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A smart and sustainable bus stop system for Mashhad (Iran).

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Abstract:

Mashhad is the second largest city in Iran after Tehran. Today, the lack of suitable, equipped and old stations at most stations has reduced the use of urban buses by citizens, which resulted in the use of increased single-passenger cars in each. This has caused more pollution in Mashhad. On the other hand, the lack of interesting and entertaining devices in the stations of Mashhad has caused a waiting time for arriving bus stop last hardly.

The purpose of this project is to tune in, make it smart and equip with a few stations on Ahmad Abad's street in the city of Mashhad, in this direction, to encourage more people to use more public transport. In this project, the necessary analyzes for the intelligence and installation of stations according to the culture of the city, the climate, and the needs of the people of the city based on the latest examples and models in the world has been made.
Hence, the main purpose of the current thesis is to use people more than public transportation.

In order to better interaction between citizens and the station, I reviewed the analyzes and requirements for a smart station in Mashhad in accordance with the people's culture and needs that I briefly explained them: first, Attention to the disabled and blind in design (audio guidance and information). Second, the use of solar cells to provide general station equipment that stabilizes the bus stop and does not require urban electricity. The third, touch screen monitor to inform passengers accurately about the latest arrivals of buses, news, weather, city maps and more.... the fourth; Benches smart design that allows for the phone is charged by the outlet. The fifth, Design of ceilings and glasses according to Iranian architectural pattern.

In the end, the effects of smarting will be attracting the passenger to more public transport, reducing single-passenger cars, reducing fuel consumption, keeping underground reserves, less traffic and therefore less pollution, considering that human-centered and systematic approach to characterize the interaction design for the purpose of the project which is sustainabilit

Introduction:

With increasing population growth and congestion of the city, as well as the advancement of technology, addressing urban spaces and bus transportation in the city seems inevitable.

Today, traffic is a major problem in our metropolitan cities are grappling with. Environmental issues, waste of time. Traffic accidents and other issues related to the consequences and costs resulting from the resolve traffic problems in big cities become a concern for the upload.

Bus transportation system is one of the tools that have always been considered to ease traffic problems and used. Rail transport systems, mobility systems that only have pre-made paths and urban traffic on all routes, especially routes have economic justification.

and in this sense there is any bus is 30 private cars. If only every week a bus can be added to the city in the year 1440 rather than take personal car.

Using this system, particularly charged bus system in the near future urban transportation systems will be added to reduce pollution, reduce urban accidents, reduce injuries, reduce fossil fuel consumption, reduce noise pollution, more systematic transport , reduce the cost.

In the direction of the definitions suitable for presenting an arrangement with the sister of the need of the plan, the materials in three chapters to the following arrangement in the next page together.

First Section: City Introduction
-Familiar with the city of Mashhad and its History:

Mashhad, also spelled Mashad or Meshed, city, capital of Khorāsān-e Razavī ostān (province), north-eastern Iran. It is located in the Kashaf River valley at an elevation of about 1,000 metres. As the burial place of Alī al-Ridhā, the eighth imam in Twelver Shīism (Ithnā Ashariyyah), Mashhad is an important pilgrimage site. Also, as the easternmost of Iran's major cities, it is a hub for trade with the countries that border Iran to the east.

Mashhad has the second largest population in Iran—after Tehrān, the national capital.

The city is laid out in a roughly circular shape, with the religious edifices and monuments located in the centre and avenues radiating outward to approximately 12 neighbourhoods, such as Malikābād, Sajjād, Shahrak-e Azadi, Kuy-e Imām Reza, and Sanābād. Mashhad differs from other Iranian cities in that a shrine—in this case, the one marking the burial place of Alī al-Ridhā—rather than a bazaar constitutes the centre of municipal life. Prior to the renovation of the shrine area in the mid-1970s, that complex was in effect a town within a city, somewhat akin to the Forbidden City in Beijing prior to the collapse of the Qing dynasty in 1911.

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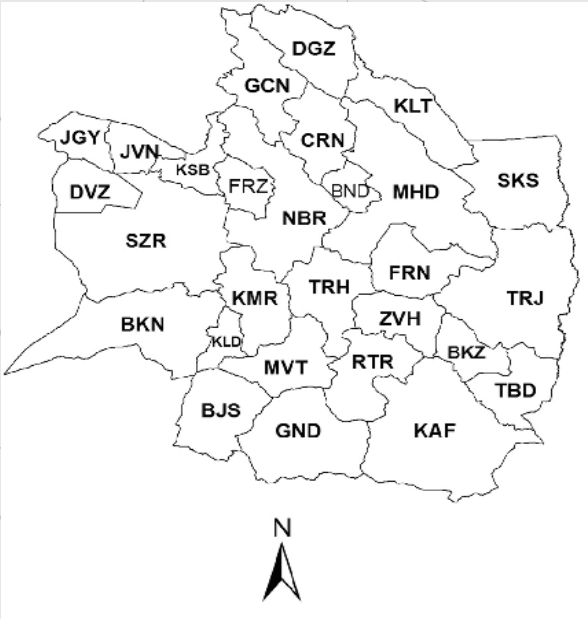
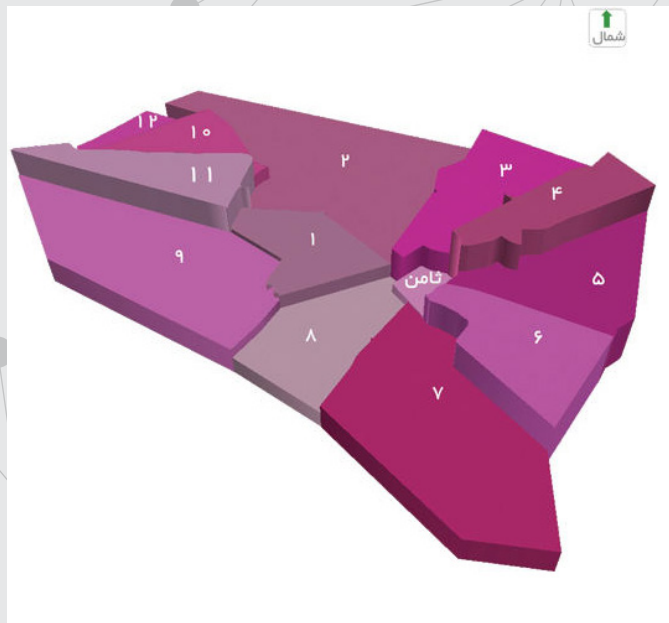
https://www.britannica.com/place/Mashhad [1]
http://www.irimo.ir/eng/ - Meteorological Organization of Iran [2]

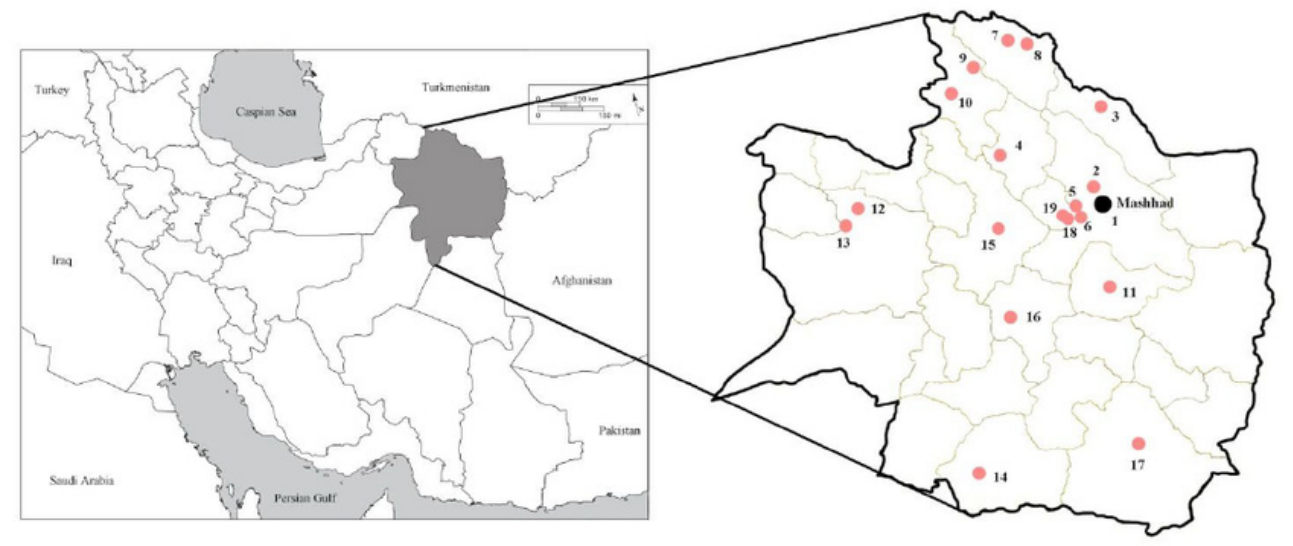
Mosques, courtyards, areas for bast (sanctuary-taking), seminaries, caravanserai (inns), and bazaars collectively formed the Haram (holy site).In the late 20th and early 21st centuries, the city grew into a major modern metropolis, and religion continued to play an enormous role in its development. The shrine's landholdings were so extensive that when a massive urban renewal project was launched just before the 1978–79 revolution, more than three-fourths of the available land belonged to the shrine.

https://www.britannica.com/place/Mashhad [1]
http://www.irimo.ir/eng/ - Meteorological Organization of Iran [2]

The city is the administrative center of Mashhad County (or the Shahrestan of Mashhad) as well as the somewhat smaller district (Bakhsh) of Mashhad. The city itself, excluding parts of the surrounding Bakhsh and Shahrestan, is divided into 13 smaller administrative units, with a total population of more than 3 million.[1]





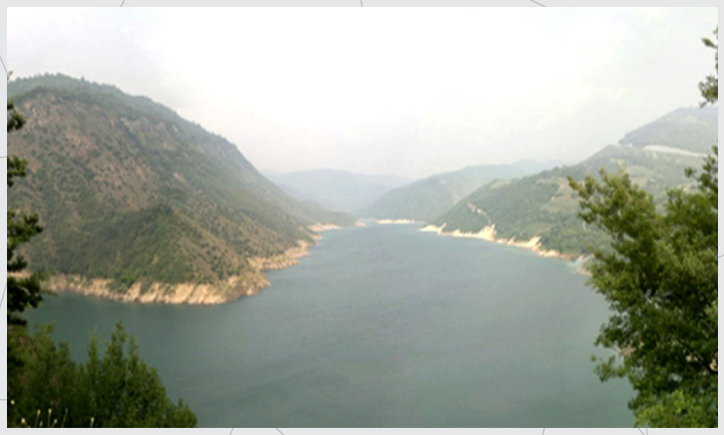


-Geography:

The city is located at 36.20° North latitude and 59.35° East longitude, in the valley of the Kashafrud River near Turkmenistan, between the two mountain ranges of Binalood and Hezar Masjed Mountains.

https://www.britannica.com/place/Mashhad [1]
http://www.irimo.ir/eng/ - Meteorological Organization of Iran [2]

summers, and beautiful autumns. It is only about 250 km (160 mi) from Ashgabat, Turkmenistan.The metropolitan area is subject to earthquakes, and seismic activity in outlying areas, such as Qāyen in 1997 and Bam in 2008, has also been recorded in Mashhad.



Mashhad features a steppe climate with hot summers and cool winters. The city only sees about 250 millimetres (9.8 inches) of precipitation per year, some of which occasionally falls in the form of snow. Mashhad also has wetter and drier periods with the bulk of the annual precipitation falling between the months of December and May. Summers are typically hot and dry, with high temperatures sometimes exceeding 35 °C (95 °F). Winters are typically cool to cold and somewhat damper, with overnight lows routinely dropping below freezing. Mashhad enjoys on average just above 2900 hours of sunshine per year.

Climate data for Mashhad (1951–2010, extremes 1951–2010) [hide]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	24.0 (75.2)	26.0 (78.8)	32.0 (89.6)	35.4 (95.7)	39.2 (102.6)	41.6 (106.9)	43.8 (110.8)	42.4 (108.3)	42.0 (107.6)	35.8 (96.4)	29.4 (84.9)	28.2 (82.8)	43.8 (110.8)
Average high °C (°F)	7.1 (44.8)	9.3 (48.7)	14.2 (57.6)	20.9 (69.6)	26.8 (80.2)	32.3 (90.1)	34.4 (93.9)	33.1 (91.6)	28.9 (84)	22.5 (72.5)	15.5 (59.9)	9.8 (49.6)	21.2 (70.2)
Daily mean °C (°F)	1.7 (35.1)	3.7 (38.7)	8.5 (47.3)	14.7 (58.5)	19.6 (67.3)	24.4 (75.9)	26.6 (79.9)	24.8 (76.6)	20.3 (68.5)	14.5 (58.1)	8.7 (47.7)	4.0 (39.2)	14.3 (57.7)
Average low °C (°F)	−3.8 (25.2)	−1.8 (28.8)	2.9 (37.2)	8.4 (47.1)	12.4 (54.3)	16.4 (61.5)	18.7 (65.7)	16.5 (61.7)	11.7 (53.1)	6.4 (43.5)	1.9 (35.4)	−1.7 (28.9)	7.3 (45.1)
Record low °C (°F)	−27.0 (−16.6)	−28.0 (−18.4)	−13.0 (8.6)	−7.0 (19.4)	−1.0 (30.2)	4.0 (39.2)	10.0 (50)	5.0 (41)	−1.0 (30.2)	−8.0 (17.6)	−16.0 (3.2)	−25.0 (−13)	−28.0 (−18.4)
Average precipitation mm (inches)	32.6 (1.283)	34.5 (1.358)	55.5 (2.185)	45.4 (1.787)	27.2 (1.071)	4.0 (0.157)	1.1 (0.043)	0.7 (0.028)	2.1 (0.083)	8.0 (0.315)	16.1 (0.634)	24.3 (0.957)	251.5 (9.902)
Average precipitation days (≥ 1.0 mm)	5.6	5.8	8.2	6.8	4.5	1.1	0.3	0.2	0.5	1.5	2.9	4.2	41.6
Average snowy days	5.6	5.8	4.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1	1.2	3.8	20.9
Average relative humidity (%)	75	73	69	62	50	37	34	33	37	49	63	73	54
Mean monthly sunshine hours	148.3	147.5	163.3	200.4	280.4	343.2	366.9	359.7	305.2	249.5	188.3	151.6	2,904.3

figure [2]

http://www.whatstheweatherlike.org/iran/mashhad.htm [1]

-Average Temperatures in Mashhad, Iran:

•The mean annual temperature in Mashhad, Iran is mild at 13.6 degrees Celsius (56.5 degrees Fahrenheit).

•Mean monthly temperatures vary by 26.7 °C (48.1°F) which is a moderate range.

•July is the warmest month (hot) with an average temperature of 26.7 degrees Celsius (80.06 degrees Fahrenheit).

•The coolest month (January) is slightly cold having an average temperature of 0 degrees Celsius (32 degrees Fahrenheit).

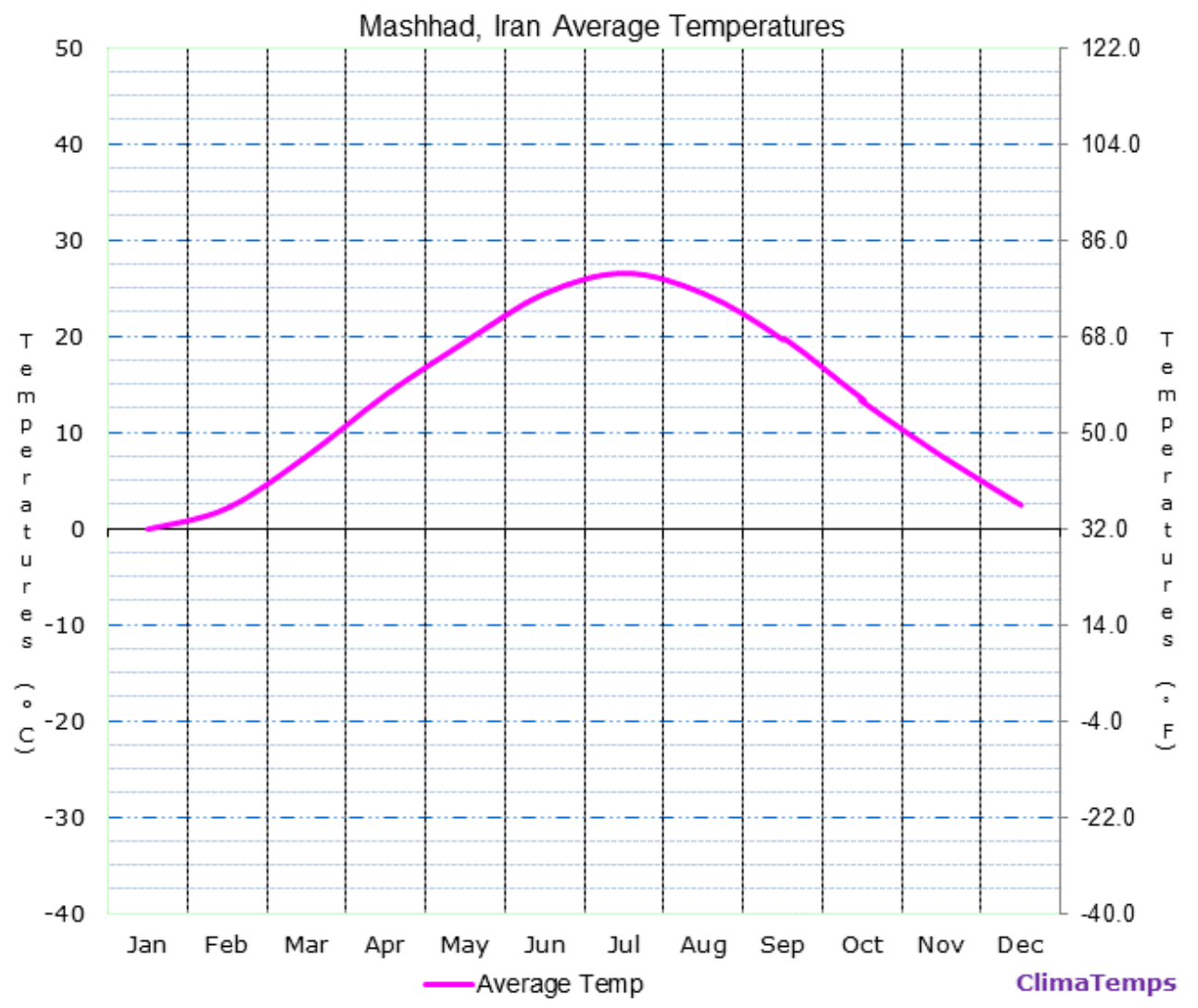


figure [2]

The charts have major grid lines at intervals of 10 °C on the left axis corresponding with intervals of 18 °F on the right axis. Minor gridlines mark intervals of 2.5 °C and 4.5 °F.

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http://www.whatstheweatherlike.org/iran/mashhad.htm [1]

The charts show the relationship between the Celsius and Fahrenheit measuring scales. Locations in the northern hemisphere run from January to December and in the southern hemisphere from July to June so that the middle of the chart always corresponds with the high sun period (for the hemisphere). figure [2]

•Freezing months: 0 (0°C / 32.0°F and below) •Cold months: 5 (0°C / 32.0°F to 10°C / 50.0°F)
•Cool months: 4 (10°C / 50.0°F to 20°C / 68.0°F) •Hot months: 0 (30°C / 86.0°F to 40°C / 104.0°F)
•Warm months: 3 (20°C / 68.0°F to 30°C / 86.0°F)•Boiling months: 0 (40°C / 104.0°F and above)

-Rainfall/ Precipitation in Mashhad, Iran:

•Mashhad attains an average of 255.7 mm (10.1 in) of rainfall per year, or 21.3 mm (0.8 in) per month.
•The driest weather is in August when an average of 0.7 mm (0 in) of rainfall (precipitation) occurs.
•The wettest weather is in March when an average of 52 mm (2 in) of rainfall (precipitation) occurs.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Precipitation mm (in)	33.1 (1.3)	36.4 (1.4)	52 (2)	48.8 (1.9)	25.5 (1)	3 (0.1)	0.9 (0)	0.7 (0)	1.5 (0.1)	11.2 (0.4)	15.7 (0.6)	26.9 (1.1)	255.7 (10.1)
Precipitation Litres/m² (Gallons/ft²)	33.1 (0.81)	36.4 (0.89)	52 (1.28)	48.8 (1.2)	25.5 (0.63)	3 (0.07)	0.9 (0.02)	0.7 (0.02)	1.5 (0.04)	11.2 (0.27)	15.7 (0.39)	26.9 (0.66)	255.7 (6.27)

figure [2]

-Daylight Hours in Mashhad, Iran:

•The longest day of the year is 14:28 long and the shortest day is 9:31 long.
•The longest day is 4:56 longer than the shortest day.
•At midday the sun is on average 54.1° above the horizon at Mashhad.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Daylight Hours & Minutes/ Day	09:59	10:48	11:54	13:05	14:04	14:35	14:21	13:30	12:22	11:11	10:12	09:43	12:00
Sun altitude at solar noon on the 21st day (°).	33.8	43.1	54	65.6	73.9	77.2	74.1	65.8	54.4	42.9	33.7	30.3	54.1

figure [2]

http://www.mashhad.climatemps.com [1]

-More climate information:

Climate figures are very useful but don't present a general impression of the climate and the eventual weather circumstances within a certain period. The figures don't always reflect the chance of wintry weather, extreme heat or hurricanes. That is why we offer useful extra climate information for each month of the year:

	chance of (very) hot weather	chance of (very) cool weather	chance of long-term precipitation	chance of hurricanes (cyclones)	chance of sunny days	UV-index
January	○	●●	○○	○	○○○	UV 3-6
February	○	●●	○○	○	○○○	UV 3-6
March	●	●	○○	○	○○○	UV 6-8
April	●●	○	○	○	○○○○	UV 8-10
May	●●●●	○	○	○	○○○○	UV 10+
June	●●●●●	○	○	○	○○○○○	UV 10+
July	●●●●●	○	○	○	○○○○○	UV 10+
August	●●●●●	○	○	○	○○○○○	UV 10+
September	●●●●●	○	○	○	○○○○○	UV 8-10
October	●●●	○	○	○	○○○○	UV 6-8
November	●	●	○	○	○○○	UV 3-6
December	○	●●	○	○	○○○	UV 0-3
click here for the explanation of the symbols						

figure [2]

-The Best time to visit Mashhad:

The best time to visit Mashhad will be when the average temperatures are at a comfortable level (between 20°C / 68.0°F and 30°C / 86.0°F on average) which is during months June, July and August. Other great months to visit Mashhad are April, May, September and October when the average temperatures are a little cooler but still between a pleasant 10°C / 50.0°F and 20°C / 68.0°F. If you don't mind bringing a coat, you might also enjoy visiting Mashhad during January, February, March, November and December but average temperatures are fairly cool (between 0°C / 32.0°F and 10°C / 50.0°F).

The warmest time of year in Mashhad is in July when it is 26.15°C / 79.1°F on average, but could get up to 34.4°C / 93.9°F maximum. On the other hand, the coldest time of year in Mashhad is in January when it is 0.8°C / 33.4°F on average, but could get down to -5.1°C / 33.4°F minimum.

http://www.whatstheweatherlike.org/iran/mashhad.htm [1]

Land Transportation in Mashhad:

bus:

Like the other modern cities, Mashhad has a complete and compact system of public transport bus service. You can travel to every point of city with a very low cost using this service. The bus stops almost can be found in nearest place to your home or office. The old paper tickets have replaced with an smart card (Man Cart). The BRT lines have a great part in this transportation service and many of large street in town are limited for an efficient use of these lines.

Urban rail line:

Mashhad benefits from urban rail line to transfer millions of people a day. It is the second rapid transit system in Iran that saves times for civil trips as well as energy and cost. The Mashhad Urban Railway operates its single line from 6:30 to 21:30 daily. The first line is active right now and second line is currently under construction.

https://en.mashhad.ir/portal_content/1341393-Transportation.html

Taxi:

In city of Mashhad there are 2 types of taxi :

1- Telephon Taxi : You can call to operator to send a taxi or just with point of your hand in street for the taxi cars.

2- Online Taxi : There are now 3 companies in mashhad that they manage online taxis for clients, clients can take taxi with their applications on theirself cellphones.

Online Company's taxi in Mashhad are : Touchsi, Snap and Cheetax

http://araktaxi.ir/

Bus and Train traveling:

Traveling from and to Mashhad by bus and train is alternative way for those who are interested to get experience from natural landscapes, towns, villages and even historical places while they are traveling on the way. The Imam Reza (PUH) Bus Terminus of Mashad is located at countryside to access easily to main input and output roads of city and is the biggest station to traffic of buses. This terminus has area of 8.600 mm and daily 2000 buses enters and exits. The ticket reservations is possible by Internet Reservation and The modern VIP buses also give the passengers the most comfort environment to rest and watch the beautiful views.

The central train station of Mashhad provides a safety and comfortable way for travelers to trip between Mashhad and their town. Tehran is the most important origin of passengers of train to mashhad and so the high class trains are on the move in this line. In the future, the government has some plan to build a transrapid line between Tehran and Mashhad.

At summer and the end of year many of people who want to visit the holy shrine of Imam Reza (PUH) invaded Mashhad through bus and train. Most of them come to Mashhad from the big city of Iran.

-Bus History in Mashhad, Iran and the world :

Bus History in Mashhad:

Since 1328 virtually closed bus route in the city of Imam Reza (AS) to the high-street, property, rare crossroads, Mydanshhda (sculpture), Ghoochan gate, Goharshad, Mirage, Saadi, Imam Reza (Shah Reza former) and on the left and pass this route for every passenger, a penny was received. Mashhad has four lines and each line will have 15 buses. The bus had a capacity of 30 people, but always consider adding 15 (outpatient) were mounted and bus drivers about the issue, was fined ten riyals. Of course, many other cases, when the police station rare four-way crossed the floor of the passengers were asked to sit, but later that Mashhad Municipality Bus Company was established, the issue of the illegality of boarding out, was legal. Most of the time the buses were blue. meeting and fares received. On the other hand the Union, service on Fridays for each bus routes lawyer Abad, City of Khwaja Rabi, Khwaja Abasalt and Khajeh Morad were determined and the bus drivers were also overtime for it.

https://www.car.ir/news/Review/volvo-scania-bus

the number of buses entering the bus company has 20 buses from Tehran to Mashhad that was brought by one of the rich, work from 6 am to 40 am Rsyd.shyft to 14, working the night shift from 14 pm to 22 22 pm to 6 am the next day, the buses to the parking lot, then took to the streets Junior Bvd,My, up to cleaning, and repair them because it was not possible during the day.

Since 1347 instead of cash, tickets cost was considered, at that time it was two rials determine which bidder once the Photo Razzaghi was first published in Mashhad bus ticket on one of the tickets.

https://www.car.ir/news/Review/volvo-scania-bus

Bus History in Iran:

Transport system in Iran, along with many progressive countries of the world took shape and course of the primary activities focused in Tehran.

Following the creation of the railway Hazrat Abdul Azim by a Belgian company and setup smoked between Tehran and Shahr-e Rey, a public transportation system with two functions of recreation and transportation within the city, began its work.

The bill was passed in 1305 established a private bus companies and in this connection a license to a Danish company was founded. Shortly after the launch of the Tehran bus lines and Shamiran because Kmbvddramd, activity buses stopped.

Following the coup of February Reza-Khani, buses and bus lines gradually expanded. At the same time the number of buses were bought from the Soviet Union Zeiss model and move them virtually "in Tehran launched eight bus lines Shd.krayh the bus 10 was a king.

Prime Minister Soheilifar legislation in 1321 to allow the creation of urban transport.

In 1323 one of the banks were ordered to enter the bus number. 50 new models imported 30 buses were allocated to Tehran. The buses were later installments were about 200 units were sold to private companies.

Bus gradually became more organized and more under the control of income. General behavior to be more correct bus ride and your people for a ride to the bus line closed.

https://www.car.ir/news/Review/volvo-scania-bus

In 1331, legislation to establish a public bus companies in cities was passed by the National Assembly and the rating was also assigned to the municipalities. Tabriz Bus Company was founded in the same year. Finally, "in the Persian date Farvardin 1335 Tehran Bus Company of Tehran and Suburbs Bus Company name was registered with a capital of three hundred million rials Ahvaz Bus Company was founded at the same time.

Gradually authorities on procurement of equipment bus system came to a more appropriate service provider, but most of the action was done without a thorough and comprehensive, did not achieve much success.

Its instance in 1338 that thousands of the selling tickets in the bus was installed but the lack of money and travelers definitely go ahead with this plan and lack of control system was that this program 8 months more lasting as it doesn't hurt and entries.

Activity established a city bus companies in the '40s with the establishment of firms in Mashhad (1342), City (1345), Isfahan (1346), Tehran and Urmia (1347) continued.

