impacts of transport on natural environments will be fully assessed.

D7.1 Sustainable Transport Taskforce

As noted previously, the Sustainable Transport Taskforce will comprise high-level representatives from DoT, Masdar, EAD and ADUPC. In addition to the Low Carbon Strategy, the taskforce will champion the Environmental Protection Strategy.

D7.2 Environmental Commitment

A strong commitment to sustainable transport is essential for the Plan to be effective. This commitment will uphold environmental stewardship and initiate self-regulation in those aspects with less developed or emerging environmental legislation.

The DoT will take the lead, through the Sustainable Transport Taskforce, to continue carrying forward the sustainable transport agenda in Abu Dhabi. As part of this commitment, one of the first steps will be to review key environmental objectives identified as part of the Plan, and establish associated targets and an implementation programme. These targets will be ambitious but also achievable and measurable.

The Plan will support existing and emerging EAD and UPC environmental and sustainability programmes. For example, one critical area will be the environmental challenges of infrastructure development on and between islands. Some of the most important and sensitive assets of Abu Dhabi are the marine and coastal resources. Under the environmental commitment, all of the Plan's projects that have a marine or coastal interface will support and promote the emerging UPC coastal development guidelines. They will be committed to protecting the natural form and biodiversity of these areas, alongside striving to enhance the aesthetics, recreational and educational value of these resources.

Public awareness raising campaigns will establish wider support and uptake of sustainable transport in order to successfully implement the Environmental Protection Strategy.

D7.3 Regulatory Framework

An existing regulatory framework for environmental permitting of new projects is legislated by Federal Law No. 24 of 1999 for the Protection and Development of the Environment; and imposed by Local Orders within each Emirate. The DoT, defined as the Sector Authority for the Transport Sector under EHS Policy 2006, soon to be EHS law, will implement the EHS MS Framework (see Part A).

The regulatory frameworks described above will be utilised for delivery, including Environmental Impact Statement (EIS) and Environmental Impact Assessment (EIA), whilst also going beyond minimum statutory requirements in key environmental and sustainability aspects of concern.

Policies and codes of practice to advance the sustainable transport agenda will be developed covering the following aspects.

D7.3.1 Air Quality and Noise

A transport specific air quality and noise strategy will address these two key environmental issues, which have significant human health implications, and will facilitate improvements to communities and the urban environment. Development of a robust strategy will be achieved through interface with the Abu Dhabi Air Quality Committee and by addressing the Emirate wide emerging policy and strategy on air and noise pollution in Abu Dhabi from EAD.

The overarching air quality strategy will also support the emissions reduction components of the Low Carbon Strategy, such as:

- Vehicle registration schemes (D6.3.3)
- Low emission zones (D6.3.4)
- Priority parking for low emission vehicles (D6.3.5)

Immediate actions required for air quality and noise are:

1. Compile existing baseline data for the Emirate, and identify any major data gaps of concern;

2. Commission additional baseline monitoring in order to address any significant data gaps;

3. Establish zoned targets and minimum standards for air quality and noise, in parallel with 1 and 2 above;

4. Set out and implement an action plan in order to achieve agreed targets and minimum standards. Key actions will include design requirements for new transport infrastructure and emission reduction policies such as those outlined in the low carbon strategy.

D7.3.2 The Natural Environment

Environmental protection zones are currently being developed by ADUPC and EAD for the Emirate of Abu Dhabi. Minimisation of the impact of transport infrastructure development on sensitive natural environments will be delivered by incorporating such environmental protection zones into all levels of planning, including prevention of encroachment on, or damage to, critical natural resource areas.

Immediate actions required for the natural environment are:

1. Environmental Impact Assessment (EIA) as part of Environmental Health and Safety Management System (EHS MS) requirements;

2. Environmental baseline assessments, prior to development of transport infrastructure in specific areas of concern;

3. Long-term environmental monitoring, management and reporting, during construction and operation of transport infrastructure;

4. Initiatives to enhance, restore and support important environmental assets.

D7.3.3 The Built Environment, Cultural Heritage and Archaeology

Existing cultural or heritage landmarks, buildings, public open space, cultural heritage and archaeology will be protected. Minimisation of the impact of transport infrastructure development on sensitive built environments, either directly by land-take or indirectly by changing access and/or views, will be achieved through:

- Prevention of encroachment or damage to identified areas;
- Avoiding disruption to important pedestrian access routes;
- Maintaining and enhancing public access to open space, and provide additional open space where possible;

The Plan will protect and enhance Abu Dhabi's cultural heritage.

- Protecting views to significant features of the built environment (e.g. Sheikh Zayed Mosque);
- Seeking to enhance the built environment, for example by incorporation of traditional Arab architecture into designs;
- Seeking to contribute to balanced, liveable communities.

D7.3.4 Marine Transport

A new marine transport code will protect the highly sensitive marine environment from further degradation. The Abu Dhabi marine environment, and wider Arabian Gulf, is already under severe stress due to human activities including dredging and land reclamation, power and desalination plants, marine infrastructure and marine traffic. It will therefore be critical that additional transport infrastructure and traffic does not add further stress to the marine environment. Good planning and regulation will seek to alleviate existing transport-related marine impacts, restoring and managing natural habitats wherever possible.

Aspects of the code will include:

- Restricted access and vessel speed restrictions to prevent damage to environmentally sensitive marine and coastal areas, caused by effects such as vessel wake wash and pollution;
- Strict controls on the release of ballast from ships;
- A fee structure for marina berthing dependant on fuel type and emissions of vessels;
- Support in ratifying Annex VI of the IMO's Marine Pollution Convention regulating air pollutants SO_2 and NO_X from ships.

The current DoT maritime department with ADTCo is in consultation with the Abu Dhabi Ports Authority and will be responsible for leading this strategy.

D8 Infrastructure Components of the Plan

D8.1 Overview

The Plan consists of a series of infrastructure schemes and other initiatives that have been costed and included in the Plan budget (not published). The Plan incorporates ongoing and committed schemes and initiatives as well as new ones identified as part of the study process.

The key infrastructure components (as described in D1.1) are set out in Table D1. The exact configuration of all the components will be subject to alteration as the Plan implementation studies refine and finalise the system designs over the next two years. Each individual component in the tables is given a reference that also appears on the corresponding figures. Details of the phased implementation of these schemes are set out in Section F.

Table D1: Summary of Infrastructure Components

Component	Description
Regional Passenger Rail	590km system of inter-regional rail forming part of a future UAE and GCC-wide passenger rail system
Freight Rail (Union Railway)	1300km system of inter-regional rail forming part of a future UAE and GCC-wide freight rail system
Metro	130km of segregated railway in Abu Dhabi Metropolitan area
Tram	340km of street running tram in Abu Dhabi Metropolitan area
Personal Rapid Transit	Demand-responsive system planned for Masdar, and potentially Lulu
Bus	A fine grained bus network will be provided in all urban areas not served by tram
Water Transport	A system of scheduled ferry services along both sides of Abu Dhabi island
Highways	1500km of new or upgraded highways

A high speed rail network will provide inter-regional and international services.

D8.2 Regional Passenger Rail

The regional passenger rail network will link the three Abu Dhabi regions together (providing a suburban rail service in the Abu Dhabi Metropolitan area) and give connections to the rest of the UAE, Oman, Qatar and the Kingdom of Saudi Arabia, thus forming part of a unified GCC-wide passenger rail network (Table D2 and Figures D1 and D2).

Table D2: Regional Passenger Rail

Ref	Scheme
PR1	Abu Dhabi CBD to Dubai via Capital City & Abu Dhabi International Airport
PR2	Capital City to Qatar and Saudi Arabia via Ruwais
PR3	Abu Dhabi CBD to Al Ain via Capital City

The technology for the regional railways services will be defined by the implementation studies, but the Plan envisages the following:

- High speed services: electrically powered multiple units with speeds exceeding 300km/hr. Approximately 500 seated passengers per train.
- Regional railway services to Dubai: electrically powered multiple units. Approximately 700 passengers per train seated and standing.
- Regional railway services to Al Ain and Al Gharbia: electro-diesel multiple units with speeds up to 200km/hr. Approximately 350 passengers per train seated and standing.

D8.3 Freight Rail

The freight railway concept under development by Union Railway is supported by the Plan. This rail network will provide dedicated rail freight services and form part of the GCC-wide railway network. The railway consists of 5 main elements within the Emirate (Table D3 and Figure D1).

Table D3: Freight Rail

Ref	Scheme
FR1	Freight main line from KSA to Dubai border
FR2	Freight line from Khalifa Port to main line
FR3	Freight line from Al Ain/Oman border to main line
FR4	Freight spur from Mussafah/ICAD to main line
FR5	Freight spur from AUH airport free zone to main line

The technology proposed for the freight line is diesel powered locomotives, with speeds of up to 160km/hr and a loading gauge capable of containing doublestack freight wagons. Safeguarding of the alignment allows for a double track railway. Outside the Metropolitan area, the freight rail and regional passenger rail share the same corridors, as far as practicable.

The Metro will provide the backbone for the public transport system in the Metropolitan area.

D8.4 Metro

The Plan includes a modern, high capacity Metro network throughout the Abu Dhabi metropolitan area that will provide the backbone for the new integrated public transport network linking key areas such as Capital City and the airport with central Abu Dhabi. The Metro will be fully segregated from the highway network, either above or below ground, to provide travel times competitive with those by road and will use electrically powered trains, travelling at speeds of up to 130km/hr, with the number of carriages

depending on the passenger loadings and service route. High quality and secure interchanges will be located throughout the network to link into complementary public transport services such as the tram and bus networks. The metro consists of 4 main elements (Table D4 and Figure D3).

Table D4: Metro

Ref	Scheme
MT1	CBD - Airport - Capital City loop
MT2	Marina Mall Spur
MT3	Capital City - Mohammed Bin Zayed loop
MT4	Shamkhah Spur

The services operated over these elements will be defined by the Metro Feasibility Study, but the Plan has identified several routes including a dedicated Airport Express from the CBD to Abu Dhabi International Airport.

A very extensive street running tram system will provide high quality services to much of the Metropolitan area.

D8.5 Tram

A comprehensive tram network is set out in the Plan to provide frequent and reliable services covering the denser development areas, where the higher capacity can be justified, with tram stops planned roughly every 500 metres to provide a fine-grained coverage and excellent accessibility. The Tram Feasibility Study will refine the alignment and location of the tram tracks and the individual routes to be operated, and will also determine whether some routes would be more appropriate as Bus Rapid Transit (BRT). The Plan presents (Figure D5) the current best estimate of where tram routes are required and also shows a number of potential alternative alignments that require further study.

The implementation of Personal Rapid Transit in new developments is supported by the Plan.

D8.6 Personal Rapid Transit (PRT)

PRT is a largely unproven system that provides a flexible demand responsive public transport using small electrically powered vehicles. The developers of Masdar City are proposing a PRT system, which is supported by the Plan and subject to the success at Masdar, a similar system for Lulu is suggested. For Masdar, the system will be located at basement level and will provide the main mobility option in the city of 100,000 residents using a fleet of around 2,200 passenger and 800 freight PRT vehicles (Figure D3).

D8.7 Water Transport

Formal maritime public transport will be introduced in the Abu Dhabi

Ferries and water taxis will be provided where appropriate.

Metropolitan area, providing links between key waterfront locations and the centre of Abu Dhabi. This will involve the development of key interchanges at ferry terminals with other public transport modes (Table D6 and Figure D2).

Table D5: Water Transport

Ref	Project title
WT1	Scheduled ferry service Emerald Gateway to Al Bateen via Zayed Sports City
WT2	Scheduled ferry service Yas Island Marina to CBD Station via Raha Beach
WT3	Circular ferry service - Suwa Island, Saadiyat Island, Al Reem Island
WT4	Network of jetties for water taxi services

D8.8 Bus

A fine-grained bus network to provide frequent and reliable services in those areas not served by trams is included in the Plan, for which a minimum peak period service frequency of 4 buses per hour is recommended. Where conventional bus services at this frequency cannot be justified, the Plan includes the provision of demand-responsive buses or minibuses to provide a door-to-door on-demand service.

D8.9 Highways

Both improvements to the existing highway system (mainly lane additions) and some new highways will be necessary to cater for 2030 demand. The Plan incorporates ongoing and committed schemes (Table D6) as well as containing a number of additional schemes (Table D7). (Figures D1, D2 and D3).

In addition to these new and upgraded strategic highways, there will continue to be the need to assess the scale and design of individual junctions or intersections and local widenings dependent on variations in traffic demand and the scale of new developments. A programme of improvements to the secondary road network will complement these highway schemes; the details will emerge and be developed over the Plan period. This secondary highway network will be developed, where feasible, to relieve the strategic highway network of the need to accommodate short distance trips, which frequently require excessive merging and weaving and reduce the capacity of the strategic network for longer distance journeys. This is subject to ongoing work by ADUPC.

