Bus Rapid Transit
BRT

A case for Dubai

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BRT

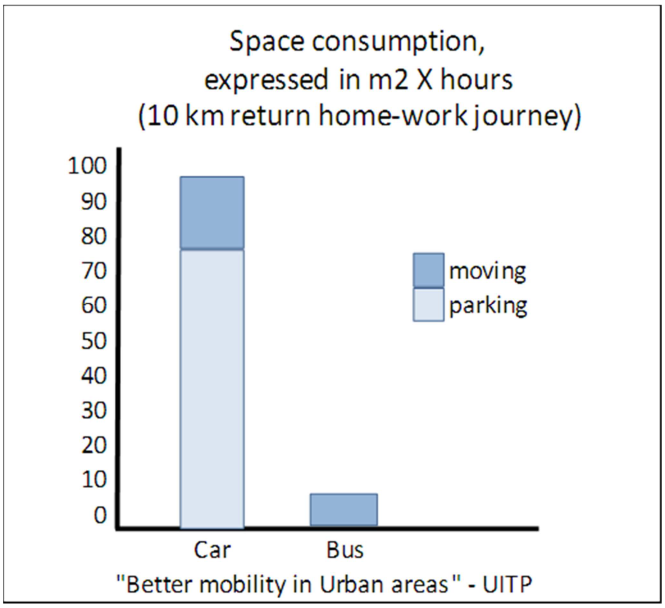
Excerpts from research reports and international practices

Transit Research Board
Federal Transit Administration
NBRTI
International Association of Public Transport
TDM Encyclopedia
Wikipedia
Dubai Bus Master Plan
TRD120: Express Bus Lane

A Congestion-Free Bus Network

Congestion slows down surface public transport and makes it more irregular. It causes longer journeys and waiting times for users and increases operational expenditure by operators. The construction of new urban road infrastructures does not provide any sustainable solutions to the problem of congestion. It is incompatible with growing environmental protection demands and public budget constraints. Rather than carry on developing expressway networks, the use of existing infrastructures needs to be optimised in terms of passenger transport capacity (and not vehicle capacity, as is still too often the case). In this respect, it is worth noting that buses (or tramways) use space far more efficiently than cars. Moreover, surface public transport seldom needs to park whereas the space needed to park one car is equivalent to the space used for an employee's office.

Public transport's appeal hinges on its speed and regularity. Analysis of the data compiled by UITP and the Murdoch University on 100 world cities shows that there is a direct link between the ratio of 'public transport average speed / automobile average speed' and PT's journey share. The most popular public transport networks are the ones that offer the best speed and regularity compared to the car. The speed and regularity of train, metro and light rail systems mean they offer a real alternative to the car. On the other hand, the bus more often remains stuck in traffic jams. A re-allocation of road space in favour of public transport is the necessary prerequisite of genuine bus prioritisation in order to protect buses from the potential hazards of general traffic. This is the condition for bus efficiency and appeal in the face of competition from the car. Opinion polls show that people support bus prioritisation measures even when these result in traffic and parking restrictions. They also show that the politicians often underestimate the will of their voters to give priority to public transport. ("Congestion-Free Bus Network" – UITP Focus paper)



Bus Rapid Transit

BRT is an innovative, high capacity, lower cost public transit solution that can significantly improve urban mobility. This permanent, integrated system uses buses or specialized vehicles on roadways or dedicated lanes to quickly and efficiently transport passengers to their destinations, while offering the flexibility to meet transit demand. BRT systems can easily be customized to community needs and incorporate state-of-the-art, low-cost technologies that result in more passengers and less congestion.

TransMelenio, Bogota

TCRP Report 90: BRT Implementation Guidelines has defined BRT as:
”a flexible, rubber-tired rapid-transit mode that combines stations, vehicles, services, running ways, and Intelligent Transportation System (ITS) elements into an integrated system with a strong positive identity that evokes a unique image. BRT applications are designed to be appropriate to the market they serve and their physical surroundings, and they can be incrementally implemented in a variety of environments. In brief, BRT is an integrated system of facilities, services, and amenities that collectively improves the speed, reliability, and identity of bus transit.

BRT, in many respects, is rubber-tired light-rail transit (LRT), but with greater operating flexibility and potentially lower capital and operating costs. Often, a relatively small investment in dedicated guideways (or “running ways”) can provide regional rapid transit.”

Tiradentes Express, Sao Paulo

This definition highlights BRT’s flexibility and the fact that it encompasses a wide variety of applications, each one tailored to a particular set of travel markets and physical environments. BRT’s flexibility derives from the fact that BRT vehicles (e.g., buses, specialized BRT vehicles) can travel anywhere there is pavement and the fact that BRT’s basic service unit, a single vehicle, is relatively small compared to rail and train based rapid transit modes. A given BRT corridor application might encompass route segments where vehicles operate on both mixed traffic and where they operate on dedicated, fully grade-separated bus- lanes with major stations.

BRT applications can combine various route segments such as the above to provide a single-seat, no-transfer service that maximizes customer convenience. Unlike other rapid transit modes where basic route alignment and station locations are constrained by right of way availability, BRT can be tailored to the unique origin and destination patterns of a given corridor's travel market. As the spatial nature of transit demand changes, BRT systems can adapt to these dynamic conditions.