In the '50s, before the Islamic Revolution, and the number of cities to 14 cities of Shiraz, Tehran, Abadan, Kermanshah, Gorgan and Babylon were also owns bus system. In the years after the revolution until 1368, nine other organization was founded, until it reached a peak time organizing bus companies (1368 to 1371)

Thus Between 68 to 71, 24 to the House in other cities have this service Pyvstnd.bdyn on until 1368, 48 cities were Vajdayn services. Now in 1391, there are 99 bus system in Iran is in service to the citizen's

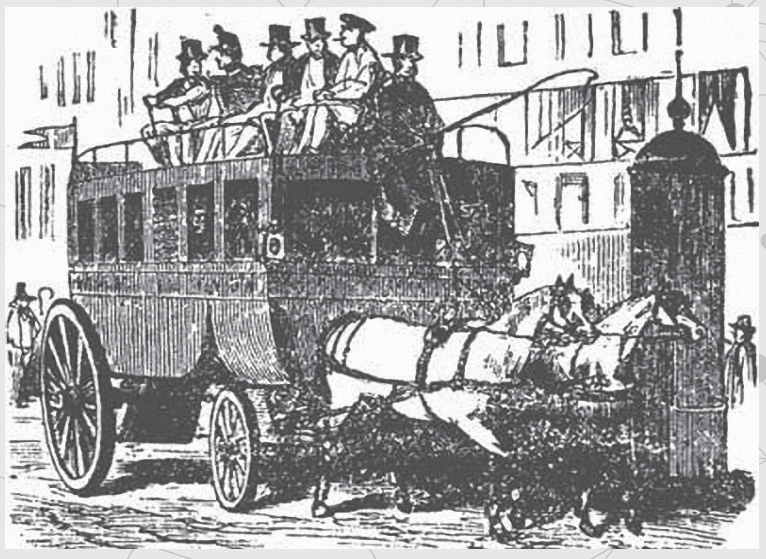
https://www.car.ir/news/Review/volvo-scania-bus

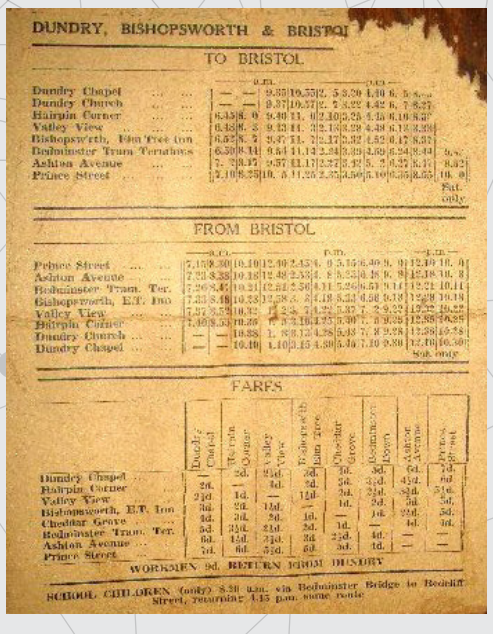
Bus History in the world:

"While there are indications of experiments with public transport in Paris as early as 1662,[1][2][3] there is evidence of a scheduled "bus route" from Market Street in Manchester to Pendleton in Salford UK which was started by John Greenwood in 1824.[4]

Another claim for the first public transport system for general use originated in Nantes, France in 1826. Stanislas Baudry, a retired army officer who had built public baths using the surplus heat from his flour mill on the city's edge, set up a short route between the center of town and his baths. The service started on the Place du Commerce, outside the hat shop of a M. Omnès, who displayed the motto Omnès Omnibus (Latin for "everything for everybody" or "all for all") on his shopfront. When Baudry discovered that passengers were just as interested in getting off at intermediate points as in patronizing his baths, he changed the route's focus. His new voiture omnibus ("carriage for all") combined the functions of the hired hackney carriage with a stagecoach that travelled a predetermined route from inn to inn, carrying passengers and mail. His omnibus had wooden benches that ran down the sides of the vehicle; passengers entered from the rear.

In 1828, Baudry went to Paris where he founded a company under the name Entreprise générale des omnibus de Paris, while his son Edmond Baudry founded two similar companies in Bordeaux and in Lyon."[5]





DUNDRY, BISHOPSWORTH & BRISTOL

TO BRISTOL

FROM BRISTOL

FARES

https://en.wikipedia.org/wiki/Public_transport_bus_service

1-"Premiers omnibus à Nantes" 4-"Greater Manchester's Museum of Transport: Public Transport in Greater Manchester"

2- "Year 1662, The First Public Bus, The Omnibus" 5-"Les omnibus à traction hippomobile (archives of Musée départemental Dobrée)"

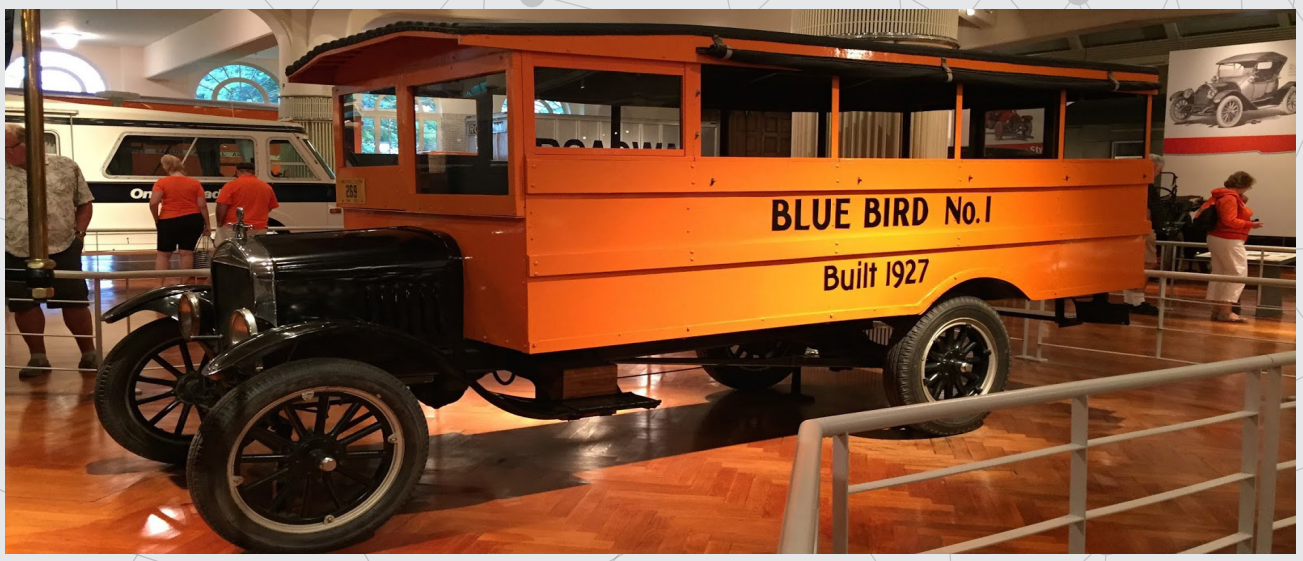
3-"When was the horse-drawn urban omnibus introduced in Paris?"

“A London newspaper reported on July 4, 1829 that “the new vehicle, called the omnibus, commenced running this morning from Paddington to the City”, operated by George Shillibeer.

The first omnibus service in New York began in 1829, when Abraham Brower, an entrepreneur who had organized volunteer fire companies, established a route along Broadway starting at Bowling Green. Other American cities soon followed suit: Philadelphia in 1831, Boston in 1835 and Baltimore in 1844. In most cases, the city governments granted a private company—generally a small stableman already in the livery or freight-hauling business—an exclusive franchise to operate public coaches along a specified route. In return, the company agreed to maintain certain minimum levels of service.

In 1832 the New York omnibus had a rival when the first trams, or streecars started operation along Bowery,[6] which offered the excellent improvement in amenity of riding on smooth iron rails rather than clattering over granite setts, called “Belgian blocks”. The streetcars were financed by John Mason, a wealthy banker, and built by an Irish-American contractor, John Stephenson. The Fifth Avenue Coach Company introduced electric buses to Fifth Avenue in New York in 1898.

In 1831, New Yorker Washington Irving remarked of Britain’s Reform Act (finally passed in 1832): “The great reform omnibus moves but slowly.” Steam buses emerged in the 1830s as competition to the horse-drawn buses.”



https://en.wikipedia.org/wiki/Public_transport_timetable

6-”Streetcar Sunday - The Bowery”

"The omnibus extended the reach of the emerging cities. The walk from the former village of Paddington to the business heart of London in the City was a long one, even for a young man in good condition. The omnibus thus offered the suburbs more access to the inner city. The omnibus encouraged urbanization. Socially, the omnibus put city-dwellers, even if for only half an hour, into previously-unheard-of physical intimacy with strangers, squeezing them together knee-to-knee. Only the very poor remained excluded. A new division in urban society now came to the fore, dividing those who kept carriages from those who did not. The idea of the "carriage trade", the folk who never set foot in the streets, who had goods brought out from the shops for their appraisal, has its origins in the omnibus crush."

Motorbus:

"John D. Hertz founded the Yellow Coach Manufacturing Company in 1923 and then sold a majority of shares to General Motors in 1925.

From the 1920s General Motors and others started buying up streetcar systems across the United States with a view to replacing them with buses in what became known as the Great American Streetcar Scandal.[7] This was accompanied by a continuing series of technical improvements: pneumatic "balloon" tires during the early 1920s, monocoque body construction in 1931, automatic transmission in 1936, diesel engines in 1936, 50+ passengers in 1948, and air suspension in 1953.[8]

The arrest of Rosa Parks in 1955 for not giving up her seat to a white man on a public bus is considered one of the catalyst events of the African-American Civil Rights Movement of the United States."

https://en.wikipedia.org/wiki/Public_transport_timetable
7-"American Public Transportation Association"
8-General Motors and the Demise of Streetcars

-The definition of the bus system and the bus stop:

The definition of bus system :

Bus is one of kind a public transport. Buses on Service Areas are divided into two groups: urban and suburban. The two buses in terms of features, safety and manufacturing costs are different.

Bus types:

-Based on the directions of movement:

-Based on fuel consumption:

-Based on the number of cabins:

-Based on the size and shape:

-By Application:

-Based on the level of access:

-Low bus:

-High bus:

Bus Low levels (low bus) is a type of bus floor and the ceiling height is lower than other buses. Low-level buses, airport shuttle first time in 1960 as in Europe came into being. Almost 30 years later in Europe of the buses in the public transport system was used. In early 1992 the first bus standard size and durable Bus New Flyer D40LF by carriers United States of America and Canada were used. a stop at the station have chosen.

In Europe the speed using low-level buses without any rules and laws are on the rise. They found that low-level buses, a better solution would be for all people. Most manufacturers offer low-level buses buses in Europe. The buses were originally the entrance height of 320 mm (6/12 inch) high and the ability Zanvzdn to 250 mm (8.9 inches) respectively. German Transport Department said in its annual report in 1992 that from 1988 to 1992, the number of 3905 low-floor city buses produced by German manufacturers, of course, areas where roads do not have much progress still asking ordinary buses.

In a report on the forty-ninth International Congress of the International Union of Public Transport (UITP) presented the following definition of a low-floor buses were provided.
Urban BUS A Streetcar Named Desire is the product of the first and second floor vehicle completely come down and its surface enough is down to the way that in the corridor and between the doors and in the vicinity of the doors any stairs not required. In order to access the bus floor without using the stairs at the entrance, away from the ground floor should be 380 mm (15 inches) or less (The distance from the ground floor in ordinary buses almost 890 mm meter 35 inches - yet). Level floor at the back of the bus should be higher. So far, two general methods have been used to increase the height of the floor at the end of the bus.

Historically, the number of low-level buses in Europe, America and Canada are buses available in the markets. Some say that the buses were not Europeans down the aisle low level because their seats were all on one platform. This method is not commonly used in North America. However, most European city buses models insoles are flat between the first and second doors (some of them are steep at the door). The final design of the family bus low-floor, the Ultra Low Floor buses. The benefits of this low-floor bus, the bus is much higher.

The benefits of lower level bus:

Accelerate the implementation and boarding all passengers (including adults, Tvanjv, the elderly, children, parents Kalskhand and people who are baskets or containers).

Time between 2.0 to 7.0 seconds boarding an effect on and off between 3.0 to 7.2 seconds faster (time ride with Wheel Chair half ride with the lift).

More stability due to low center of gravity bus.

Reduce the time to stop at the station.

Walk and ride passenger in the accident reduction.

Very good bus steering

The definition of bus stop system :

A bus stop is a designated place where buses stop for passengers to board or alight from a bus. These are normally positioned on the highway and are distinct from off-highway facilities such as bus stations. The construction of bus stops tends to reflect the level of usage. Stops at busy locations may have shelters, seating, and possibly electronic passenger information systems; less busy stops may use a simple pole and flag to mark the location. Bus stops may be clustered together into transport hubs allowing interchange between routes from nearby stops and with other public transport modes

Bus Stops based on the size and location on the streets are diveded into two groups:

Bus stop based on the size:

- Basic bus stop
- Sheltered bus stop
- Transit station stop
- Bus transit center

Bus stop based on location on the streets:

- In-lane Sidewalk Stop
- Median Stop, Side Boarding
- On-street Terminal

Basic bus stop:

A basic bus stop normally includs these elements:

-Bus Stop Sign

-Paved Boarding Area

-Information/Schedule

-Sidewalk Connection

-Street Lighting

Example:

Mode: Bus

Sheltered bus stop:

A sheltered bus stop normally includsthese elements:

-Bus Stop Sign

-Paved Boarding Area

-Information/Schedule

-Sidewalk Connection

-Small Shelter/Seating

-Trash Receptacle

-Bus Bay or Curb Extension

-Lighting & Real-Time Display

Example:

Mode: Bus, Bus Rapid Transit (BRT)

Transit station stop:

A basic bus stop normally includs these elements:

-Station Signage

-Raised Platform/Level Boarding

-Information/Schedule/System Map

-Pedestrian Facilities -Distinctive Design

-Lighting -Bicycle Racks/Parking

-Large Shelter/Seating -Trash Receptacle(s)

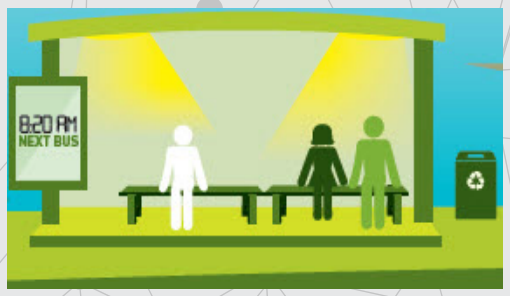
-Real-Time Display -Branding Elements

-Off-board fare payment

-Newspaper vending machines

Example: Walter Reed Super Stop

Mode: Bus, BRT, Streetcar, Light Rail Transit (LRT)



Bus transit center:

A sheltered bus stop normally includsthese elements:

-Information/Schedule/System Map

-Lighting & Security -Bicycle Access/Parking

-Trash Receptacle(s) -Distinctive Design

-Off-Street Bus Bays -Branding Elements

-Off-board fare payment -Real-Time Display

-Park-and-Ride Lot/Garage

-Enclosed Waiting Areas/Restrooms

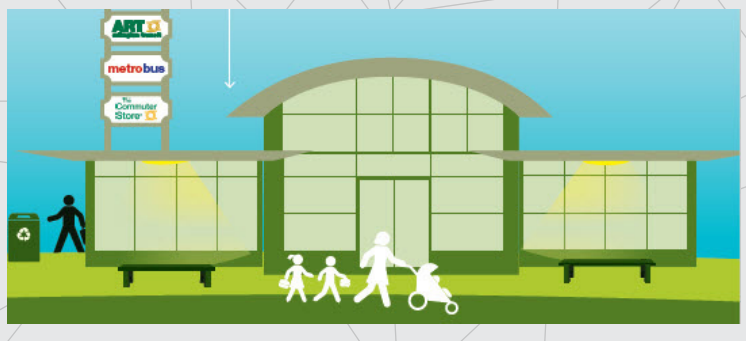
-Enhanced Passenger Amenities

-Kiss-&-Ride/Taxi Facilities

-Information/Commuter Center

Example: Shirlington Station

Mode: Bus, BRT



The latest publication of the National Association of City Transportation Officials, NACTO, is the "Transit Street Design Guide" in which tips and proposals are presented on how to improve streets through urban design.

The ideas are centered on prioritizing sustainable mobility so that both the member cities of the organization and those that have access to this document can improve their practices in relation to public spaces, mobility, and transportation.

These are the 3 bus Stop types based on location on the street:

1. In-lane Sidewalk Stop:

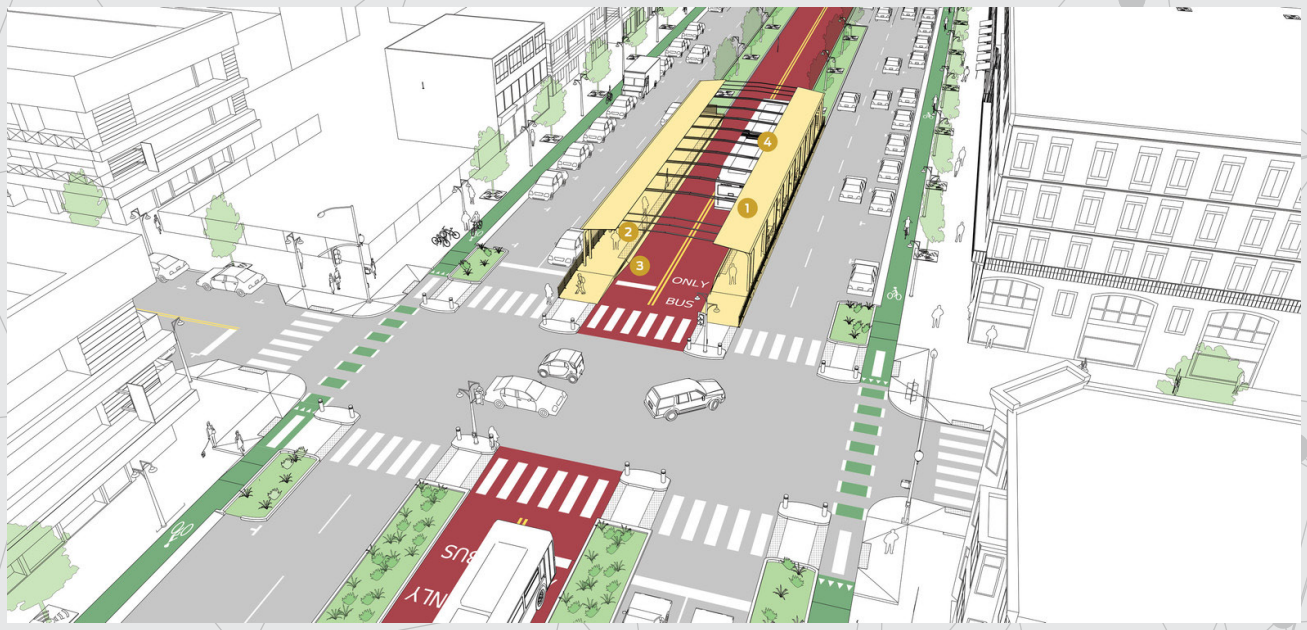
"Bus stops on sidewalks are probably the most common due to their low economic cost and how quickly they can be made.

In addition, the design is easy to replicate on both the smaller and larger streets where traffic is mixed and bus lanes and car lanes aren't necessarily separated by barriers.

However, keeping cars or other private vehicles from traveling on bus routes is possible if the latter are painted with bright colors. Nevertheless, NACTO maintains that on very narrow sidewalks shelters for bus stops should be omitted."

http://www.archdaily.com/800590/these-are-the-3-bus-stop-types-needed-for-sustainable-transit-solutions [1]

2. Median Stop, Side Boarding:



"In many cities around the world, it has become more common to see center lanes of large streets designated as bus lanes for public transport.

This design is classified by NACTO as something that gives identity to the service and offers some of the following functional advantages; greater safety to passengers, allows buses to pass more frequently by reducing the presence of other types of vehicles, and gives a more orderly visual appearance.

According to NACTO obtaining part of these advantages is possible if the size of the passenger waiting area is determined by the expected number of buses and the demand of the passengers.

Additionally, options include using visual methods to indicate safe waiting areas for passengers, making sure the height of the platforms allows both passengers with or without reduced mobility to board the buses without inconvenience, and equipping stops with certain elements that provide comfort and protection such as seats, railings and ceilings."

3. On-street Terminal:

“Streets referred to as terminals can be those close to intermodal stations or where a bus routed begins or ends. It is common for crowds of passengers to be present on the sidewalks and for buses not to travel with a fixed frequency.

For this reason, NACTO recommends putting signage in sidewalk waiting areas so that people know where each bus stops and what their routes are. These signs should also use braille to keep passengers with reduced vision equally informed.

They also advise against other activities taking place on the sidewalk so as not to get in the way of passengers getting on and off the buses or affect foot traffic.”

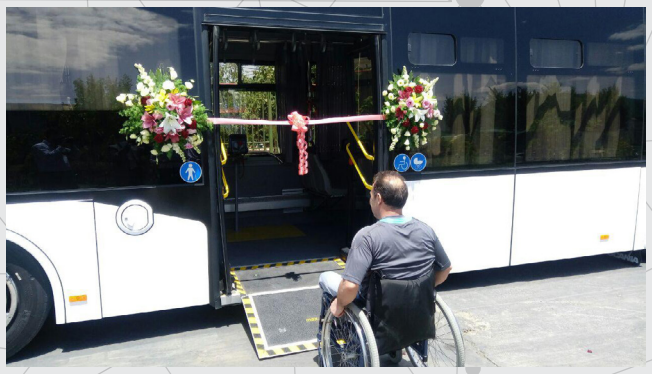
Introduction of Mashhad Bus Transportation System:

The city of Mashhad, with a population of more than 3 million people, is the annual reception of millions of inhabitants, the world's second largest metropolitan metropolis, the traffic area of the city is 275 km, and the bus system in the city employs a million and two hundred thousand people every day in the city. he does. The religious situation in the city of Mashhad increases the metropolis by about 15 million people per year, and given that the bus after the car is the main personal vehicle of the passenger movement, there are some problems such as: passenger-filled stations busy buses, moving buses in busy ways, disrupting buses, and so on.

The total number of buses in Mashhad is 2,460 units, and stated: 2,000 of them are currently active in Mashhad, 700 of whom are over 10 years old and there are 217 units BRT bus in mashhad. 233 units are euro 4 buses that have low floor. near 90% of buses in mashhad are buses that they have not low floor, this is one of big problem for disable people.

BRT BUS (Usability of the disabled)

Old bus (Non usability for disabled)



Euro4 BUS (low level)

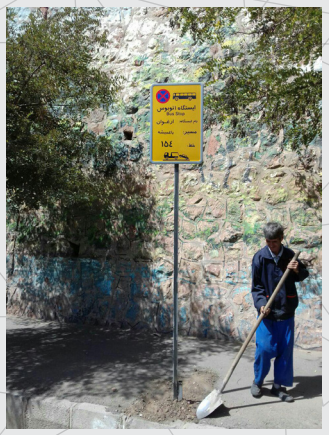
There are currently 3395 bus stations in Mashhad, of which there are 1353 stations equipped with unified glass vents. there are 4 types of bus stop in mashhad:

BRT Stations orTransit station stop

Bus transit center

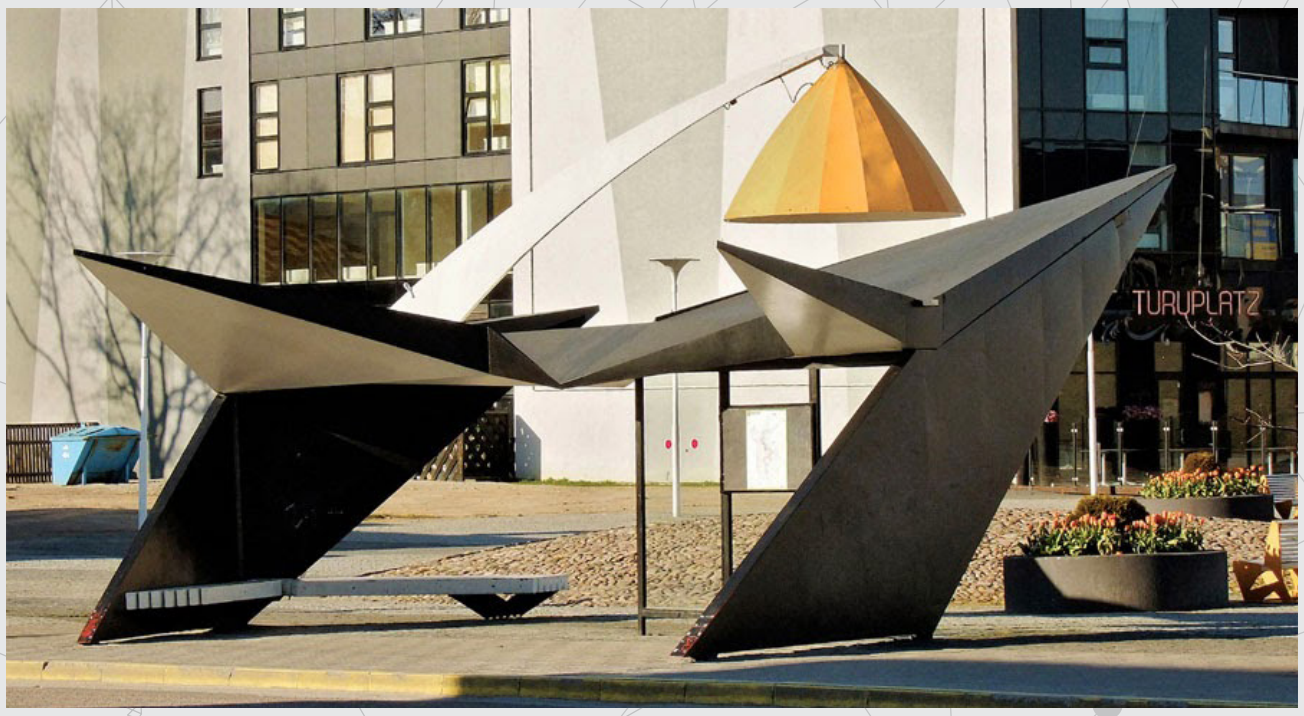
Sheltered bus stop

Basic bus stop



The most interesting of the bus stations in the world:

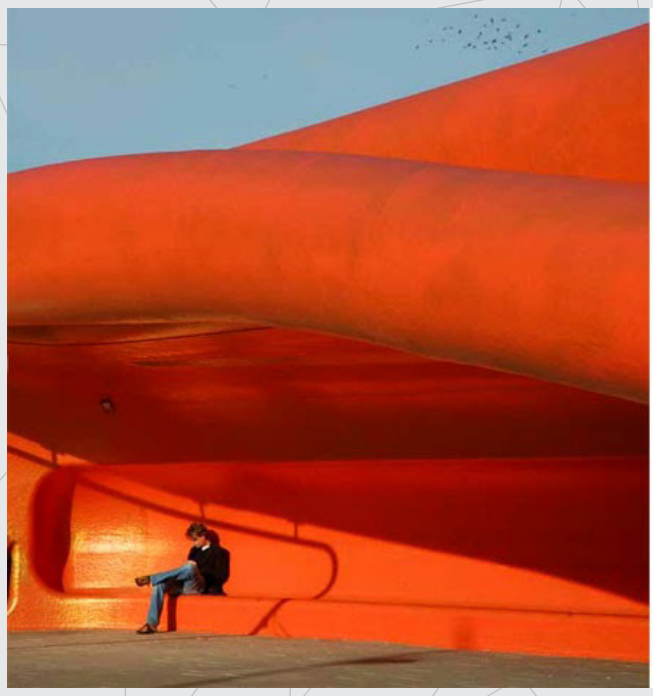
Ventura, California , USA



Estonia

https://www.oddee.com/item_96481.aspx

Japon



Estonia

https://www.oddee.com/item_96481.aspx


North Sydney


Norway

Pitsunda, Abkhazia

https://www.oddee.com/item_96481.aspx

Third section:
problem statement,necessity and objetives.

problem statement of the project:

Buses and coaches are the most important form of urban and rural passenger transport around the world. Increases in population, shifting mobility patterns and a greater focus on environmental issues are changing the face of public transport. Whether over short or long distances, buses and coaches are one of the safest, the greenest, and most user-friendly, affordable and inclusive means of transport.

As a result, these buses needed station for services to citizens. Considering the importance of transport in the city of Mashhad,that is the second largest city after Tehran In terms of population and area.

Lack of facilities at stations, people's interest to have more features, no drawings of some stations, smart and unavailability of stations to the system bus arrival times, lack of attention to the standards of the disabled, old stations, no updating stations system requirements or cleaning in a timely manner has caused many citizens in Mashhad less use of buses.

In fact, the question in my mind was created Why metropolis such as Mashhad, which has a large number of buses and minibuses to displacement of citizens, stations not equipped for a big city?Given that the city several years as the most beautiful and cleanest and highest quality-largest city in Iran, has been selected by the municipality.

My passion as someone who was born in this city was wanting me to do this project. My ideal is more people use public transport and have a cleaner city and therefore have a cleaner world.

This research could play an important role in the development of urban transport, a more intelligent urban spaces with modern furniture and in accordance with the environment role in Mashhad.And promote the use of solar cells in urban furniture and especially the buildings.

The project is divided into three parts: the critical point (the current situation), problems and proposed solutions and the ideal spot.

Critical point:

Factors such as low utilization of the rich society of the bus due to lack of facilities and equipment stations - the lack of stations and large distances between them - worn some of the buses - overpopulation in some of the lines has led to some people under the bus. Experience and statistics show an increase in equipment and advanced it can be more groups of people invited to use the buses.

Development of urban transport decreased, traffic and urban pollution. Now a days the city of Mashhad in many parts of downtown have traffic and air pollution.

Problems and proposed solutions:

Problems:

- Station with a simple form and inefficient environment and the absence of non-smart devices.
- non-compliance with the appropriate standards for people with disabilities and the lack of necessary conditions for the disabled with wheelchair ride
- Lack of bicycle parking at the stations
- Failure to comply with the form factor stations climate and weather conditions
- the use of clean energy for power supply bus stations

Solutions:

- Design station with beautiful form and in accordance with the environment, intelligent urban stations with modern equipment
- Ease of use disabled spaces and facilities for utilities
- Create a small parking lot near the station
- Design stations due to the climate and the environment
- The use of solar panels to provide electricity for the station station

Ideal poinnt:

According to the last paragraph mentioned critical point we came to the conclusion that by solving problems and appropriate solutions, the number of users of the bus can be increased and a decline in used cars, single-seat personal on the streets of the city will be .As a result, we reduce congestion, reduce air pollution, high-speed bus transportation, reducing municipal costs, reduce road accidents, reduce distances between stations, create culturally appropriate and greater use of public transportation there.

The importance and necessity of the project:

One of the reasons for choosing this project in addition to removing the problem of people use vehicles, giving new life to urban spaces, modernizing it with regard to environmental issues, the environment and in accordance with the culture of the region, less use of public transportation Personal and reduce single-seat personal vehicles.

Project scope:

According to case studies on a variety of buses including bus stations, streets, highways and terminals.The plan was to focus on street stations. This includes different types.