Table D6: Ongoing and Committed Highway Schemes

Ref	Project title	Description
CH1	Sheikh Zayed Bridge	NC (2x4)
CH2	Saadiyat - Shahama Freeway	NC (2x5)
CH3	Shahama Freeway Extension to E11	NC (2x4)
CH4	Mafraq - Ghwaifat (E11)	W (1)
CH5	Gayathi - Madinat Zayed Rd	NC (1x2)
CH6	Salaam Street Tunnel (includes four grade separated junctions on Salam Street)	NC (2x4), G5
CH7	Saadiyat Bridge to Mina Road Tunnel	NC (2x4)
CH8	Connecting City to Suwa Island - Bridges 1- 4	NC (2x3)
CH9	Connecting City to Suwa Island - Bridges 5-7	NC (2x3)
CH10	Connecting Suwa and Reem Islands - Bridges 8-10	NC (2x3)
CH11	Connecting Suwa and Reem Islands - Bridges 11-13	NC (2x3)
CH12	Al Ain to Dubai Highway (E66) Upgrading	W (1)
CH13	Lulu Highway (with bridge links from Marina Mall to Mina Zayed)	NC (2x3)
CH14	Al Ain Northern Bypass	NC (2x4)
CH15	Bainuna Street widening	W (1)
CH16	Electra Street Tunnels at Junctions 6 and 4	GS
CH17	Tunnels linking Lulu Island to Abu Dhabi Island	NC (2x2)

NC – New Construction (carriageways x lanes)
GS – Grade Separated Junctions
W – Widening (number of extra lanes for each direction)

Table D7: New Highway Schemes

Ref	Project title	Description
NH1	Shahama Freeway Extension from E11 to NH2	NC (2x4)
NH2	Second Abu Dhabi - Dubai Highway (as far as E30)	NC (2x4)
NH3	Reem Island to Abu Dhabi	NC (2x4)
NH4	Saadiyat to Reem Island Bridge	NC (2x5)
NH5	Mid Island Parkway	NC (2x4)
NH6	Al Ain to KPIZ Highway	NC (2x2)
NH7	Mussafah to Abu Dhabi Island new link	NC (2x3)
NH8	Desert Highway Extension	NC (2x2)
NH9	Marina Mall/Corniche Grade Separated Junction	GS
NH10	Upgraded E10 Freeway from Sheikh Zayed Bridge to E11	W (1)
NH11	Upgraded E20 Freeway form Mussafah Bridge to E11	W (1)
NH12	Upgraded E22 Freeway from Maqta Bridge to E11	W (1)

Ref	Project title	Description
NH14	Airport Western Link	W (2)
NH15	South Hodariyat - link from Mussafah	NC (2x3)
NH16	South Hodariyat - link to Abu Dhabi Island	NC (2x4)
NH17	Upgrade E15 to Dual 2	W (1)
NH18	Upgrade E65 to Dual 2	W (1)
NH19	Upgrade E90 to Dual 2	W (1)
NH20	Second Link From Reem Island to Saadiyat - Abu Dhabi Island link	NC (2x4)
NH21	Muroor Road Extension to Capital City	NC (2x3)
NH22	Tunnel from Reem Island to 31st Street	NC (2x4)
NH23	Khaleej Al Arabi upgrading (including ADNEC tunnel)	NC (2x6)

NC – New Construction (carriageways x lanes)
GS – Grade Separated Junctions
W – Widening (number of extra lanes for each direction)

The transfer of freight from road to rail is a key policy of the Plan.

D8.10 Freight

The Plan supports the implementation of a number of regional freight distribution centres (Table D8) and the construction of the UAE freight railway (Figure D3).

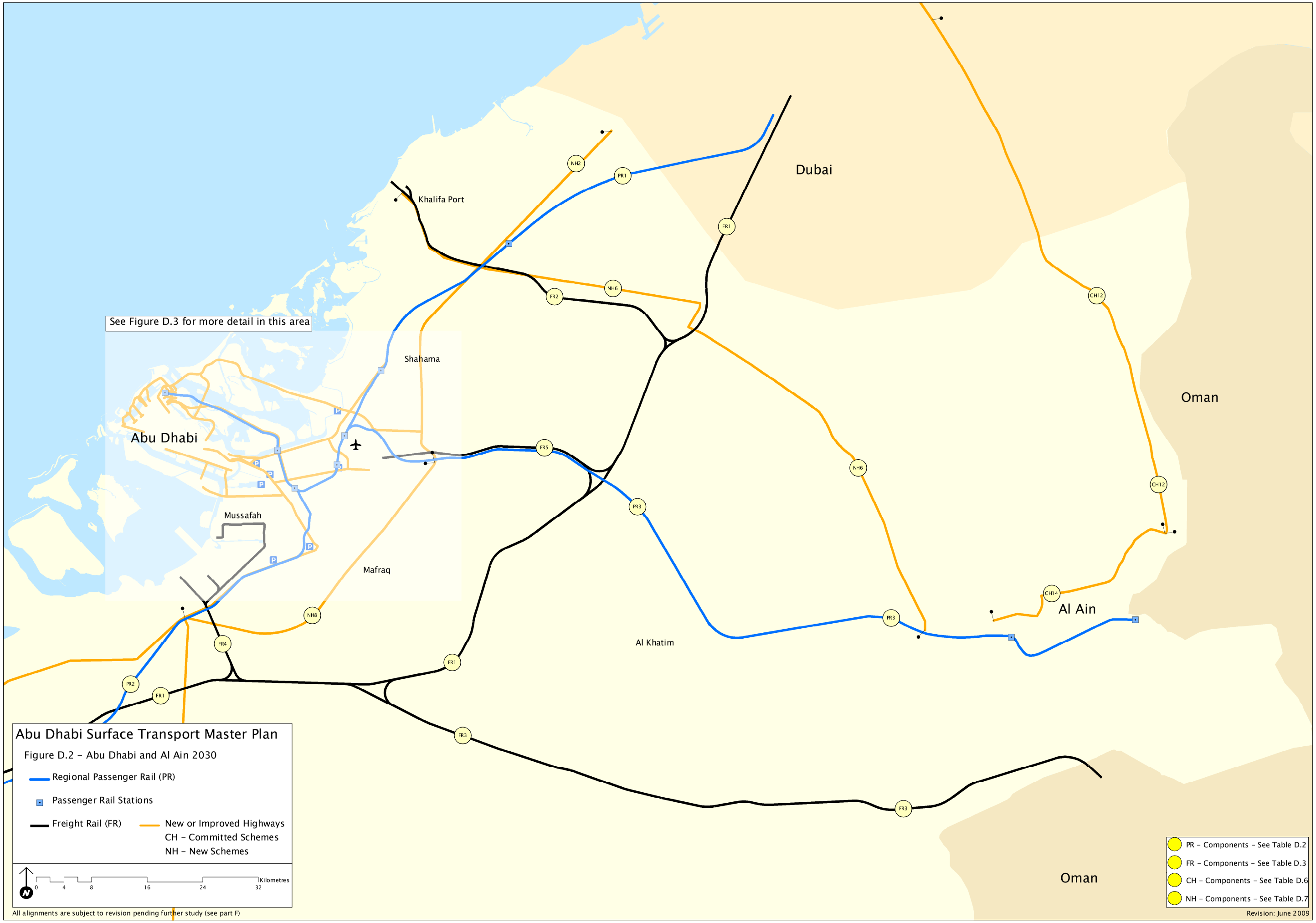
Table D8: Freight Schemes

Ref	Project title
FS1	Multimodal waterfront distribution centre at ICAD and secondary bimodal waterfront distribution centre at Mina Zayed
FS2	Multimodal distribution centre at Khalifa Port
FS3	Multimodal distribution centre at Airport free trade zone
FS4	Freight rail line (see D8.3)
FS5	Water freight service from Mussafah to KPIZ
FS6	New Multimodal distribution centre at Al Ain

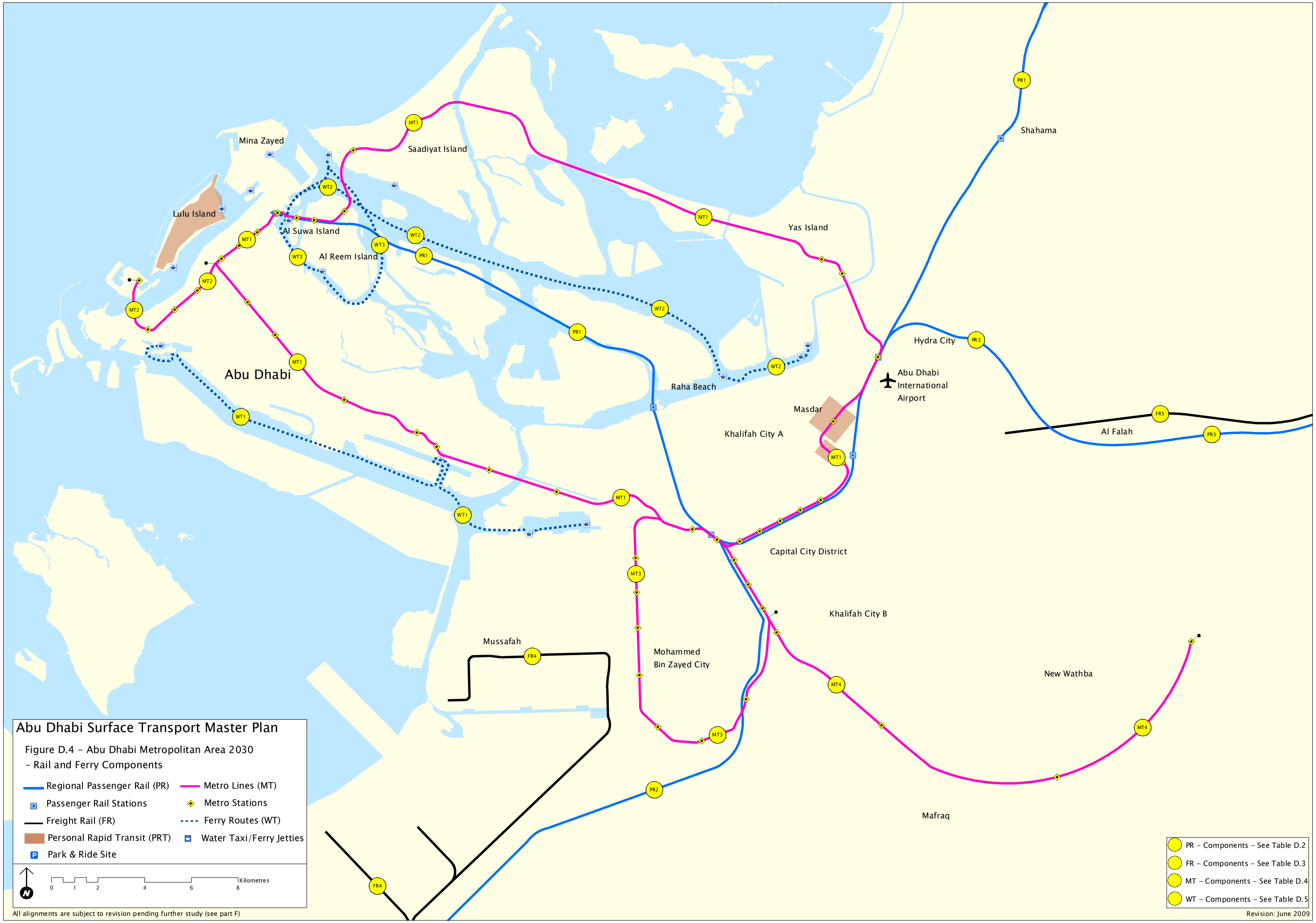
D9 References

1. Plan Abu Dhabi 2030: Urban Structure Framework Plan. Urban Planning Council. Sep 2007.


Qatar
See Figure D.2 for more detail in this area
Dubai
Khalifa Port
Abu Dhabi
Shahama
Oman
Mussafah
Mafraq
Jebel Dhanna
Sila
Ruwais
Al Khatim
Al Ain
Tarif
Al Mirfa
Gayathi
Madinat Zayed
Al Qua'a
Liwa
Oman
Saudi Arabia
CH4
PR2
FR4
CH5
NH18
NH17
NH19
Abu Dhabi Surface Transport Master Plan
Figure D.1 – Abu Dhabi Emirate 2030
Regional Passenger Rail (PR)
Passenger Rail Stations
Freight Rail (FR)
Ferry Route
New or Improved Highways
CH – Committed Schemes
NH – New Schemes
0 10 20 40 60 80 Kilometres
PR – Components – See Table D.2
FR – Components – See Table D.3
CH – Components – See Table D.6
NH – Components – See Table D.7
All alignments are suject to revision pending further study (see part F)
Revision: May 2009


Dubai
Khalifa Port
NH2
PR1
FR1
NH6
FR2
See Figure D.3 for more detail in this area
Shahama
Abu Dhabi
FR5
NH6
CH12
Oman
PR3
Mussafah
Mafraq
NH8
CH14
Al Ain
PR3
FR4
FR1
PR2
FR1
Al Khatim
FR3
FR3
Oman
Abu Dhabi Surface Transport Master Plan
Figure D.2 – Abu Dhabi and Al Ain 2030
Regional Passenger Rail (PR)
Passenger Rail Stations
Freight Rail (FR)
New or Improved Highways
CH – Committed Schemes
NH – New Schemes
0 4 8 16 24 32 Kilometres
PR – Components – See Table D.2
FR – Components – See Table D.3
CH – Components – See Table D.6
NH – Components – See Table D.7
All alignments are subject to revision pending further study (see part F)
Revision: June 2009