RIT, Curitiba

BRT may be considered an alternative to rail, particularly light rail transit (LRT), in an urban area. BRT can provide rail-like operating characteristics in terms of operating speed, capacity, and dependability.

BRT rather than referring to a type of bus, is an umbrella term encompassing a set of technologies and service innovations that improve bus service along selected routes, lines, or corridors. Within a metropolitan region, BRT is typically associated with trips of medium length or longer because it is on these longer trips that the "rapid" aspect becomes important—where saving time helps bus service compete with automobile transport. Depending on how they are deployed, BRT's technology and service innovations may also attract additional riders for short trips.

DTC, New Delhi

BRT works best in urban and suburban areas characterized by

1. high employment and population density
2. an intensively developed downtown area with limited street capacity and high all-day parking costs
3. urban sprawl where substantial medium to long trip patterns occur
4. a long-term reliance on public transport
5. highway capacity limitations on approaches to the city center
6. major physical barriers that limit road access to the CBD and channel bus flows.

Salient Features Of BRT (source: NBRTI Report)

BRT features are summarised as follows:

- Relatively low capital costs for infrastructure (i.e., no need for track, electrification, and other fixed plant)
- The ability to alter design standards as volumes increase over various segments of a route in accordance with capacity needs (i.e., much greater "staging" or incremental development capability)

T-WAY, New South Wales

- Simpler procurement practices for both construction and vehicles;
- Shorter implementation periods
- The ability to start construction on key sections first, such as segments that provide congestion relief or are the easiest to build, and still provide integrated service for an entire corridor
- No requirements for additional organizational structures such as those usually associated with building and operating rail systems
- Greater flexibility for off-line stations that can increase capacity
- The ability to use existing roads and streets when an incident occurs that would otherwise cause major disruption in service
- A variety of competitive vehicle suppliers and less need for conformity in vehicle procurement
- Less expensive vehicles, even when accounting for capacity and service life differences.
- The potential for higher and more flexible types and frequencies of service over different route segments (i.e., capacity need not be constant over the entire route)


Rouen, France

- The flexibility to combine feeder (i.e., collector and distribution on local streets) and line-haul services without the need for a physical transfer between vehicles
- Opportunities to extend service into low-density areas without the need for additional dedicated running ways
- The capability of being used by a variety of vehicle sizes and types

- The ability to accommodate a diversity of operating organizations (e.g., public operators, school buses, and private carriers)

BRT Components

Running (Bus) ways	BRT vehicles operate primarily on fast and easily identifiable exclusive transitways or dedicated bus lanes. BRT may also operate in mixed traffic
Stations	BRT stations, ranging from enhanced shelters to large transit centre, are attractive and easily accessible. They are also conveniently located and integrated into the community they serve
Vehicles	BRT uses rubber-tired vehicles that are easy to board and comfortable to ride. Quiet, high-capacity vehicles carry many people and use clean fuels to protect the environment
Services	BRT's high-frequency, all day service means less waiting time and no need to consult schedules. The integration of local and express service can reduce long-distance travel times
Route Structure	BRT uses simple, often color-coded routes. They can be laid out to provide direct, no-transfer rides to multiple destinations
Fare Collection	Simple BRT fare collection systems make it fast and easy to pay, often before you even get on the bus. They allow multiple door boarding, reducing time in stations
Intelligent Transportation Systems	BRT uses advanced digital technologies that improve customer convenience, speed, reliability and operations safety

TCRP Report 90

BRT system benefits

- Higher ridership
- Cost effective
- Increased operating efficiency
- Customer satisfaction
- Reduced congestion
- Environmental quality
- Reduced road accidents
- Increased revenue
- Economic productivity
- Enhanced urban quality

Reported ridership growth figures (TCRP 118 & TDM Encyclopedia)

BRT	% ridership growth	% reduction in travel time
Adelaide	76	
Bogota		32
Boston	84	25
Brisbane	60	
Las Vegas	40	
Leeds	50	
Los Angeles	40	25
Miami	85	30
Oakland	66	17
Pittsburg	38	
Vancouver	60	16

List of reported BRT systems

Country	City
Argentina	Buenos Aires
Australia	Adelaide, Brisbane, Sydney
Belgium	Liege
Brazil	Curitiba (earliest successful system 1974), Sao Paulo, Goiania
Canada	Montreal, Toronto, Ontario, Calgary, Vancouver
Chile	Santiago, Concepcion
China	Hangzhou, Beijing, Kunming, Changzhou, Xiamen, Jinan, Zaozhuang, Zhengzhou, Guangzhou
Columbia	Bogota, Barranquilla
Ecuador	Quito, Guayaquil
France	Ile-de-France, Nantes, Douai, Maubeuge, Rouen
Germany	Essen
Greece	Athens, Thessaloniki
India	Ahmedabad, Delhi, Jaipur, Pune
Indonesia	Jakarta (172 km, 11 lines, 520 buses, 340,000 pax), Yogyakarta, Bali, Bandung, Baton, Semarang
Iran	Tehran, Tabriz, Shiraz, Kerman
Mexico	Mexico city, Leon
Netherlands	Almere, Schiphol, Eindhoven
Nigeria	Lagos
Peru	Lima
South Africa	Cape Town, Johannesburg, Port Elizabeth
Sweden	Goteborg, Stockholm
Turkey	Istanbul
United Kingdom	Swansea, Crawley, Leeds
United States	Albany, Albuquerque, Baltimore, Boston, Cleveland, Houston, King County, Kansas City , Las Vegas, Miami, Oakland, Philadelphia, Pittsburgh, San Diego, Seattle
Venezuela	Merida