Project Objectives:

Like other projects in the project we set goals that include the following:

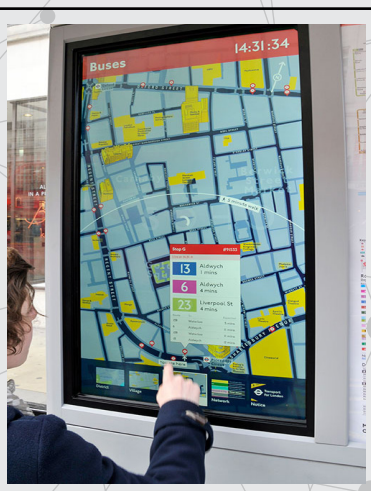
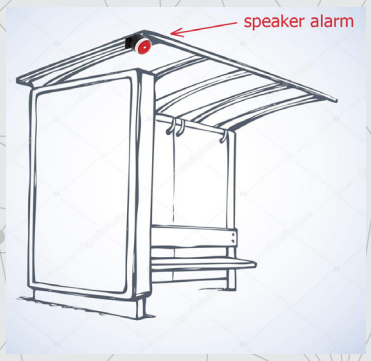
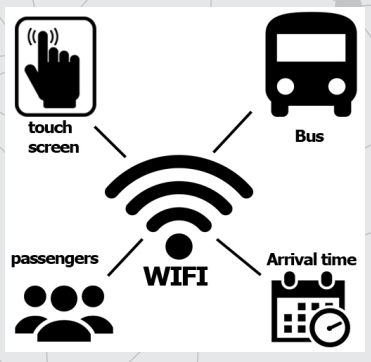
- smart bus stops
- Due to the design and beautification of stations with regard to the environment
- solve the problem of the disabled bus stations
- Due to the design of the stations in the cold and rainy
- attract people and create more passion in them to use buses
- the use of clean solar energy power stations through its supply

Project limits:

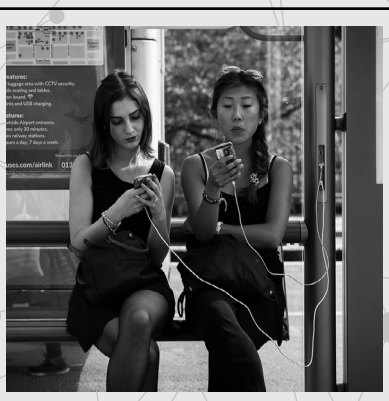
According to Mashhad bus system, which is the founder and host bus stations in the city, setting this thesis was associated with a series of restrictions. Including a station designed in accordance with the standards of the organs of the state. For example, elevation should be consistent with the buses in the city. And standards must be in accordance with the wishes of the government agency. The design part will refer to it.

fourth section: Analysis of stations in Mashhad and Saples.

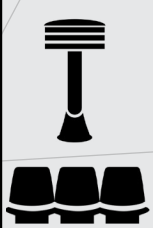
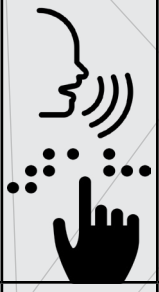
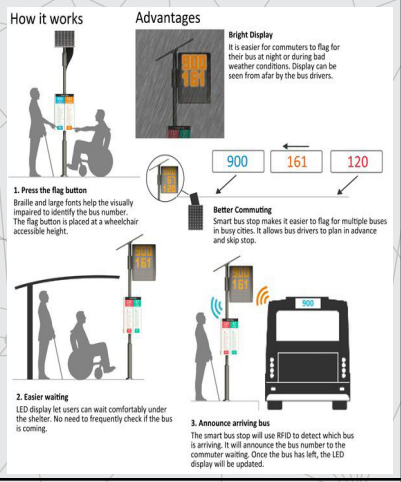
System of needs:

N	needings	requirments	performances	metaprojective notes
1	**Touch screen** 	A. It shows bus arrival time B. it gives ability to download E-book by users from smart screen to theirs cellphones. C. showing events/notice: users can be aware about events will be held on futur in city or be aware from changing line in some patricular case. D. showing of prediction of weather,air and temprature. E. ability to find way by GPS of station/what bus needs to get on and get off.	screen dimension: 50 inches (110.4 cm×62.2 cm) energy consume: 100 w/h position: The best position is the right side of shelter,but it could be put on the big side of shelter between seats.	
2	**Recycle bins** 	A. it can help to Isolation and separation of waste objects, for this case i design this item to 4 parts : metal and glass,platic, paper and organic	dimension: H 78cm × D33cm Volume: 72Litrs Position: is has to design in out of shelter near bus stop Preferably with a canopy.	
3	**Speaker for announcement blind people** 	A. it helps blind people to realize number of arrival bus and bus destination.	dimension: 10cm ×10cm ×9cm energy consume: 13 w/h- 125 db Position: near the roof of shelter,inner part,Above at least 2 meters from floor	
4	**WIFI** 	A. it uses for touchscreen B. users can access free to internet. C. Coordination between bus,arrival time and users.	dimension: 20cm ×15cm ×4cm energy consume: 6 w/h Position: Should be out of the reach and sight of passengers. at least 2 meters above from floor.	

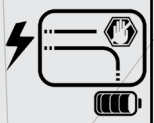
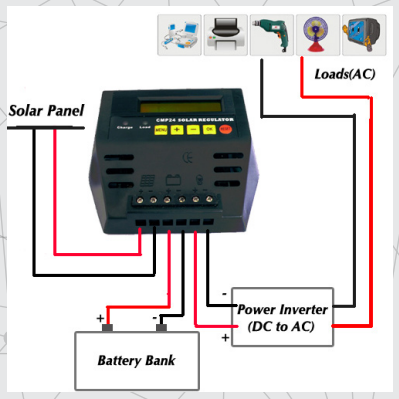
System of needs:

N	needings	requirments	performances	metaprojective notes
5	**Outlet charging** 	A. ability to charge user's cell phone or laptops through electricite that photovoltaic panel provide it.	port dimension: 6cm × 4cm energy consume: 4 w/h (4 ports) position: The best position is near seats of shelter where users can charge their cellphones.	
6	**Advertisement** 	A. give beaty to bus stop B. Product promotion and marketing	dimension: H 2m × L1m energy consume: 60 w/h (12 LED) Position: can be choose in outer part of right side of shelter, because inner part has been considered for touch screen.	
7	**Arrival monitor** 	A. a monitor to show time of arrival bus to passengers and local time.	dimension: 32 inches (39.8 cm×70.6 cm) energy consume: 50 w/h (10 LED) Position: It can be put above screen touch or above left side of shelter.2m from floor.	 6:25 PM M34 JAVITS CONVENTION CENTER 7 MIN M16 PORT AUTHORITY TERMINAL 13 MIN INFO for information on the Metro above touch screen  1 295 L'BROKE GROVE due 2 190 RICHMOND 14 min 3 220 WILLESDEN JUNC 16 min 4 211 HAMMERSMITH 18 min above left side of shelter
8	**Bus stop Pole(sign)** 	A. it helps passenger to know about next stops and destinations and number of busses.	dimension: 320cm ×15cm Position: should be attached to bus shelters above roof level wherever possible	 450mm Metro Bus Stop Maysfield 620 to 780mm 2.5 Minimum clearance J Southbury Road 279 349 377 491 N279

System of needs:

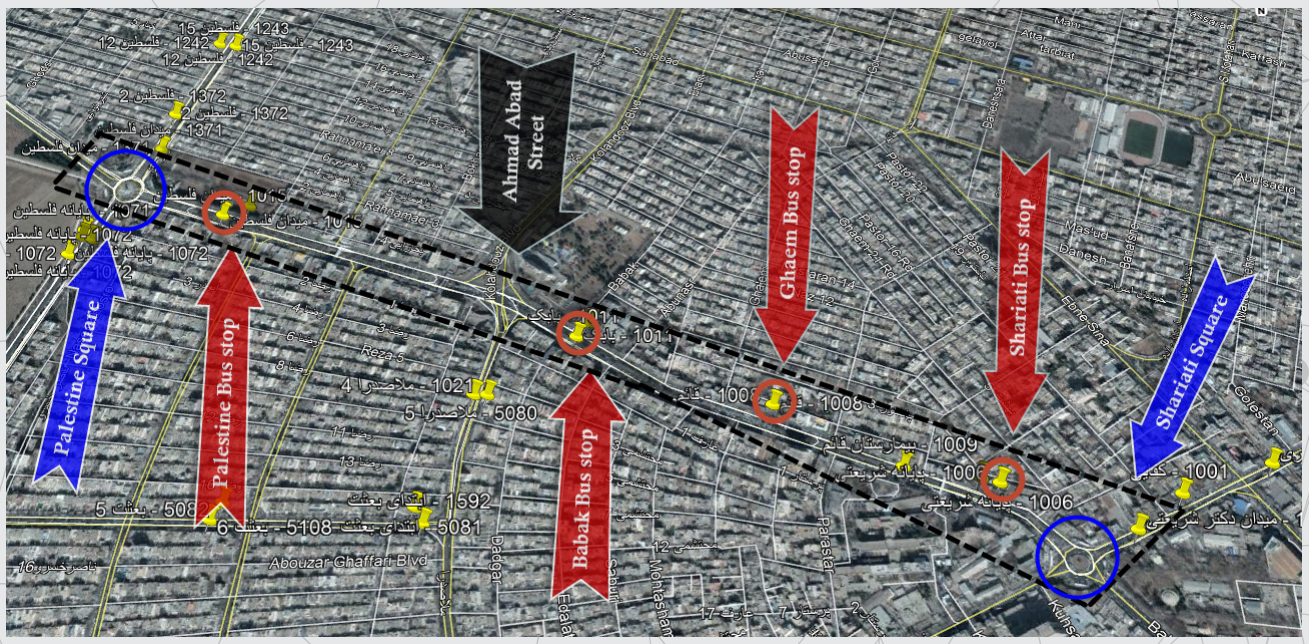
N	needings	requirments	performances	metaprojective notes
9	**seats and standing seat** 	A. For the comfort and convenience of passengers B. it can useful for person that do not want to seat and just lean to seat.smokers can use these kind of seats and do not bother other users inside shelter.	dimension: h45×w45×L40 cm standing seat: L1.5 m×H1m Material: metal grids position: Along the big side of shelter	
10	**Disable people area** 	A. help disable peolpe to get on in bus easily B. increase of loading passenger into bus	dimension: at least 125cm × 70cm Position: clear area for boarding at least 2m×2m if wheelchair lift is used. the area has to be paint with weelchair sign.	 
11	**braille map and voice gaudiness for blind people** 	A. they can get infromation that need by special rout map that it has been designd for blind B. blind people can be inform by special voice gaudiness when a bus is coming to station and its number.	dimension: 32 inches (39.8 cm×70.6 cm) Position: It can be put above screen touch or above left side of shelter.2m from floor.	
12	**Place of loading bicycle** 	A. reduce of loading bike and getting passenger. B. driver can see easily an user need to load its bike.	dimension: 200cm ×200cm Position: the best position is right side of shelter . the area has to be paint with bicycle sign.	

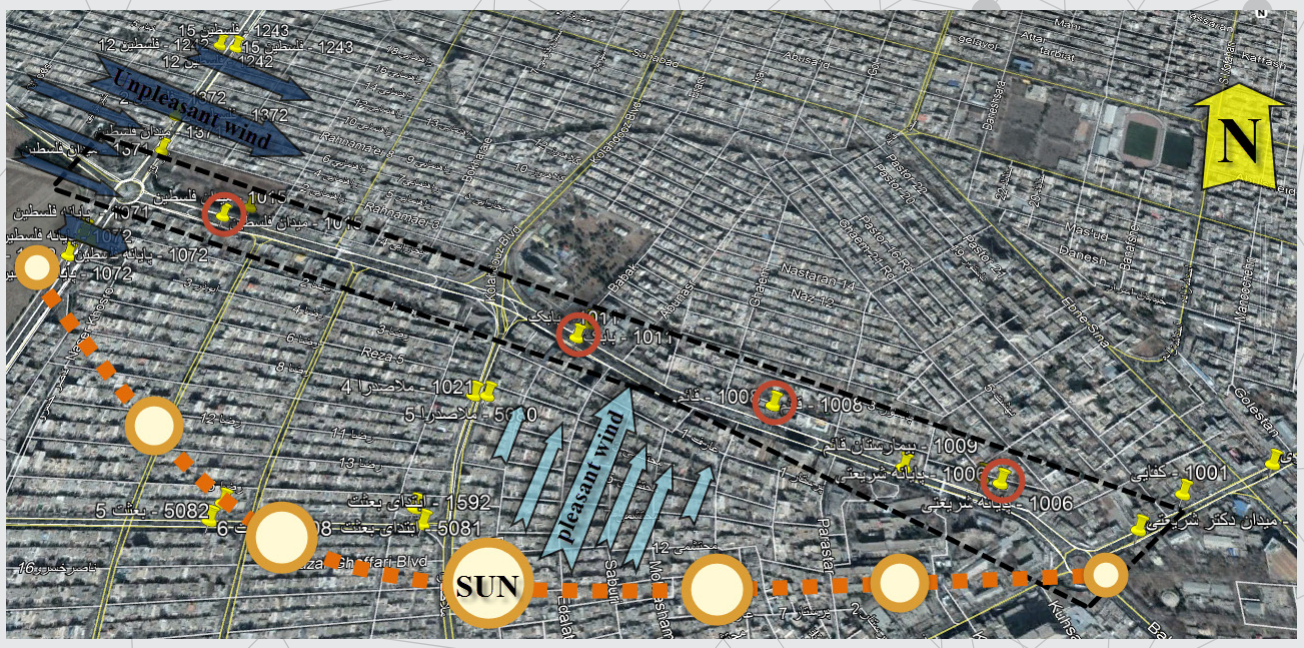
System of needs:

N	needings	requirments	performances	metaprojective notes
13	**Photo voltaic panel** 	A. chaning sunlight energy to electricity. B. resource of energy for all devices that need to work with electricity in bus stop like smart manitor,lighting, arrival monitor and	dimension: 195cm × 99cm Energy produce: 330 w (4 panels) position: In the roof of shelter,A bit slope consistent with the angle of sunshine.	
14	**inverter** 	A. it that converts DC electricity generated by solar panels into AC power consumption of AC loads.	dimension: 30cm × 50cm number and size: 1inverter- 550 W Position: Under the photo voltaic panel Far from the rain and snow.	
15	**Charge controller** 	A. it this adjusts the voltage and output current from the panel to the battery and protects the battery from overcharging and discharging, which increases battery life.	dimension: 20 cm×25 cm number and size: 1charge controller 50 A Position: Under the photo voltaic panel Far from the rain and snow.	
16	**battery** 	A. it stores energy needed during the night and on cloudy days.	dimension: 200cm ×200cm number and size: 9 batteries- 200 A Position: the best position is right side of shelter . the area has to be paint with bicycle sign.	

The analysis of the site:

I choose 4 bus stops in the one of famous and crowded street in city of mashhad:

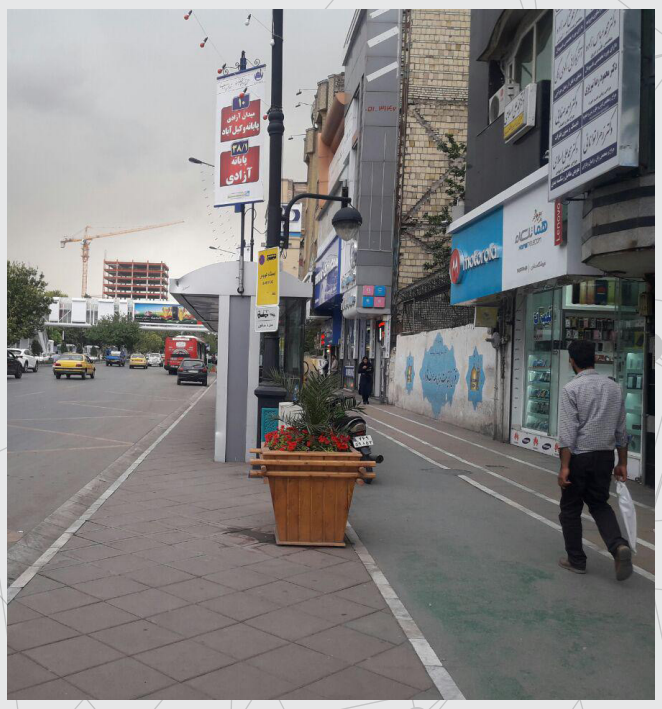




Analysis Similar samples in the world:

Mashhad-Shariati 1th point(Iran)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart			•
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form		•	
8	Color	•		
9	Equipments		•	
10	Disabled area			•
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements			•
14	Sustainability			•
15	Beauty		•	



https://www.britannica.com/place/Mashhad [1]
http://www.irimo.ir/eng/ - Meteorological Organization of Iran [2]

Analysis Similar samples in the world:

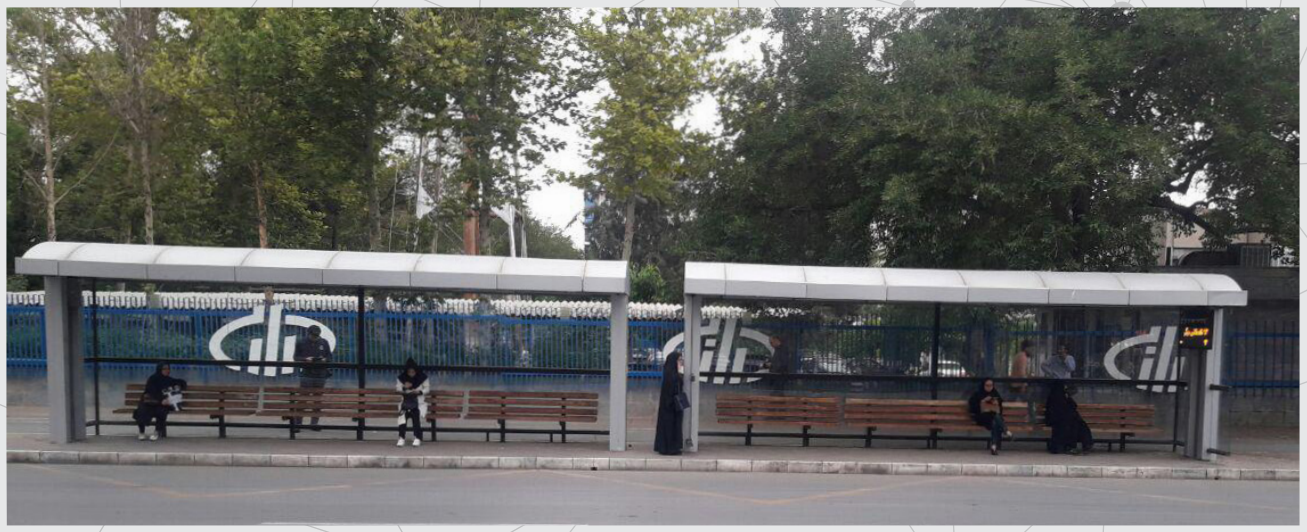
Mashhad-Ghaem 2 st point(Iran)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart			•
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form		•	
8	Color	•		
9	Equipments		•	
10	Disabled area			•
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements			•
14	Sustainability			•
15	Beauty		•	

Analysis Similar samples in the world:

Mashhad-Ghaem 3rth point(Iran)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart		•	
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form		•	
8	Color	•		
9	Equipment		•	
10	Disabled area			•
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements			•
14	Sustainability			•
15	Beauty		•	



Analysis Similar samples in the world:

Mashhad-Ghaem 3rth point(Iran)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart		•	
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form		•	
8	Color	•		
9	Equipment		•	
10	Disabled area			•
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements			•
14	Sustainability			•
15	Beauty		•	

Analysis Similar samples in the world:

Curitiba(Brazil)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart		•	
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form	•		
8	Color	•		
9	Equipment		•	
10	Disabled area	•		
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements			•
14	Sustainability			•
15	Beauty	•		

https://www.mimoa.eu

Analysis Similar samples in the world:

Mosco(Russia)

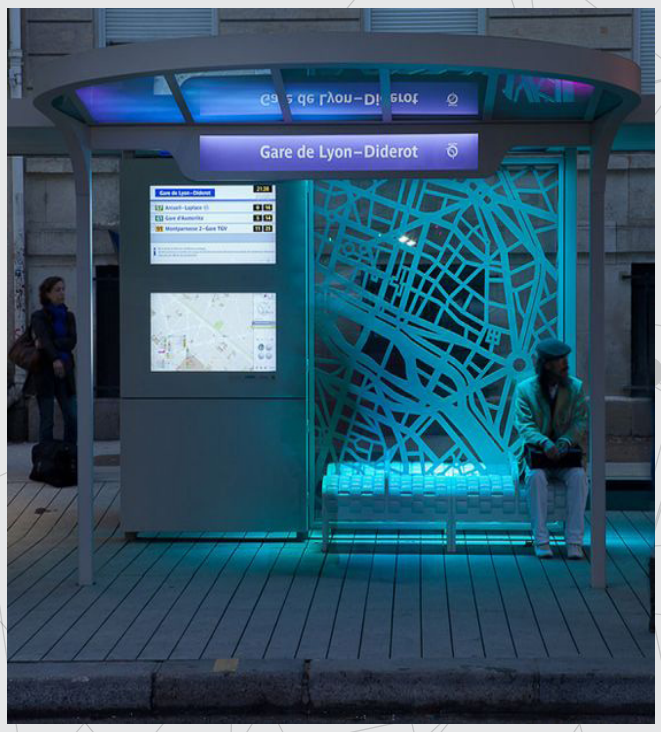
N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart	•		
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form		•	
8	Color		•	
9	Equipment		•	
10	Disabled area			•
11	Material of seats		•	
12	Material of shelter	•		
13	Advertisements			•
14	Sustainability			•
15	Beauty		•	

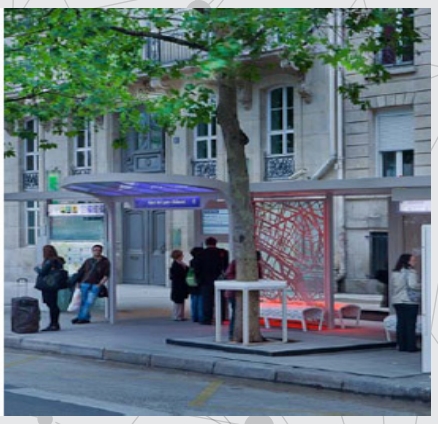
https://www.mimoa.eu

Analysis Similar samples in the world:

Paris(France)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart	•		
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form	•		
8	Color	•		
9	Equipment	•		
10	Disabled area			•
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements		•	
14	Sustainability		•	
15	Beauty	•		





https://www.mimoa.eu

Analysis Similar samples in the world:

Reggio Emilia(Italy)

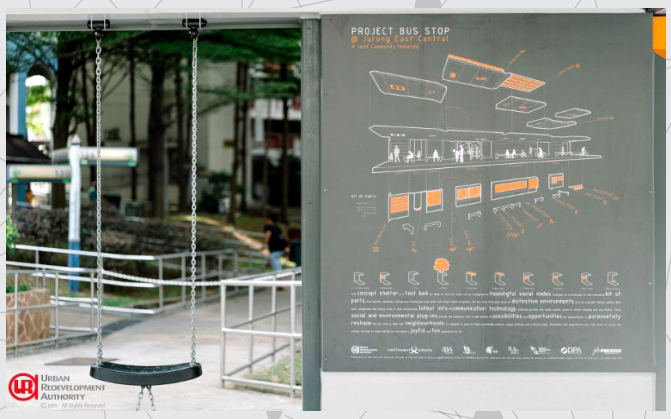
N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart		•	
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form	•		
8	Color	•		
9	Equipment		•	
10	Disabled area	•		
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements			•
14	Sustainability			•
15	Beauty	•		

https://www.mimoa.eu

Analysis Similar samples in the world:

Jurong (Singapore)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart	•		
4	Light	•		
5	Wifi	•		
6	Rain	•		
7	Form	•		
8	Color	•		
9	Equipment	•		
10	Disabled area	•		
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements	•		
14	Sustainability	•		
15	Beauty	•		



https://www.mimoa.eu

Analysis Similar samples in the world:

Jurong (Singapore)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape		•	
3	Make smart	•		
4	Light	•		
5	Wifi	•		
6	Rain	•		
7	Form		•	
8	Color	•		
9	Equipment	•		
10	Disabled area	•		
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements		•	
14	Sustainability		•	
15	Beauty			

https://www.mimoa.eu

Analysis Similar samples in the world:

Jurong (Singapore)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape		•	
3	Make smart	•		
4	Light	•		
5	Wifi			•
6	Rain	•		
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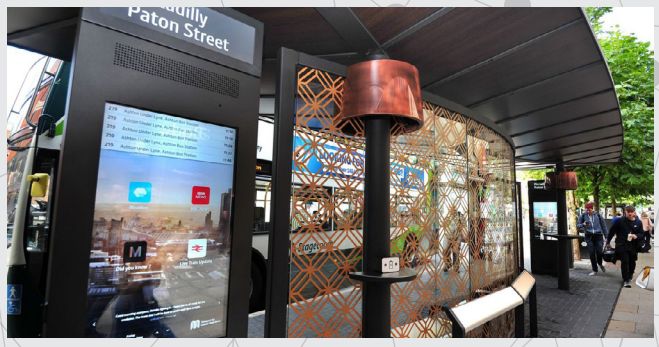
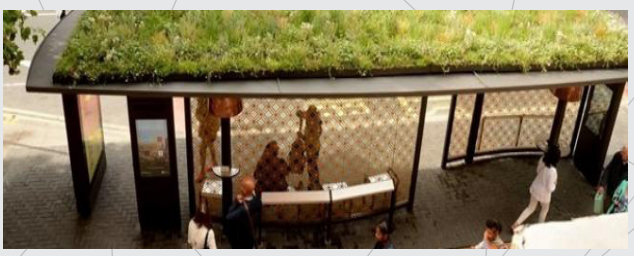
9	Equipment	•		
10	Disabled area			•
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements	•		
14	Sustainability	•		
15	Beauty	•		



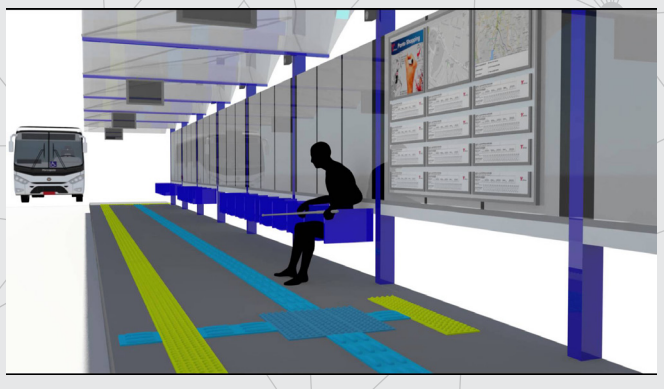


https://www.mimoa.eu

Analysis Similar samples in the world:

Jurong (Singapore)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape	•		
3	Make smart	•		
4	Light	•		
5	Wifi			•
6	Rain		•	
7	Form		•	
8	Color		•	
9	Equipment	•		
10	Disabled area			•
11	Material of seats		•	
12	Material of shelter		•	
13	Advertisements	•		
14	Sustainability	•		
15	Beauty		•	



https://www.mimoa.eu

Analysis Similar samples in the world:

Jurong (Singapore)

N	needings	Great	weak	not exsist
1	Location	•		
2	Landscape		•	
3	Make smart		•	
4	Light	•		
5	Wifi			•
6	Rain	•		
7	Form	•		
8	Color	•		
9	Equipment		•	
10	Disabled area	•		
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements	•		
14	Sustainability	•		
15	Beauty		•	

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Jurong (Singapore)

N	needings	Great	weak	not exsist
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4	Light	•		
5	Wifi			
6	Rain	•		
7	Form	•		
8	Color	•		
9	Equipment	•		
10	Disabled area			•
11	Material of seats	•		
12	Material of shelter	•		
13	Advertisements		•	
14	Sustainability	•		
15	Beauty	•		

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Fifth section: Climate impact and study material

Properties of components :