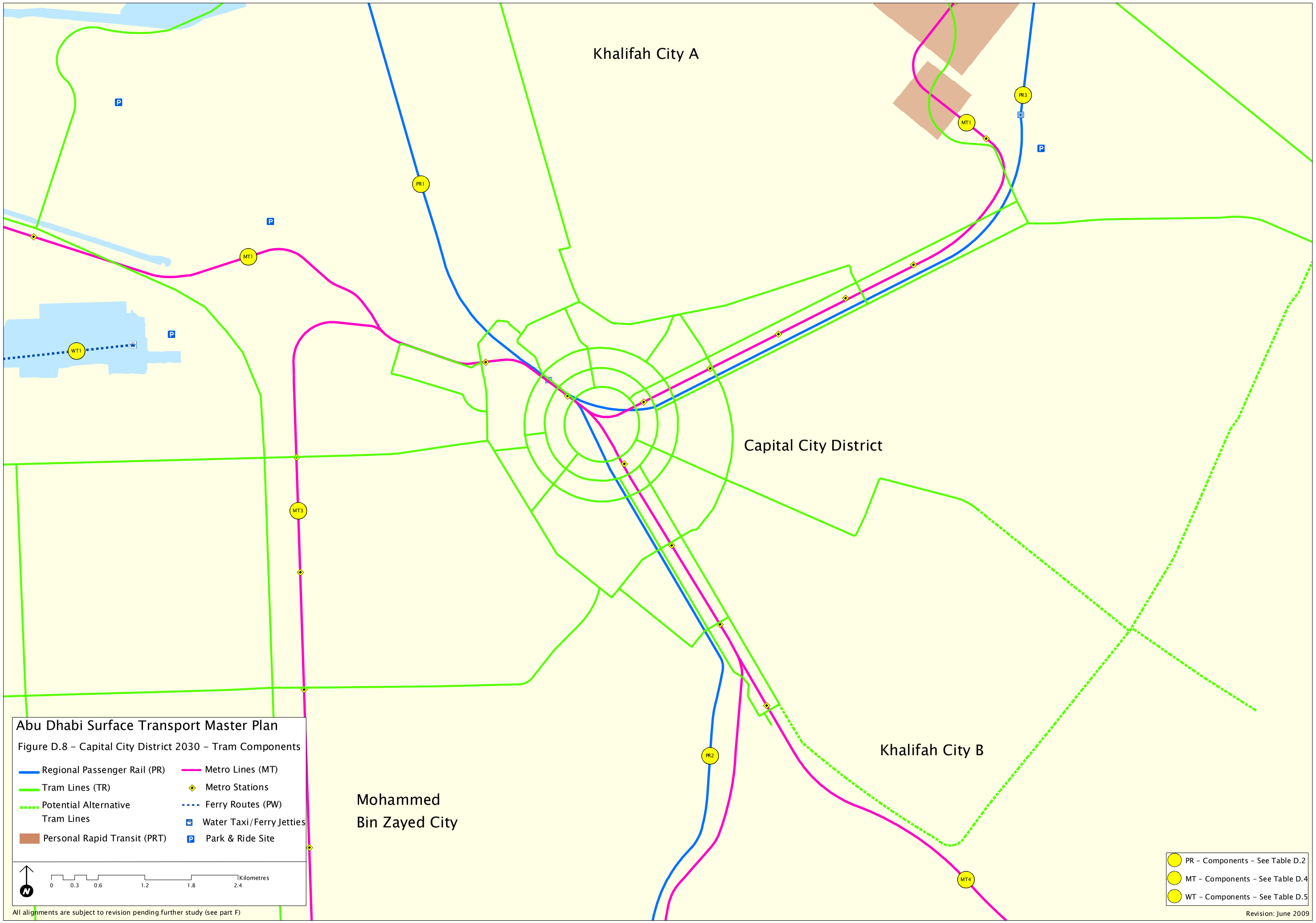

Mina Zayed
Saadiyat Island
Shahama
Lulu Island
Al Suwa Island
Al Reem Island
Yas Island
Abu Dhabi
Hydra City
Abu Dhabi International Airport
Raha Beach
Masdar
Khalifah City A
Al Falah
Capital City District
Khalifah City B
Mussafah
Mohammed Bin Zayed City
New Wathba
Mafraq
Abu Dhabi Surface Transport Master Plan
Figure D.3 – Abu Dhabi Metropolitan Area 2030
Regional Passenger Rail
Passenger Rail Stations
Freight Rail
New or Improved Highways
Personal Rapid Transit (PRT)
Park & Ride Site
Tram Lines
Potential Alternative Tram Lines
Metro Lines
Metro Stations
Ferry Routes
Water Taxi/Ferry Jetties
0 1.25 2.5 5 7.5 10 Kilometres
All alignments are subject to revision pending further study (see part F)
Revision: June 2009


Mina Zayed
Saadiyat Island
Lulu Island
Al Suwa Island
Al Reem Island
Abu Dhabi
Yas Island
Shahama
Hydra City
Abu Dhabi International Airport
Raha Beach
Masdar
Khalifah City A
Al Falah
Capital City District
Khalifah City B
Mussafah
Mohammed Bin Zayed City
New Wathba
Mafraq
MT1
MT2
MT3
MT4
WT1
WT2
WT3
PR1
PR2
PR3
FR4
FR5
Abu Dhabi Surface Transport Master Plan
Figure D.4 – Abu Dhabi Metropolitan Area 2030 – Rail and Ferry Components
Regional Passenger Rail (PR)
Metro Lines (MT)
Passenger Rail Stations
Metro Stations
Freight Rail (FR)
Ferry Routes (WT)
Personal Rapid Transit (PRT)
Water Taxi/Ferry Jetties
Park & Ride Site
Kilometres
0 1 2 4 6 8
PR – Components – See Table D.2
FR – Components – See Table D.3
MT – Components – See Table D.4
WT – Components – See Table D.5
All alignments are subject to revision pending further study (see part F)
Revision: June 2009


See Figure D.7 for more detail in this area
Mina Zayed
Saadiyat Island
Shahama
Lulu Island
Al Suwa Island
Al Reem Island
Yas Island
Hydra City
Abu Dhabi
Abu Dhabi International Airport
Raha Beach
Masdar
Khalifah City A
Al Falah
See Figure D.8 for more detail in this area
Capital City District
Mussafah
Khalifah City B
Mohammed Bin Zayed City
New Wathba
Mafraq
Abu Dhabi Surface Transport Master Plan
Figure D.5 – Abu Dhabi Metropolitan Area 2030 – Tram Components
Tram Lines (TR)
Potential Alternative Tram Lines
Personal Rapid Transit (PRT)
N
0 1 2 4 6 8 Kilometres
All alignments are subject to revision pending further study (see part F)
Revision: June 2009


See Figure D.9 for more detail in this area
Mina Zayed
Saadiyat Island
Lulu Island
Al Suwa Island
Al Reem Island
Abu Dhabi
Yas Island
Shahama
Hydra City
Abu Dhabi International Airport
Raha Beach
Masdar
Khalifah City A
Al Falah
Capital City District
Mussafah
Mohammed Bin Zayed City
Khalifah City B
New Wathba
Mafraq
CH2
CH3
NH5
NH1
NH2
NH10
NH14
NH21
NH23
CH1
NH16
NH7
NH15
CH4
NH8
Abu Dhabi Surface Transport Master Plan
Figure D.6 – Abu Dhabi Metropolitan Area 2030 – Highway Components
New or Improved Highways
CH – Committed Schemes
NH – New Schemes
Personal Rapid Transit (PRT)
Park & Ride Site
N
0 1 2 4 6 8 Kilometres
All alignments are subject to revision pending further study (see part F)
CH – Components – See Table D.6
NH – Components – See Table D.7
Revision: June 2009


Mina Zayed
Saadiyat Island
Lulu Island
Al Suwa Island
Al Reem Island
Abi Dhabi Island
MT1
MT2
WT2
WT3
PR1
Abu Dhabi Surface Transport Master Plan
Figure D.7 – Abu Dhabi Island CBD 2030 – Tram Components
Regional Passenger Rail (PR)
Passenger Rail Stations
Freight Rail (FR)
Tram Lines (TR)
Potential Alternative Tram Lines
Metro Lines (MT)
Metro Stations
Ferry Routes (WT)
Water Taxi/Ferry Jetties
Personal Rapid Transit (PRT)
0 0.3 0.6 1.2 1.8 2.4 Kilometres
PR – Components – See Table D.2
MT – Components – See Table D.4
WT – Components – See Table D.5
All alignments are subject to revision pending further study (see part F)
Revision: June 2009


Khalifah City A
Capital City District
Khalifah City B
Mohammed
Bin Zayed City
PR1
PR2
PR3
MT1
MT3
MT4
WT1
Abu Dhabi Surface Transport Master Plan
Figure D.8 – Capital City District 2030 – Tram Components
Regional Passenger Rail (PR)
Tram Lines (TR)
Potential Alternative Tram Lines
Personal Rapid Transit (PRT)
Metro Lines (MT)
Metro Stations
Ferry Routes (PW)
Water Taxi/Ferry Jetties
Park & Ride Site
0 0.3 0.6 1.2 1.8 2.4 Kilometres
All alignments are subject to revision pending further study (see part F)
PR – Components – See Table D.2
MT – Components – See Table D.4
WT – Components – See Table D.5
Revision: June 2009


Mina Zayed
Saadiyat Island
Lulu Island
Al Suwa Island
Al Reem Island
Abu Dhabi Island
CH7
CH9
CH11
CH8
CH10
NH3
NH5
NH20
CH6
CH13
CH17
CH16
NH9
CH15
Abu Dhabi Surface Transport Master Plan
Figure D.9 – Abu Dhabi Island CBD 2030
– Highway Components
New or Improved Highways
CH – Committed Schemes
NH – New Schemes
0
0.25
0.5
1
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Kilometres
All alignments are subject to revision pending further study (see part F)
CH – Components – See Table D.6
NH – Components – See Table D.7
Revision: June 2009

Part E
Delivery

E Delivery

E1 The Challenge

Delivering the Plan will be extremely challenging. Out of the total programme around 110km of Metro, 50 km of tramway and 1000 km of new or expanded highway may have to be constructed in a six-year period (subject to further detailed study), from practically a standing start.

The scale of the challenge can be illustrated by a number of examples:

- The Singapore and Hong Kong systems took approximately 30 years to extend to 100km length
- The Dublin-based procurement agency for metro and tram has a staff complement of 200 to deliver a network less than 100km in total
- The planned Crossrail railway under London has been planned for many years and has a procurement agency that will soon be expanding its staff from 200 today to 600 when the project is under construction
- Berlin has a passenger transport authority with 450 staff to plan, procure and monitor multi-modal services in that city of 3.4 million people.

In all the above cases, the private sector play an important role.

The Abu Dhabi Metro will be of similar scale to Singapore's, but will have to be built in a much shorter time scale.

E2 Gearing up for Delivery

E2.1 Proposed Institutional Structure

The DoT has full responsibility for delivering the Plan. To do this it will need:

- streamlined procurement procedures supported by a new law
- full support from other government agencies
- new executive agencies to implement its strategy and plans
- to engage private sector skills to supplement its resources while these agencies develop
- strong governance through the EHS MS framework (see Part A for details).

DoT will work closely with a number of Government agencies including:

- the ADUPC: to ensure a close coordination of land development and transport infrastructure provision and the implementation of planning guidance and controls that embody the philosophy and strategies of the Plan and Plan Abu Dhabi 2030

- the Municipalities: to ensure that the Plan policies are carried through to the street level and that the transfer of responsibilities and staff to the DoT and its agencies happens smoothly
- the National Transport Authority: whose actions at the Federal level on aspects of driver, vehicle and operator regulation have the potential to support Emirate policies and magnify their effectiveness
- Union Rail: when it is created with its Federal freight and passenger rail responsibilities, with whom an integrated national rail network will need to be planned
- The EAD, in development of the Plan's low carbon and environmental strategies, for current environmental regulation of projects and as the authority responsible for supervising the implementation of the EHS MS.

The DoT will create two new statutory implementation agencies to implement the Plan:

- a public transport agency Abu Dhabi Transport Company ('ADTCo') to deliver bus, ferry and car park services, procure the construction and operation of the new tram, metro and regional rail network and ensure a seamless passenger experience across all modes
- a roads agency ('RoadCo') to maintain the road network and to procure the construction, maintenance and operation of the strategic highway network.

These new agencies will work in parallel with DoT's successful taxi agency, TransAD.

The skills, capacity and resources of the private sector must be used to the maximum to achieve the challenging timescales demanded by the Plan. In particular, the private sector will need to play a role in the following areas:

- coordinating and ensuring delivery of the wide range of Plan projects and strategies
- designing and developing projects and strategies from concept to feasibility level
- designing, building, maintaining and operating infrastructure and procuring, maintaining and operating rolling stock, vessels or vehicles to provide the transport services
- financing selected projects or the procurement of moveable assets.

E3 The Role of the Private Sector

To coordinate and ensure delivery of the wide range of projects and strategies that form the Plan, the DoT will engage Programme Management Consultants (PMCs) to oversee the procurement of the highway and public transport programmes. The strengthening of central planning and coordination may also involve the private sector.

The Private Sector will have a critical role in delivering the Plan, for example with provision of rolling stock.

The private sector will play a critical role in delivering the bulk of the Plan programme in partnership with ADTCo and RoadCo. A variety of partnership arrangements will be adopted to tap the capability and capacity of global and local contractors, manufacturers and operators to design, build and operate major Plan components. These contractual arrangements and competitive tendering should ensure that the contractors and service providers have strong incentives to deliver the operational specifications and performance that the DoT, or its agencies, have specified.

A variety of models for delivery has been considered and will be further developed during preliminary design. They vary by mode but all take the form of transferring delivery, cost and performance risk to the private sector and giving the contractor, supplier and operator as much freedom as practicable to develop the detailed solutions to deliver a service specification defined by the DoT. Revenue (fare) policy will not be transferred, since DOT will wish to control fares as an integral part of the Plan.

Probable business models include:

- for highways – design, finance, build, operate and transfer solutions and a variety of performance based operations and maintenance contracts
- for buses – competitive franchising of defined services, including vehicle purchase in the future
- for the Metro – traditional procurement of the civil infrastructure of the initial system, because of its magnitude, with the possible supply of systems and/or rolling stock on an availability basis and operating concessions thereafter. Extensions may be procured on a turnkey basis
- for the tram – turnkey procurement of sub-networks may be attractive, with options for how rolling stock and operations are procured.
- for the regional rail system – this is farther into the future and options are open depending on the developing concepts for inter-Emirate and international services.

E4 Funding the Plan

The capital and operating costs of the Plan are very large, commensurate with the scale of transport capacity that it provides.

The programme will be funded from a balanced mix of sources. The operating and maintenance costs of the public transport system will be met through a combination of public transport fares and demand management measures including roaduser charges and surcharges on public parking and taxi fares. Congestion charges and other fees on car users particularly in central areas will promote mode shift and the use of low emission vehicles, and will also generate revenue to finance the public transport system and to offset the maintenance costs of the extra highway capacity provided.

Developers will benefit greatly from the increased accessibility afforded to their developments by the transport systems in the Plan. In many countries, developers contribute to the cost of infrastructure provision through value- or cost-sharing mechanisms. This is not the case in Abu Dhabi and the DoT is currently studying how a cost-sharing approach might be applied.

The Plan will be funded from a balanced mix of sources

Private sector project finance is used increasingly by Governments the world over to bring forward capital expenditure that would not otherwise be affordable and to gain from efficiencies in delivery and operation. The cost of private sector capital is higher than that of public sector borrowing and therefore it should only be used where it gives value for money through the performance incentives it generates, or where some other strategic purpose is served. This method of funding could be applied to many of the projects within the Plan.

Government funding will have to be used for the balance. The Abu Dhabi Government wishes to broaden the sources of funding available to it and it has recently successfully issued Government bonds. Alternatively it can provide guarantees to loans made to RoadCo and ADTCo to fund projects or asset purchases.