BRT

A Case for Dubai

Dubai Public Transport

Public Transport runs 880 buses over 90 bus routes carrying about 300,000 passengers on a specimen working day. 75% of the urban populated area is serviced by bus route network. The service offered includes superior quality buses, air-conditioned passenger shelters and advanced bus information. Most of the services operate at headways of 10 – 15 minutes. Detailed Strategic Plans are drafted for the period 2011-2015 to consolidate and increase the public transport ridership.

Goal		Objectives
❷	Dubai for people	- Make roads & public transport people-friendly
❹	From cars to public transport	- Shift demand to public transport - Increase ridership
❺	Safety & environmental sustainability	- Reduce number of accidents & fatalities - Minimise adverse environmental impact of public & private transport

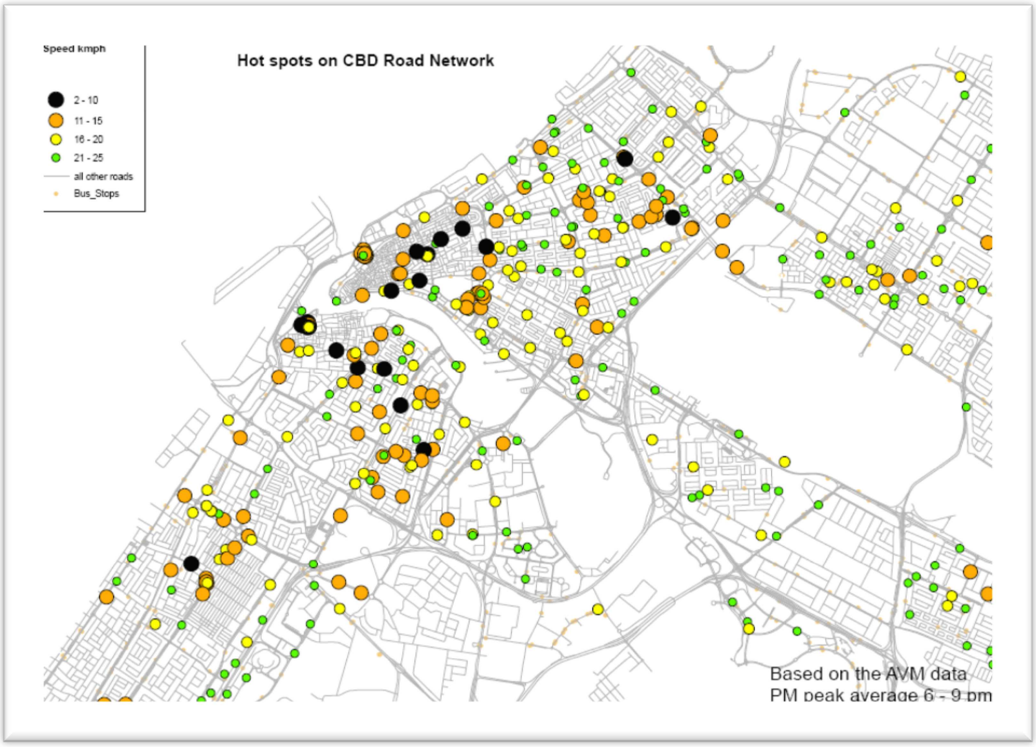
The market share of Public Transport is less than 7% primarily because of:

- slower bus speeds
- longer travel times &
- poor timekeeping

Over the last 2 years, PTA has consumed about 15% of its resources in correcting the bus trip times in order to improve the timekeeping: this has now improved from 35% to 70%, but at considerable cost

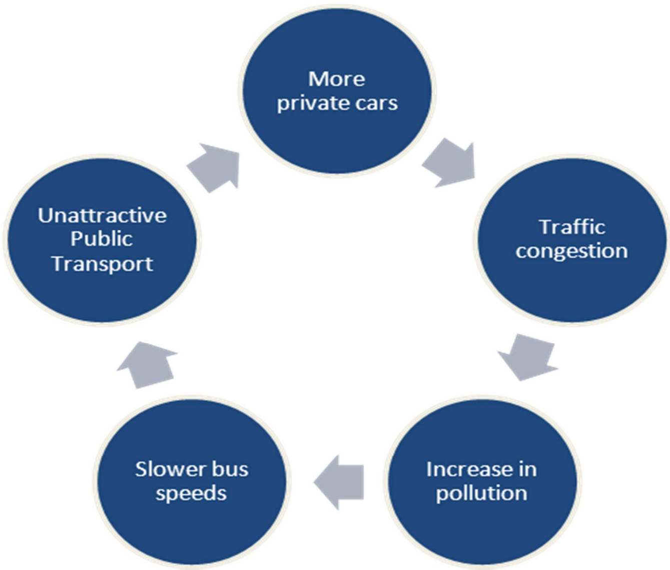
The adverse phenomenon of slower bus speeds and resulting longer travel times however, continues thereby making bus travel an unattractive alternative.