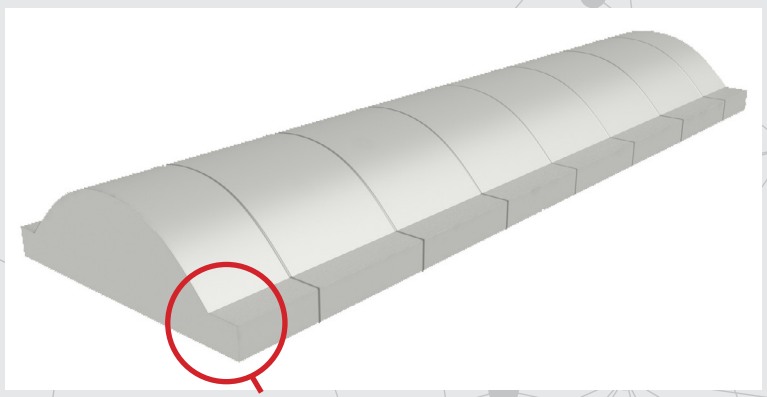
Material: Aluminum composite panel

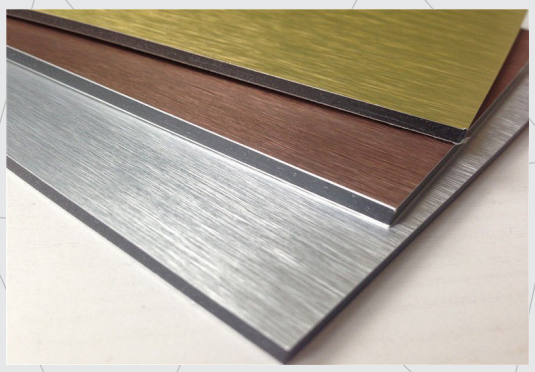
Measure: 3.20*1.25 m *0.5 mm

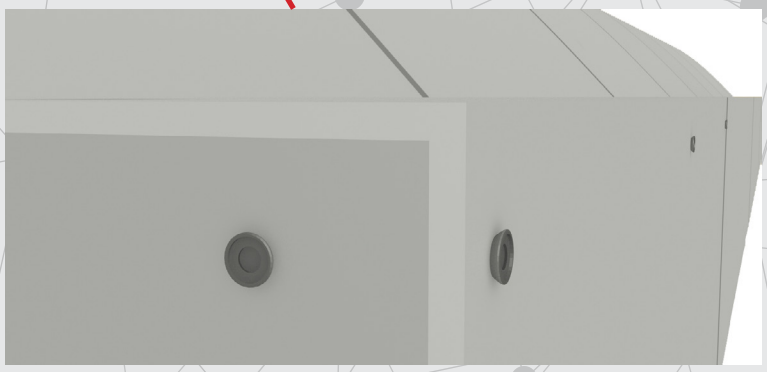
Application: cover of shelter

Features: Stainless, lightweight, run fast and easy to install

Connection type : Connector with





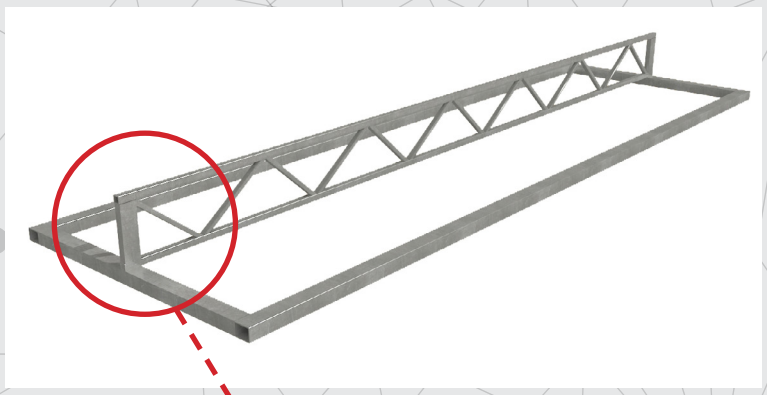


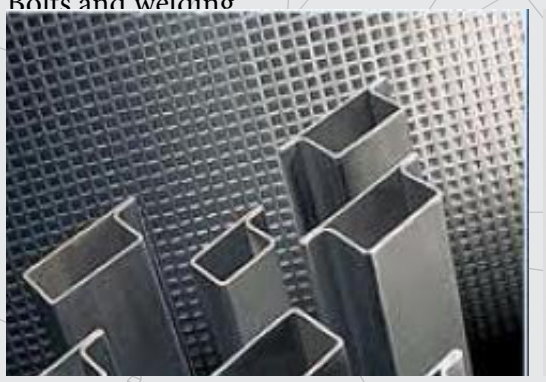
Material: Aluminum profile

Application: for fixing composite panel

Features: Stainless, lightweight, run fast easy to install, Screw up easy

Connection type : Connector with Bolts and welding





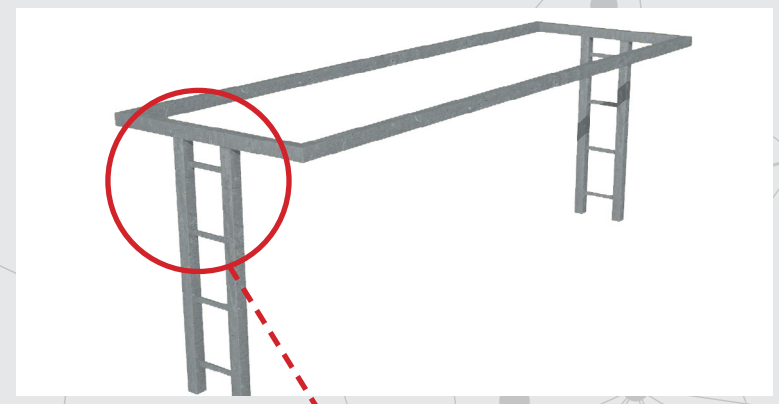
Properties of components :

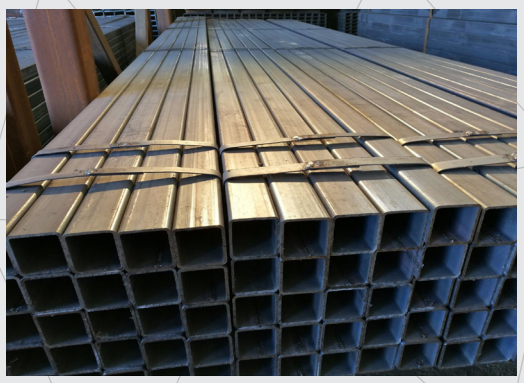
Material: Iron profile

Application: main structure of shelter

Features: Firmly, Screw up

Connection type : Connector with welding



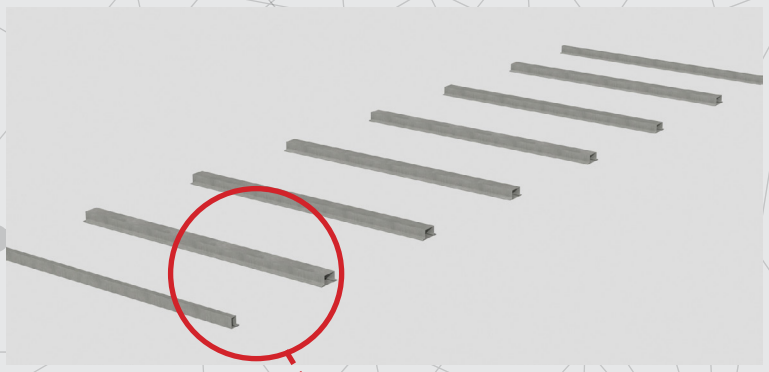


Material: Aluminum profile prot

Application: to instal panel of roof

Features: Stainless, run fast

Connection type : Connector with screw and rivet



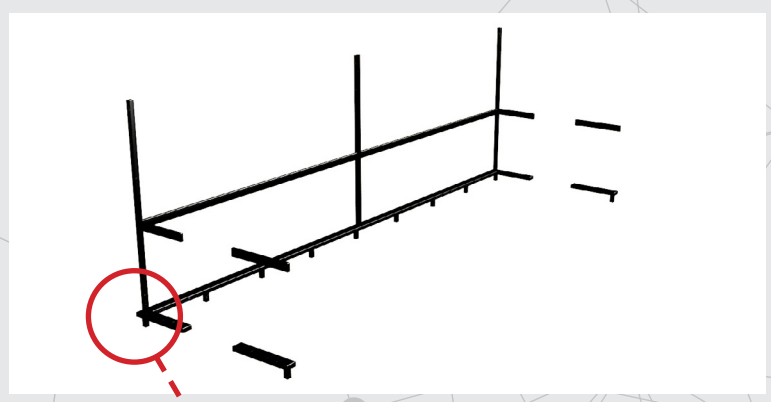
Analysis Similar samples in the world:

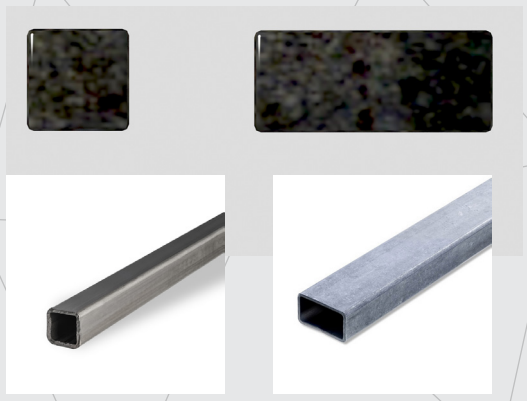
Material: Iron profile

Application: to protect and instal glasses

Features: run fast, Firmly, Screw up

Connection type : Connector with screw for glasses and welding for iron



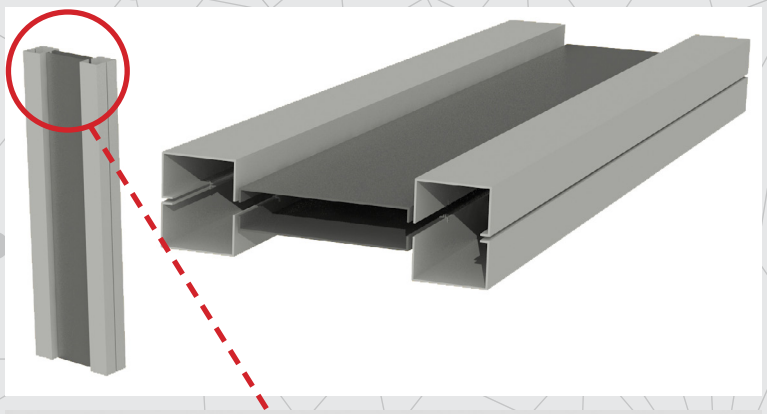


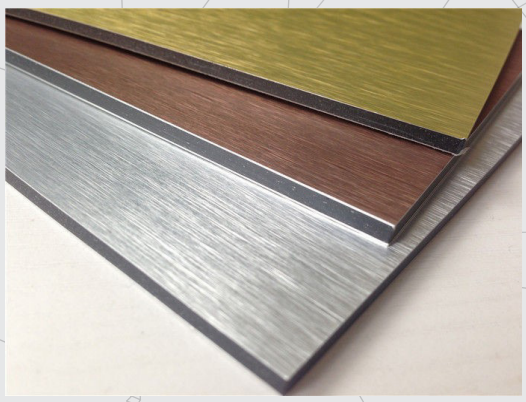
Material: Aluminum composite panel

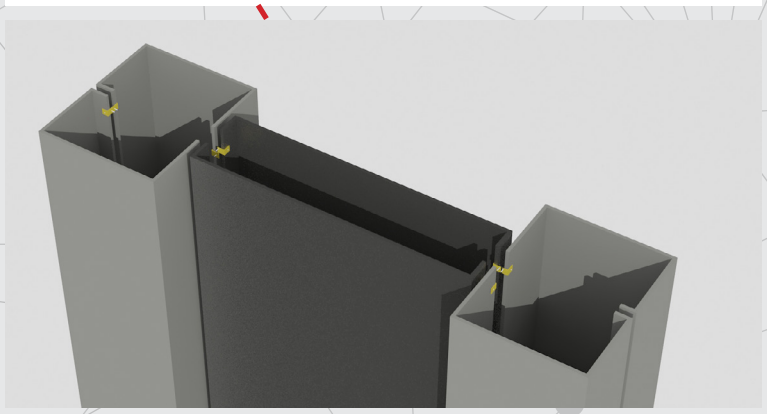
Application: cover of structure

Features: Stainless, lightweight, run fast and easy to install

Connection type : Connector with screw and rivet







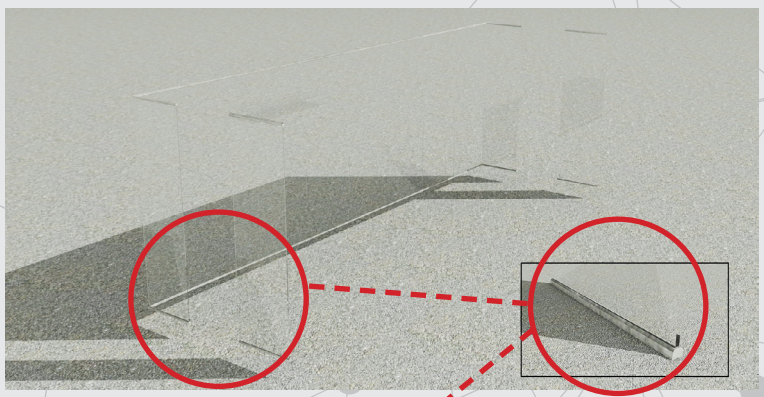
Analysis Similar samples in the world:

Material: Glass

Application: Cover shelter

Features: Stainless,transparent and Anti-scratch

Connection type : Connector with special screw for glasses and keep inside aluminum profile

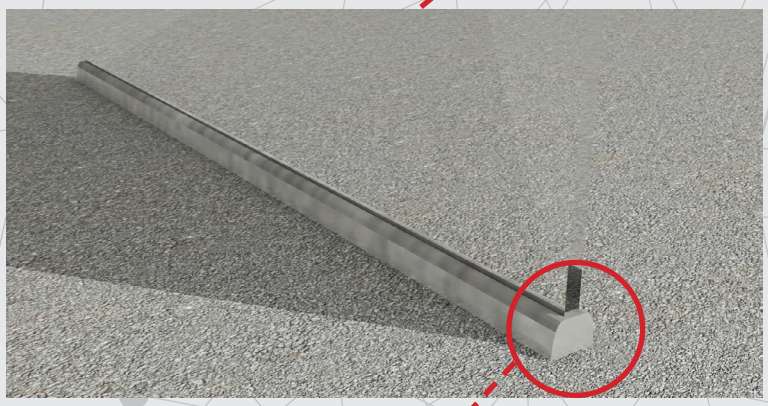


Material: Aluminum profile

Application: to instal glasses of shelter

Features: Stainless, run fast

Connection type : Connector with screw and rivet

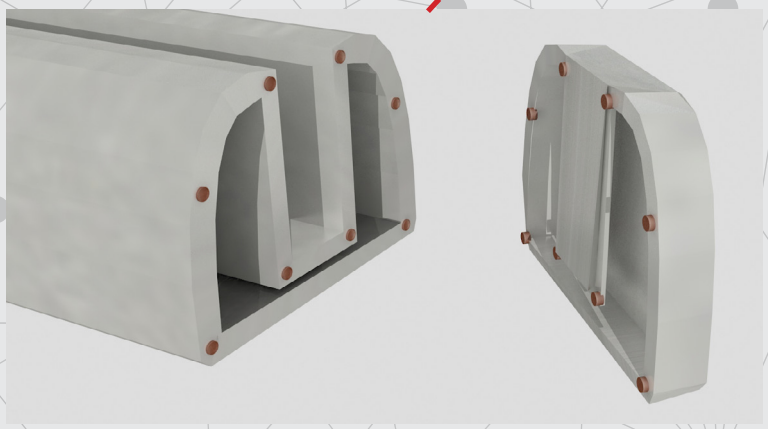


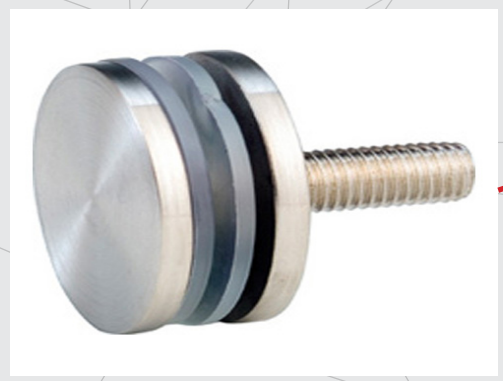
Material: Aluminum screw

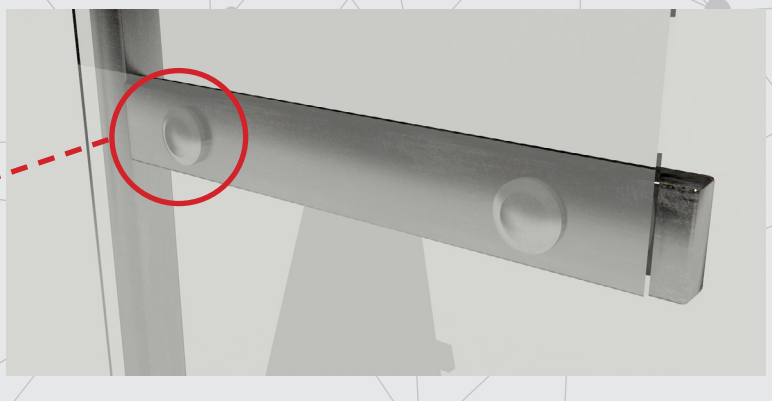
Application: to fix glasses of shelter

Features: Stainless, lightweight

Connection type : Connector with screw







t

Sixth part: Make smart and Energy calculations

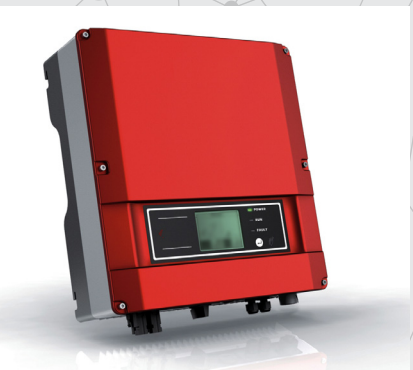
Calculation method for designing a solar system at bus stop:

To design a solar system, we must first measure the energy consumption of the devices and calculate them, then depending on the need; we can determine the watts and the number of solar panels, controller charge, solar battery, inverter, protective devices and cables. A solar PV system consists of several sections that must be selected according to the application, location and type of system.

The main components of the solar system are:

1- PV module that it turns sunlight to DC power.

2- An inverter that converts DC electricity generated by solar panels into AC power consumption of AC loads.



3- Charging the controller, which adjusts the voltage and output current from the panel to the battery and protects the battery from overcharging and overheating, which increases battery life.

4- A battery that is used to store energy needed during the night] and on cloudy days.

Solar System Calculations:

Step 1: Determine power consumption:

The first step in designing a photovoltaic solar system is to determine the total power and energy consumption for all the loads that need to be fed.

1-1. Calculate the watts you use each device in one day. Then add the watts of the hours of use of all the appliances for one day.

We have 6 items that they need electricity to work. In this table we can see all of properties of them that we need for calculating of a solar system.

N	Name of item	Watt /Hours(W/h)	The hourly consumption forecast (h)	Number
1	Smart Screen monitor(50inch LED)	100W	10h	2
2	Arrival time's monitor(32 inch LED)	50W	16h	1
3	WIFI Router	6W	16h	1
4	Speaker	13W	2h	1
5	LED lamp (lighting bus stop in the night)	12W	6	8
6	outlet Charging	5W	4	4

Total consumption of electrical appliances:

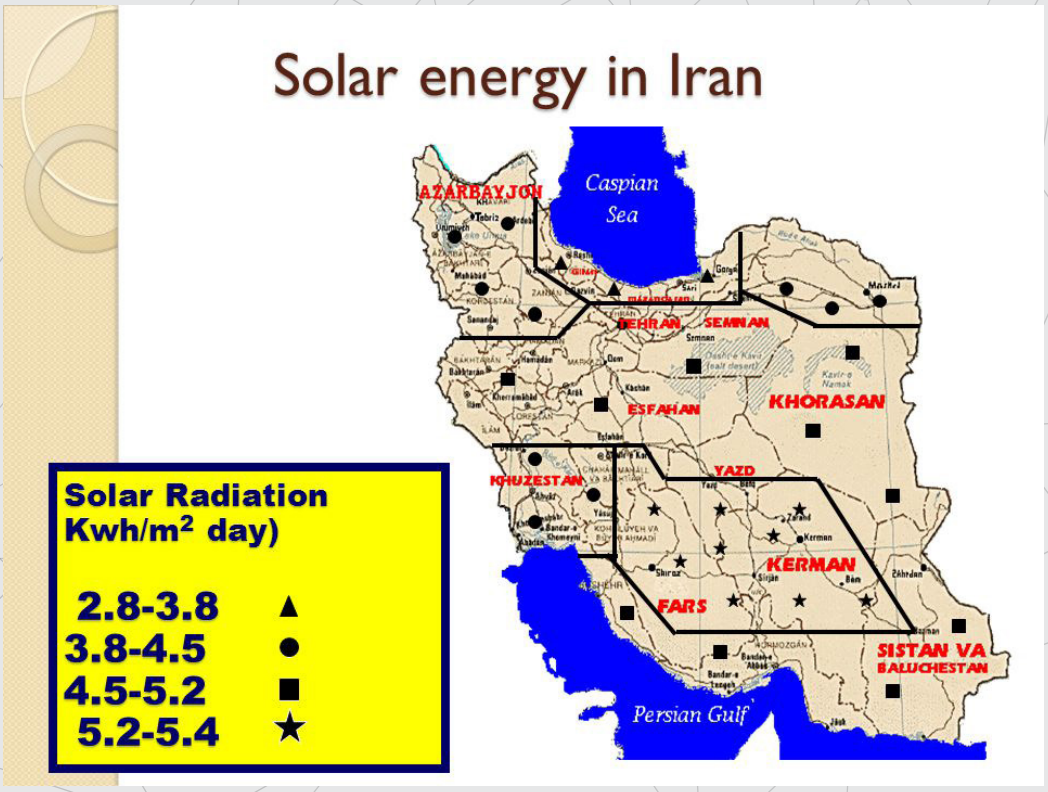
(100w×16h)+(50w×16h)+(6w×16h)+(13w×2h)+(15w×6h×10)+(5w×12×2)= 3452wh/day

2-1. Multiply the resulting number by 1.3 (sometimes 1.2) so that the watth of the hour the panel should produce over a day is obtained. (Coefficient 1.3 is the amount of energy losses in the system).

3452×1.3(The coefficient of energy loss is in the system)= 4487.6 wh/day

Step 2: Determine the size of the PV module:

Different sizes of PV panels produce different power levels. The larger the panel's size, the more power it produces. To determine the size of the PV module, we must first obtain the highest possible output. The maximum power output or wattage (Wp) depends on the PV module and the climate of the desired area. To do this, we need a "radiation potential" that varies from place to place.



1-2. Total watts calculation (Wp Total): The total watts of the hours that we need to be generated by the module during the day (the number obtained from section 2.1) is divided by the radiation coefficient to the watt of the peak that should be provided by the panels To be produced.

Assuming we consider the radiation coefficient 4.1, we will:

Total watt peak = 4487.6 ÷ 4.1 (solar radiation of Mashhad) = 1094.53 WP

2-2. Calculate the number of panels required for the system: Divide the answer given in section 1 to 2 into the nominal power of the panels that you have and get the result to a larger integer. The answer is the number of panels to use.

However, it should be noted that the result of this calculation determines the minimum panels that we should use. Of course, if we use more panels, the performance of the system will be better, and the battery life will also increase.

Profile panel intended:

Pm: 330wp

Im = 8.78 a

Isc = 9.29a

Vm = 37.57 Vdc

Voc = 46.34 v

Module efficiency [%]= 17.02

1094.53÷330= 3.31~ 4

So 4 panels of 330-watt will be considered.

Step 3: Select the inverter:

First, we start with here that electrical appliances are of two types:

Conventional (Resistive) Power Supplies: This type of device does not run out of circuit during a current upgrade. (They get a bit more streams during startup, but not so much that it can affect the calculation).

Motor-powered devices: These devices have a start-up current when starting up, which means that the current is flowing when the multi-mode current is running.

So, in selecting the inverter, it should be noted that what kind of devices we are. All of our devices that we choose for bus stop are from the first type, so we don't need to select a strong invertor for photovoltaic panel.

Total power of all appliances= 100w + 50 + 6 + 13 + (15w×10) + (5w×2) = 329 W

Suitable inverter= 329×1.3= 427.7 So, A 550-watt inverter is considered.

The size of the inverter is between 25% and 30% larger than the total power of all the devices.

Step 4: Determine the battery size:

Recommended batteries are solar-powered dip-type batteries (high-cycle batteries). In fact, the batteries used in solar PV systems should have the ability to discharge to the lowest level of energy and then quickly charge. (Commonly used dry acid lead acid batteries). Their capacity is also such that they can use the equipment at night and on cloudy days.

We use the following to determine the battery size:

1-4. Calculate the total watt-hour consumption of all appliances during a day.

2-4. Divide the resulting number by 0.85 (due to battery losses).

3-4. Divide the result by 0.6 (due to the depth of discharge).

4-4. Divide this number by the rated voltage of the battery.

5-4. Now multiply this number in the number of days that there is no sunlight or the same cloudy days (that is, the number of days that the panels actually do not generate power) that we need to get from the voltage system. (Usually between 3 and 5 days, with most companies taking 2 days depending on the area)

Battery capacity=

$$\frac{[(100w\times10h\times2)+(50w\times16h)+(6w\times16h)+(13w\times2h)+(12w\times6h\times8)=(5w\times4\times4)]\times3}{(0.85\times0.6\times12)}=1753.9$$

1692.15 ÷200 A = 8.46~ 9

Therefore, we can consider 9 x 200 amp 12 volt batteries.

Step 5: Determine the charge size of the solar controller:

The controller charge is generally assessed based on the voltage and current capacity. The voltage should be in accordance with the battery and PV array, and can also withstand the flow of the PV array.

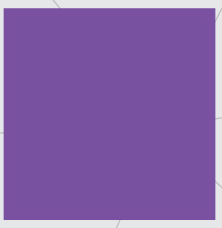
To charge the serial controllers, the controller size depends on the total input of the PV that enters the controller, as well as the structure of the PV panel (series or parallel). It is standardized to set the charge size of the short-circuit controller of the array PV (Isc) at 1.3.

Controller Charger Capacity=

4(Number of panel) × 9.29 a (Isc) × 1.3 = 48.30 A

Hexagonal geometric shapes:

Used as a form factor element in the plan. Possibility to combine and create an expandable texture for a hexagonal larger than the circle. When viewed from a cube building, the shape of the front of the sense of depth disappears, which means that we only see the construction front, which is a level. In the case of a cylindrical body, we feel the shape of the depth. But since the circle is without direction, there is actually no front, but when the building is six or octagonal, the depth of the building can be understood, and on the other hand the building remains distinct.



✕ Has direction ✓ - Lack of depth ✕

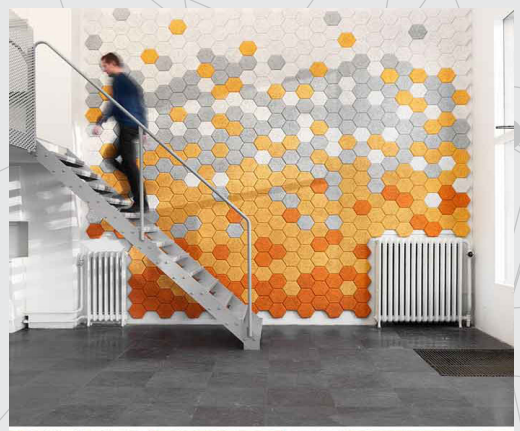
✕ Lack of direction ✕ - With depth ✓

✓ Has direction ✓ - With depth ✓

Among these three forms is only a hexagon that has a direction and depth and can be expanded with the saving of materials.

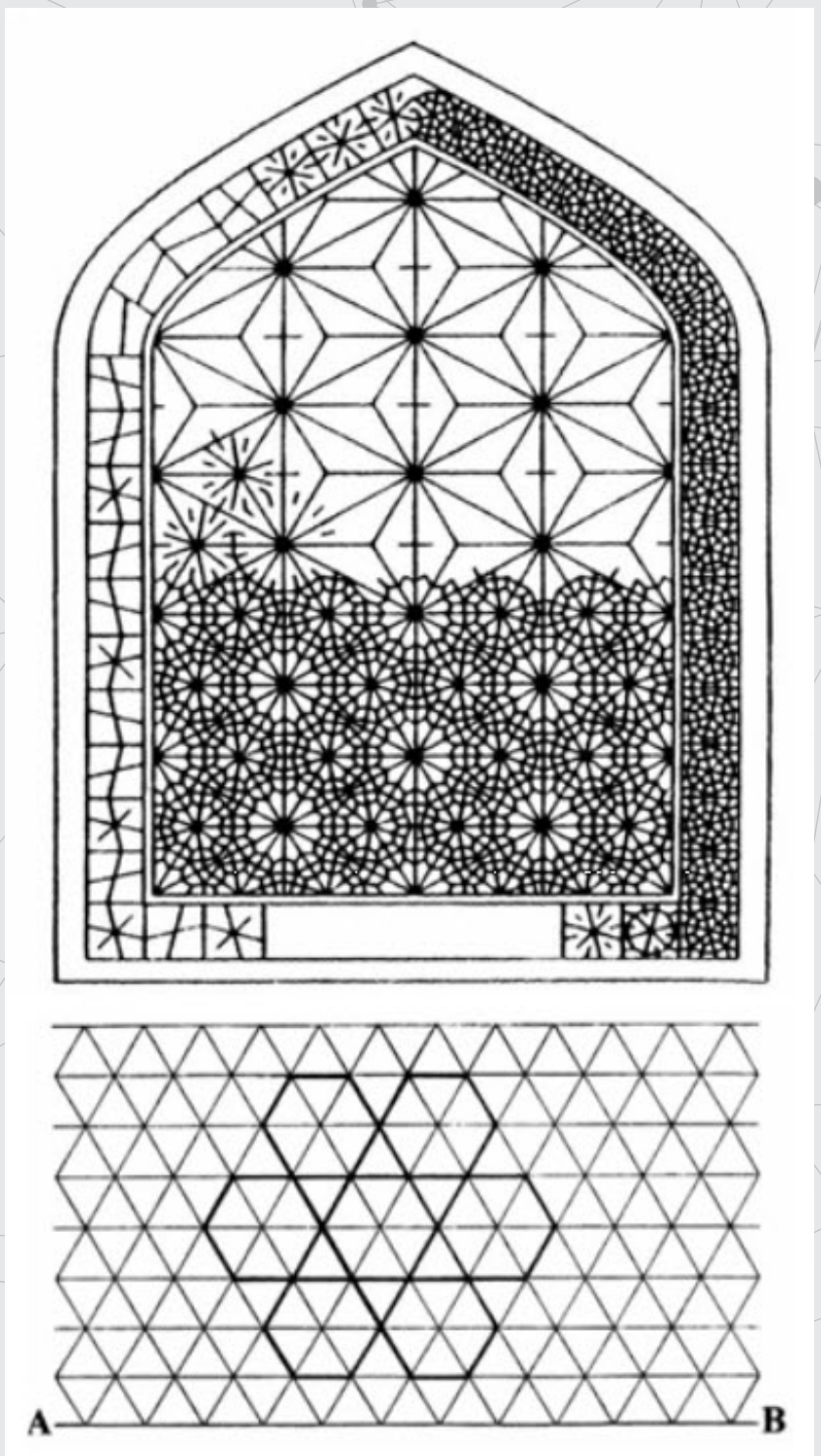
Hexagonal in architecture:

Everything that has six sides. (The term geometry) is a multidimensional word that has six sides. The mosadis, six-sided, regular 6-sided, is a solid and stable form because of its use of 6 triangles to draw it. And all sides and angles are equal. Below are examples and examples of how to use the hexagonal form in a generic architecture.