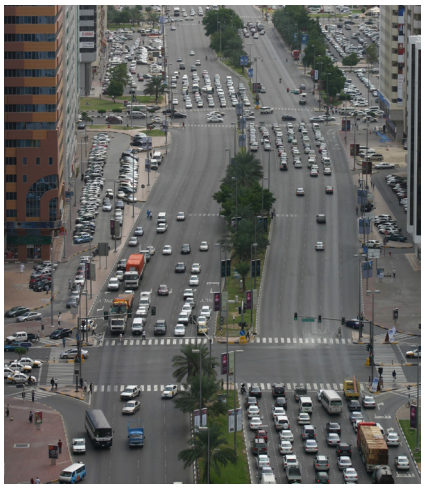
In summary, capital expenditure will be funded by a combination of developer cost-sharing contributions, private finance, government grant and government-backed borrowing. The appropriate balance of these sources of funds should be determined by the Abu Dhabi Government. The balance will vary depending on the prevailing economic environment, other demands on the Abu Dhabi Government's resources and the availability and cost of credit and equity for privately funded elements of the programme.

E5 Performance Monitoring

To successfully deliver the Plan, it will be important to monitor progress. The performance monitoring for the Plan will:

- focus on key outcomes rather than outputs;
- provide a hierarchy of performance indicators;
- make best use of available data sources and collect statistically reliable data;
- include targets and trajectories;
- monitor the external influences and impacts that might influence delivery of the programme and the desired outcomes; and
- include a balanced set of indicators measuring technical performance, value for money and customer satisfaction.

A significant amount of data needs to be collected and analysed to effectively assess the performance of the transport strategy and its impacts on the economy, society and the environment. An early action will be to develop a detailed survey programme to provide the base-line data required. The programme will include surveys at different times of year to reflect changing travel patterns and measures that will vary with the seasons, with some surveys being annual and others monthly.



Detailed monitoring of traffic and many other indicators will be required to assess delivery of the Plan's performance outcomes.

In assessing whether the Plan objectives are on course to be delivered, targets and trajectories will be set to enable progress to be monitored every year and for corrective actions to be planned. Targets will be set according to international benchmarks, where appropriate, to ensure that the Plan is delivering world class performance.

The performance indicators collected and monitored will extend beyond the confines of technical performance, such as traffic flows, mode shares, accident statistics, and the environment, and will ensure that value for money and customer perceptions are also captured.

The performance monitoring system will also address the indicators contained in the Strategic Plan and the Environmental Health and Safety (EHS) performance requirements as stipulated by EHS law. DoT corporate EHS will require each of the DoT sectors to develop an EHS performance monitoring plan on an annual basis, of which the Plan and project-related performance monitoring will be an important component.

The planning, monitoring and review cycle will be supported by a set of reports and meetings to include:

- A monthly monitoring meeting – supported by a monthly monitoring report;
- A quarterly review meeting – supported by a quarterly monitoring report;
- An annual review meeting – supported by a more detailed monitoring report that is also aimed at external stakeholders, the public and the media; and
- A 5-yearly strategy review – supported by a detailed review of the 5-year implementation plan and a revised Plan document.

The annual review will consider the full range of performance metrics, financial and scheme delivery information. Progress towards all key outcomes and Key Performance Indicators (KPIs) would be presented in an internal monitoring report, identifying variations from the Plan and identifying clearly the reasons why, through analysis of the other indicators in the KPI hierarchy as well as external influences. Where necessary, the scope of corrective actions to keep the Plan outcomes on track will also be defined.

A detailed Action Plan for the following year would also be agreed at the meeting. The information would be used to prepare a report for stakeholders, the public and the media, which would 'sell' the successes from the year and set out key goals for the year ahead.

The annual review would be linked to the agencies' service level agreement reviews, and individual staff appraisal reviews to ensure that all aspects of the performance management system are aligned towards achieving the Plan objectives.

The 5-yearly strategy review will take a 20-year forward perspective on the Plan, reviewing the goals and objectives as well as the strategies and programmes of work required to deliver them. The review of the Plan will involve extensive stakeholder consultation and engagement and would result in an updated document for both internal and external consumption. The revised Plan will drive the direction of the surface transport strategy for the next five years.

The outputs from the Strategy Review process will be adjustments to:

- Vision, Mission, Values, Policies, and Corporate Structure;
- Updated Plan;
- Updated budget projection (next year, 5yr, 20yr); and
- Input to the next year Delivery Plan - Critical Success Factors, Key Objectives and Targets.

Part F
Action Plan

F Action Plan

F 1 Overview

The Action Plan for implementation is broken down into a series of five year plans, as follows:

- 2009 to end 2010 – the 2010 Action Plan
- 2011 to end 2015 – the 2015 Action Plan
- 2016 to end 2020 – the 2020 Action Plan
- 2021 to end 2025 – the 2025 Action Plan
- 2026 to end 2030 – the 2030 Action Plan

Each contains:

- a summary of the schemes and strategies to be completed in each period
- an implementation schedule for each infrastructure component

Figures F.1 to F.5 show the phasing of the Plan. This is driven mainly by the need to put infrastructure in place to meet travel demand: the phasing of the Plan, which forecasts a step-change in land use by 2015, requires the core Metro system and a number of key tram and highway components to be open by then.

The Action Plan will be subject to annual review. The first major review will be published at the end of the first plan period (2010) as the large number of initiatives that are either ongoing or due to start in the first plan period are expected substantially to influence phasing and implementation. It is also possible that further detailed evaluation may result in the exclusion of a limited number of schemes, in particular, Bainuna Street widening [CH15], Electra Street tunnels [CH16], and tunnels linking Lulu Island [CH 17], and those with adverse environmental impacts.


Qatar
Dubai
Khalifa Port
Abu Dhabi
Shahama
Oman
Mussafah
Mafraq
Jebel Dhanna
Sila
Ruwais
Al Khatim
Al Ain
Al Mirfa
Tarif
Gayathi
Madinat Zayed
Al Qua'a
Oman
Liwa
Saudi Arabia
Abu Dhabi Surface Transport Master Plan
Figure F.1 – Abu Dhabi Emirate Wide Highway Phasing Plan
Highway schemes in operation by:
2010
2015
2020
2025
2030
Ferry Route in operation by:
2015
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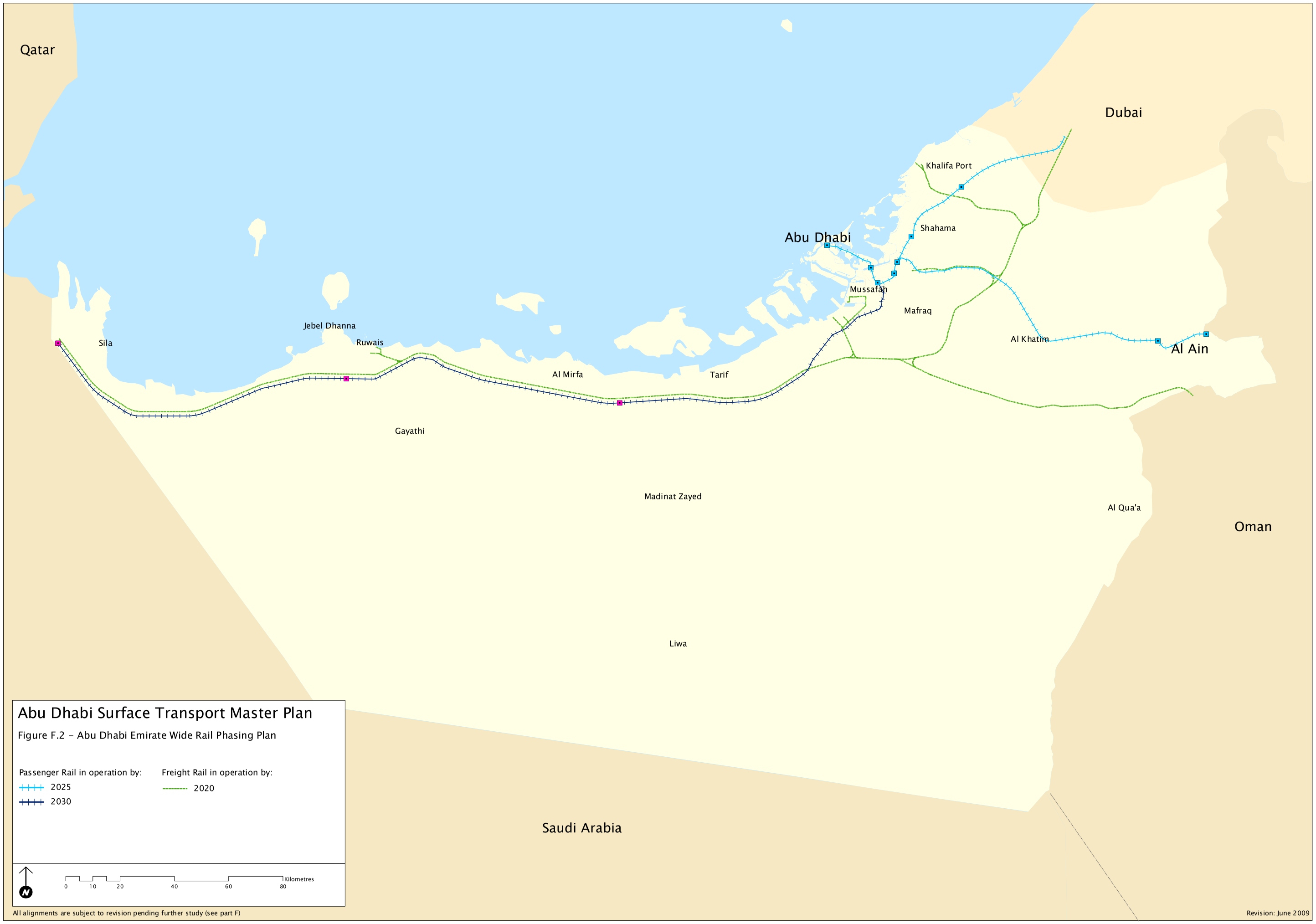
20
40
60
80
Kilometres
All alignments are suject to revision pending further study (see part F)
Revision: May 2009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Madinat Zayed
Al Qua'a
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Liwa
Saudi Arabia
Abu Dhabi Surface Transport Master Plan
Figure F.2 - Abu Dhabi Emirate Wide Rail Phasing Plan
Passenger Rail in operation by:
2025
2030
Freight Rail in operation by:
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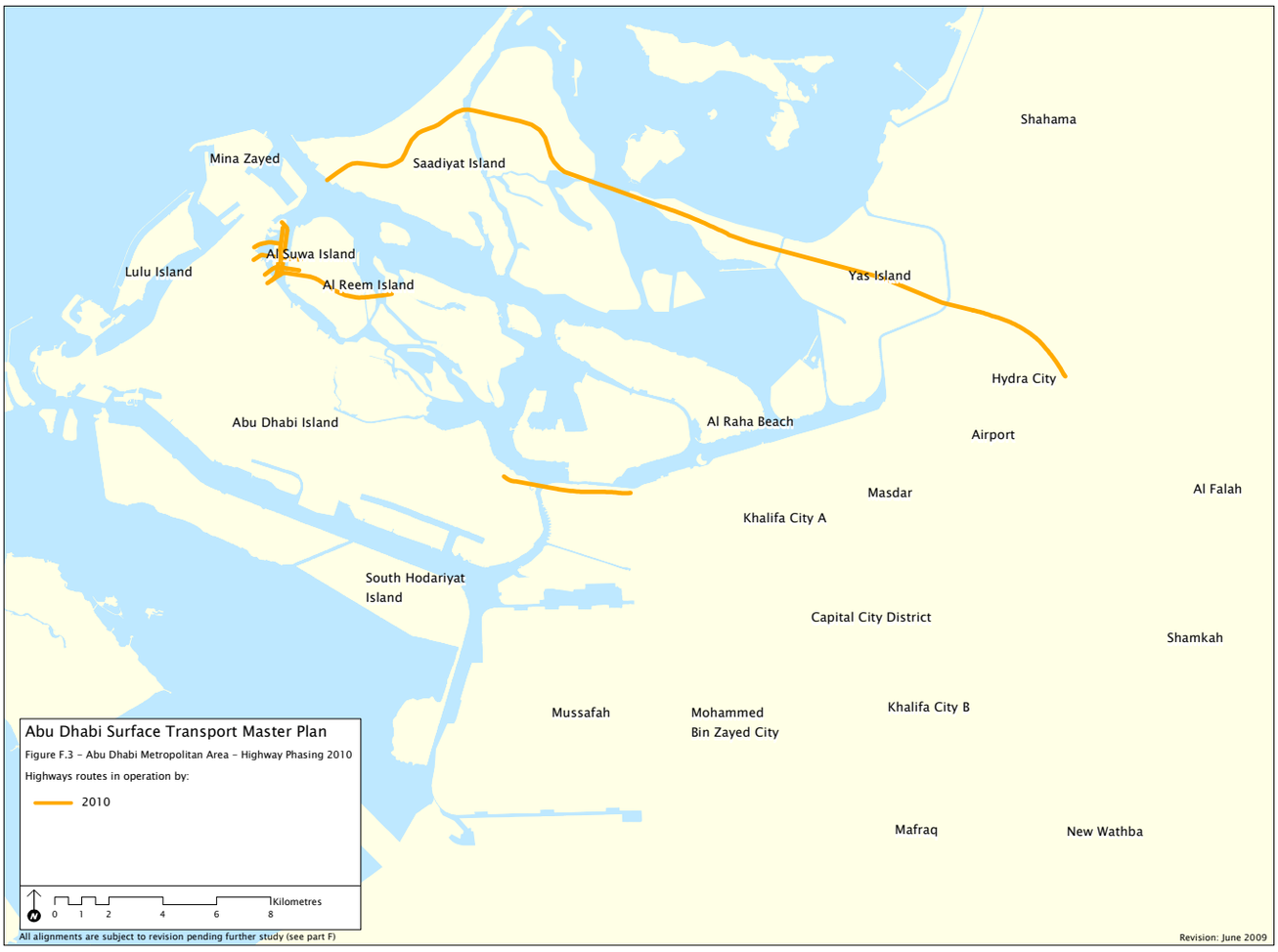
All alignments are subject to revision pending further study (see part F)
Revision: June 2009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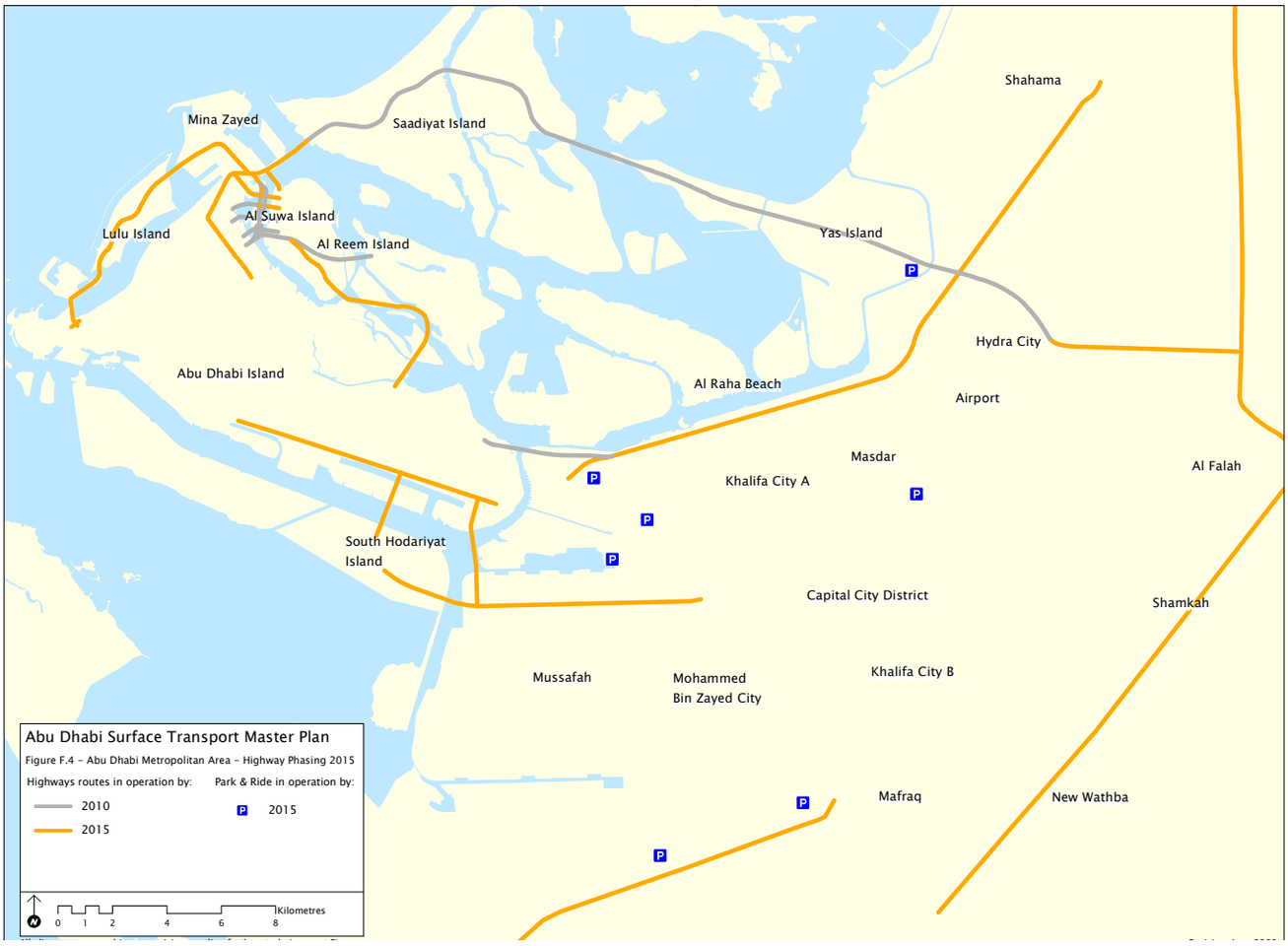
Abu Dhabi Surface Transport Master Plan
Figure F.3 – Abu Dhabi Metropolitan Area – Highway Phasing 2010
Highways routes in operation by:
2010
0 1 2 4 6 8 Kilometres
All alignments are subject to revision pending further study (see part F)
Revision: June 2009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New Wathba
Abu Dhabi Surface Transport Master Plan
Figure F.4 – Abu Dhabi Metropolitan Area – Highway Phasing 2015
Highways routes in operation by:
2010
2015
Park & Ride in operation by:
P 2015
0 1 2 4 6 8 Kilometres