Public buses suffer from severe traffic congestion on urban roads: the average bus speed is about 15 kph in the CBD and is worse at less than 10 kph in the inner CBD.



As the traffic congestion gets worse, bus trip times will increase with considerable adverse impacts to both PTA and passengers:

- Increase in bus operating costs
- Additional bus requirement to maintain the level of service
- Discomfort to bus passengers due to longer travel times
- Reduced bus passengers
- More private cars resulting in further traffic congestion



Dubai road congestion

With more than a million cars registered, car ownership rate in Dubai is very high at 541 per 1000 population against New York-444, London-345 and Singapore-111. More than 1 million cars are registered here.

Proliferation of private automobiles not only creates traffic congestion, but also corrupts the ecological balance through emission of toxic gases such as carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs) and particulates (PM10) whose impact on urban air quality is negative and alarming. As per Dubai Municipality statistics, more than 23,000 tonnes of toxic gases were emitted in 2009 by 1.2 million automobiles in Dubai; petrol-driven cars accounted for more than 82% of this emission compared to 1.8% by heavy buses.

In another joint report produced by Dubai Municipality and Roads & Transport Authority, *"Dubai's choking traffic jams are contributing to some of the world's worst air pollution".* The emission level of harmful pollutants including hydrocarbons, carbon monoxide, nitrogen oxides and carbon dioxide is measured at 13% for Dubai compared to Virginia-2.5%, Michigan-2.0% and Canada-4.7%.

The cost of congestion on Dubai roads is estimated to be AED 4.6 million per year.

Road accidents and fatalities in Dubai (source: Dubai Statistics Centre)

	accidents	deaths
2010		*154*
2009	3576	225
2008	4011	294
2007	3335	332
2006	3224	312
2005	2794	236
2004	2413	206
2003	2287	218
2002	2153	192
2001	2208	185
2000	2135	165
1999	2286	148

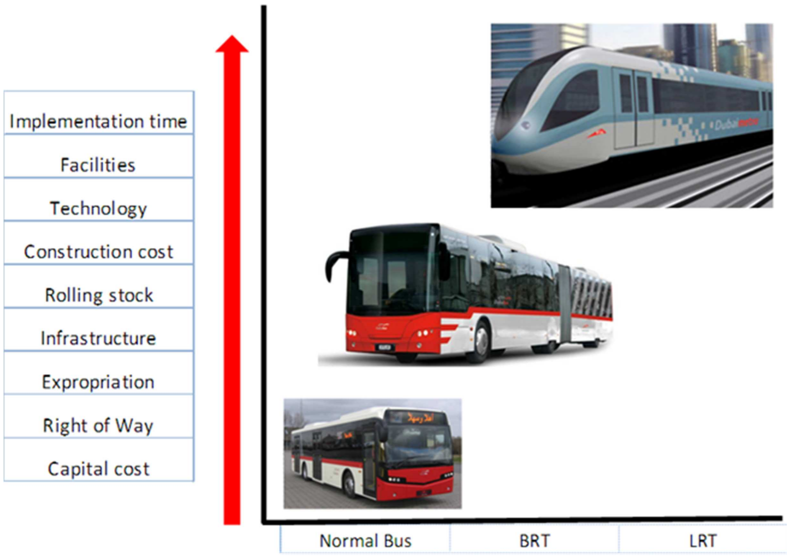
BRT for Dubai

A proactive and attractive bus transport has the ability to reduce car population, decongest the city roads, reduce toxic emission, protect the urban environment and combat global warming. There is an imminent need to increase the attractiveness of bus transport by reducing the journey times in order to encourage a substantial shift from private cars.

Public transport's appeal hinges on its speed and regularity. There are research works to prove that public transport share is directly influenced by the ratio of public transport average speed to automobile average speed. The most popular public transport networks are the ones that offer the best speed and regularity compared to the car. At present, bus journeys take twice as much time as cars to traverse similar trips.

Public buses experience severe delays in CBD. Majority of our bus services run to and from the CBD's since 67% of bus passenger trips are oriented towards CBD. Consequently our resources are adversely impacted by this phenomenon. PTA believes that BRT with preferential treatment on the streets by way of exclusive busways, signal pre-emption and q-jumpers is the immediate remedy to achieve quality bus-based transport in Dubai. A similar project, albeit with different target demand, was evaluated under TRD 120: Express Bus Lane. BRT is tried, tested and has succeeded in a large number of cities in Americas, Europe, Asia and Australia because of relative lower investment and operating cost and ease of implementation.