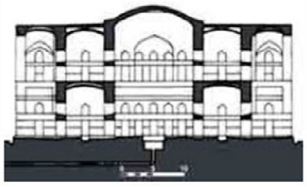
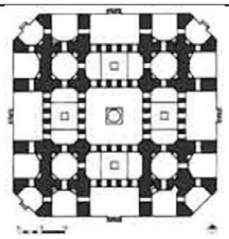
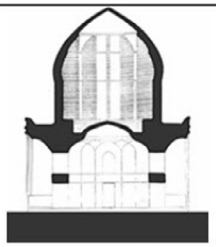
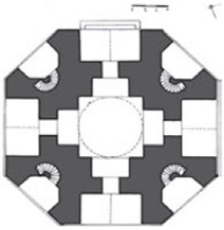
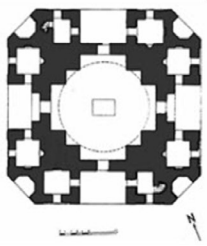
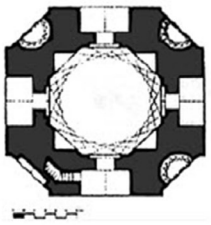
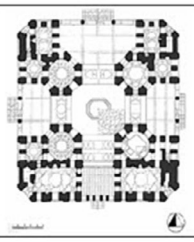
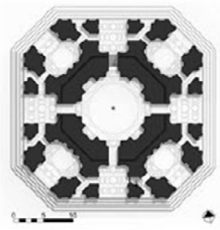


Symbolic meanings of geometric shapes:

The number six in Islamic culture is the number of days of creation of the whole universe. (Younis: 3 and Hood: 7). In addition, this number is the symbol of the universe of nature. As Suhrawardi refers to the Sixth Prison as a prison in the textbook of the Faqiqat al-Aqsa. In the same treatise, in the interpretation of six ropes, he has also identified six ropes.Professor Donato considers the Islamic city, in spite of its organic appearance, to have precise geometrical foundations. By examining Islamic geometric designs, he turns from the square as a symbol of the universe to a hexagonal hinge in the Chinese knot, and then e xtends it to the urban context. The hexagonal geometric analysis of the sunflower in different layers plays an important role.



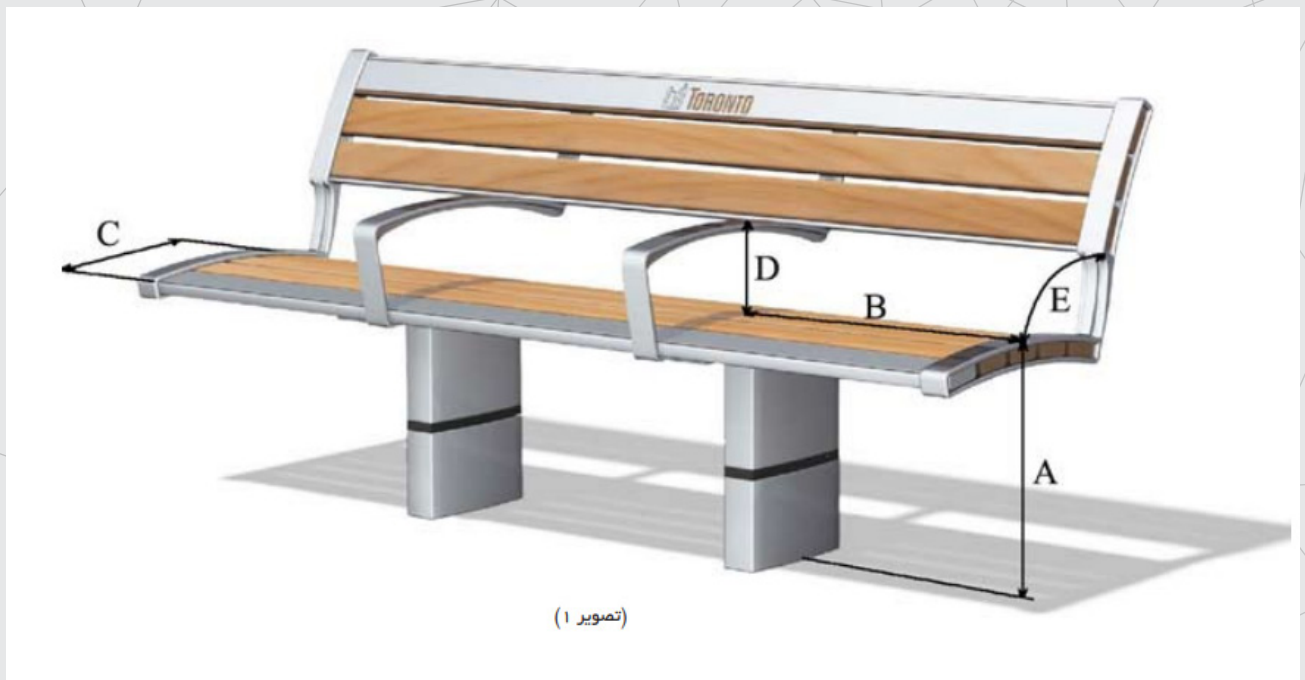
Professor Donato's study on examples of Chinese knot and hexagonal tile. (112, 1990, Donato)

picture	Section	Plan	Description
			Farah Bagh
			Qadamgah palace
			Khajeh Rabie
			Blue Dome
			Hasht Behesht
			Kakh -e-Khorshid
			Pars Museum

Seventh Sextion: Standards and Ergonomics

Introduction:

The bus stop is a structure that is located between the sidewalk and the street to Provide suitable conditions for stopping passengers waiting for a bus to arrive.Therefore, in addition to identifying the bus stop location, it must have features to meet the needs of users during the time it is used. It should be noted that a closer look in addition to waiting passengers who are the main users are pas-sers-by-passers for the installation of a bus stop and bus drivers It is also considered to be the target audience of this product. Obviously, in designing a bus stop, as well as other products, passing the design process and studying the expected features of the product with respect to the audience, the time and location of its use can lead to a desirable design.



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Design a chair or bench inside the station:
1-Seat level

Inside the bus station, you can use either a separate living room or a seating (bench), in which the second option is the possibility of designing the forearm support at specified intervals that separate the level of sitting people. In general, a bus stop should be able to sit at least three people.

• Seat height(A):

Given that the table or level of work does not fit with the person's height and does not require mastery of such a level,The height of the chair should be proportional to the fifth percentile of Women popliteal height, corrected by the height of the shoes, which is about 40 cm.

• Width of seat area in separate seats:

As the width of the hips in women is more than men, the width of the seat surface is designed according to the size of the HIP in women. Therefore, in order to sit comfortably and take off, the width of the chair should be 5 centimeters over the Ninety-fifth percentile of the width of the buttocks in the female, and this is about 50 cm

• The interior widths of the couches in which they are designed to divide the support joints of the living floor into equal parts(B):

In this case, the distance between the two adjoining foreheads, as before, should be about 50 cm and the width of the forearm should be about 10 cm. Therefore, the center of the two adjacent living spaces should be 60 cm. In this case, two men with maximum shoulder width (The ninety-fifth percentile is 510 mm wide). Considering the thickness of the clothes, they can sit on two adjacent chairs. This type of design makes it more comfortable for users, but is not cost effective in mass production.

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• Interior width of the integrated bench:

In this type of design, due to the lack of forearm support between the two adjacent users and the greater size of the width of the shoulder of the shoulders of the width of the hips in the midst of the ninety-fifth of the shoulder width in men. It seems that the easiest way is to select the number of users for this criterion, but the statistics show that the probability that two people with a maximum shoulder width sit on a bench are very small (About one in four hundred.).Therefore, in order to save more in production, they should consider smaller sizes than the number of their shoulders.

• Seat Level Tilt:

If the outer edge of the seat level is designed to fit the Popliteal height, it can have a gradient of 5 to 10 degrees.

• Seat depth:(C):

If the depth of the seat according to the fifth percentile female buttocks popliteal space to be designed, The possibility of relying on the use of seat will be available for all users. This amounts to about 435 mm.

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• Seat surface quality characteristics:

If the depth of the seat according to the fifth percentile female buttocks popliteal space to be designed, The possibility of relying on the use of seat will be available for all users. This amounts to about 435 mm

A- The seat surface should not be too large.

B- The edge of the chair or bench level should be arched

C- It must be permeable to air and do not cling to individual clothing.

D- It must have a relatively rough texture to help stabilize the person.

E- The level of surface flexibility should be small and the surface deformation in the seats with flexible coatings does not exceed 25 mm.

F- It should be carefully selected in the selection of the floor of the chair and back so that there is little heat transfer. This item in the cold and hot seasons prevents the body temperature from transmitting to the body. For example, wood can be appropriate in designing the surface of the user's body.

2-Seat level (D)

The forearm support helps people get up and rise and is very useful for the elderly. In this case, the user should be spaced 10 cm from the back so that the nerves can not be stimulated in the elbow's bone or 10 cm in the end with a suitable level at the lower level. The height of the forearm's support should be 10 to 15 mm shorter than the height of the elbow in the sitting position(Fifth percentile female, About 185 mm), with no sharp or sharp edges in contact with the user's hands.

3-Seat back design: (E)

• The angle of the seat cushion or bench:

The angle around 100 to 110 degrees is considered to be the best angle for designing the back of the bus stop.

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- Form and height of the back of the chair or bench:

The bus stop can be used with short hinges, with the ultimate height of 38 to 40 cm from the chair, and the upper edge of the upper should be below the shoulder blade, supporting the backbone. The bottom edge of the back should be 15 to 17 cm from the level of the chair or up to the height of the arches to prevent the arches from falling. The back should be in accordance with the curvature of the waist, with a maximum inclination of 15 to 20 mm at a height of 23 to 25 cm from the floor of the chair.

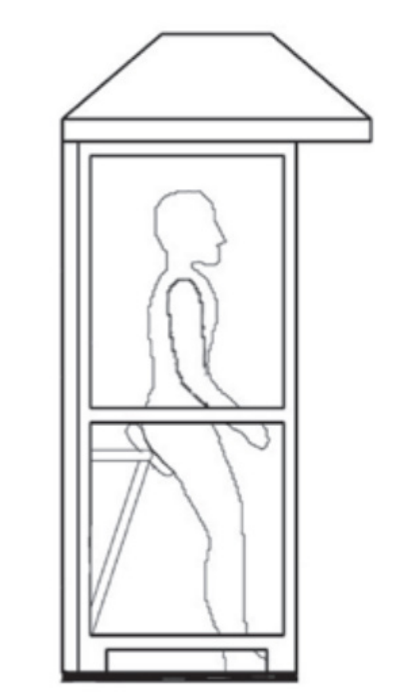
4-Space required in front of the chair for free access to users

If a tall man is sitting on a chair or bench with a height of 40 cm and his legs are placed in free-forward position, the tip of his leg will be at a distance of about 119 cm from the back of the chair, and if the legs are comfortable, this limited amount 80 cm.

In other words, the space needed to open the legs is about 75 cm from the edge of the chair. Accordingly, the ergonomically designed space for free-standing legs is 60 to 75 cm from the edge of the chair, which is considered to be the distance between the seat and the passageway.

5-Use Stand-Sit at the bus stop

Stand-up stations can be used if there is a long wait for travelers or small sidewalks and no design of the seats in the bus stop. In fact, surfaces are designed that people rely on in a standing position and transfer part of their weight to it. The very small space occupancy of bus stations is the main advantage of the use of these products.



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4-Entrance to the station

-Station Entry Width:

In order to determine the maximum width of the users during passage, it should be noted to the ninety-fifth of the width of the shoulder in men, which is about 510 mm.

Of course, the largest amount that the thickness of the dress adds to this amount, as well as the extra space that is needed for the comfort of a person. So the width required to pass a person is at least 600 mm.

At the bus station and designing the entrance and exit point of the users, it is necessary to cross the two passengers together. In this case, the likelihood of two persons crossing the maximum width is very small, but the probability that a carrier or regular load will be carried by at least one of the users, as well as the additional spaces required between the two individuals, and the left and right sides, should be in the design Calculate.

It should be noted that the location of the arrival and departure of the users to the bus station should have a proper connection with the sidewalk. That is, the design of the stations that are not connected to the station with the sidewalk is incorrect.

-The height of the entrance to the station:

The height of the place of entry and exit must be more than one hundred and ninety fifths of height in men. The value of this percentile is about 185 cm. So the height of the location should be at least 195 to 200 centimeters.

-Privacy and view in the bus stop:

Personal space or privacy is meant to be privacy, obscurity, and latency, and view or Vista means visually appealing or perspective. These two factors are very important in the design of urban furniture. Increasing the vista relative to the inside of an enclosed space means reducing the privacy of that space And increase Privacy it means that Vista than it has fallen.

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These two seemingly opposing factors, but in the design principles, are two complementary factors that determine the correct design of the boundary between them. The excessive increase in the privacy of the bus stop may result in inaccurate social activities inside it.

Therefore, it can be said that observing the possibility of Vista from outside the various aspects of the interiors of the station is one of the design needs. The ability to see the outside of the environment by users inside the station also creates a sense of tranquility and security on the nobility on the environment, a psychological need of cognitive psychology. Therefore, the designer is required to consider the safety and comfort of the users in the interiors of the bus station, allowing a two-way vista.

Vandalism and bus station design:

Vandalism, or the damage and destruction of environmental objects and products, is also a phenomenon that should be considered in the design of the bus station. The bus station is a type of product used by large groups And the exact identification of the culture and behavioral characteristics of users or its audience is very difficult and complex due to the diversity of users with different culture and behavioral norms, the impossibility of accurate prediction and the lack of understanding of the designer.

But at least the designer is required to design a product specific to each region in the light of the differences in design, if there are significant cultural and behavioral differences in different urban areas. Selection of the components, joints and other structural features can be affected by the material and will result in different product stability against fire, sharp and winning tools, impact and so on.

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The walls of the bus stop:

When inside the bus stop, three main walls are located on the left, right and behind you. At some stations, the walls are also spaced apart between the street and the station, which will be explained in detail. The wall of the bus arrival to the station is called the left wall. This wall should be completely transparent. The transparency of this wall makes it possible for the two sides to look good, which is a desirable factor. In a way, passengers will notice that the bus is approaching the station and the bus driver will be aware of the passenger's presence at the station when approaching the station.
Another feature of this wall is the lack of light reflection. When lit up inside the station, the reflection of the wall prevents the visibility of the outside of the station by passengers, and the external reflection makes it difficult for the bus driver to see the inside of the station.

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The wall of the exit of the bus from the front of the station is called the right wall. There is no obligatory requirement for the transparency of this wall and it is possible to design any level of information on this wall. At some stations, five promotional maps, or a city guide or metropolis, light urban educational information lights are installed on this wall. The wall behind the station is also very important in design. This wall should provide double-sided visibility. Therefore, at least part of the back wall should be transparent or semi-transparent. The need to understand the peace and security of users at the station and the complete intrusion prevention at the station, which may lead to inappropriate events, is one of the goals described in the bus and coach perspective. In some stations, which are used in more polluted or crowded cities, the front wall, which has mechanized doors, creates a closed space. In fact, the sensors installed at the entrance to the station will open and close the station doors, noting the arrival of the station. This control of the temperature and ventilation inside the station, reducing the impact of voice pollution on users and to a degree more security than the most important.But in general, the cost of production and initial construction, the cost of equipment such as heating equipment, pollution control and maintenance costs of such structures are much more important and should be evaluated in the application area.

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Ceiling or canopy station:

The canopy is a covered bus stop that prevents direct sunlight from reaching the station and protects the passengers at the station against atmospheric factors such as rain and snow.

1-The canopy of the station is designed with any form, and should have at least a shibi on the back of the station so that rain and snow do not fall on the passengers. A gradient of about 10 degrees can be responsive. In cases where the ceiling forms a forward slope, the waterway design on the front of the roof is required.

2-The length of the canopy is proportional to the overall length of the station, and is usually designed to cover the entire surface of the living room, the walls and the advert surface.

3-The width of the canopy is proportional to the station's final width, but is sometimes considered a function of the climatic conditions along the street. Because according to the above mentioned, it should provide at least the optimum conditions at the time of

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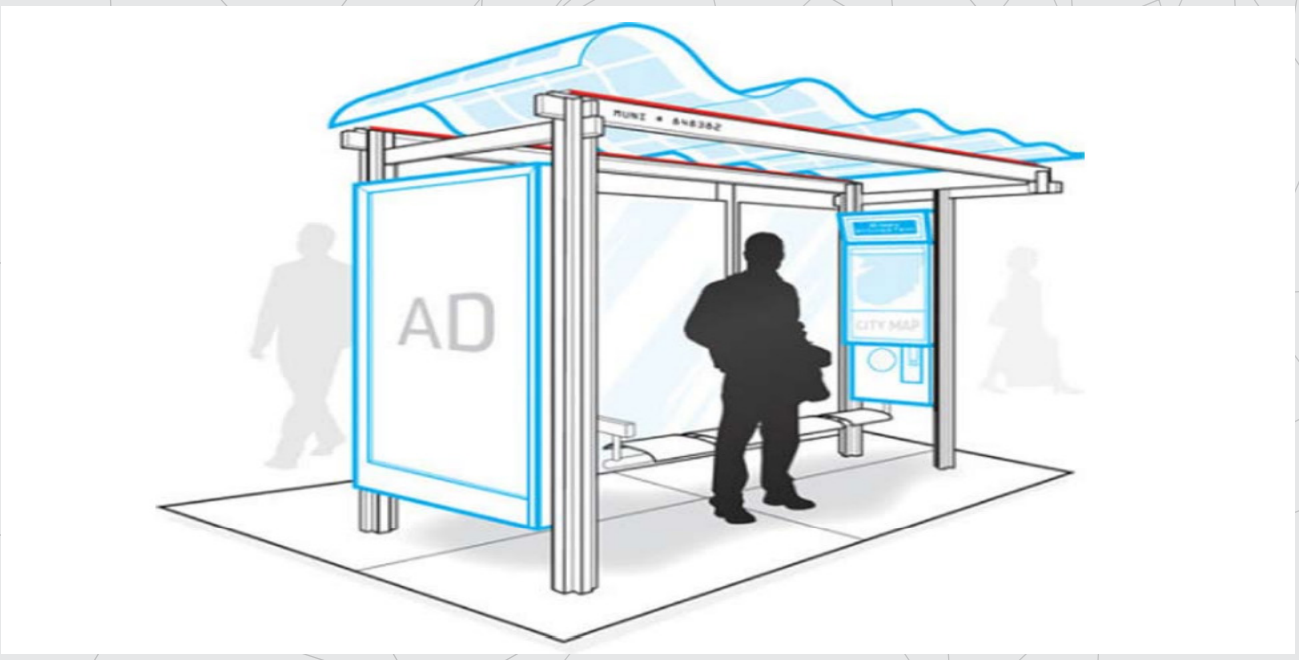
4-Height of the canopy: the roof shape and how it is installed determines the final height, but the minimum height under the roof should be more than one hundred and ninety fifths of height in men, and this height is about 200 cm. But usually the canopy of the stations is installed in such a way that their interior height is about 220 cm.

5-Material and color of the station's canopy: In addition to the characteristics of resistance to atmospheric agents, the sex and color of the ceiling of the station should be chosen in such a way that the absorber does not have excessive sunlight and does not transmit sunlight to the space inside the station. Therefore, textured and dark metallic surfaces are considered to be inappropriate with high absorption of sunlight and transparent transparent glass surfaces, and bright and reflective surfaces that are less absorbing and transmitting heat are preferable.

6-The possibility of installing practical equipment: The possibility of installing solar cells on the ceiling of bus stations today is considered necessary and in fact allows you to absorb and save electricity in the solar energy during the day, and at night for the lighting of the same station used. The possibility of installing lamps and lighting sources under the ceiling must also be taken into consideration.



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Bus station floor features:

1-The floor slope of the station: the floor of the station should have at least a slope facing the station, atmospheric water or a space unrelated to passers-by and users so that water and pollution flow to the outside of the station. Excessive gradients may cause users to fall and damage in winter conditions.

2-It is best to have a tiled floor of the station to prevent users from slipping and sliding in different conditions.

3-There should be no significant difference between the station and the outer space (sidewalk), which may cause users to fall and damage, water accumulation and pollution within the station, and the like.

4-The internal dimensions of the station should be commensurate with the approach and take-off. The design of any factor that prevents these users from circulating or causing a person to encounter is inaccurate.

5-Sometimes improper design creates spaces inside the stations, which becomes the hideout and place of life of animals and animals. Any space that is difficult to access or can be a source of pollution and waste or animal life is the result of improper design.

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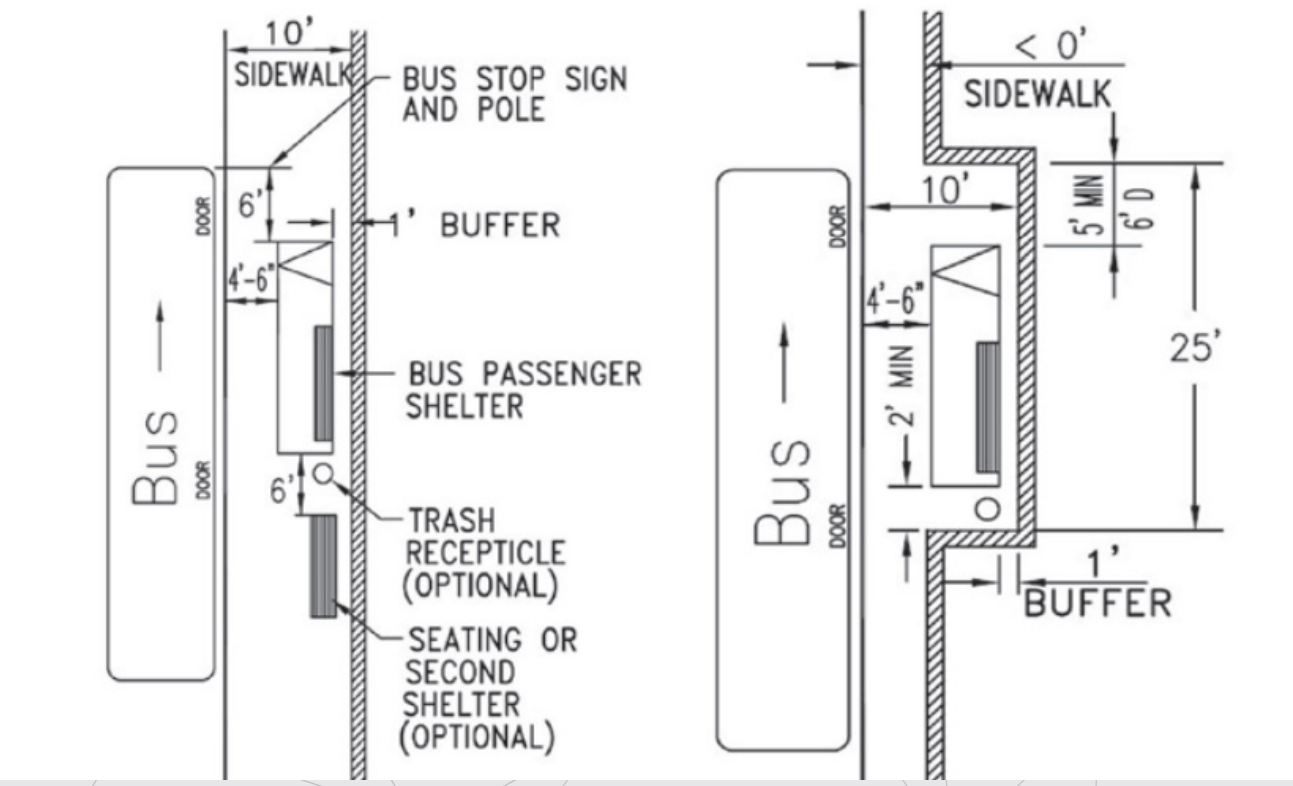
Bus stop on sloping streets:

On steep streets, it's best to set the bus stop at the horizontal level, just like the staircase design for the stairs. Because always the design of a steep slope or the presence of stairs at the station level is considered inappropriate. However, if the creation of the same horizontal level is not possible for the entire length of the station, at least stations with a length of more than 4 meters and a slope of more than 10 degrees should design the minimum number of steps.

The width of the pavement and its relation to the location of the bus station:

1-If the width of the sidewalk is very small (about 120 to 140 centimeters), the space behind the sidewalk is considered to be the wall surface, so that the outer edge of the shelter is almost adjacent to the building, so the body of the bus stop will not stop pedestrians and traffic. In this case, the space between the body of the station and the back wall is at least 30 cm long, so that it is possible to remove and clean up the waste and accumulated contaminants.



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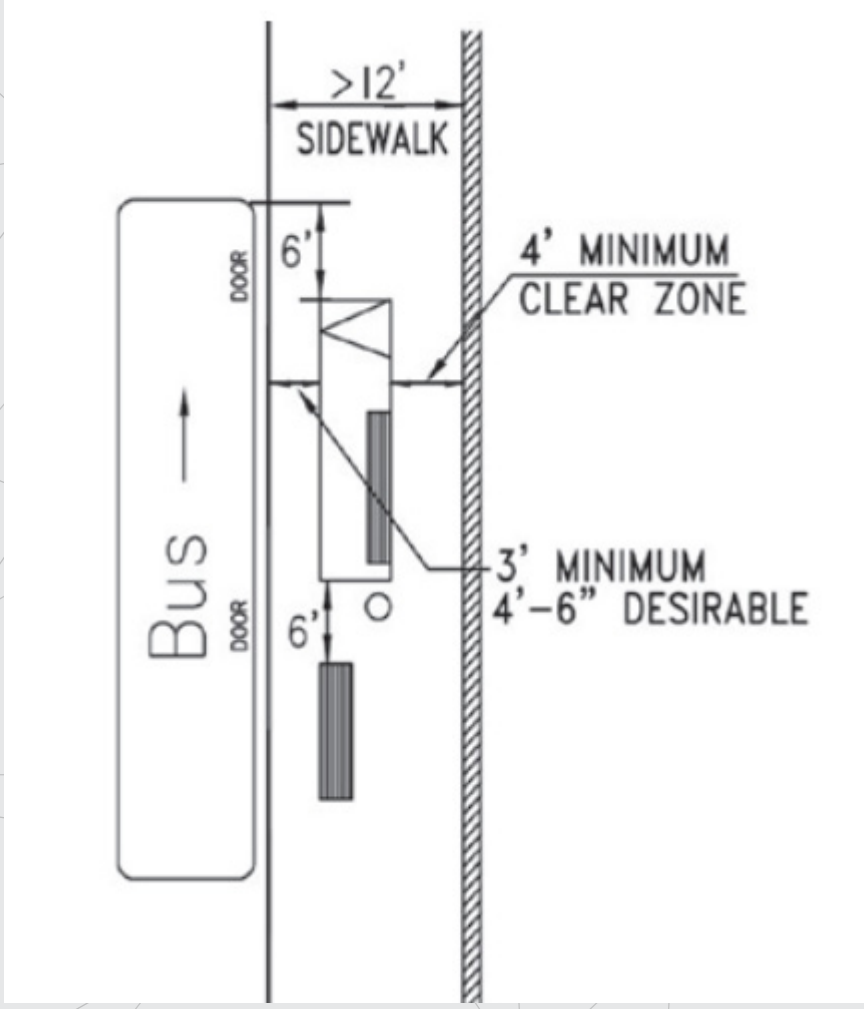
2-If the usual walkways are about 3 meters wide, the body of the bus station is installed inside the sidewalk. In fact, the distance from the edge of the street is approximately 120 to 140 centimeters, so that pedestrians can walk in front of the station. In this case, the distance of 30 cm from the station to the wall of the adjacent building should be taken into account for the removal and cleaning of garbage and contaminants.

3-If the width of the sidewalk is 360 cm, the body of the station is installed in a position between the station and the wall of the adjoining building at least 120 cm apart and the distance between the station and the edge of the street is 90 to 140 cm. Because the width of the canopy can vary according to the application and the location of the installation, it should be kept in mind that the minimum distance between the edge of the shadow and the edge of the street should be 60 cm.



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Bus station lighting:

In addition to the beauty of the bus, the lighting of the bus stations makes the visibility and safety of users more comfortable. Inside the bus stop and below the canopy, there should be the same lighting. These 7 or 5 feet of candlelight are equivalent to at least 50 lux. The amount of lighting is not responsive to the reader or the precision of users, and if necessary, higher-level led lighting should be used. The bus stop should be clearly identified from the distance, so it should also be within the perimeter light.

To save energy during dark hours, it's best to have bus stations close to street light (Light beams) sources. Other lighting sources that can affect indoor and outdoor lighting of stations are advertised light boxes that are installed along with the body of the station or adjacent to them. It should be noted that using a ceiling or awning on the body of the station, the use of lighting sources within the station is imperative, so that the daylight saving time does not stop Vista from coming into contact with any problems.

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Transforming natural light into electricity and storing it can provide the energy needed for artificial lighting. Installing solar cells on the station's canopy and storing the power supply can be used with low light consumption lighting such as LED lights, the lighting response required inside the station. Simple sensors and control kits can be turned on and off by detecting ambient light and light inside the station as well as the presence or absence of passengers inside the station. This makes it difficult for environmental conditions, such as the presence of high buildings, streets and similar lighting control stations.

Putting a light source at a good viewing angle or seeing the image of light sources at the reflection surfaces causes a nuisance, so the bus stations should also prevent as much as possible from the appearance of dazzle.

Form and structure of the station body:

1-The body of the bus station can be designed in a modular manner and after the assembly of components and the use of the corresponding connections, the final structure will be formed. It can also be designed in a non-modular fashion and integrated seamlessly in place. The modular design of bus stations has advantages and disadvantages, but the overall predominance of its benefits justifies this type of design. The advantages of modular design include: easy transportation and less vulnerability, the possibility of installation in place, the possibility of changing dimensions in accordance with the required capacity, the possibility of replacing parts for the whole structure, which makes it easy to repair, Economical savings and more harmony with the principles of green design, and the disadvantages of it can be easiest to open and the ease of stolen components, as well as more vulnerability to the phenomenon of vandalism.

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2-In the design of the bus stop form, the following are important:

• The station form should fit with urban architecture and design

• In the design of different stations, despite the difference in form, the integrated design language must be observed.

• In the design of different stations, despite the difference in form, the integrated design language must be observed.