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Abu Dhabi Surface Transport Master Plan
Figure F.5 – Abu Dhabi Metropolitan Area – Highway Phasing 2020
Highways routes in operation by:
2010
2015
2020
Park & Ride in operation by:
2015
0 1 2 4 6 8 Kilometres
All alignments are subject to revision pending further study (see part F)
Revision: June 2009


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Abu Dhabi Surface Transport Master Plan
Figure F.6 – Abu Dhabi Metropolitan Area – Highway Phasing 2025
Highways routes in operation by:
2010
2015
2020
2025
Park & Ride in operation by:
2015
0 1 2 4 6 8 Kilometres


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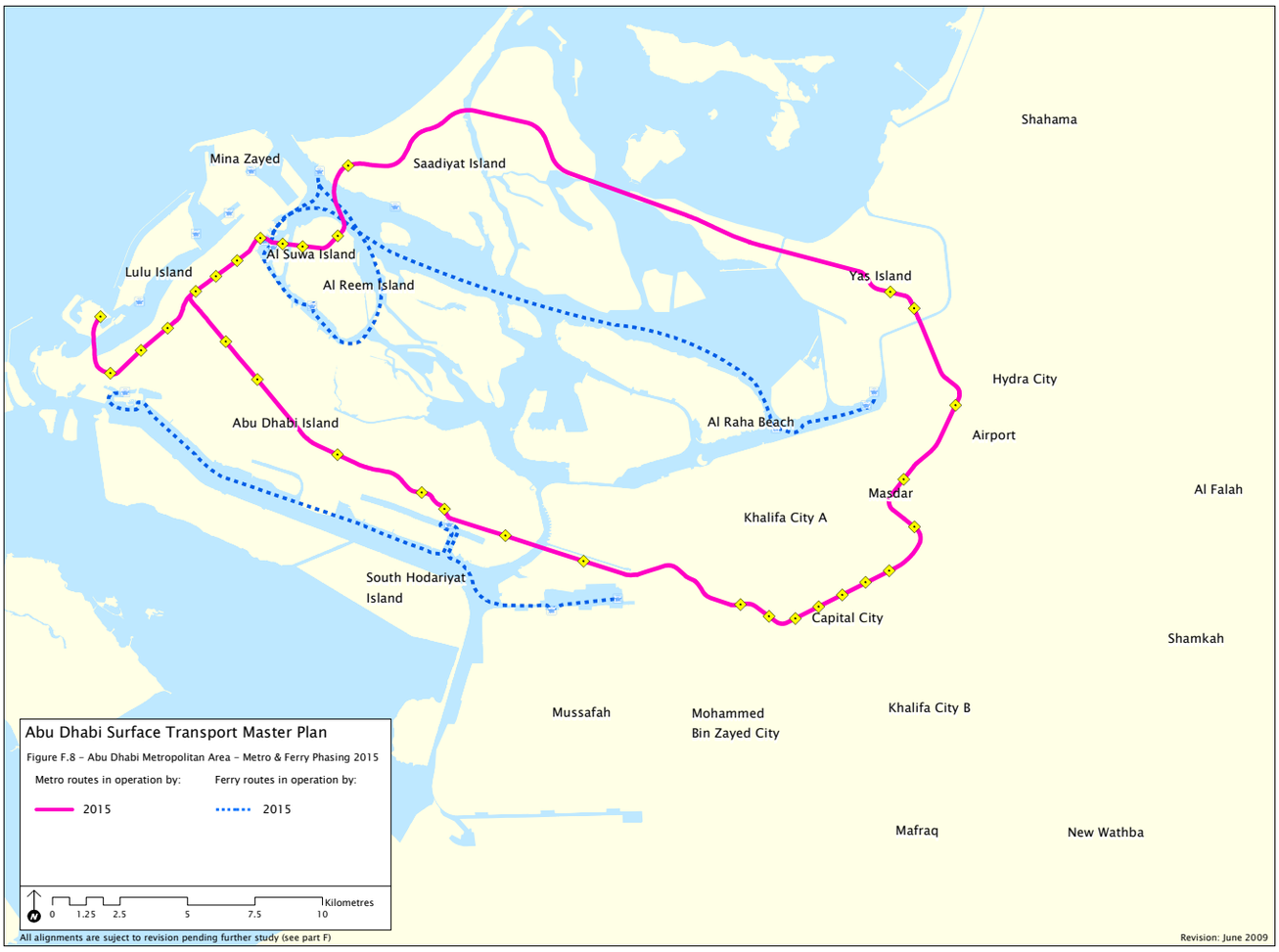
Abu Dhabi Surface Transport Master Plan
Figure F.7 – Abu Dhabi Metropolitan Area – Highway Phasing 2030
Highways routes in operation by:
2010
2015
2020
2025
2030
Park & Ride in operation by:
2015
0 1 2 4 6 8 Kilometres
All alignments are subject to revision pending further study (see part F)
Revision: June 2009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Abu Dhabi Surface Transport Master Plan
Figure F.8 – Abu Dhabi Metropolitan Area – Metro & Ferry Phasing 2015
Metro routes in operation by:
2015
Ferry routes in operation by:
2015
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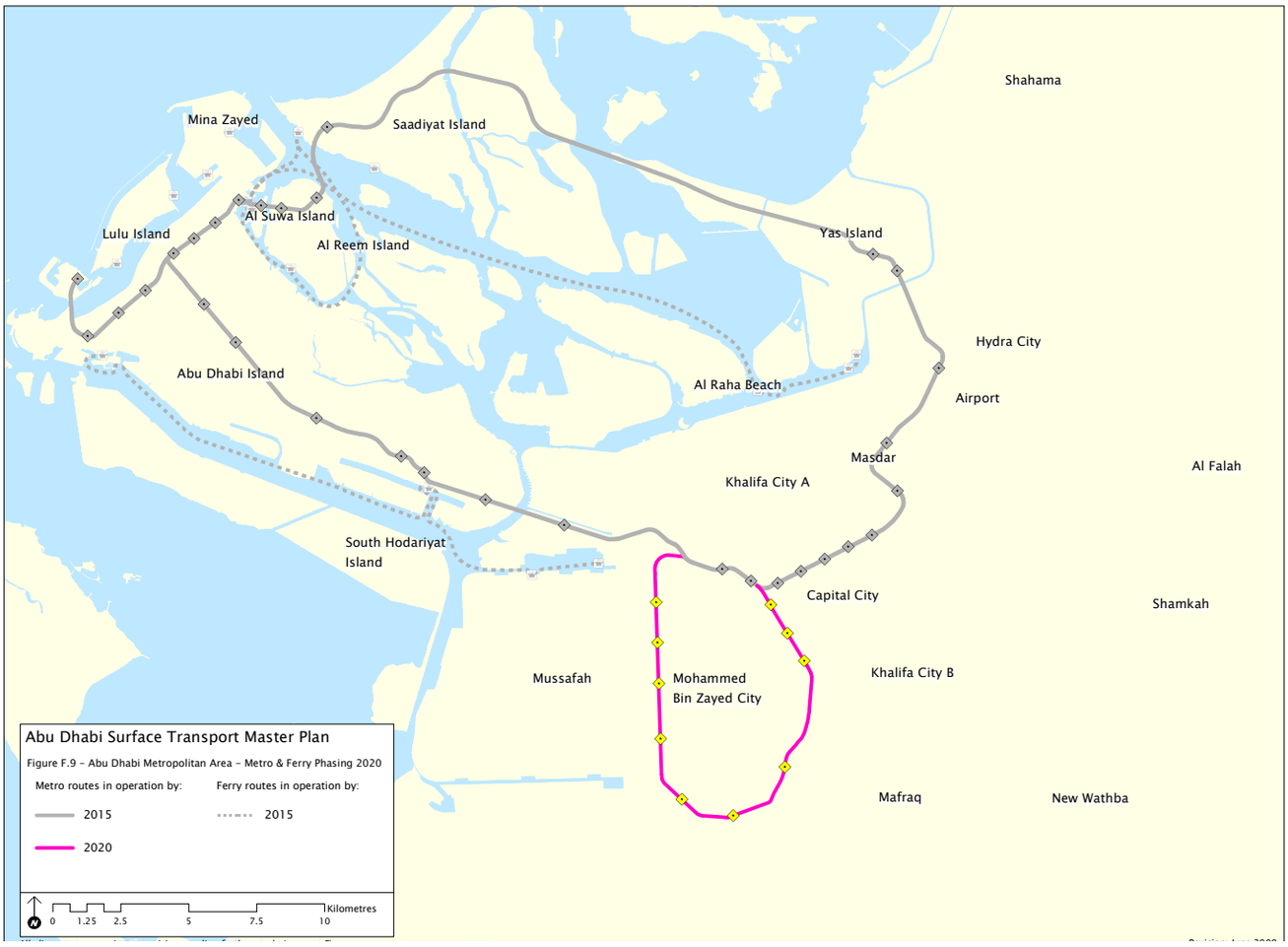
All alignments are suject to revision pending further study (see part F)