A high-quality public transport system remains an indispensable element in creating a city where people and community come first….Bus Rapid Transit (BRT) is increasingly recognised as amongst the most effective solutions to providing high-quality transit services on a cost-effective basis to urban areas, both in developed and developing world. The growing popularity of BRT as a viable solution to urban mobility underscores the success of initial efforts in cities such as Curitiba, Bogota and Brisbane….However, BRT is not just about transporting people. Rather, BRT represents one element of a package of measures that can transform cities into more liveable spaces. Integration of BRT with non-motorised transport, progressive land-use policies, and car-restriction measures forms part of a sustainable package that can underpin a healthy and effective urban environment. In this sense, BRT represents one pillar in efforts to better urban quality of life for all segments of society, and especially in providing greater equity across an entire population – Institute for Transportation & Development Policy (ITDP)



4 high density bus corridors are identified for initial BRT project

A combination of “Quick assessment method” and “Evaluation through Transportation modeling” is adopted in estimating the likely ridership demand for these BRT corridors. UAFC data provided accurate OD information by road corridors

2012 Transportation Planning Model was run with suitable bus network, service levels, stop spacing, operating hours and bus speeds. The output passenger kms were translated into passenger numbers

Proposed BRT coridors:

R-1	Muhaisnah4-Amman rd-Rasheed rd-Naif rd-Khaleej rd-Mankhool rd-Al Satwa bus stn
R-2	Airport T3-Al Maktoum rd-Omer bin Khattab rd- Naif rd-Khaleej rd-Mankhool rd-Al Satwa bus stn
R-3	Gold souq bus stn-Khaleej rd-Mina rd-Jumeirah rd-Internet City
R-4	Al Ghubaiba bus stn-Khalid bin Waleed rd-Trade centre I/C-Ras al Khor-International city

Detailed logistics are furnished below:

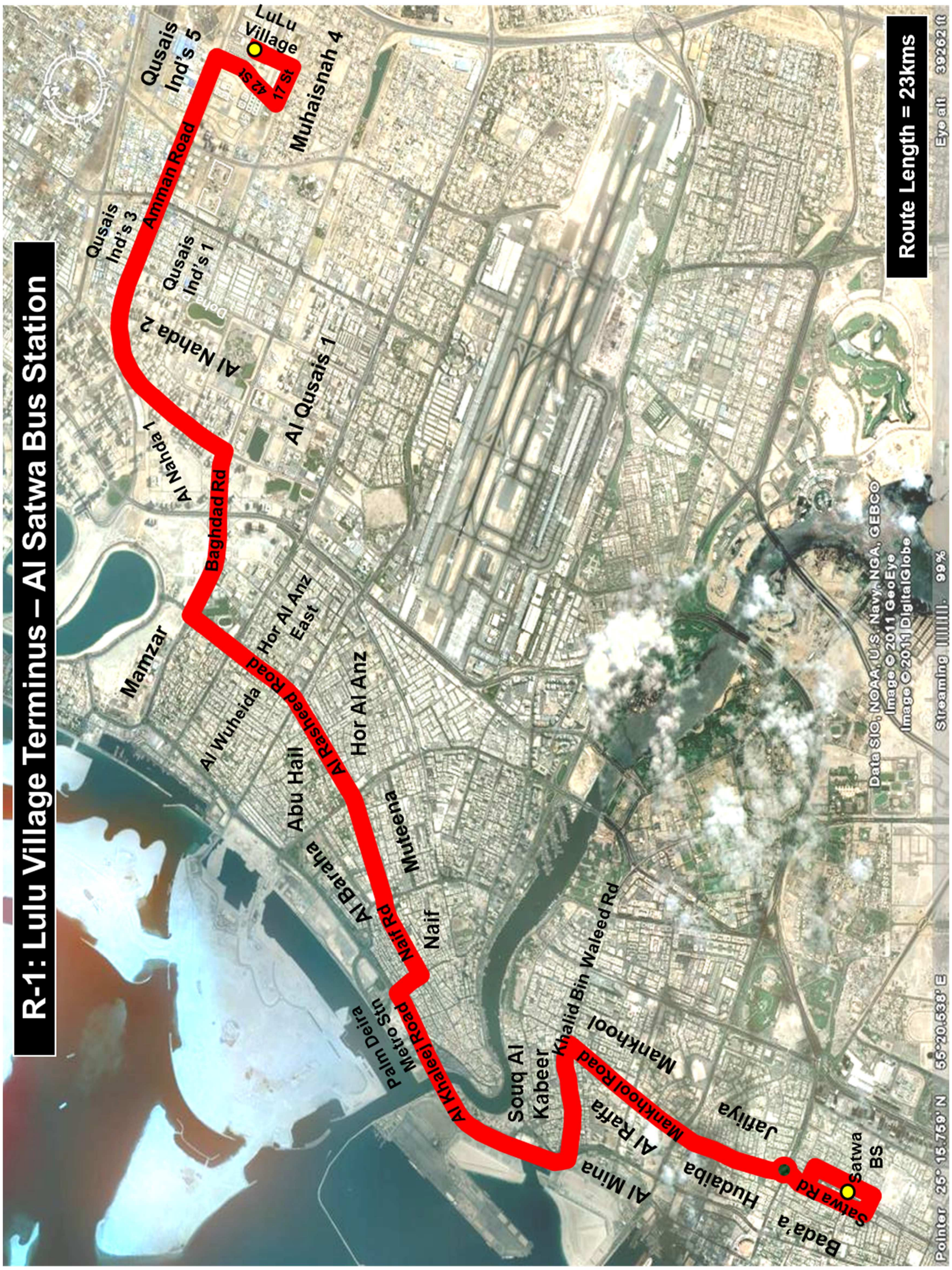
indices	R-1	R-2	R-3	R-4
Route length	23	18	33	29
Bus stops	35+38	25+27	51+49	38+36
A/C shelters	38	26	85	61
Demand estimate				
Current demand	27,600	28,000	12,300	16,100
New riders	30%	30%	30%	30%
Total estimated ridership/day	35,880	36,400	15,990	20,930
Passenger Lead	7.54	3.74	12.78	15.22
Passenger kms	270,535	136,136	204,352	318,555
Target Load Factor	50%	50%	50%	50%
Seat kms	541,070	272,272	408,704	637,109
Bus type	articulated	articulated	articulated	articulated
Payload	90	90	90	90
Seat km/phpd	27,054	13,614	20,435	31,855
Peak trips/phpd	13	8	7	12
Peak headway	5	7	9	5