• Simultaneousity and differentiation: The fitbility of other elements of urban furniture is also important and can reduce the confusion and contradictions of city furniture.But it should be noted that, as well as pictograms and environmental graphics, the distinction between a bus station and an ease of identification between other elements of urban furniture is necessary and considered worthy of design. This distinction can be achieved by applying color, a slight difference in form, and so on.

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• The beauty of the bus stop as one of the elements of urban furniture is important and can be achieved through the beauty of the form, proportions, colors, and so on. But it should be noted that this beauty should be examined and then designed from different angles and angles.

• The use of natural elements such as flowers and plants in the design of the station can make the desired space contrast with the rough forms of the city.

User safety inside the station:

Considering the following to increase user safety is considered essential:

1-Glass and transparent surfaces should be resistant to impact.

2-Sharp surfaces and sharp edges should be removed.

3-The prediction of the occurrence of vandalism should be made and the gender and strength of the main structure of the station should be determined in such a way that the occurrence of vandalism does not endanger the health and life of the users.

4-The dynamic nature of the environment increases the likelihood of an incident in the environment. Therefore, the sex and strength of the station parts should be chosen to protect against the users in their semi-enclosed space against physical deterioration factors such as sound and explosive wave in the streets. Glass and coatings for light sources are affected by the above.

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Facilities at Bus Stations:

The concentration of essential facilities within the boundaries of the bus stop provided that it is not complicated and crowded and does not impede the proper use of the facilities will prevent their dispersal across the city and prevent good urban design. These facilities are installed in and out of the body, depending on their type and function:

1-Ticket Sales Box: The closeness of a gay ticket to a bus stop is not an option if it does not impede the proper circulation of the tickets to users. In the situation where the two stations are close to each other, the ticket sales office can be installed between them.

2-Clock: Installing the two-way clock on the station's body allows station users and pedestrians to use. The installation location should be outside of the reach and at the same time possible to see it with the smallest possible location.

3-First aid box: The first aid box must be installed inside the station and in a position where people can be reached by placing them on the station chair in the necessary conditions. The fire extinguisher can also be installed in the vicinity of the box and used in emergency situations.

4-Emergency telephone and the possibility of contacting the police and the fire department: Usually, public telephones are installed with specific distances within the streets and near bus terminals. Emergency telephone calls or simple telecommunication calls within the stations can save time and money in emergencies and, since these communication devices have urban codes, the closest police stations or firefighters without the need to provide Address at the place.

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5-Trash Bins: Delivering a garbage bin next to the station is one of the design needs. Pay attention to the following:

• The location of the trash bin should be outside the station and at least 150 cm from the bench or the seat.

• Trash bins adjacent to the stations should be used only for dry wastes. Therefore, the presentation of a pictogram or explanatory board is required.

If possible, should at a minimum of space, two or three small bins for placement (Glass, paper and cardboard, plastic ...) of waste separation.

• The design of the canopy for the garbage can make the sunlight and heat in the day-time do not increase the smell of bad waste and release it. The garbage bins prevent animals from communicating and spread contamination.

• The location of the trash can not cause people to move.

6-Advertising levels: Advertising levels can be installed on the ceiling of the station, the exit wall of the bus from the station (right wall), part of the wall behind the station and even part of the body of the station, such as its wider base.

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• Advertising elements affect the beauty and final station gestalt. So they have to be very careful about their size, type, design and color. Providing more than one level of advertising can cause a clutter of the station's inappropriate display.

• The installation of a luminous advertising space can provide part of the lighting needed at the station's location.

Information at bus stations:

Notification can be made through station profiles, cursor maps, urban communication and directional boards, as well as applied picks.

1-Station Profile Display: This panel should contain information about line numbers, destination and destination stations, and bus intervals.

2-Cursor maps and urban communication: These maps can be installed on the right wall of the station and inward. It contains a map showing the location of the station, the bus route passing from the station and the relevant routes and stations, as well as the main city centers near the station. These boards require brightness to easily be seen in conditions where dark air or insufficient ambient light is sufficient.

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3-Deck Decals: These boards are less used. But they can show the direction and position of ticket sales, public telephone and the like. Leading boards can be placed on a base or surface with the signs of the station's profile.

4-Pictograms: They can introduce visual imaging, prohibited items or special situations, etc. Pictograms: They can introduce visual imaging, prohibited items or special situations, etc.

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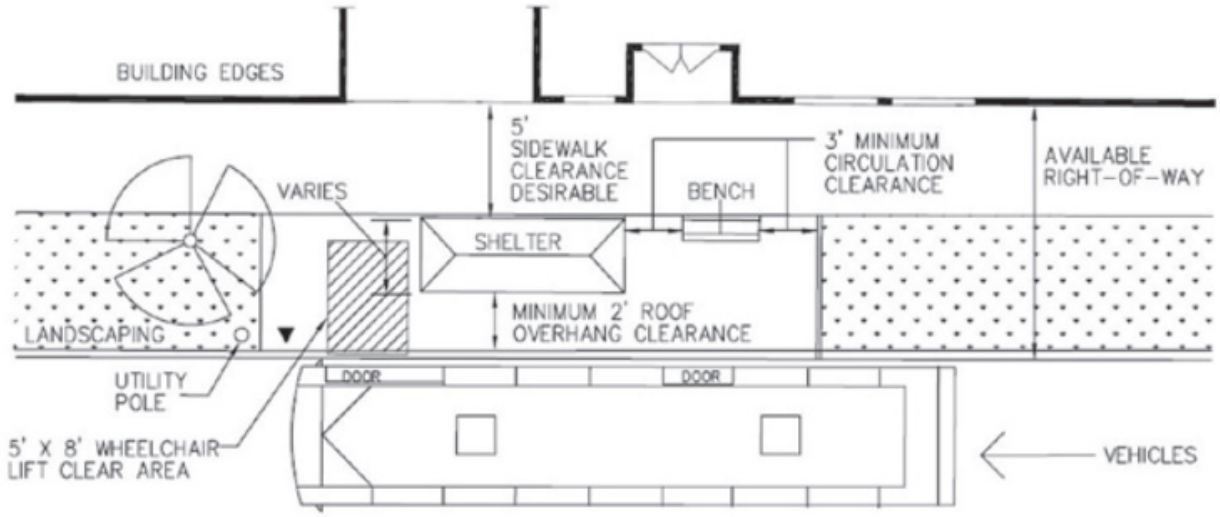
Application of ADA rules in bus station design:

In the 1990s, ADA rules were designed to give all Americans equal access to information and facilities in the internal and external environment, and since then, all designers and design centers are trying to comply with their own laws. These laws target people with disabilities, and their observance makes it possible to address the disadvantages of this social group as a response to the design of all people in the community. These rules are very extensive, but here are three of them that are very useful in the design of the bus station:

1-The possibility of wheelchair access to the bus station should be easily accessible and should be included in the surface station at least 75 × 120 cm (48 inches) (48 inches) to accommodate these persons. The route or surface should also be connected to the bus to the wheelchair for at least 120 and 240 centimeters in length.(A width of 150 cm is more suitable.)



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2-Tactile surfaces: Designing and installing outstanding levels of intersections or specific points within the pavement to the point of entry to stations can be important in directing blind people to bus stations. Indicators at ground level can alert obstacles and dangers or change the route and position to blind or visually impaired people.

(تصویر ۱۶) کاربرد خط بریل در نقشه‌های راهنما و پیکتوگرام‌ها

3-The use of Braille language in guide maps that are installed inside stations can also be used for visual impairment. It is advisable that the guideline cards first introduce the current position of the person more clearly so that all people with that aim inquire into their intentions.

Repair and maintenance:

Urban furniture maintenance plays a decisive role in urban design. Bus stations require monthly visits to wash and remove contaminants, replace damaged lighting sources or repair related equipment, paint surfaces that are damaged, damage damage and replacement of parts and fittings if needed. Meanwhile, the maintenance and repair of components that are related to the safety and health of users is of particular importance:

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1-The design must take into account the stability and strength of the components in accordance with the environmental conditions and in the time dimension. For example, a solid frame design suitable for glass surfaces reduces the cost of maintenance in the time dimension.

2-The ease of maintenance is also one of the things that should be considered when designing. For example, when replacing parts or connections, ease of access to them, lack of physical damage during repair, and the simplicity of assembly and disassembly algorithms are important design factors. It should be noted that modular structures in maintenance are always more successful and less costly.

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Do's and Don'ts In the design of a bus stop:

Millions of people use the bus every day, so urban bus stations are of great importance, with full compliance with the standards and at the required number at certain intervals.

Following are some of the criteria for building a bus stop:

-Certain criteria:

1 - the height of the chair from the ground is 45 cm

2 - Specific sitting area for each person 75 cm

3 - Bench height 45 cm

4. Design a suitable back support for the back of the waist.

5 - Suitable for rear seat and seat anchor more than 95 degrees

6. Suitable for seat armchairs of 10 to 15 degrees

7-Sitting seat - standing between 75 to 85 cm

8. Suitable forehead chair seat between 30 to 40 cm

9. Minimum height of the canopy with obstacles up to 195 to 220 cm

-Physiological criteria:

1-Use proper forms and wings at the site so that it does not cause localized muscular pressures.

2-Determine the dimensions appropriate especially for the height of the seat to prevent isometric states of lower limb muscles.

3-Use appropriate material with minimum weight to facilitate handling

-Human Machine System Criteria:

1-Use standard elements and symbols for proper notification

2-Use of uniforms and colors

3-Design based on forms that are associated with relaxation and resistance.

-Form:

1-Design based on modular system.

2-Observe golden proportions in three layout views and in the ratio of the size of the arches and subdivisions of the plot.

3-The use of signs of Persian culture and civilization and symbolic symbols for the design of the privilege.

4-The coordination of the form with other forms of urban furniture elements.

-Color:

The use of these colors is not recommended:

1-Tones of gray and in the form structures.

2-Dark colors like black, crimson, brown, etc. on a large surface of the shelter.

3-The combination of yellow and black - red and yellow.

4-Pure paints like mustard, bright gray.

5-Cool color combinations without interfering with warm colors

6-Special colors for special sectors such as army, fire department

-These colors are suggested:

1-Brilliant colors

2-light colors

-General considerations for the design and construction of bus stop shelters:

1-Non-use of non-polluting and non-recyclable materials and toxic substances such as baculites and asbestos.

2-Use of light bulbs to provide illumination in the shelter with less heat and longer life.

3-Hiding the shelter to permanently replaceable parts and permanently permanently.

4-Maximum corrosion resistance.

-Bench:

1-Seatings are usually for short or long term use.

2-Couches and street chairs are used shortly in the group without back and with long-term use in the group of back benches.

3-Generally, benches and chairs that are long-lasting should be more comfortable, so use the handle and back (for example, the park chair and the market). But benches can be simpler and more convenient for short-term use. They are more likely to complement architectural spaces and often have aesthetic and decorative uses and are less likely to be thought of as easily.

-Locating:

It is possible to sit down and sit down a few things:

1-Face to face to communicate, talk and talk.

2-Together without any contact.

3-Sitting in the spotlight and activities such as squares, recreation, markets and stores.

4-Sitting for special purposes such as shelter at the bus or cafeteria.

5-The bench and the chair are placed individually along the trees and create a completely private environment.

It should always be very careful to locate the seats, in order to provide user comfort, prevent the interference of others. For this purpose, places are usually selected that have the following general characteristics:

1-Be as safe as possible from wind and other atmospheric agents.

2. Use environmental perimeter.

3. Have at least a two-sided view.

4. Individuals have different choices to choose from, such as sun, shadows, relaxation, activity.

5 - In combination with other essential furniture close to them.

Correct location of the couches in open spaces of the city, the floor of the streets or on the edge of wide pedestrians, especially at the points of attraction and admiration, can provide the opportunity for visitors to enjoy the beauty of the street. Obviously, combining this type of furniture with green space and plants will increase the attractiveness of the environment. It is noteworthy, however, that this kind of landscape is only suitable in places where there is enough space and no disturbance for pedestrians.

One of the best ways to locate benches is to deploy them in well-defined and dedicated locations.

In fact, it identifies and defines the location of the place for the benches and the various places of sitting. On the other hand, the integrity of the plan and its components (for example, furniture types) are not sparse and free of distortion in the environment.

The placement of these sites, depending on the creativity and initiative of the designer can be done by changing the texture, material, color, removal or addition of edges, change of height, etc.

One of the important issues that should always be considered in the layout of different types of furniture is their respective spacing. For example, trash cans are not suitable for safety and sanitation in the vicinity of the season's benches.

Criteria:

The factors to be considered in the design of the chair are:

1-Comfort

2-Durability

3-Absorption of heat

4-Comfortable pouring water on it

5-Less care (Easy maintenance)

6-Resistance to destruction

7-Simplicity of form and stability in construction

SITING OF BUS STOPS:

"Bus stops should be located where they are convenient to use and the safety of passengers and other road users has been taken into account.In assessing the suitability of a potential site, the prime considerations will be road and pedestrian safety. Issues to be considered include environmental intrusion and road and pavement constraints.The following factors can influence the detailed location of a bus stop or bus shelter and should be taken into consideration at the planning stage:

- Proximity to adjacent junctions;
- Proximity to pedestrian crossings;
- Bends or crests in the road;
- On-street parking;
- Existing accesses to residential and business properties; and,
- Footway or verge width.

Designers should also be looking for sites where there is the opportunity to install shelters or lay-bys."

www.roadsni.gov.uk.

Representation from immediate frontagers should be carefully considered. In some circumstances, informal discussion with a local councillor may be helpful in resolving disputes.Any 'nuisance' for residents may be minimised by selecting sites adjoining gable walls or garden walls.

In addition, alternative sites for bus stops should be assessed to look at ways of maximizing their use. One method is an analysis of the catchment area (i.e. the number of residents within walking distance of the stop) using a Geographical Information computer Software (GIS) package such as 'MapInfo'. In this way, an economic assessment can also be undertaken to estimate the revenue that could occur if a bus stop is moved.

In designing new developments, any required bus stop sites should be located so that they are integral to the housing layout. It is important that the stops are established during construction of the roads and preferably before the occupation of adjacent premises.

Various authorities have suggested design standards for residential areas where walking distances to reach the bus stop vary up to a maximum of 400m. Clearly, convenience of location is of prime importance for existing bus users and to encourage new users.

www.roadsni.gov.uk.

This guide advocates the use of the accepted standard recommended in Creating Places[6] that bus stops should be provided so that:

- No resident has to walk more than 400m from their home to the bus stop;
- The majority of residents have no more than 200m to walk between their homes and the bus stop;
- In the case of residences designed specifically for the elderly and mobility impaired, there should be not more than 100m between the development and the bus stop; and,
- Where there are gradients, the suggested walking distances should be reduced by 10m for every 1m rise or fall.

To maximise the catchment area, and wherever possible, the bus stop should be located close to the junction of the side road to meet the standards described above.Visibility requirements and road safety will however have to be given consideration in locating such a bus stop.

6-Creating Places – achieving quality in residential development.
www.roadsni.gov.uk.

Where a bus stop is to be located close to a junction, the preferable location for it is on the leaving side of the junction (See Diagram 3a).This has the advantage that the presence of the junction keeps the approach to the bus stop clear of parked vehicles. Extra consideration needs to be given however to stops at locations such as this where it is likely that two buses could arrive at the same time. In such circumstances, additional length needs to be provided for the buses to clear the junction.

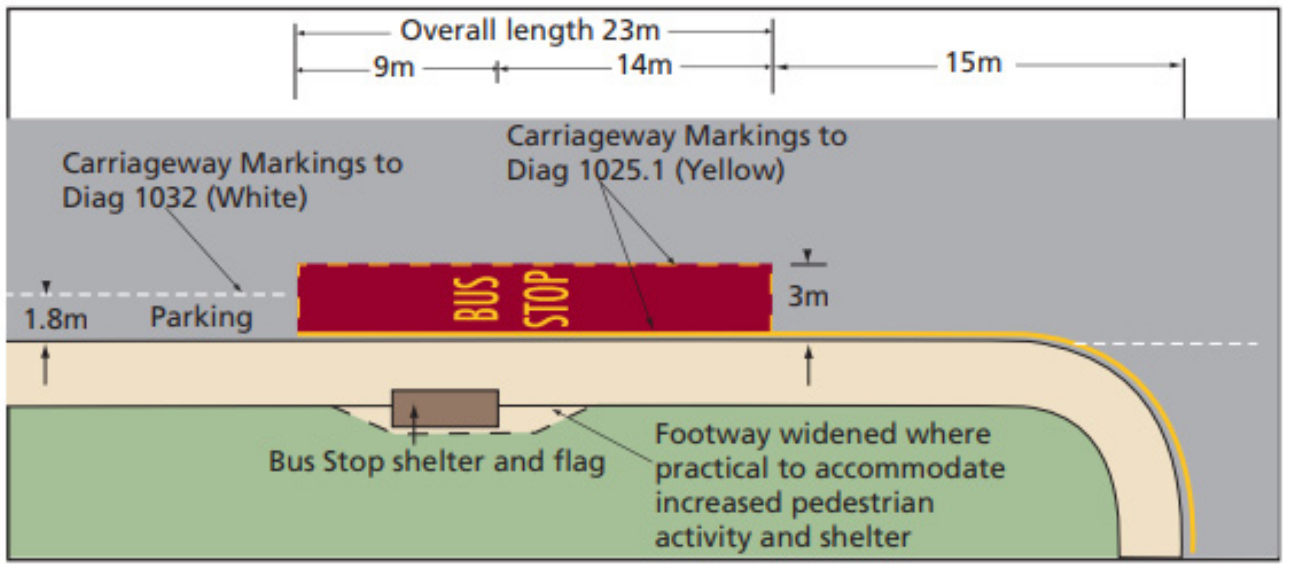


Diagram 3a – Bus stops near junctions

In relation to the spacing of bus stops along a bus route, thecompromise is between minimising walking distances forresidents on one hand and avoiding the extension of the overall journey time as the number of stops is increased on the other.

Bus stop spacing may be determined more by the frequency of side road accesses than by the distance travelled.A general indication of 250 - 350m for bus stop spacing along the route may be quite adequate where there are few side accesses.

Bus stops should be located as close as possible to locations of passengers' destinations such as schools, shops, libraries, old people's homes, hospitals, railway stations etc.

www.roadsni.gov.uk.

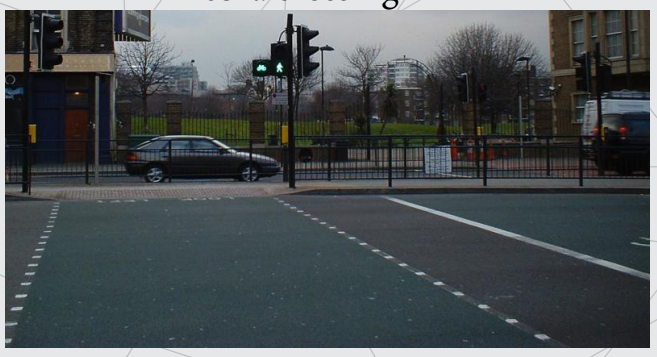
Where bus stops are to be introduced on traffic-calmed routes, account should be taken of the bus stop's position to make allowance for buses needing to align with any speed cushions or other traffic-calming feature.There is also the possibility of incorporating bus stops into traffic calming features such as build-outs.

Many bus passengers need to cross the carriageway either before boarding or after alighting and general consideration should be given to providing facilities for pedestrians to enable them to cross the road safely and conveniently.

In relation to signalled controlled crossings such as Pelican, Puffin and Toucan crossings, it should be recognised that usage of bus stops and crossings may be interrelated. Safety considerations favour the placing of a bus stop on the leaving (downstream) side of the crossing (See Diagram 3b).The distance between the stop and the crossing depends on the 'controlled area' the length of which can vary in response to local road conditions. NOTE: a bus stop may be placed within or partially within the downstream zigzag marking.

Zebra crossing

Puffin crossing



Toucan crossing

Pelican crossing

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Placing the bus stop downstream from a Pelican, Puffin or Toucan crossing has the benefit of keeping the approach to the bus stop clear of parked vehicles, and therefore allows the bus to pull safely into the kerb.This also ensures that the bus does not block others drivers' view of pedestrians on or waiting at the crossing.

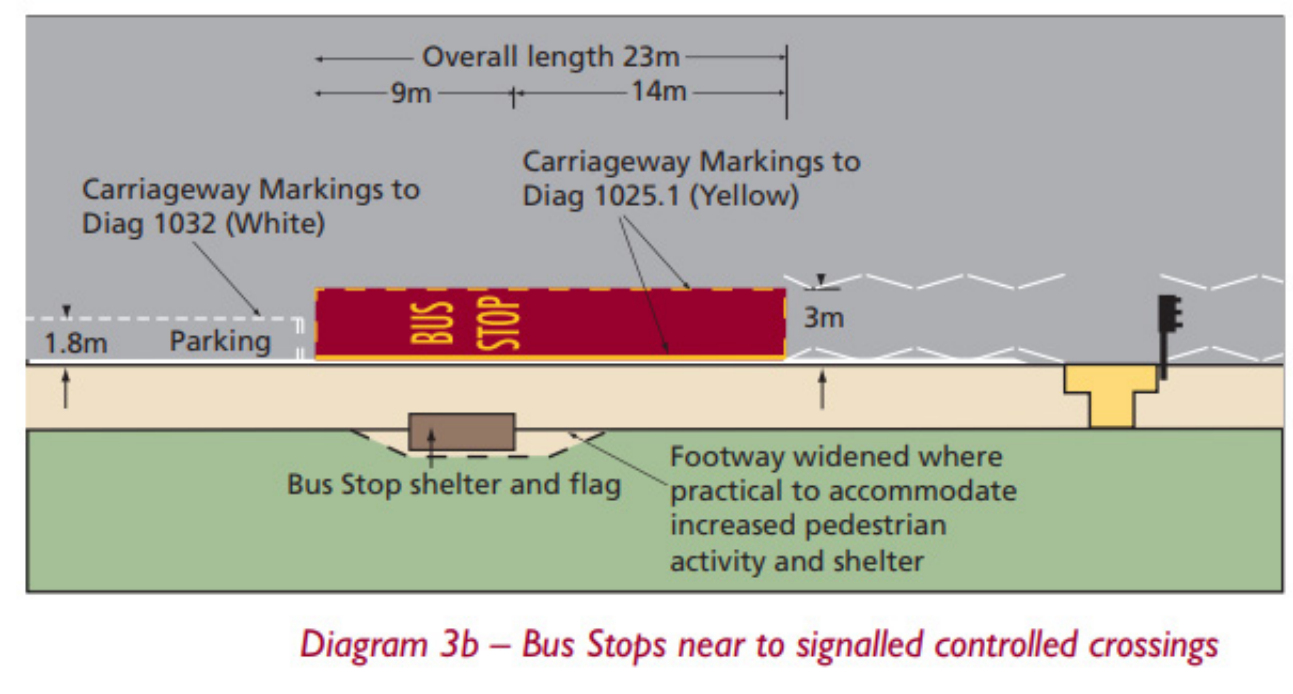

Diagram 3b – Bus Stops near to signalled controlled crossings

Care needs to be taken at Zebra crossings as a bus stopped at any location close to a Zebra crossing can block other drivers' view of pedestrians on the crossing. It is therefore not advisable to locate bus stops in the immediate vicinity of Zebra crossings.

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It is generally not advisable to position bus stops opposite each other on a two-lane carriageway. Safety and sightline considerations suggest a minimum separation of three bus lengths (36m), with the stops positioned in such a way that the buses stop 'tail to tail' and move off away from each other (See Diagram 3c).

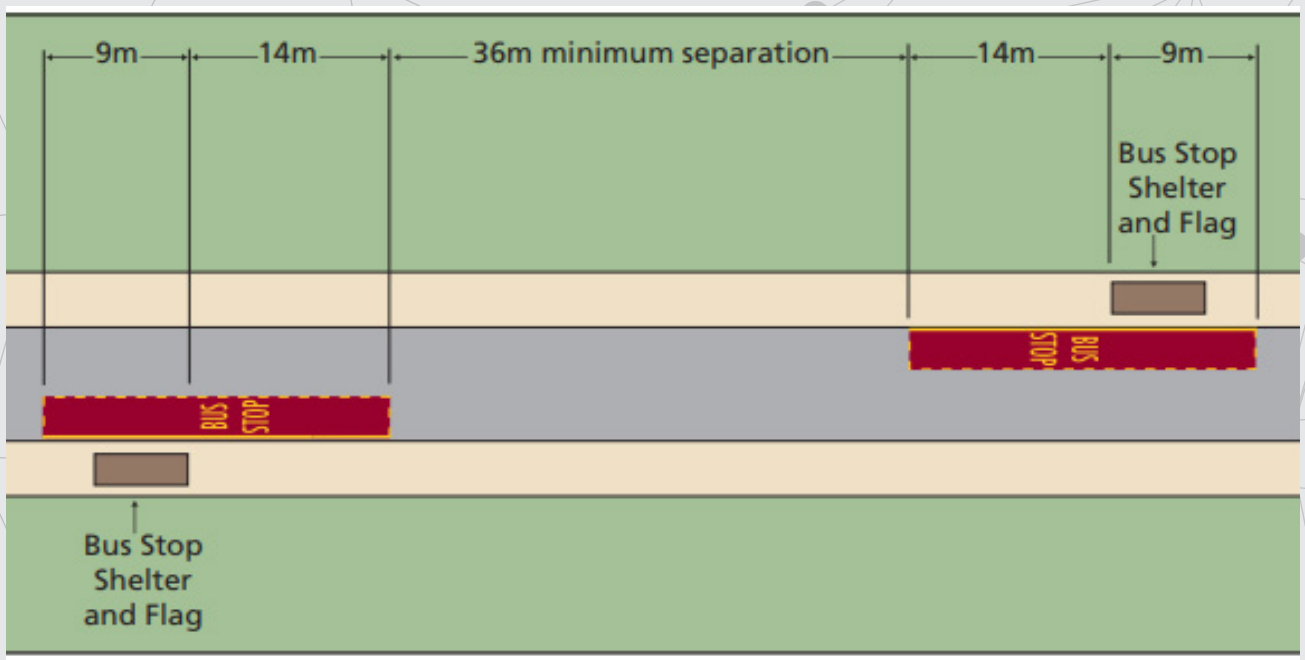

Diagram 3c – Bus stops on opposite sides of a two-lane carriageway

In the absence of any better alternatives, where there is a need for a bus stop close to a bend or the crest of a hill, there may be cause for concern on safety grounds that the bus or its intending passengers may be at risk from other vehicles.In such cases, consideration should be given to an advanced warning sign. Such a sign will require Departmental approval and authorisation by Road Service.

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It is preferable that bus stops be positioned away from local drainage facilities such as gullies. Slotted gratings can present difficulties for people with walking aids and those wearing shoes with pointed heels. Gullies can also block causing ponding which can be a major inconvenience to waiting passengers.

In rural locations, consideration should be given to how the passengers get to and from the stop. It is recommended that hard standings[7] should be provided at all rural stops for people to wait on.

examples of hard standings

7 ground surfaced with a hard material for parking vehicles on

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Bus Stop Signage:

Historically, bus stop signs were not regarded as traffic signage for design control purposes until the 'Worboys' Committee Report (1963)[7] , which produced the current style of traffic signage.This committee specified a standard bus stop sign with the 'BUS' pictogram and the words "BUS STOP." Permitted additions included - location name, bus operator's name and service numbers.A range of sizes was offered within the specification, recognising that needs varied between urban and rural applications.

Although the British standard sign was not adopted in the Traffic Signs Regulations (Northern Ireland) 1979, (nor indeed in the revised Regulations, 1997), Ulsterbus/Citybus voluntarily adopted the standard design around the mid 1970's, which was then progressively introduced throughout the province.There was a major effort between 1989 and 1991 to upgrade sign quality and to replace signs of outdated design. Initiatives such as Rural Transport Plans, QBC's etc; standardised signs are now in widespread use (See Photos 4a).

Photos 4a – Examples of permitted signs

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The information which needs to be conveyed by bus signage falls into two groups:

(1) That required for driver recognition; and,

(2) That required for customer information.

The following information may be included in the sign (see Photos 4b):

- Operator Logo and route branding, e.g. “Metro” and, where appropriate, unique Bus Stop reference number;
- The words “Bus Stop” and/or a “Bus” pictogram;
- Location name;
- Miscellaneous information, e.g. fare stage or zone name, number or information;
- Information on time restrictions relevant to the stop, e.g. “After 9 a.m. only”;
- A tablet of service numbers; and,
- Call centre number and web site address.

Photos 4b – Typical Metro flags

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Bus stop signs should be clearly visible to pedestrians and bus drivers by being located above road traffic, pedestrians and street furniture.The bottom of the sign should not be less than 2.5m above ground level and the sign not less than 450mm wide and 620mm high (See Diagram 4c). It is recognised that in certain situations higher mounting positions have been successful in deterring vandalism.

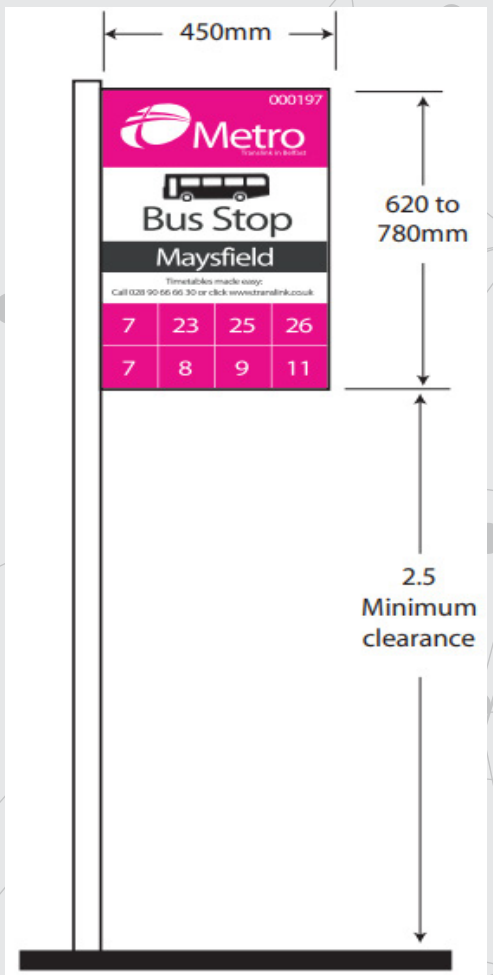

Diagram 4c - Standard bus stop pole and flag

Bus Stop Poles:

Basic bus stops consist of a simple vertical pole with a 'flag' sign attached to it.Whilst this is the simplest form of sign to erect and maintain, it is considered to lack prominence and image in urban situations (See Photos 4d and 4e).