Revision: June 2009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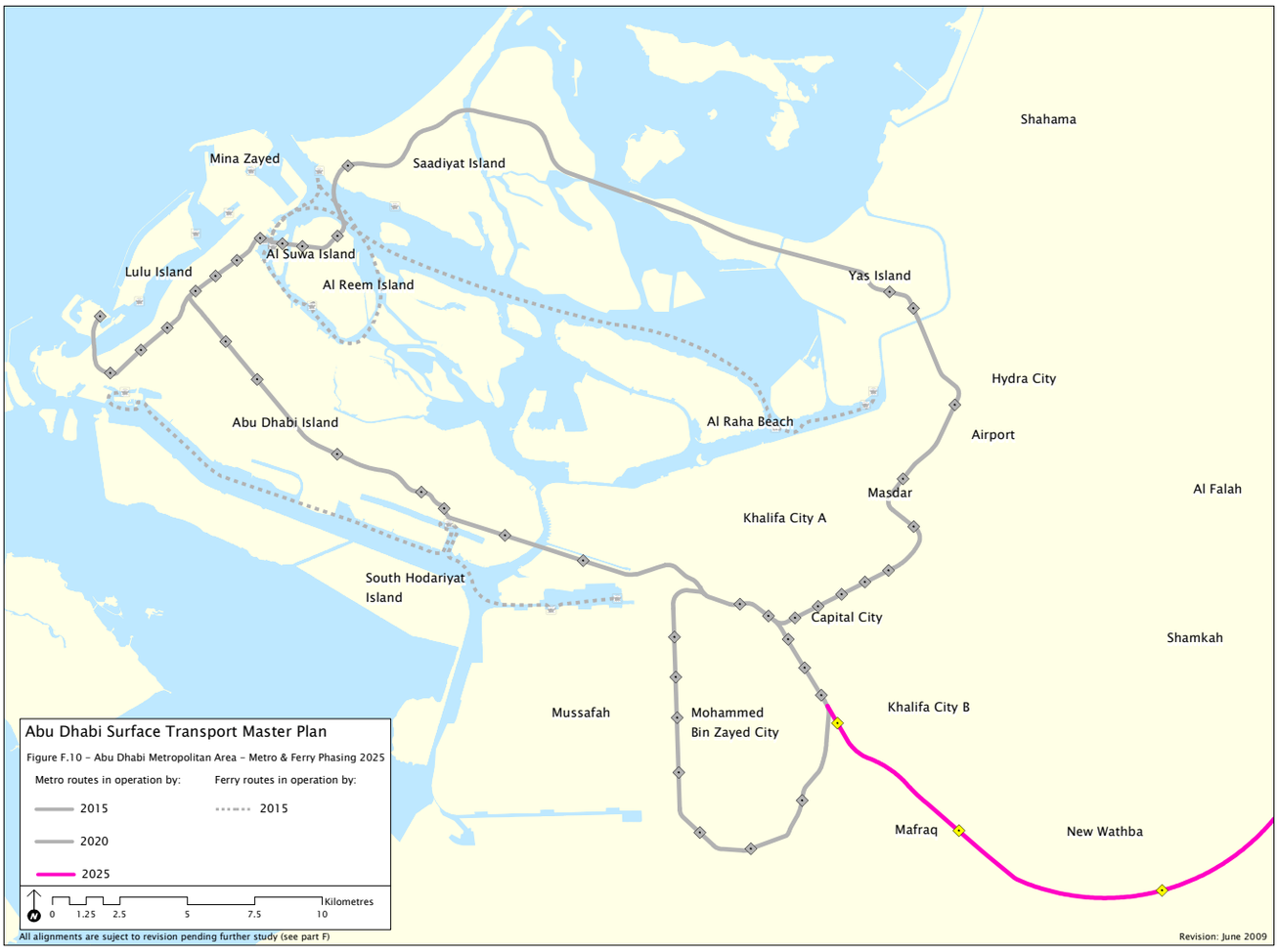
Abu Dhabi Surface Transport Master Plan
Figure F.9 – Abu Dhabi Metropolitan Area – Metro & Ferry Phasing 2020
Metro routes in operation by:
2015
2020
Ferry routes in operation by:
2015
0 1.25 2.5 5 7.5 10 Kilometres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Abu Dhabi Surface Transport Master Plan
Figure F.10 – Abu Dhabi Metropolitan Area – Metro & Ferry Phasing 2025
Metro routes in operation by:
2015
2020
2025
Ferry routes in operation by:
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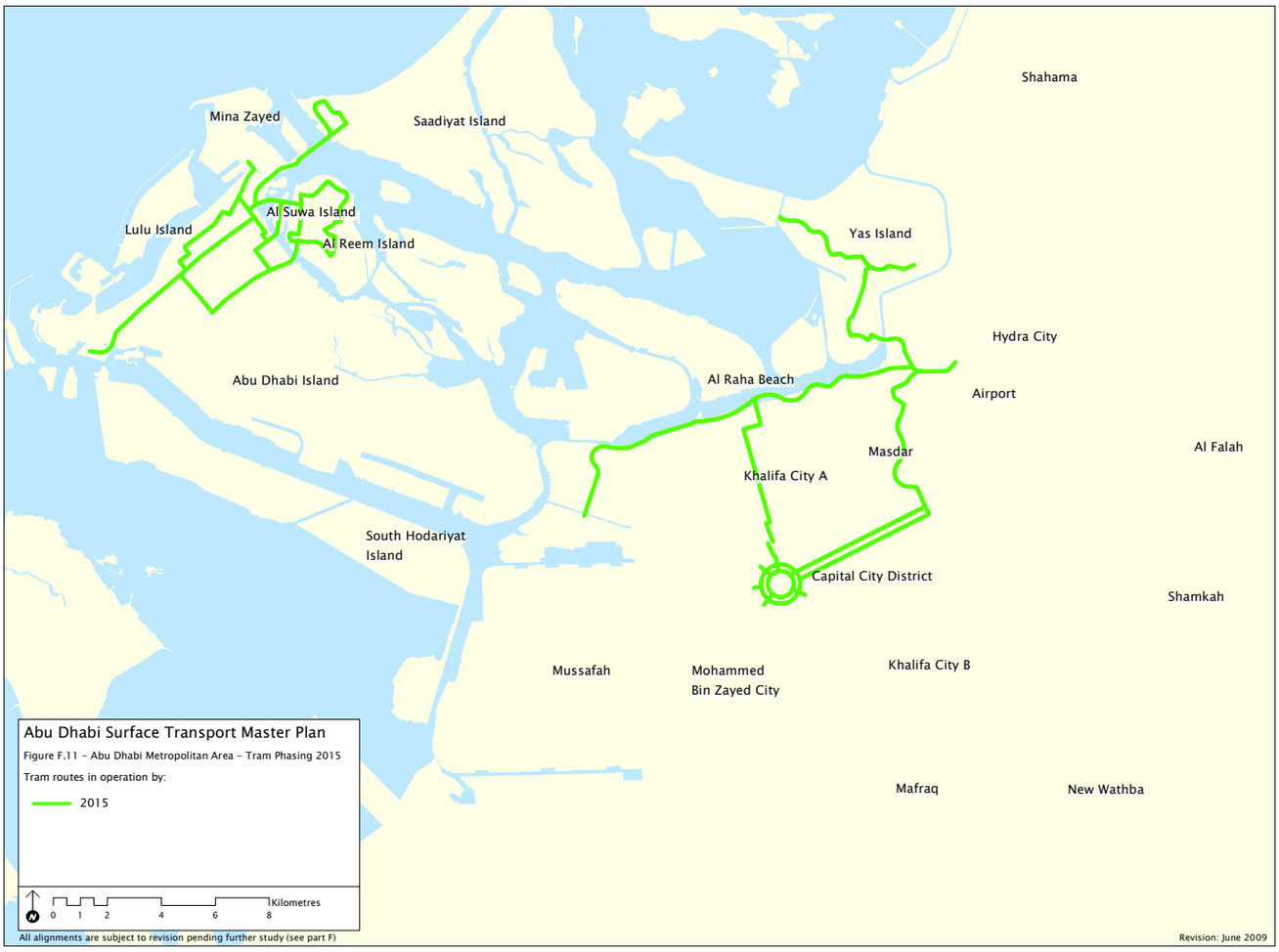
0 1.25 2.5 5 7.5 10 Kilometres
All alignments are suject to revision pending further study (see part F)
Revision: June 2009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Abu Dhabi Surface Transport Master Plan
Figure F.11 – Abu Dhabi Metropolitan Area – Tram Phasing 2015
Tram routes in operation by:
2015
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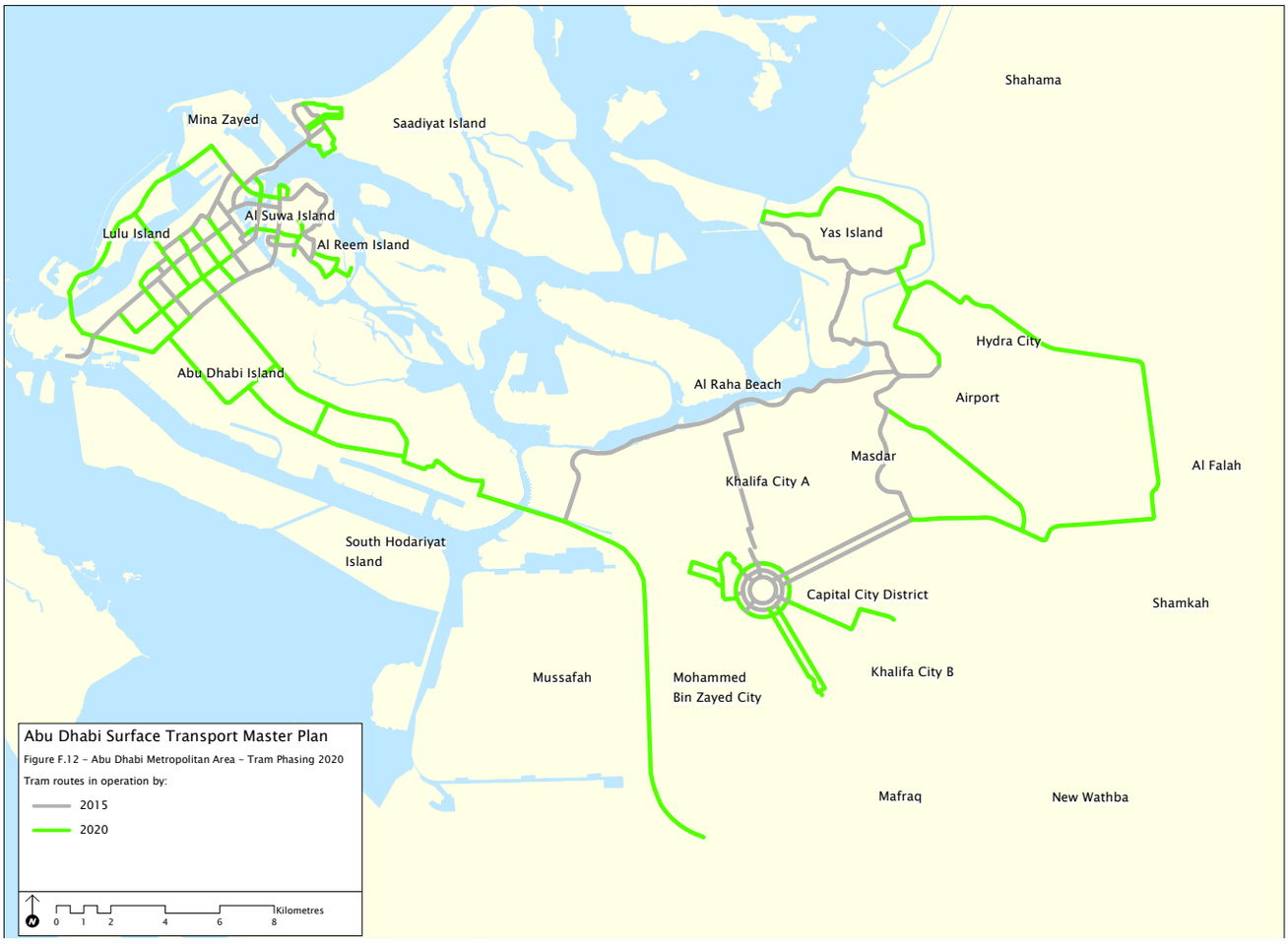
All alignments are subject to revision pending further study (see part F)
Revision: June 2009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Abu Dhabi Surface Transport Master Plan
Figure F.12 – Abu Dhabi Metropolitan Area – Tram Phasing 2020
Tram routes in operation by:
2015
2020
0 1 2 4 6 8 Kilometres