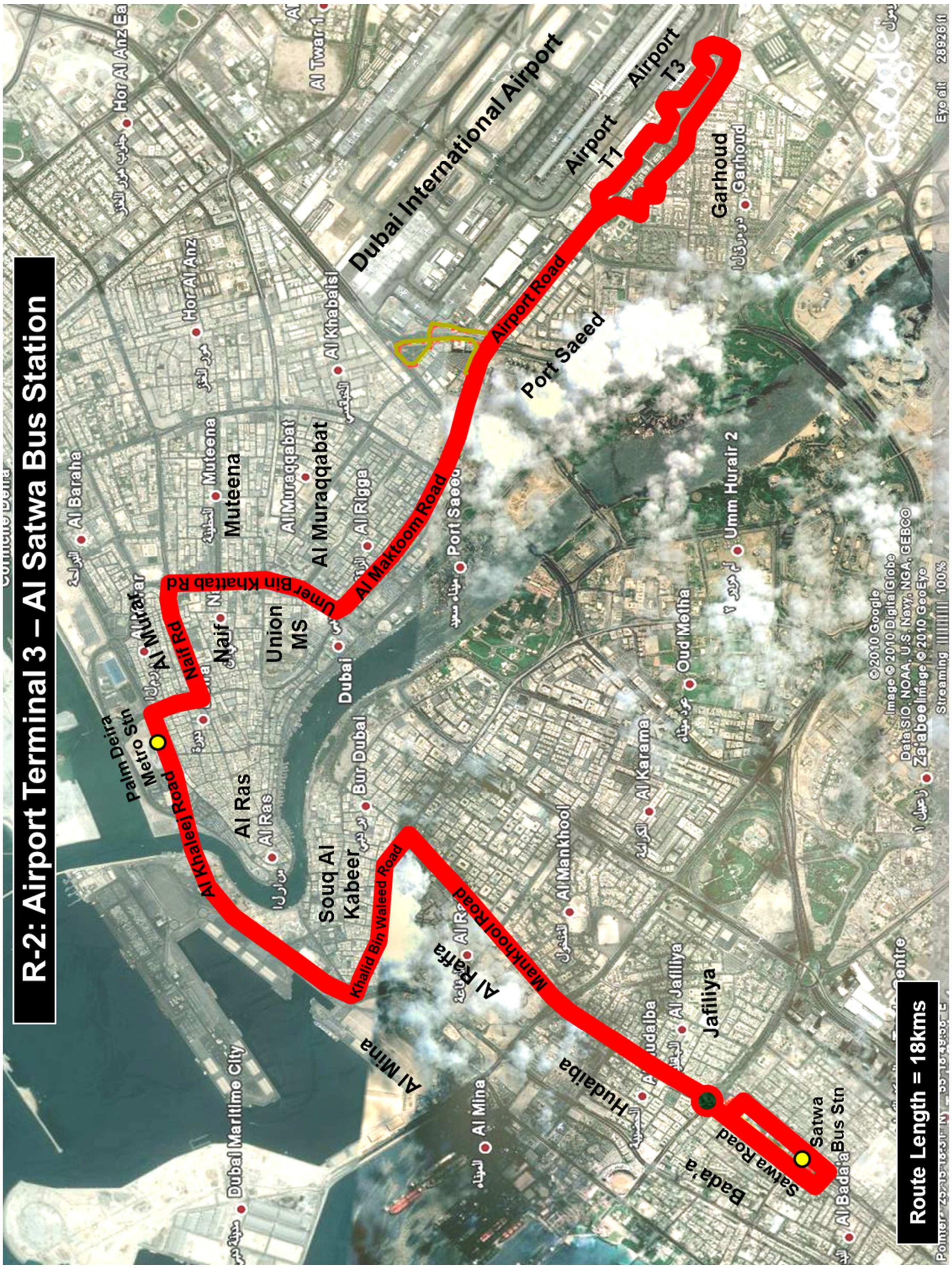
Note: Current demand is derived from the Planning Model except for R-4 for which actual ridership is taken because of abnormality