Photo 4d - Typical bus stop pole and flag

Photo 4e - Quality Bus Corridor pole and flag

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Photos 4a – Examples of permitted signs

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Photos 4a – Examples of permitted signs

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Bus stop signs should be attached to bus shelters above roof level wherever possible. To minimise street clutter and to avoid creating additional hazards for the visually impaired, where there is no shelter, bus stop signs should be attached to existing poles such as street lighting columns, where there is a suitably sited item available.This may not be permitted if other signage exists and if certain utilities do not permit the attachment of bus stop signs to their poles. If the total area of signage exceeds 0.3m2 , the sign, pole and base will need checked in line with the Department's Technical Approval for Structures scheme.

Bus stop poles should be positioned so that they cause the least possible obstruction to boarding or alighting passengers and to passing pedestrians, with the optimum location of the pole being at the back of the footway and the flag pointing towards the road (See Photos 4f and 4g). If the pole must be erected close to the road edge, it should be positioned so that the flag points inwards, away from the road and does not hang over the carriageway . No part of the pole or flag should be closer than 450mm from the face of the kerb line.

Photos 4f and 4g – Bus stop poles at back of footways

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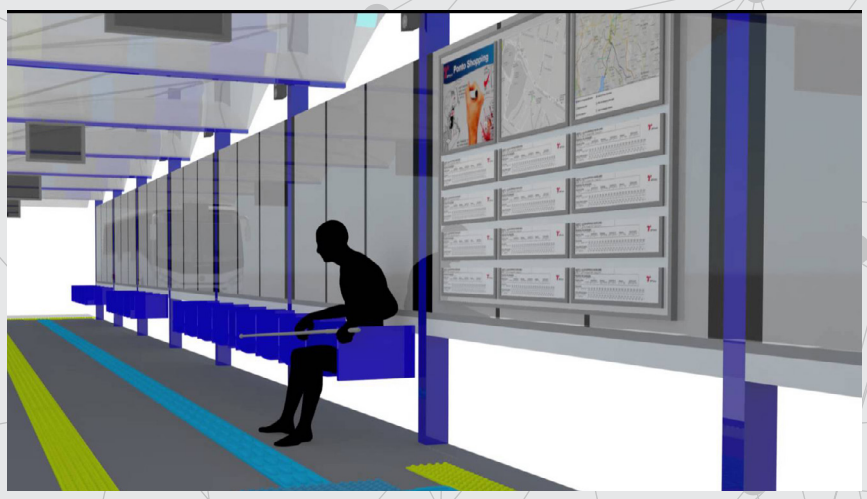
To help passengers, especially the visually impaired, to distinguish bus stops from other street furniture, bus stop poles may be of distinctive design or contrasting colour with the background. If bus stops are attached to other poles or structures, colour banding will help identify them.The Department for Transport's guide Inclusive Mobility[8] provides comprehensive details.



8
Inclusive Mobility,A Guide to Best Practice on Pedestrian and Transport Infrastructure

Travel Information:

It is generally accepted that amongst the largest deterrents to using public transport is the lack of information about the services on offer.This has been recognised by Translink who provide a dedicated telephone enquiry service (028 9066 6630) between 7 a.m. and 8 p.m., as well as full journey planning facilities, timetable and key fares information on their website - www.translink.co.uk.

Where provided, a timetable display case (See Photos 5a and 5b) should be attached to the pole at a convenient level for reading.

Photo 5a – Timetable display case

Photo 5b – Info panel on bus stop pole

Display panels should be located between 0.9m and 1.8m above ground level.Where longer panels are required, the height should not exceed 1.9m, with the most important information located no higher than 1.7m so that wheelchair users can read them.

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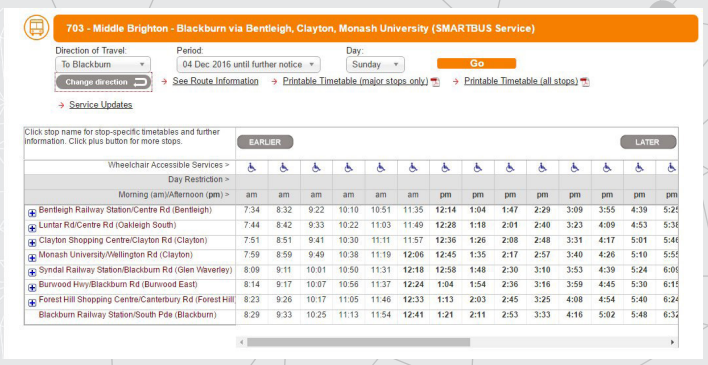
The information displayed should be readily visible at all times and opportunities for using existing street lighting should be maximised.The following may be included in the information display:

- Service number;
- Destination;
- Points served;
- Timetable;
- Route details;
- Information on fares;
- Information on alternative stops or services for selected destinations or times of day;
- Information promoting travel by public transport;
- Announcements about temporary alterations to services, routes, or stopping places; and,
- Maps or diagrams for routes or local stopping arrangements.



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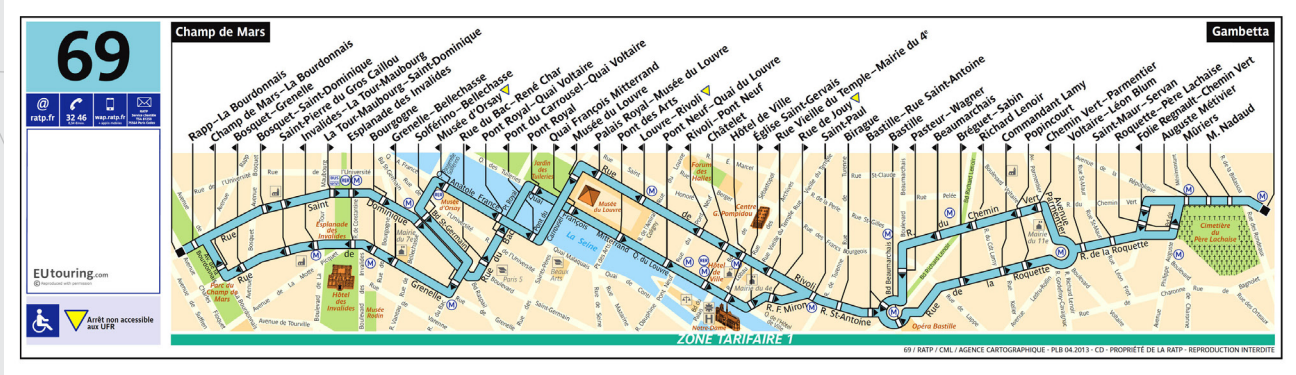
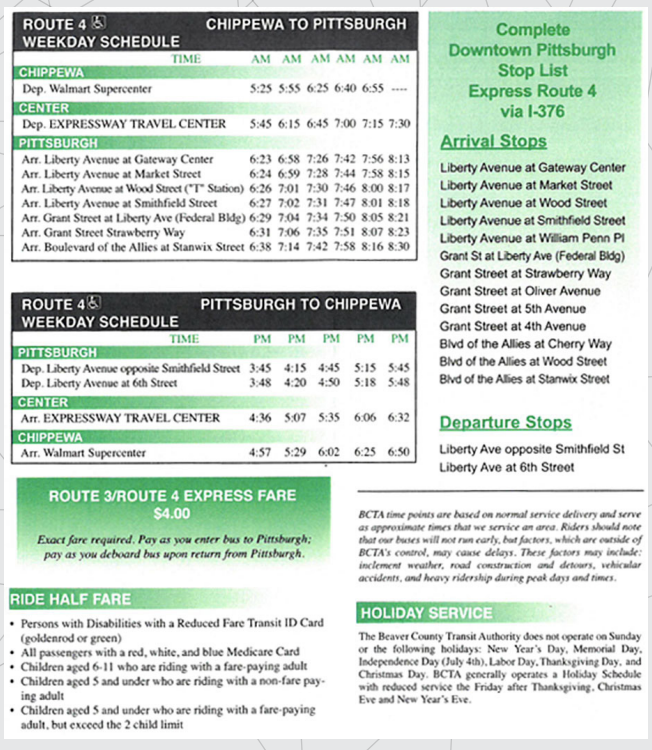
For frequent local services details of routes, destinations and a timetable may be sufficient; but for passengers unfamiliar with the service a full timetable and route diagram are more helpful and these may be regarded as essential for longer or infrequent services. For busy bus stops, stations and interchanges the provision of the following types of information should be regarded as good practice:

- Stop / Station / Interchange name;
- Usage of bus frequencies rather than times;
- Route information including stops;
- Journey length of details; and,
- Fare information – if practicable.



At less well-used bus stops include:

- Stop name;
- Which buses stop there;
- Where they go;
- How frequent they are; and,
- The time of first and last buses.



ROUTE 4 CHIPPEWA TO PITTSBURGH
WEEKDAY SCHEDULE

TIME	AM	AM	AM	AM	AM	AM
CHIPPEWA						
Dep. Walmart Supercenter	5:25	5:55	6:25	6:40	6:55	----
CENTER						
Dep. EXPRESSWAY TRAVEL CENTER	5:45	6:15	6:45	7:00	7:15	7:30
PITTSBURGH						
Arr. Liberty Avenue at Gateway Center	6:23	6:58	7:26	7:42	7:56	8:13
Arr. Liberty Avenue at Market Street	6:24	6:59	7:28	7:44	7:58	8:15
Arr. Liberty Avenue at Wood Street ("T" Station)	6:26	7:01	7:30	7:46	8:00	8:17
Arr. Liberty Avenue at Smithfield Street	6:27	7:02	7:31	7:47	8:01	8:18
Arr. Grant Street at Liberty Ave (Federal Bldg)	6:29	7:04	7:34	7:50	8:05	8:21
Arr. Grant Street Strawberry Way	6:31	7:06	7:35	7:51	8:07	8:23
Arr. Boulevard of the Allies at Stanwix Street	6:38	7:14	7:42	7:58	8:16	8:30

ROUTE 4 PITTSBURGH TO CHIPPEWA
WEEKDAY SCHEDULE

TIME	PM	PM	PM	PM	PM
PITTSBURGH					
Dep. Liberty Avenue opposite Smithfield Street	3:45	4:15	4:45	5:15	5:45
Dep. Liberty Avenue at 6th Street	3:48	4:20	4:50	5:18	5:48
CENTER					
Arr. EXPRESSWAY TRAVEL CENTER	4:36	5:07	5:35	6:06	6:32
CHIPPEWA					
Arr. Walmart Supercenter	4:57	5:29	6:02	6:25	6:50

ROUTE 3/ROUTE 4 EXPRESS FARE
$4.00

Exact fare required. Pay as you enter bus to Pittsburgh; pay as you deboard bus upon return from Pittsburgh.

RIDE HALF FARE

- Persons with Disabilities with a Reduced Fare Transit ID Card (goldenrod or green)
- All passengers with a red, white, and blue Medicare Card
- Children aged 6-11 who are riding with a fare-paying adult
- Children aged 5 and under who are riding with a non-fare paying adult
- Children aged 5 and under who are riding with a fare-paying adult, but exceed the 2 child limit

Complete Downtown Pittsburgh Stop List
Express Route 4 via I-376

Arrival Stops

Liberty Avenue at Gateway Center
Liberty Avenue at Market Street
Liberty Avenue at Wood Street
Liberty Avenue at Smithfield Street
Liberty Avenue at William Penn Pl
Grant St at Liberty Ave (Federal Bldg)
Grant Street at Strawberry Way
Grant Street at Oliver Avenue
Grant Street at 5th Avenue
Grant Street at 4th Avenue
Blvd of the Allies at Cherry Way
Blvd of the Allies at Wood Street
Blvd of the Allies at Stanwix Street

Departure Stops

Liberty Ave opposite Smithfield St
Liberty Ave at 6th Street

BCTA time points are based on normal service delivery and serve as approximate times that we service an area. Riders should note that our buses will not run early, but factors, which are outside of BCTA's control, may cause delays. These factors may include: inclement weather, road construction and detours, vehicular accidents, and heavy ridership during peak days and times.

HOLIDAY SERVICE

The Beaver County Transit Authority does not operate on Sunday or the following holidays: New Year's Day, Memorial Day, Independence Day (July 4th), Labor Day, Thanksgiving Day, and Christmas Day. BCTA generally operates a Holiday Schedule with reduced service the Friday after Thanksgiving, Christmas Eve and New Year's Eve.

www.roadsni.gov.uk.

Fares information, if provided, encourages passengers to have the 'exact fare' ready before they board, helping to reduce busstopping times. However, fares information must be updatedm promptly when fares are revised, otherwise, advertising legislation may be breached.The use of 'Smartcards' should be encouraged as they offer convenience to both the bus passenger and bus operator. Prepaid Smartcards reduce the number of on-board cash transactions which shortens boarding times and consequently improves overall bus speeds and journey times. Removing the need to have money on the bus makes it safer for both the driver and the passenger.

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Electronic passenger information systems:

Electronic passenger information systems will display the times;destinations and service numbers of successive buses as they are due to arrive at the stop (See Photos 5c and 5d).These may be based on 'scheduled times' triggered by a pre-determined database of bus service timetables, or 'real time' which are activated by prior detection of the actual buses approaching the stop, predicting the arrival/departure times and automatically responding to delays or irregularities.Visual displays of this type must be clear under all lighting conditions (including bright sunlight) and easily understood.

Photo 5c – Electronic passenger information display

Photo 5d – Electronic passenger information display flag.

www.roadsni.gov.uk.

General Rreqirements:

Shelters should be designed and sites to provide maximum weather protection, bearing in mind the prevailing winds and the need for protection against splashes from passing vehicles.

Shelters can also be designed to provide weather protection for pedal cycles (See Photos 6a and 6b).

Photo 6a – Shelter for pedal cycles

Photo 6b – Shelter for pedal cycles

www.roadsni.gov.uk.

Waiting passengers must have a clear view of approaching buses, and be themselves clearly visible to bus drivers and passers-by.

Shelters should provide minimum obstruction to the pavement, and a recommended width of 1.8m should be allowed for passing pedestrians.There should be at least 0.5m clearance between any part of the shelter and the kerb edge.The shelter should have no projecting sections or sharp corners that would create a hazard to pedestrians.Although designs should not visually clash with their surroundings, there should be sufficient use of bright colour contrast to identify the shelter to those with visual impairments. Further specific siting details for disabled passengers are available from the Inclusive Mobility[8] guide.

Where glass is used to provide a light interior, it should have a tonally contrasting band 140 - 160mm wide at a height of approximately 1.5m from the ground to improve visibility. This band can possibly incorporate shelter provider's name and/or logo.

Shelters should be constructed from vandal resistant materials that are easy to clean and need minimum maintenance. Materials and designs used should be of standard size, shape and type to allow easier maintenance.

A bus shelter should not be sited where it might cause obstruction to passengers who are boarding or alighting or obstruct sight lines for other drivers.

www.roadsni.gov.uk.

Combining bus shelters with commercial advertisements or public telephones (so long as these do not have priority over bus service information) will reduce costs, minimise footway obstruction, and facilitate lighting the shelter at night, thereby reducing passenger fear of assault.Any shelter without lights should be sited in open, well-lit areas. In addition, all new enclosed shelter designs should have entrance and exit choices which avoid entrapment.

Passenger information displays should be mounted on the shelter and the bus stop flag fixed to the shelter above roof level to do away with the need for a bus pole and thereby help reduce street clutter.

The long-term objective is to provide a shelter at as many bus stops as possible. Priorities in the short and medium term should be given in proportion to the volume of usage by boarding passengers, especially schoolchildren and the elderly, and the degree of exposure to wind and driving rain.

There is an almost infinite range of design styles and materials available for shelter manufacturing and construction. It is not the purpose of these guidelines to be prescriptive of materials or designs. However, we do recommend that careful consideration is given to the options available, having regard to the aesthetic qualities required for the site and, to long-term durability and maintenance.

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Shelters can vary greatly in dimensions according to likely demand and usage. In general, it is recommended that minimum dimensions of 1.5m x 4.0m for cantilever styles and 2.0m x 4.0m for enclosed designs are used (See Photos 6c and 6d). Larger dimensions should be provided where above average usage is anticipated, such as key stops in residential developments and at town/city centres or route or modal interchanges.

Photo 6c – Typical shelter

www.roadsni.gov.uk.

Photo 6d – Rural shelter

In exceptional cases, the bus stop layout may be designed to provide for passengers to step directly between the bus doorway and the shelter. In such cases, the shelter should have an open front of at least 3.0m to allow for variation in bus stopping positions and, an independent means of access to the footpath, preferably towards the oncoming vehicle or towards the rear of a stationary bus.

At important locations or interchange points, the opportunity should be considered to install 'Super Shelters'.These have more comprehensive information displays, larger sheltered areas and other passenger facilities such as - public telephones, a direct information hotline and coin-operated drinks machines (see Photos 6e and 6f).There will be places where a bus station is not appropriate or possible, but where attractive waiting facilities are needed to achieve comparable objectives on a more modest scale.

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Photo 6e – Example of 'Super Shelter' at Antrim Area Hospital

Photo 6f – Example of 'Super Shelter' at Causeway Hospital, Coleraine

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Another type of shelter, which could be particularly useful in rural settings where there is little chance of electricity supply, is the solar-powered shelter (See Photo 6g). These can provide lighting for display panels and timetables as well as heating for seats.

Photo 6g - Solar-powered shelter

Seats in shelters:

Unless services are very frequent or stops very rarely used, seats should be provided in all shelters. Many passengers such as the elderly or those with mobility impairments may be able to walk to or from their nearest bus stop, but find it impossible or very painful to stand waiting.

Typically, seats should be provided as a bench or horizontal rail to provide waiting passengers with something to sit on, rest against, or 'perch' on. Whenever possible, sharp edges and corners should be avoided (See Photo 6h).

www.roadsni.gov.uk.

Photo 6h - Typical shelter with perch seat

Dimensions for seats:

- For 'perch' rails – approximately 700mm above ground level.
- For other seats – approximately 450mm above ground level.
- If seats are used – arm rests, if provided, should be 200mm

above seat level and be sufficiently robust to allow passengers to push themselves up from the seat.

Benches and seats should be in bright,'warm' materials with a non-slip surface, which is strong, easy to clean, and (in exposed positions) quick to dry. Slatted wood or plastic coated metal meet these requirements.

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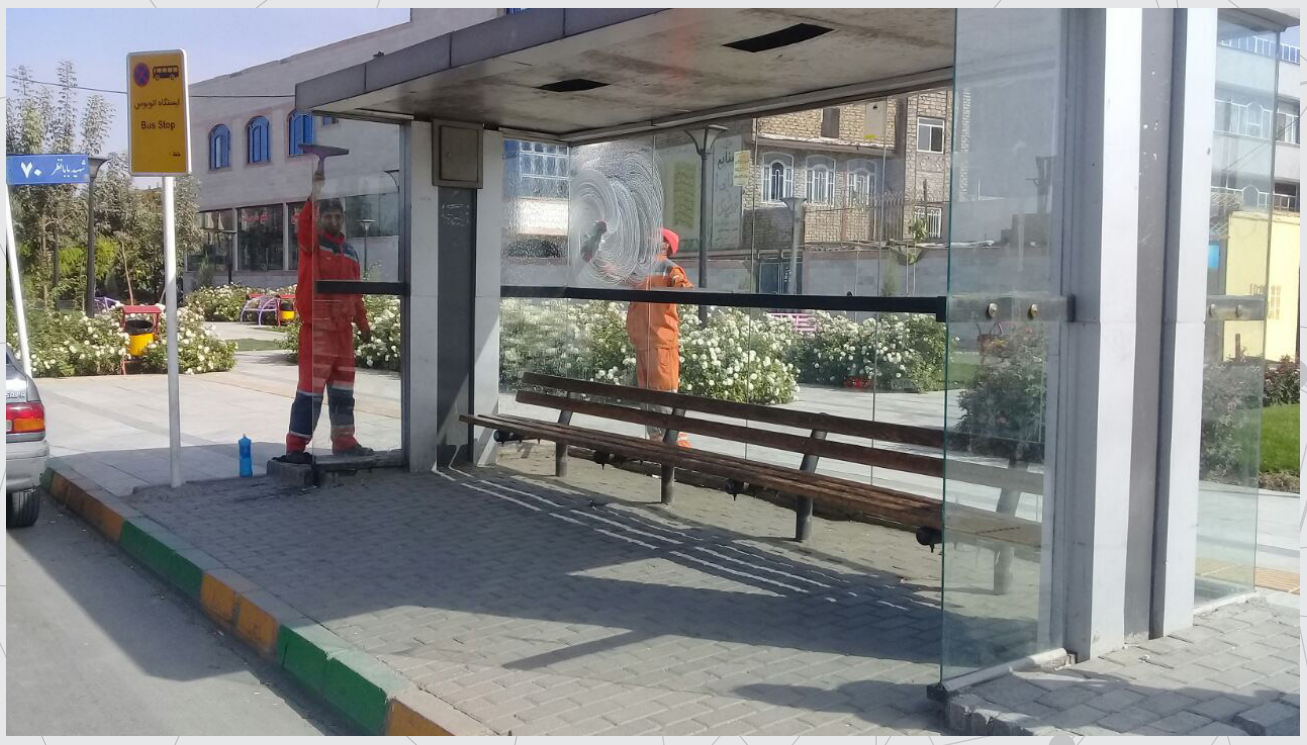
In all shelters, and for obvious reasons, consideration should be given to the provision of litterbins and regular cleaning and maintenance are essential.



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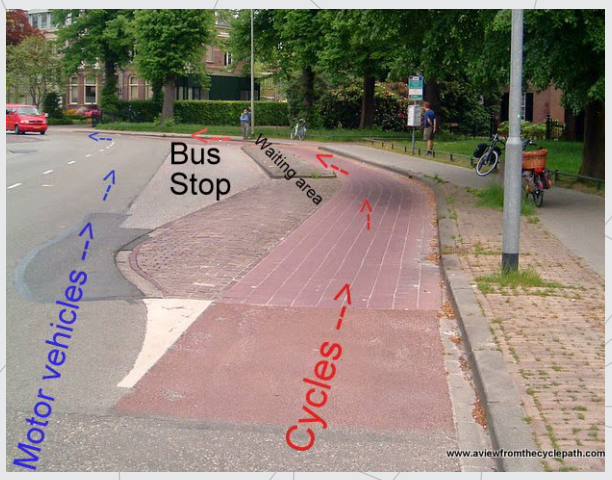
Footway infrastructure for bus stops:

Convenience of access to buses requires that the bus draws up close to and parallel with the edge of the footway so that passengers can step easily across between the kerb and the bus platform. For many passengers serious difficulty arises if they are obliged to enter or leave the bus from carriageway level.

The current trend in bus design is the ultra-low floor type, in which steps or ramping within the vehicle is virtually eliminated, consequentially benefiting passengers with mobility impairment. Such designs also facilitate movement of a wheelchair within the vehicle. However, the problem of access to the entrance step itself remains, and the arrival of the low floor bus concept has increased awareness of the importance of achieving consistent high quality access between footways and the bus entrance step.



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The low floor bus typically has a step height of between 300mm and 400mm above carriageway level and whilst the kneeling mechanism on the suspension lowers the entrance step by 50 - 80mm, it does not totally resolve the difficulty faced by some in boarding from or alighting to the footway. Furthermore, activation of the kneeling system takes time, which extends bus stopping times, slowing journeys by public transport and extending delays to following traffic, and is therefore used only when there is an obvious need or when it is requested.

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The recommendations contained in this guide are designed to facilitate targets for access, comprising of step height from kerb to (kneeling) bus platform not exceeding 150mm and lateral gap from kerb face to bus platform not exceeding 200mm, without either the front or rear overhang of the bus overrunning the footway during either approach or departure (see Diagram 7a).

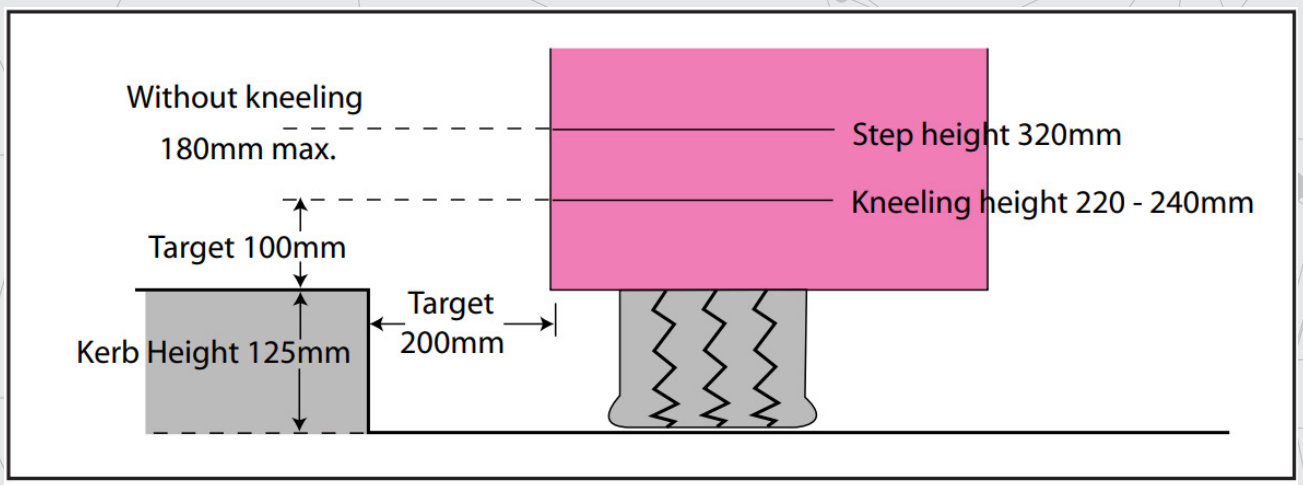

Diagram 7a – Example of bus kneeling

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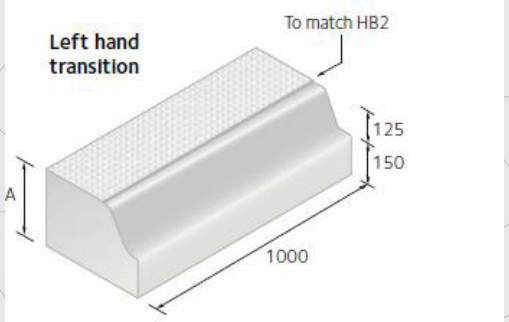
It is clear that to achieve these targets, passengers must board from or align to a kerb height footway, not an area at carriageway level.

In establishing an optimum height for the kerb, it is necessary to find a compromise between, on one hand, the objective of raising the footway as near as practical with the entrance platform of the low floor bus (in kneeling mode), and on the other hand, the objective of avoiding the risk of physical contact of parts of the bus with the actual kerb-stone.

Based on an analysis done,it is recommended that a kerb height of 125mm will reduce the potential 'grounding' by the latest generation of low floor vehicles.

European cities have experimented with higher raised kerb areas at bus stops to achieve level access to floor height of low floor buses.The experimental kerb height is 280mm. This is significantly more than the 'normal' kerb height and raises safety issues for pedestrians, as well as serious damage risk to buses if a parallel approach is not consistently practical. Some operators lessen the risk of damage by fitting guide wheels to the bus, thereby preventing physical contact between the kerb and the bus. Overall, the stop infrastructure design requires more space than is generally available in our situation. For these reasons adoption of this practice is not recommended for Northern Ireland at present unless this or an equivalent 'docking' technology is incorporated within a segregated busway network such as is proposed for EWAY.



Transition kerbs

160mm unit	LH	RH	Wt (kg)
Concrete:	KK60TLH	KK60TRH	265
Granite:	KK60TLHG	KK60TRHG	310
Height:	314 (A) down to 275mm		

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Whilst buses with a single entrance/exit doorway are in use, a recommended length of kerbing of 5m should be available for boarding and alighting.Where this is not possible, a minimum of 3m should be provided. Buses with separate entrance and exit doors will require at least 10m clear length kerbing.

single entrance/exit doorway

separate entrance

Dropped kerbs or flat kerbstones should NOT be used in the immediate area of a bus stop or in the parallel face of a bus lay-by.Any facilities for uncontrolled or informal pedestrian crossings should be located at least 15m from the bus stop, and preferably to the rear of the bus stopping position. In addition, the avoidance of conflict with property entrances should be considered in placing the bus stop, as these also require dropped kerbstones.

flat kerbstone

Dropped kerbs

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Easy access kerbing:

Special kerbing (See Photos 7b and 7c) has been designed to improve access for bus users as well as providing docking guidance for vehicle drivers in order to minimise the horizontal separation between the bus and the footway. It allows the vehicle to make low speed close contact with the kerb in a parallel direction without causing damage to the tyres.Where possible these kerbs should be used as part of a comprehensive whole route treatment, for example, on Quality Bus Corridors.

Photo 7c – Easy access kerbs used in bus boarder

Specification of these kerbs with a maximum kerb show height of 160mm is ideal for low-floor buses to get as near as possible to the kerb, but kerbs higher than 125mm may cause damage to the underside of a low-floor bus if it has to approach at an angle. To avoid this easy access kerbs or similar should be considered in the following situations:

- Bus boarders/footway build-outs;
- Conventional bus lay-bys with straight section dimension of 15m or more;
- Shallow sawtooth lay-bys;
- Straight kerb edge bus stop locations where parked vehicles are unlikely to interfere with the bus approach; and,
- Road narrowing (traffic calming) features.

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Photo 7c – Easy access kerbs used in bus boarder

Photo 7d – Easy access radius and transition kerbs

Easy access kerbs are not appropriate where there is a likelihood of front or rear over-hang or sharp angle tyre impact as they are designed for parallel running. They are also not appropriate where car parking may prevent buses approaching parallel with the kerbline. For the same reasons, lengths of this kerbing or similar should be introduced with a specially designed leading corner or transition stone and/or a lead in taper so as to negate a sharp angle tyre impact (see Photo 7d).