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Abu Dhabi Surface Transport Master Plan
Figure F.13 – Abu Dhabi Metropolitan Area – Tram Phasing 2025
Tram routes in operation by:
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2020
2025
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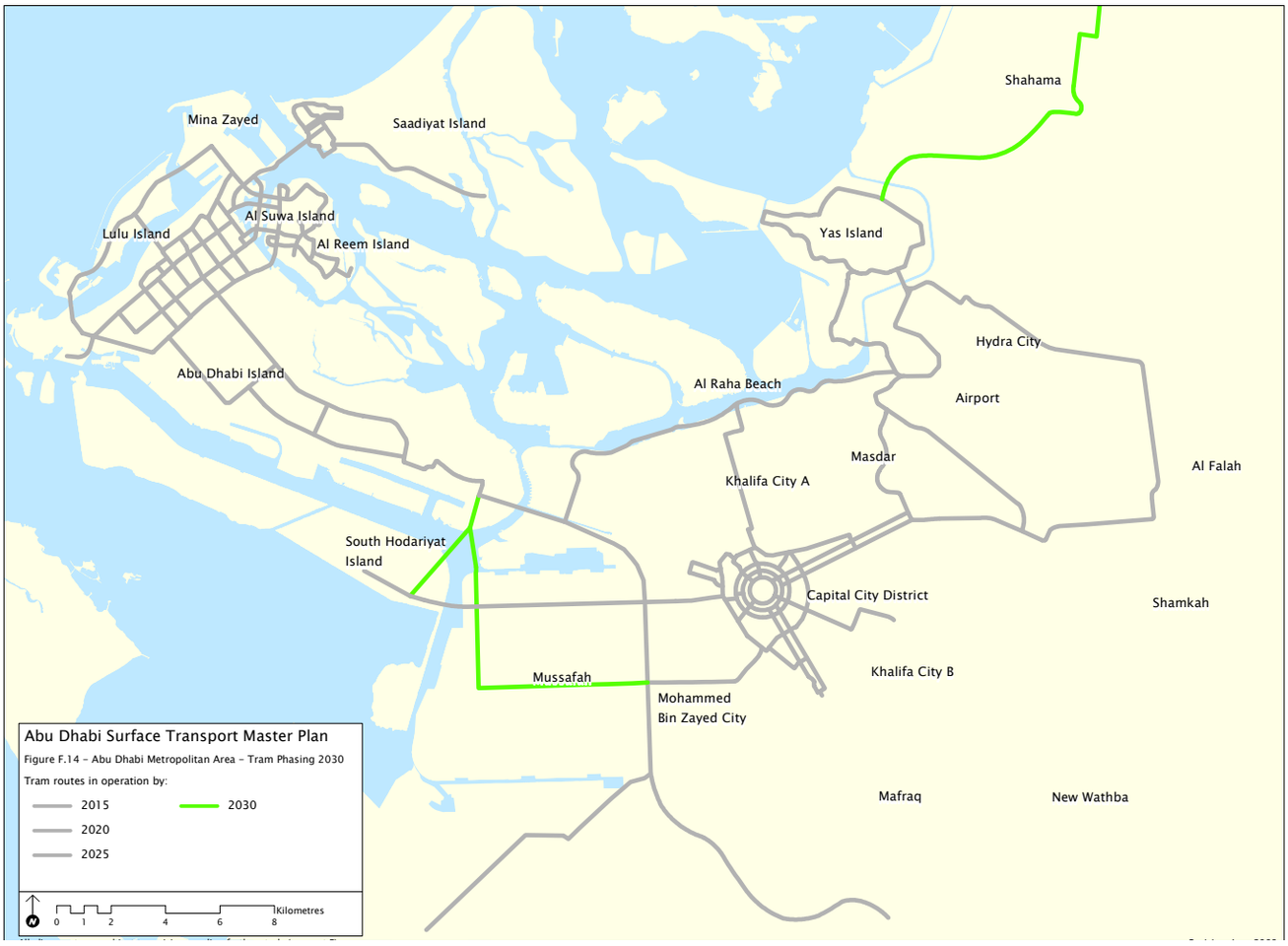
All alignments are subject to revision pending further study (see part F)
Revision: June 2009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Abu Dhabi Surface Transport Master Plan
Figure F.14 – Abu Dhabi Metropolitan Area – Tram Phasing 2030
Tram routes in operation by:
2015
2020
2025
2030
0 1 2 4 6 8 Kilometres

2010 Action Plan

F2 2010 Summary

F2.1 Infrastructure Components

The infrastructure components in the Plan period 2009-10 are set out in Table F1, which shows the latest dates to start the necessary feasibility study and design, the suggested start of construction and the planned opening date by when the Plan indicates the component is required. This table, and those in subsequent sections, shade those activities to be carried out within this Action Plan

Only a limited number of schemes, already committed prior to the Plan, will be open by the end of 2010, including 1,360 new buses to be purchased and the continnuing upgrading of the taxi fleet.

There will be an intensive study and design effort to validate and develop the Plan proposals. The following major studies will be started:

- Regional Rail Safeguarding Study
- Metro Feasibility Study
- Tram Feasibility Study
- Ferry Feasibility Study

In addition, a detailed transport masterplan for Al Ain will be prepared and intensive modelling of the Abu Dhabi Metropolitan CBD and Capital City District completed. Measures to address short term congestion issues in this period will also be addressed through a DoT programme of immediate alleviation measures on Abu Dhabi Island.

Table F1: Action Plan 2010 Infrastructure Components

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
	COMMITTED HIGHWAY SCHEMES			
CH1	Sheikh Zayed Bridge	2004	2006	2010
CH2	Saadiyat - Shahama Freeway	2003	2006	2009
CH3	Shahama Freeway Extension between E10 and E11	2004	2006	2010
CH4	Mafraq - Ghwaifat Highway (E11)	2007	2009	2013
CH5	Gayathi - Madinat Zayed Rd	2004	2006	2010

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
CH6	Salaam Street Tunnel (includes grade separated junctions on Salaam Street)	2005	2009	2011
CH7	Saadiyat Bridge to Mina Road Tunnel	2009	2011	2015
CH8	Connecting City to Suwa Island - Bridges 1-4	2004	2007	2010
CH9	Connecting City to Suwa Island - Bridges 5-7	2009	2011	2015
CH10	Connecting Suwa and Reem Islands - Bridges 11-13	2004	2006	2010
CH11	Connecting Suwa and Reem Islands - Bridges 8 - 10	2009	2011	2015
CH12	Al Ain to Dubai Highway (E66) Upgrading	2009	2012	2015
CH13	Lulu Highway (with bridge links from Marina Mall to Mina Zayed)	2009	2012	2015
CH14	Al Ain Northern Bypass	2008	2009	2011
CH15	Bainuna Street widening	2009		
CH16	Electra Street Tunnels at Junctions 6 and 4	2009		
CH17	Tunnels linking Lulu Island to Abu Dhabi Island	2009		
	PROPOSED HIGHWAY SCHEMES			
NH1	Shahama Freeway Extension between E11 and NH2	2009	2011	2015
NH2	Second Abu Dhabi – Dubai Highway	2009	2012	2015
NH3	Reem Island to Abu Dhabi	2006	2008	2010
NH5	Mid Island Parkway	2009	2017	2020
NH6	Al Ain to KPIZ Highway	2009	2017	2020
NH7	Mussafah to Abu Dhabi Island new link	2009	2011	2015
NH9	Marina Mall/Corniche Grade Separated Junction	2010	2012	2015
NH10	Widen E10 Freeway from Sheikh Zayed Bridge to E11	2009	2009	2012
NH15	South Hodariyat - link from Mussafah	2009	2011	2015
NH16	South Hodariyat - link to Abu Dhabi Island	2009	2011	2015
NH17	Upgrade E15 to Dual 2 with grade separated junctions and crossings (from E11 to south of Gayathi)	2010	2012	2015
NH17	Upgrade E15 to Dual 2 with grade separated junctions and crossings (remainder)	2010	2027	2030

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
NH19	Upgrade E90 to Dual 2 with grade separated junctions and crossings	2010	2012	2015
NH20	Second Link from Reem Island to Saadiyat - Abu Dhabi Island Bridge	2010	2012	2015
NH22	Tunnel from Reem Island to 31st Street	2009	2013	2015
NH23	Khaleej Al Arabi upgrading (including ADNEC tunnel)	2009	2011	2015
	METRO			
MT1	CBD - Airport - Capital City loop	2009	2010	2015
MT2	Link to Marina Mall	2009	2012	2015
	TRAM			
TR1	First stage route linking Reem, Suwa, CBD and Marina Mall	2009	2010	2012
TR2	Independent route linking Raha, Yas, Masdar and Airport	2009	2010	2012
TR3	Second stage route extensions to serve Saadiyat and Capital City	2009	2011	2015
TR4	Completion of tram network on Abu Dhabi Island, including connections to ADNEC, Zayed Sports City, Grand Mosque and Lulu Island	2009	2016	2020
TR5	Extension of Capital City network with links around Airport to Al Falah	2009	2016	2020
TR6	Extend tram network, in stages as appropriate, to serve Musaffah, South Hodariyat, Mohammed bin Zayed City, ICAD and Mafraq	2009	2021	2025
TR7	Extend tram network, in stages as appropriate, to serve Shahama and to complete planned network	2009	2026	2030
	PERSONAL RAPID TRANSIT			
RT1	PRT Masdar City	2009	2010	2015
	BUS			
BS1	Fine grained network of local buses with bus priority	2009	2010	2015
BS2	Enhanced inter-regional long-distance coach network	2010	2012	2015
	WATER TRANSPORT			
WT1	Scheduled ferry service Emerald Gateway to Al Bateen via Zayed Sports City/ADNEC	2010	2012	2015
WT2	Scheduled ferry service Yas Island Marina to CBD Station via Raha Beach	2010	2012	2015

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
WT3	Circular ferry service - Suwa Island, Saadiyat, Reem Island	2010	2012	2015
WT4	Network of jetties for water taxi services	2010	2012	2015
	FREIGHT			
FS1	Multimodal distribution centres at ICAD and Mina Zayed	2010	2012	2015
FS2	Multimodal distribution centre at Khalifa Port	2010	2012	2015
FS3	Multimodal distribution centre at Airport free trade zone	2010	2012	2015
FS4	Union Railways freight rail lines	2010	2018	2020
FS5	E40 Truck Route extension to E11 (ICAD)	2009		

F2.2 Other Plan Initiatives

The following studies and measures will be implemented to develop the Plan strategies as set out in Part D:

Congestion Management (D1)

- Develop interchange planning strategy and best practice guidance (D1.1.3)
- Complete the development of the Emirate-wide roads and streets hierarchy that will be identified for urban streets in the "Abu Dhabi Urban Street Design and Mobility Standards Manual". (D1.2.1)
- Develop transit-oriented development guidelines in the Abu Dhabi Development Management Programme (D1.3.1)
- Develop parking standards guidance for new developments (D1.3.2)
- Develop and implement fares policy (D2.2.2)
- ITS Feasibility Study (D1.2.2)
- Pricing Strategy Study (D1.4.3)
- Park and Ride Locations Study (D1.4.4)
- Bus Priority Study (D1.1.1)
- Start introduction of Parking Management in CBD (D1.4.1)
- Bikeway Master Plan (D1.1.2)

Accessibility (D2)

- Mobility Management Study (D2.1.1)
- Mobility Impaired Study (D2.2.1)
- Review bus stop locations with respect to catchment areas and increase number and quality (D2.1.1)
- Taxi and Minibus Study (D2.2.4)

Safety and Security (D3)

- Strategic Road Safety Plan (D3.1)
- Road safety promotion / education campaign (D3.1.4)
- Identify and implement pedestrian safety priorities (D3.1.2)
- Accident investigation programme (D3.1.5)
- Develop a speed management policy and implement speed limit changes (D3.1.1)
- Develop security standards for interchanges and public transport vehicles (D3.2)

Pedestrian Realm (D4)

- Pedestrian Master Plan (D4.2.1)
- Complete Abu Dhabi Urban Street Design and Mobility Standards Manual (ADUPC) (D4.1.1)
- Start pilot implementation of Abu Dhabi Urban Street Design and Mobility Standards Manual (ADUPC) (D4.1.1)

Freight Management (D5)

- Freight Logistics Study (D5.2)
- Promote the Development of RDCs (D5.1.1)
- Facilitate the Freight Rail Line (D5.1.2)

Low Carbon (D6)

- Establish 'Sustainable Transport Taskforce' (D6.1 & D7.1)
- Strategic objectives setting for low carbon strategy (D6.1 & D7.1)
- Develop Life Cycle Sustainability Management Framework (D6.1.1)

- Develop Low Carbon Framework and regulatory documents (D6.3)
- CDM study (D6.3.1)
- Develop system of incentives for low carbon vehicle fleet purchase by bus and taxi operators (D6.3.2)

Environment (D7)

- Establish 'Sustainable Transport Taskforce' (D6.1 & D7.1)
- Set strategic objectives for Environment strategy (D6.1 & D7.1)
- Environmental Baseline Studies (D7.3)

2015 Action Plan

F3 2015 Summary

F3.1 Infrastructure Components

There will be intensive construction activity during this period. The status of infrastructure components at the end of the 2011-2015 period is set out in Table F2.

The DoT will manage and coordinate this construction programme to miminise impacts on traffic movements, including implementation of short-term measures such as temporary park-and-ride sites and bus priority.

Table F2: Action Plan 2015 Infrastructure Components

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
	COMMITTED HIGHWAY SCHEMES			
CH4	Mafraq - Ghwaifat Highway (E11)	2007	2009	2013
CH6	Salaam Street Tunnel (includes grade separated junctions on Salaam Street)	2005	2009	2011
CH7	Saadiyat Bridge to Mina Road Tunnel	2009	2011	2015
CH9	Connecting City to Suwa Island - Bridges 5-7	2009	2011	2015
CH11	Connecting Suwa and Reem Islands - Bridges 8-10	2009	2011	2015
CH12	Al Ain to Dubai Highway (E66) Upgrading	2009	2012	2015
CH13	Lulu Highway (with bridge links from Marina Mall to Mina Zayed)	2009	2012	2015
CH14	Al Ain Northern Bypass	2008	2009	2011
	PROPOSED HIGHWAY SCHEMES			
NH1	Shahama Freeway Extension between E11 and NH2	2009	2011	2015
NH2	Second Abu Dhabi – Dubai Highway	2009	2012	2015
NH7	Mussafah to Abu Dhabi Island new link	2009	2011	2015
NH9	Marina Mall/Corniche Grade Separated Junction	2010	2012	2015
NH10	Widen E10 Freeway from Sheikh Zayed Bridge to E11	2009	2009	2012
NH11	Upgrade E20 Freeway from Mussafah Bridge to E11	2014	2017	2020
NH15	South Hodariyat - link from Mussafah	2009	2011	2015
NH16	South Hodariyat - link to Abu Dhabi Island	2009	2011	2015
NH17	Upgrade E15 to Dual 2 with grade separated junctions and crossings (from E11 to South of Gayathi)	2010	2012	2015

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
NH19	Upgrade E90 to Dual 2 with grade separated junctions and crossings	2010	2012	2015
NH20	Second Link from Reem Island to Saadiyat- Abu Dhabi Island Bridge	2010	2012	2015
NH22	Tunnel from Reem Island to 31st Street	2009	2013	2015
NH23	Khaleej Al Arabi upgrading (including ADNEC tunnel)	2009	2011	2015
	METRO			
MT1	CBD - Airport - Capital City loop	2009	2010	2015
MT2	Link to Marina Mall	2009	2012	2015
MT3	Capital City - Mohammed Bin Zayed loop	2014	2018	2020
	TRAM			
TR1	First stage route linking Reem, Suwa, CBD and Marina Mall	2009	2010	2012
TR2	Independent route linking Raha, Yas, Masdar and Airport	2009	2010	2012
TR3	Second stage route extensions to serve Saadiyat and Capital City	2009	2011	2015
	PERSONAL RAPID TRANSIT			
RT1	PRT Masdar City	2009	2010	2015
RT2	PRT Lulu Island	2014	2016	2020
	BUS			
BS1	Fine grained network of local buses with bus priority	2009	2010	2015
BS2	Enhanced inter-regional long-distance coach network	2010	2012	2015
	WATER TRANSPORT			
WT1	Scheduled ferry service Emerald Gateway to Al Bateen via Zayed Sports City/ADNEC	2010	2012	2015
WT2	Scheduled ferry service Yas Island Marina to CBD Station via Raha Beach	2010	2012	2015
WT3	Circular ferry service - Suwa Island, Saadiyat, Reem Island	2010	2012	2015
WT4	Network of jetties for water taxi services	2010	2012	2015
	FREIGHT			
FS1	Multimodal distribution centre at ICAD and Mina Zayed	2010	2012	2015
FS2	Multimodal distribution centre at Khalifa Port	2010	2012	2015