Route maps attached

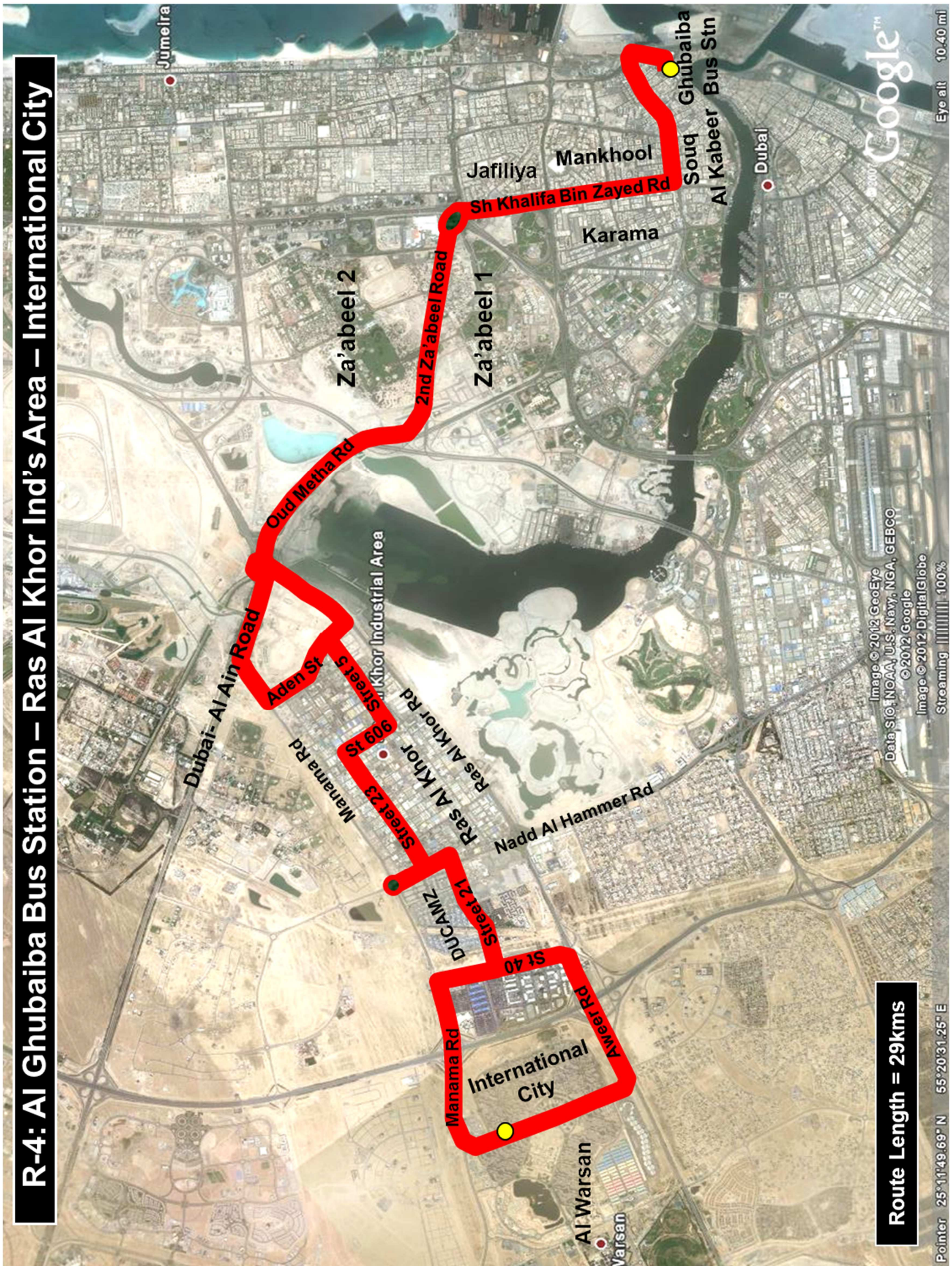
BRT Corridor Characteristics

route	road section	road type	lanes/dirn	length/meters	median	ROW
R-1	Muhaisnah 4 internal streets	single	1	1600	✕	✓
R-1	Amman road	dual	2	5200	✓	✓
R-1	Baghdad road	dual	3	1900	✓	✓
R-1	Rasheed road	dual	3	4200	✓	✓
R-1	Naif road	dual	2	967	✓	✓
R-1	Musallah road	dual	2	422	✓	✓
R-1	Khaleej road	dual	3	2901	✓	✓
R-1	Khaleed bin Waleed road	dual	3	1405	✓	✓
R-1	Mankhool road	dual	3	3240	✓	✓
R-1	Satwa road	one way	2	1005	✕	✓
R-2	Airport road	dual	3	2086	✓	✓
R-2	Al Maktoum road	dual	3	1845	✓	✓
R-2	Omer bin Khattab road	dual	3	1393	✓	✓
R-2	Naif road	common				
R-2	Musallah road	common				
R-2	Khaleej road	common				
R-2	Khaleed bin Waleed road	common				
R-2	Mankhool road	common				
R-2	Satwa road	common				
R-3	Al Ras, street 15A	dual	2	210	✓	✓
R-3	Corniche road	dual	3	802	✓	✓
R-3	street 27	one way	2	341		✓
R-3	Khaleej road	common				
R-3	Al Ghubaiba street	dual	2	484	✕	✓
R-3	Al Mina road	dual	3	2796	✓	✓
R-3	Dhiyafa road	dual	3	353	✕	✓
R-3	Jumeirah road	dual	3	14567	✕	✓
R-3	Safouh road	dual	3	3029	✕	✓
R-3	street 331	dual	3	440	✕	✕
R-3	DIC internal streets	dual	2	5212	✕	✕
R-4	International City internal streets	dual	3	2704	✓	✓
R-4	Manama road	dual	3	2679	✓	✓
R-4	Ras al Khor, street 40	dual	3	1979	✕	✓
R-4	Ras al Khor, street 21	dual	2	1702	✕	✓
R-4	Nad al Hammar road	dual	2	963	✕	✓
R-4	Ras al Khor, street 23	single	1	2145	✕	✓
R-4	Ras al Khor, street 606	dual	2	884	✕	✓
R-4	Ras al Khor, street 5	single	1	1743	✕	✓
R-4	Aden street	dual	2	1755	✕	✓
R-4	Manama road	dual	3	739	✕	✓
R-4	Dubai-Al Ain road	dual	3	1640	✓	✓
R-4	Oudh Metha road	dual	3	3479	✕	✓
R-4	2nd Za'abeel road	dual	3	3286	✕	✓
R-4	Sheik Khalifa bin Zayed road	dual	3	3105	✕	✓
R-4	Khaleed bin Waleed road	dual	3	2177	✕	✓
R-4	Al Ghubaiba street	common				


R-1: Lulu Village Terminus – Al Satwa Bus Station
Route Length = 23kms
LuLu Village
Qusais Ind's 5
Muhaisnah 4
42 St
17 St
Amman Road
Qusais Ind's 3
Qusais Ind's 1
Al Nahda 2
Al Qusais 1
Al Nahda 1
Baghdad Rd
Mamzar
Hor Al Anz East
Al Rasheed Road
Hor Al Anz
Al Wuheida
Abu Hail
Muteena
Al Baraha
Naif Rd
Naif
Palm Deira Metro Stn
Al Khaleej Road
Souq Al Kabeer
Khalid Bin Waleed Rd
Mankhool
Mankhool Road
Al Raffa
Jafilya
Al Mina
Hudaiba
Satwa BS
Satwa Rd
Bada'a


R-2: Airport Terminal 3 – Al Satwa Bus Station
Route Length = 18kms
Dubai International Airport
Airport T1
Airport T3
Airport Road
Garhoud
Port Saeed
Al Maktoom Road
Umer Bin Khattab Rd
Naif Rd
Al Khaleej Road
Palm Deira Metro Stn
Al Muraqqabat
Muteena
Naif
Union MS
Al Ras
Souq Al Kabeer
Bur Dubai
Khalid Bin Waleed Road
Mankhool Road
Al Raffa
Al Mina
Hudaiba
Jafiliya
Satwa Road
Satwa Bus Stn
Bada'a
Umm Hurair 2
Oud Metha
Al Karama
Al Mankhool
Dubai Maritime City
Al Baraha
Hor Al Anz
Al Khabaisi
Al Rigga
Al Twar 1


R-3: Gold Souq Bus Station – Jumeirah Road – Nakheel Metro Station
Gold Souq Bus Stn
Ghubaiba Bus Stn
Dubai
Al Mina Road
Jumeira 1
Jumeira 2
Jumeira 3
Jumeira Road
Umm Seqeim
Al Sufouh
Sufouh Road
DIC
NakheelMS Seaside
Palm Jumeira
Al Barsha
Route Length = 33kms


R-4: Al Ghubaiba Bus Station – Ras Al Khor Ind's Area – International City
Route Length = 29kms
Jumeira
Ghubaiba Bus Stn
Souq Al Kabeer
Dubai
Mankhool
Jafiliya
Karama
Sh Khalifa Bin Zayed Rd
Za'abeel 2
Za'abeel 1
2nd Za'abeel Road
Oud Metha Rd
Dubai- Al Ain Road
Aden St
Street 5
Khor Industrial Area
Ras Al Khor Rd
St 606
Manama Rd
Street 23
Ras Al Khor
Nadd Al Hammer Rd
DUCAMZ
Street 21
St 40
Aweer Rd
International City
Manama Rd
Al Warsan

Summary

- Dubai Public Transport buses carry an average of 250,000 passengers on 90 urban routes and 718 bus schedules
- Modal share in favour of bus transport is less than 7%; this is primarily because slow bus speeds and long travel times
- Buses encounter severe congestion in urban area, especially on CBD roads where the speeds drop down to 10 kph: bus journeys take twice as much time as cars to traverse similar trips.
- Public transport's appeal hinges on its speed and regularity. There are research works to prove that public transport share is directly influenced by the ratio of public transport average speed to automobile average speed
- Dubai needs BRT which is an efficient, relatively inexpensive and easy to implement option
- These system is implemented in a large of cities in Americas, Europe, Asia and Australia with great success: a modal shift 30-60% is reported
- 4 heavy density corridors are identified for the purpose with an estimated ridership of over 100,000 per day
- PTA is in possession of adequate articulated buses and drivers to run these routes
- 50% of the bus stops on the above route alignment have air-conditioned shelters
- TRA and PTA to jointly evaluate the technical and financial logistics