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
FS3	Multimodal distribution centre at Airport free trade zone	2010	2012	2015
FS4	Union Railways freight rail lines	2010	2018	2020
FS5	E40 Truck Route extension to E11 (ICAD)	2009		

F3.2 Other Plan Initiatives

The following studies and measures will also be implemented by 2015:

Congestion Management (D1)

- Enhance and expand UTC system (D1.2.2)
- Provide reliable journey time information system (D1.2.3)
- Develop detailed cycle strategy and design guidance (D1.1.2)
- Introduce integrated smartcard ticketing (D1.1.5)
- Upgrade and extend Traffic Management Control Centre (D1.2.2)
- Implement ITS measures (D1.2.2)
- Implement most urgent bus priority measures (D1.1.1)
- Introduce initial Park and Ride (D 1.4.4)
- Implement the first stage of road user charging (D1.4.3)
- Monitor and further expand parking management in the CBD (D1.4.1)
- Promote teleworking and other measures to reduce trip making (D1.4.5)
- Develop and implement management plans for events and incidents (D1.2.4)
- Develop detailed strategy for travel plans for new developments (D1.3.3)
- Develop and implement public travel behaviour change campaign (D1.4.2)

Accessibility (D2)

- Monitor performance of taxi service and adjust taxi numbers as required (D2.2.4)
- Develop policy for women and children using public transport (D2.2.3)
- Develop accessibility design guidance for infrastructure and services (D2)

- Mobility improvement measures (D2.2)
- Increase number and quality of bus stops (D2.1.1)

Safety and Security (D3)

- Improved traffic enforcement and speed management (D3.1.1)
- Introduce road safety education programme (D3.1.4)
- Develop a new Highway Code (D3.1.3)
- Carry out road safety audits on all roads (D3.1.6)
- Develop and implement vehicle regulations – safety, emissions, HGV loads / driving hours, annual safety checks (D3.1.7)

Pedestrian Realm (D4)

- Pilot street re-design (D4.1)
- Identify priority areas for pedestrian realm improvements (D4.1)

Freight Management (D5)

- Promote freight transport modal shift (D5.1)
- Active freight traffic management (D5.2)

Low Carbon (D6)

- Initiate implementation of Life Cycle Sustainability Management, subject to development of framework (D6.1.1)
- Initiate Low Carbon Framework implementation and regulation subject to development of framework and regulatory documents (D6.3)
- Implement system of providing incentives for low carbon vehicle fleet purchase by bus and taxi operators (D6.3.2)
- Low carbon energy from renewables and energy policy for transport study (D6.3.1)
- Emissions based vehicle registration scheme study (D6.3.3)
- Low emissions zone study (D6.3.4)
- Priority parking for Low Emissions vehicles study (D6.3.5)
- Continued awareness raising campaign based on campaign plan (D6.3.6)

Environment (D7)

- Develop robust air quality and noise strategy for transport based on outcomes of baseline monitoring and studies and emirate wide emissions policy (D7.3.1)
- Develop environmental protection zones, regulations/principles/ guidance documentation (natural environment) for infrastructure and environmental enhancement programmes based on outcomes of environmental baselines and emirate environmental protection zones (D7.3.2)
- Develop environmental protection zones, regulations/principles/ guidance documentation (built environment) for infrastructure and environmental enhancement programmes based on outcomes of environmental baselines and emirate environmental sites, buildings and landscape viewsheds (D7.3.3)
- Draft marine code based on outcome of environmental baselines (D7.3.4)

2020 Action Plan

F4 2020 Summary

F4.1 Infrastructure Components

The status of infrastructure components in the 2016-2020 period is set out in Table F3.

Table F.3 Action Plan 2020 Infrastructure Components

Ref.	Project title	Start Study & Design	Start Construction	Open
	PROPOSED HIGHWAY SCHEMES			
NH4	Saadiyat to Reem Island Bridge	2019	2021	2025
NH5	Mid Island Parkway	2009	2017	2020
NH6	Al Ain to KPIZ Highway	2009	2017	2020
NH11	Upgraded E20 Freeway from Mussafah Bridge to E11	2014	2017	2020
NH12	Upgraded E22 Freeway from Maqta Bridge to E11	2019	2021	2025
NH14	Airport Western Link	2019	2021	2025
NH18	Upgrade E65 to Dual 2 with grade separated junctions and crossings	2015	2016	2020
	REGIONAL RAIL			
PR1	Abu Dhabi to Dubai via Capital City & Airport Midfield Terminal	2019	2023	2025
PR3	Abu Dhabi to Al Ain	2019	2023	2025
	METRO			
MT3	Capital City - Mohammed Bin Zayed loop	2014	2018	2020
MT4	Shamkhah to Capital City spur	2019	2023	2025
	TRAM			
TR4	Completion of tram network on Abu Dhabi Island, including connections to ADNEC, Zayed Sports City, Grand Mosque and Lulu Island	2009	2016	2020
TR5	Extension of Capital City network with links around Airport to Al Falah	2009	2016	2020
	PERSONAL RAPID TRANSIT			
RT2	PRT Lulu Island	2014	2016	2020
	FREIGHT			
FS4	Union Railways freight rail line	2010	2018	2020
FS6	Water freight service from Mussafah to KPIZ	2017	2018	2020

F4.2 Other Plan Initiatives

The following studies and other measures will also be implemented in this period:

Congestion Management (D1)

- Continued implementation of ITS measures (D1.2.2)
- Continued implementation of road charging (D1.4.3)
- Continued implementation of bus priority measures (D1.1.1)
- Expansion of parking management beyond CBD and to Capital City (D1.4.1)
- Continued implementation of teleworking and other measures to reduce trip making (D1.4.5)

Accessibility (D2)

- Continued implementation of mobility improvement measures (D2.2)
- Increase number and quality of bus stops (D2.1.1)

Safety and Security (D3)

- Continued implementation of improved enforcement and speed management (D3.1.1)
- Continued implementation of improved vehicle regulations (D3.1.7)
- Continued implementation of education programme (D3.1.4)
- Continued implementation of road safety audits on all road schemes (D3.1.6)

Pedestrian Realm (D4)

- Street re-designs rolled out (D4.1)

Low Carbon (D6)

- Continued implementation, regulation and reporting on Life Cycle Sustainability Management framework (D6.1.1)
- Continued implementation, regulation and reporting on Low Carbon Framework (D6.3)
- Continued implementation, regulation and reporting on low carbon vehicle fleet procurement (D6.3.2)

- Initiate low carbon energy from renewables projects based on outcome of study (D6.3.1)
- Initiate change in energy policy based on outcome of study (D6.3.1)
- Establish scaled emissions based vehicle registration scheme based on outcome of study (D6.3.3)
- Establish low emissions zones based on study (D6.3.4)
- Establish priority parking for low emissions vehicles based on study (D6.3.5)
- Continued awareness raising campaign based on campaign plan (D6.3.6)

Environment (D7)

- Continued update and reporting on air quality and noise strategy (D7.3.1)
- Implementation of natural environment guidance documentation (subject to development), environmental enhancement programmes and proactive environmental management (D7.3.2)
- Implementation of built environment guidance documentation including that on incorporation of traditional Arabic features into design (subject to development), environmental enhancement programmes and proactive environmental management (D7.3.3)
- Implementation and regulation of marine code (D7.3.4)

2025 Action Plan

F5 2025 Summary

F5.1 Infrastructure Components

The status of infrastructure components in the 2021-2025 period is set out in Table F4.

Table F.4 Action Plan 2025 Infrastructure Components

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
	PROPOSED HIGHWAY SCHEMES			
NH4	Saadiyat to Reem Island Bridge	2019	2021	2025
NH8	Desert Highway Extension (E20 to E11/E65)	2024	2026	2030
NH12	Upgraded E22 Freeway from Maqta Bridge to E11	2019	2021	2025
NH14	Airport Western Link	2019	2021	2025
NH21	Muroor Road Extension to Capital City	2024	2027	2030
	REGIONAL RAIL			
PR1	Abu Dhabi to Dubai via Capital City & Airport Midfield Terminal	2019	2023	2025
PR2	Capital City to Al Gharbia & KSA/Qatar via Ruwais	2024	2028	2030
PR3	Abu Dhabi to Al Ain	2019	2023	2025
	METRO			
MT4	Shamkhah to Capital City spur	2019	2023	2025
	TRAM			
TR6	Extend tram network, in stages as appropriate, to serve Musaffah, South Hodariyat, Mohammed bin Zayed City, ICAD and Mafraq	2009	2021	2025
	FREIGHT			
FS7	New Multimodal distribution centre at Al Ain	2025	2027	2030

F5.2 Other Plan Initiatives

The following studies and measures will also be implemented:

Congestion Management (D1)

- Continued implementation of ITS measures (D1.2.2)
- Continued implementation of road charging (D1.4.3)
- Continued implementation of bus priority measures (D1.1.1)
- Further expansion of parking management (D1.4.1)
- Continued implementation of teleworking and other measures to reduce trip making (D1.4.5)

Accessibility (D2)

- Continued implementation of mobility improvement measures (D2.2)
- Increase number and quality of bus stops (D2.1.1)

Safety and Security (D3)

- Continued implementation of improved enforcement and speed management (D3.1.1)
- Continued implementation of improved vehicle regulations (D3.1.7)
- Continued implementation of education programme (D3.1.4)
- Continued implementation of road safety audits on all road schemes (D3.1.6)

Pedestrian Realm (D4)

- Street re-designs rolled out (D4.1)

Low Carbon (D6)

- Continued implementation, regulation and reporting on Life Cycle Sustainability Management framework (D6.1.1)
- Continued implementation, regulation and reporting on Low Carbon Framework (D6.3)
- Continued implementation, regulation and reporting on low carbon vehicle fleet procurement (D6.3.2)
- Expand low carbon energy from renewables projects (D6.3.1)
- Full implementation of scaled emissions based vehicle registration

scheme (D6.3.3)

- Operation and enforcement of low emissions zones and associated monitoring (D6.3.4)
- Expand amount of priority parking for low emissions vehicles (D6.3.5)
- Continued awareness raising campaign based on campaign plan (D6.3.6)

Environment (D7)

- Continued update and reporting on air quality and noise strategy (D7.3.1)
- Update and continued use of natural environment guidance documentation (subject to development), environmental enhancement programmes and proactive environmental management (D7.3.2)
- Update and continued use of built environment guidance documentation including that on incorporation of traditional Arabic features into design (subject to development), environmental enhancement programmes and proactive environmental management (D7.3.3)
- Continued regulation of marine code (D7.3.4)

2030 Action Plan

F6 2030 Summary

F6.1 Infrastructure Components

The status of infrastructure components in the period 2026-2030 is set out in Table F5.

Table F5: Action Plan 2030 Infrastructure Components

Ref.	Project title	Start Study & Design	Start Constr-uction	Open
	PROPOSED HIGHWAY SCHEMES			
NH8	Desert Highway Extension (E20 to E11/E65)	2024	2026	2030
NH17	Upgrade E15 to Dual 2 with grade separated junctions and crossings (remainder)	2010	2027	2030
NH21	Muroor Road Extension to Capital City	2024	2027	2030
	REGIONAL RAIL			
PR2	Capital City to Al Gharbia & KSA/Qatar via Ruwais	2024	2028	2030
	TRAM			
TR7	Extend tram network, in stages as appropriate, to serve Shahama and to complete planned network	2009	2026	2030
	FREIGHT			
FS7	Multimodal distribution centre at Al Ain	2025	2027	2030

F6.2 Other Plan Initiatives

The following studies and measures will also be implemented:

Congestion Management (D1)

- Continued implementation of ITS measures (D1.2.2)
- Continued implementation of road charging (D1.4.3)
- Continued implementation of bus priority measures (D1.1.1)
- Further expansion of parking management (D1.4.1)
- Continued implementation of teleworking and other measures to reduce trip making (D1.4.5)

Accessibility (D2)

- Continued implementation of mobility improvement measures (D2.2)

Safety and Security (D3)

- Continued implementation of improved enforcement and speed management (D3.1.1)
- Continued implementation of improved vehicle regulations (D3.1.7)
- Continued implementation of education programme (D3.1.4)
- Continued implementation of road safety audits on all road schemes (D3.1.6)

Pedestrian Realm (D4)

- Street re-designs rolled out (D4.1)

Low Carbon (D6)

- Continued implementation, regulation and reporting on Life Cycle Sustainability Management framework (D6.1.1)
- Continued implementation, regulation and reporting on Low Carbon Framework (D6.3)
- Continued implementation, regulation and reporting on low carbon vehicle fleet procurement (D6.3.2)
- Expand low carbon energy from renewables projects (D6.3.1)
- Full implementation of scaled emissions based vehicle registration scheme (D6.3.3)
- Operation and enforcement of low emissions zones and associated monitoring (D6.3.4)
- Expand amount of priority parking for low emissions vehicles (D6.3.5)
- Continued awareness raising campaign based on campaign plan (D6.3.6)

Environment (D7)

- Continued update and reporting on air quality and noise strategy (D7.3.1)
- Update and continued use of natural environment guidance documentation (subject to development), environmental enhancement programmes and proactive environmental management (D7.3.2)
- Update and continued use of built environment guidance documentation including that on incorporation of traditional Arabic features into design (subject to development), environmental enhancement programmes and

proactive environmental management (D7.3.3)

- Continued regulation of marine code (D7.3.4)

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