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To facilitate the bus making a parallel approach to the kerb the recommended minimum length of easy access kerbing is:

- 4m at lightly used or alighting bus stops;
- 8m at single bus stops where only one bus is scheduled to arrive at any one time and a standard shelter is provided;
- 16m at a double bus stop; and,
- 28m at a double bus stop used by standard (12m) and articulated buses.These lengths do not include for transition kerbs.

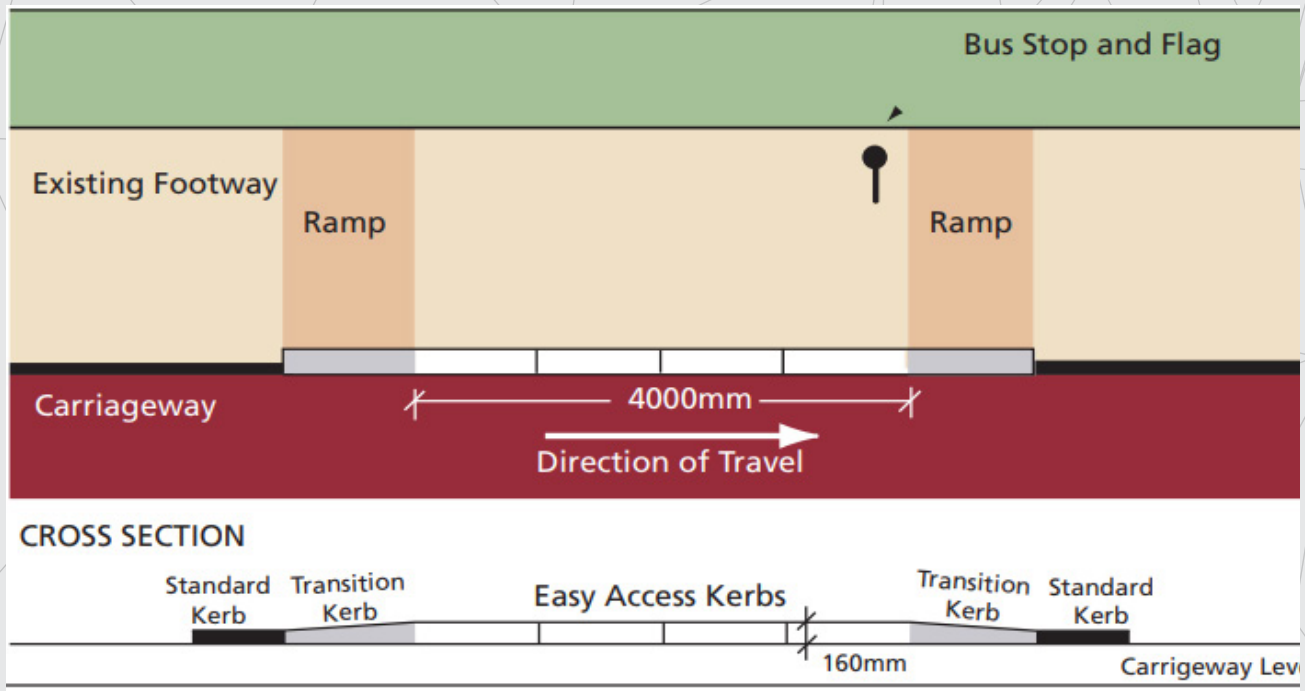

Diagram 7e - Easy access kerb layout

To avoid tyre impact damage, all build out features at bus stops (and other locations on bus routes) , should have leading corners designed and constructed with radius corners and not mitred corners.

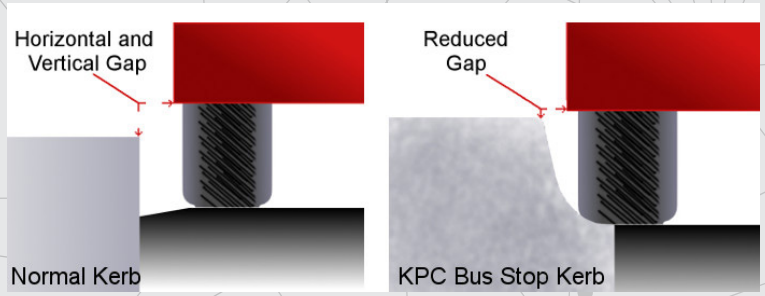

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Photo 7f – Easy access kerbing

Photo 7g – Close-up of easy access kerbing

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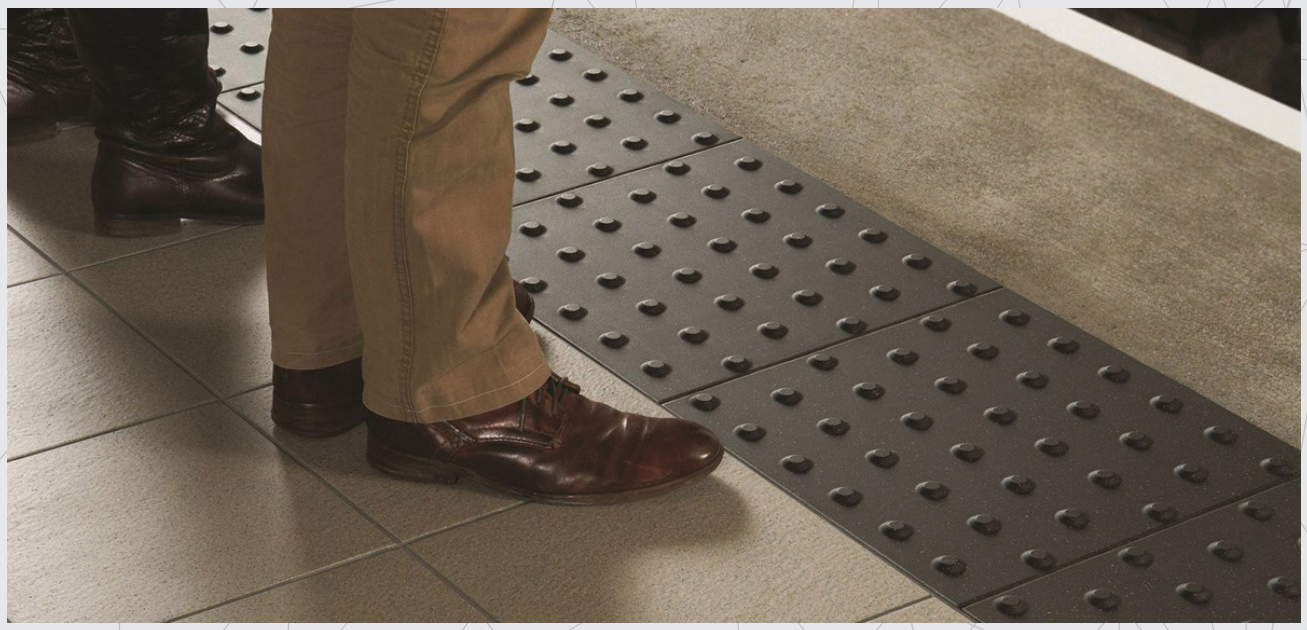
Footway and hard standings:

Footways should be hard surfaced, well drained and lit. If it is proposed to install a bus stop on an adopted grass verge, hardstanding provision should be made for boarding and alighting passengers.The area of verge/footway adjacent to bus stops should be kept clear of street furniture and other obstructions, and a good quality kerb and paving surface maintained.

The use of 'modified blister' tactile paving, approved by the Department, is intended to assist identification of pedestrian crossing points for visually impaired people to highlight the absence of kerb height at this point. Use of this paving in the immediate vicinity of bus stops would be misleading and potentially hazardous and is therefore not recommended.



In general, the recommendation for footway width in the vicinity of a bus stop is 3m, to allow for queuing and alighting passengers as well as passing pedestrians. Local reduction of this dimension to 1.8m may be acceptable where pedestrian movement is low. Consideration must be given to the needs of wheelchair users accessing the bus stop and space requirements for manoeuvring on and off any boarding ramp that may be fitted to the bus.

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Bus borders and footway build outs:

In the traditional urban traffic environment there may be pressure on kerbside space due to parking and loading, bus drivers often encounter great difficulty approaching the kerbside at stops. Often buses are obliged to stop in the running lane forcing passengers to step down to carriageway level, while intending passengers have to negotiate their way between parked vehicles to board the bus, and to step up from carriageway level.

Where such circumstances exist, a built out footway called a 'bus boarder' may improve the situation. These can be used to provide a kerb height boarding/alighting area for bus passengers with minimal reduction in kerbside parking. It is recommended that easy access kerbs should be used wherever possible. Alternatively, a physical feature to control kerbside parking over a longer length will allow a bus to move partly off the running lane and stop close to the kerbside, offering some opportunity for other vehicles to overtake.

Bus Boarders can be most useful in two main situations:

- Where a car-parking bay has been constructed alongside the main carriageway.
- Where on-street parking prevents access to the kerb, a physical build out may be required so that the bus can access the kerbline while still pulling over from the centre line further than would otherwise be possible.

Where car-parking bays are present along a route a short build out between car parking spaces will be sufficient to allow the bus doorway to stop adjacent to the kerb. A straight kerb length of 3m - 5m is recommended (See Photo 7h and Diagram 7i). Where footway width is very limited, and in order to accommodate waiting passengers, a longer build out minimum 10m - desirable 12m - will permit the installation of a passenger shelter without obstructing the footpath (See Diagram 7j). These dimensions may require to be extended if front entrance/ centre exit buses are reintroduced in Northern Ireland.

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Photo 7h – Bus boarder between parked cars

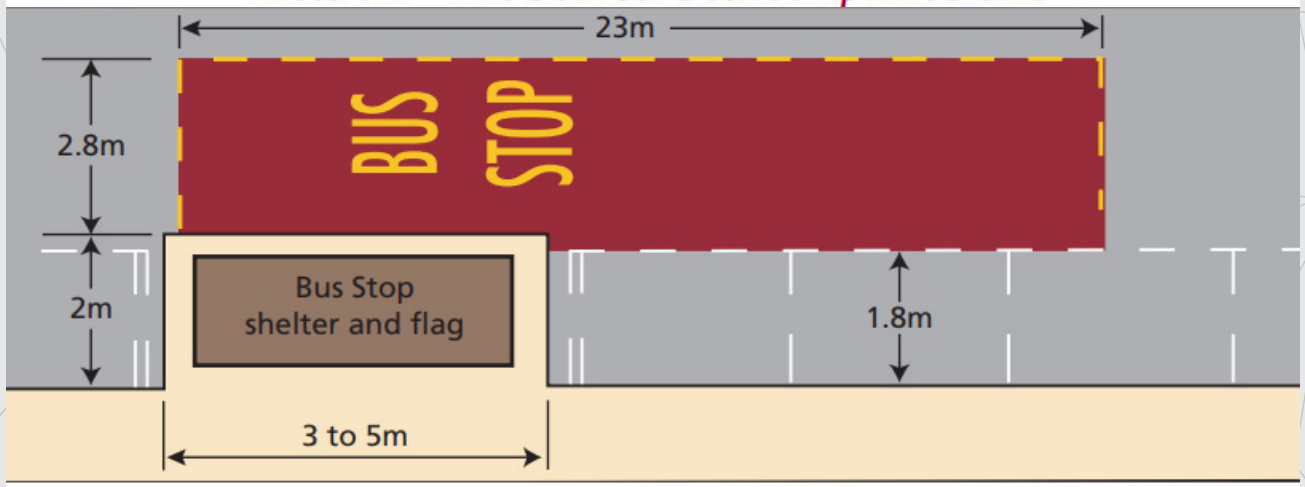

Diagram 7i – Bus boarder between parked cars

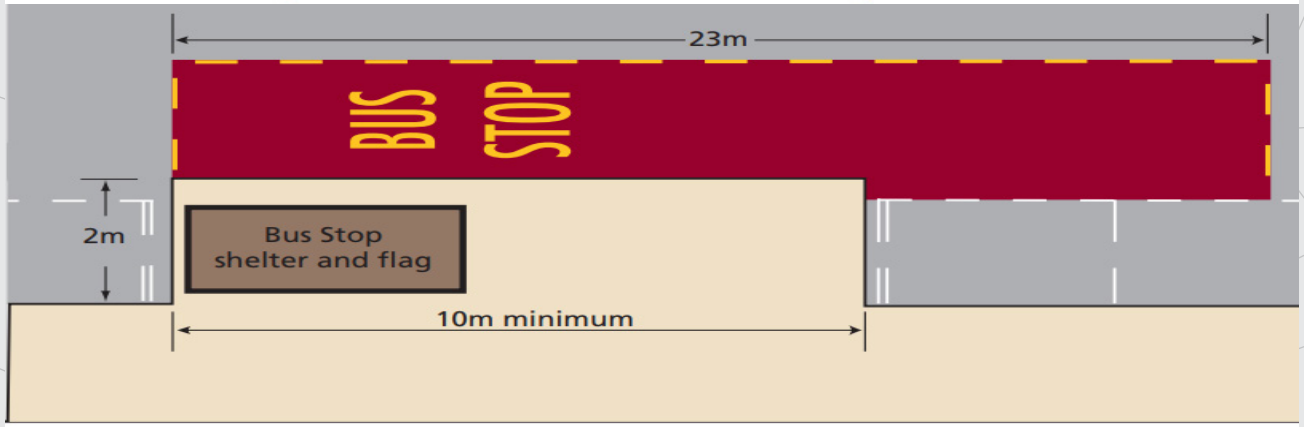

Diagram 7j – Bus boarder with shelter

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Alternatively, where on-street parking is restricting bus access, two types of bus boarder build outs can be considered:

- The full width bus border (approximately 2m deep as in Diagram 7k and Photo 7l); and,
- The half width bus border (approximately 1m deep as in Diagram 7m).

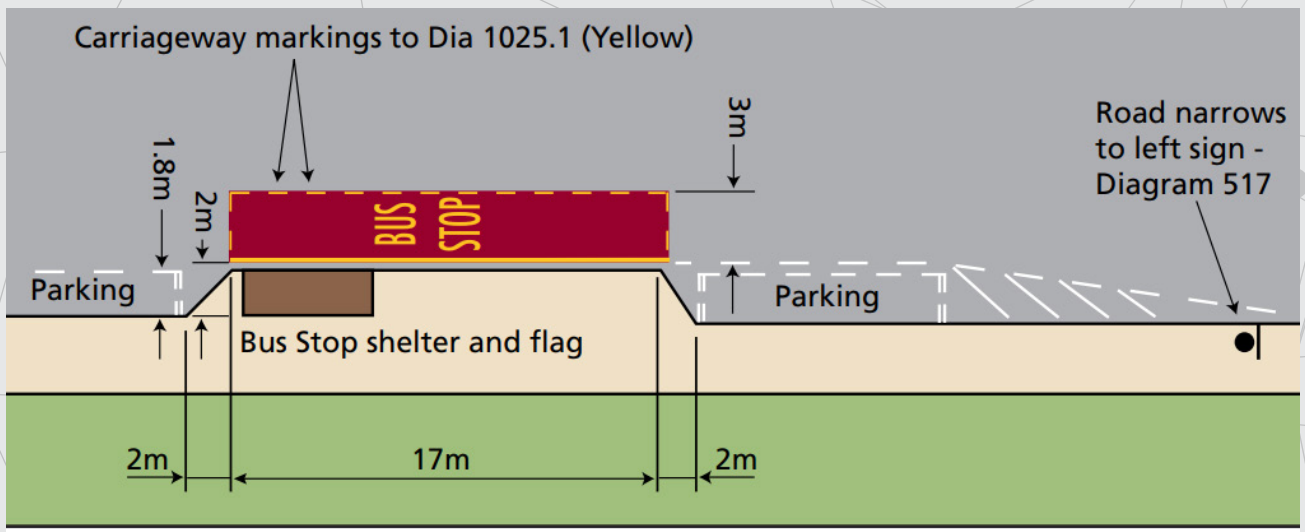

Diagram 7k – Full width bus boarder

Photo 7l – Full width bus boarder

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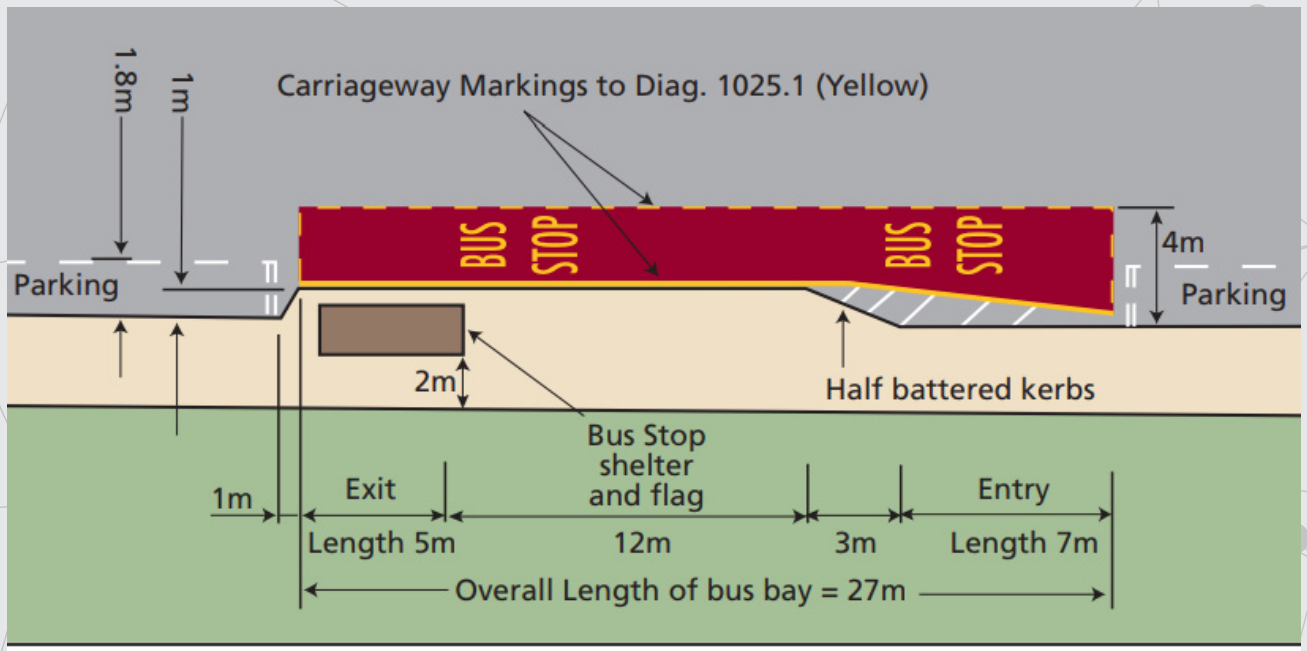

Diagram 7m – Half width bus boarder

Consideration should be given to the safety implications of constructing a bus boarder on free-flowing traffic when there is no parking in the vicinity. It may be necessary to include reflective marker bollards in the design of these bus boarders. In general, such bollards are recommended where the bus boarder projects more than 1m into the carriageway. Reflectorised bollards should be 1.0m high and incorporate a clear colour contrast with the general environment.'Edge of carriageway' and 'hatching' markings may also enhance safety.

Photo 7n – Alternative bus boarder

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It is acknowledged that in urban areas the kerbside must cater for pedestrian crossings, service vehicles and short term parking as well as bus stops and that junction approaches must also be protected to safeguard sightlines.Therefore kerbside space is at a premium and it is important that the kerbside space requirements for bus operation should be kept to a minimum consistent with the achievement of reliable and consistent access to bus transport.

Very often, the bus is physically unable to access the kerb, sometimes because of infrastructure design such as car-parking bays, and due to parked vehicles encroaching upon the bus stop area (See Photo 8a).

Photo 8a – Parked vehicles obstructing bus stop

Difficulties due to inconsiderate parking have often made it impossible for buses to approach the kerb side and bus drivers have over many years, been accustomed to having to stop well out into the carriageway to set down or pick up passengers.

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In addition to the physical measures required to overcome the underlying problem, there is also a major training and attitudinal task required to ensure that bus drivers are convinced of the justification for taking the trouble to ensure good bus to kerb alignment.

Carriageway colouring:

Consideration should be given to applying a contrasting surface colour within bus stop areas at selected stops where the level of parking infringement within the bus bay has proved to be a particular problem.The most suitable and readily available colour is red. Durability, colourfastness and skid resistance of selected materials must be ensured (See Photo 8f).As with the bus bay, enforcement is necessary to ensure that the coloured markings do not fall into disrepute.

Photo 8f – Typical NI carriageway markings

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BUS LAY-BYS:

Bus lay-bys can present inbuilt problems for buses in that:

• Many existing lay-bys are built to dimensions that do not allow buses to stop close to the kerbside and do not accommodate all modern bus types;

• Bus drivers experience delays rejoining the traffic stream from the lay-by and can be reluctant to make proper use of them; and,

• They are often used by motorists seeking a parking space, thereby frustrating proper use by buses.

For these reasons bus lay-bys are generally not recommended for typical urban streets with a 30mph (or less) speed limit. Different considerations apply to trunk roads and rural areas where higher traffic speed makes it desirable to move the bus out of the main traffic stream in the interests of road safety. Bus lay-bys may also be justified at stops where buses may be stationary for longer than usual, such as terminal points for the bus service or for specific journeys e.g. routes accommodating schools.

The standard dimensions for bus lay-bys are shown in Diagram 8g.Where kerbside length is constrained, an alternative layout is given in Diagram 8h. However, this lay-out requires substantially more verge/footway depth to provide and is only designed to accommodate buses up to a maximum length of 11m whereas modern buses have a maximum permissible length of 12m.

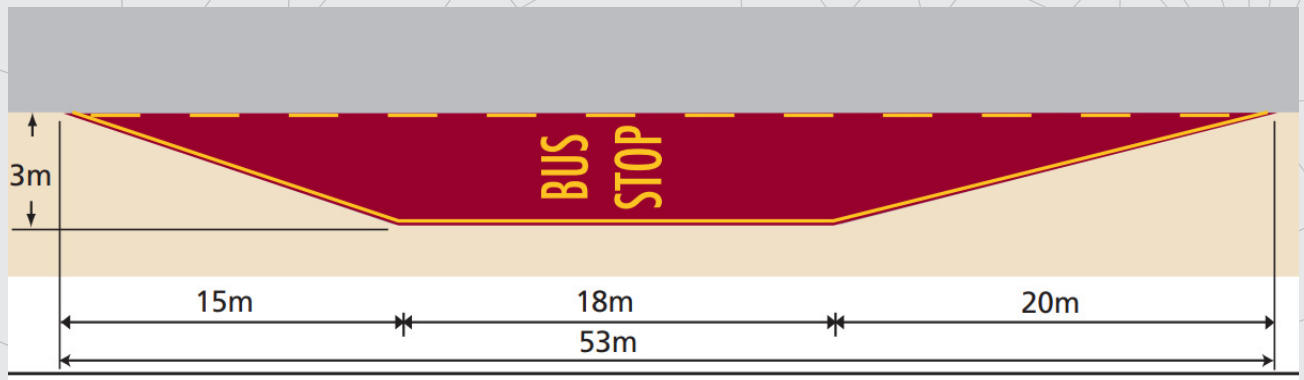

Diagram 8g – Standard layout of bus lay-by

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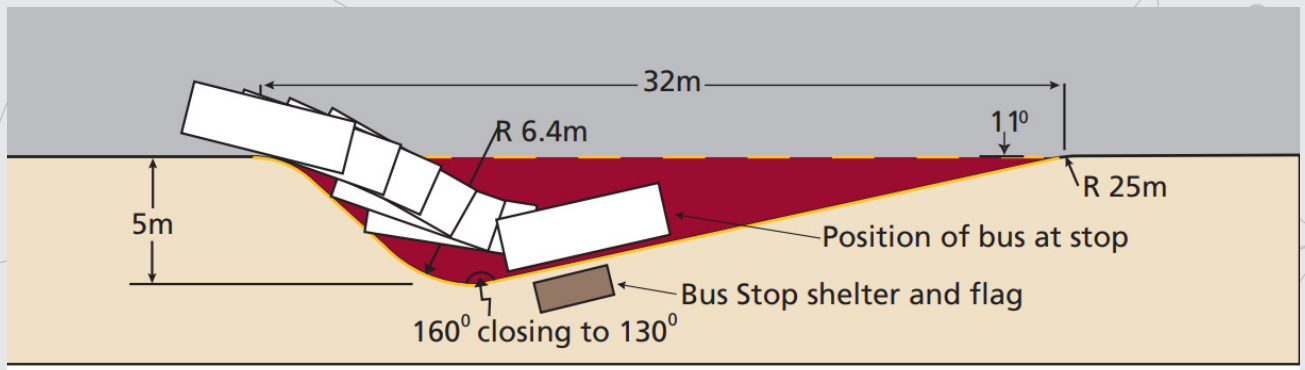

Diagram 8h– Saw tooth bus lay-by

Diagram 8j shows a modification to a standard bus bay which reduces the amount of footway/verge required by allowing the marked bay to encroach into the carriageway. This extension to the length of the parallel kerbface provides a beneficial increase in the stopping area and helps the driver to properly align the bus. Designers will need to consider the implications of a stopped bus encroaching into the inside lane of the carriageway.

Photo 8k - Typical lay-by – Toome Bypass

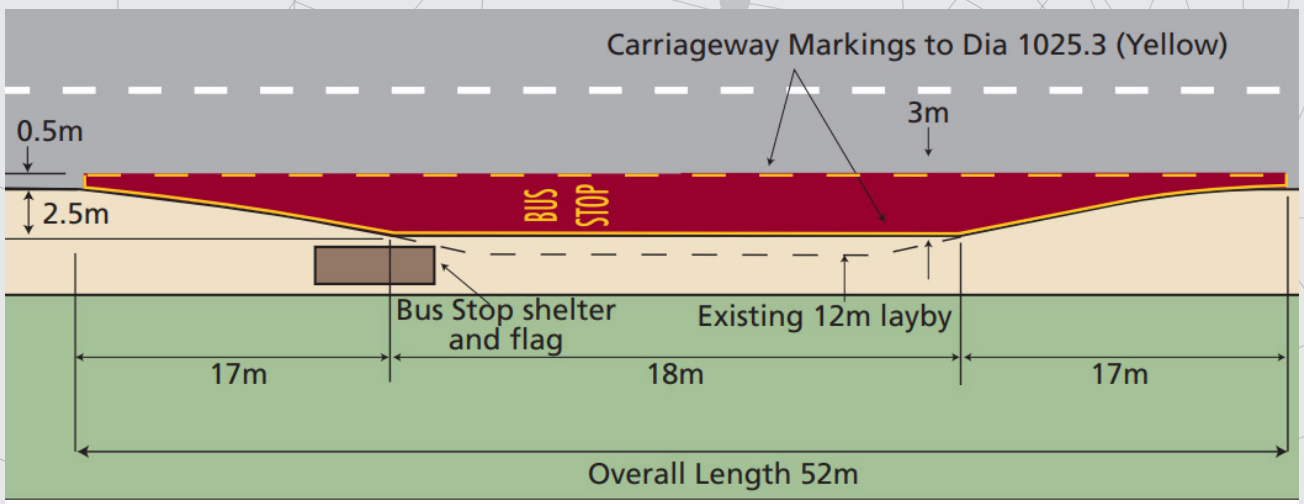

Diagram 8j – Modified layout

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'The Location and Layout of Lay-bys' from the Design Manual for Roads and Bridges, gives details for the provision of bus lay-bys on roads where traffic speeds are high. Figure 1a – Geometric Layout of Lay-bys (re-produced below as Diagram 8l) shows the required layout of a bus lay-by on a dual carriageway.

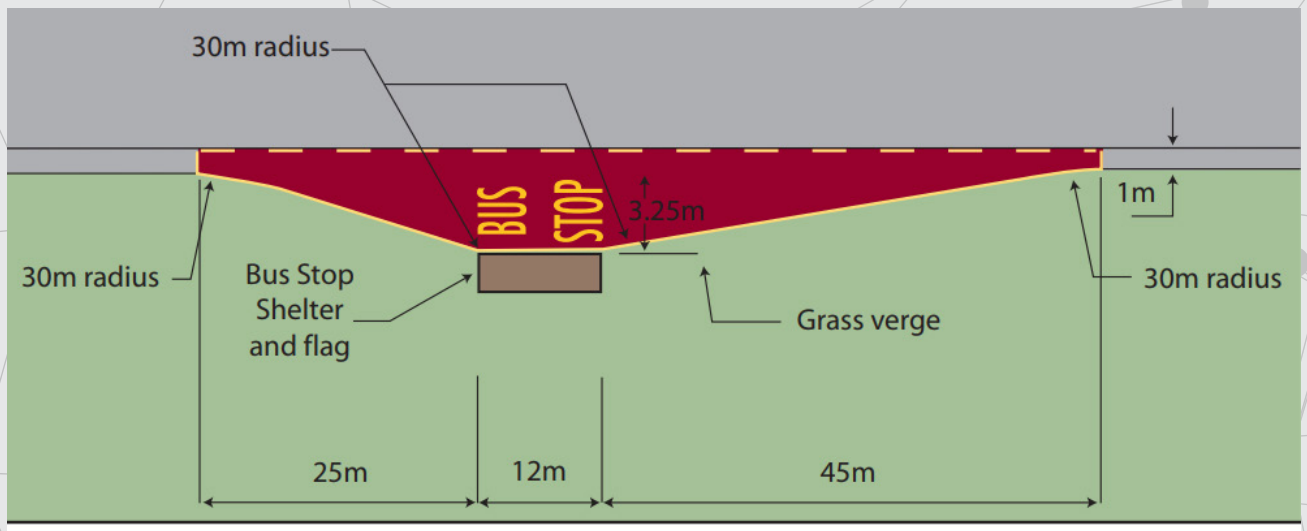

Diagram 8l – Typical bus stop layout dimensions for high-speed road

BUS BAYS:

The permitted width of a bus bay is fixed at 3.0m.The permitted length will vary according to the specific requirements found at the proposed bus stop site.

The minimum permitted length of a bus bay should be 19m (see Diagram 8m). However, this should only be used:

- Where no parking is allowed on either side of the road;
- On an all day bus lane;
- On local distributor roads in new developments where parking is unlikely; or,
- Where the stop is deemed to be low-usage.

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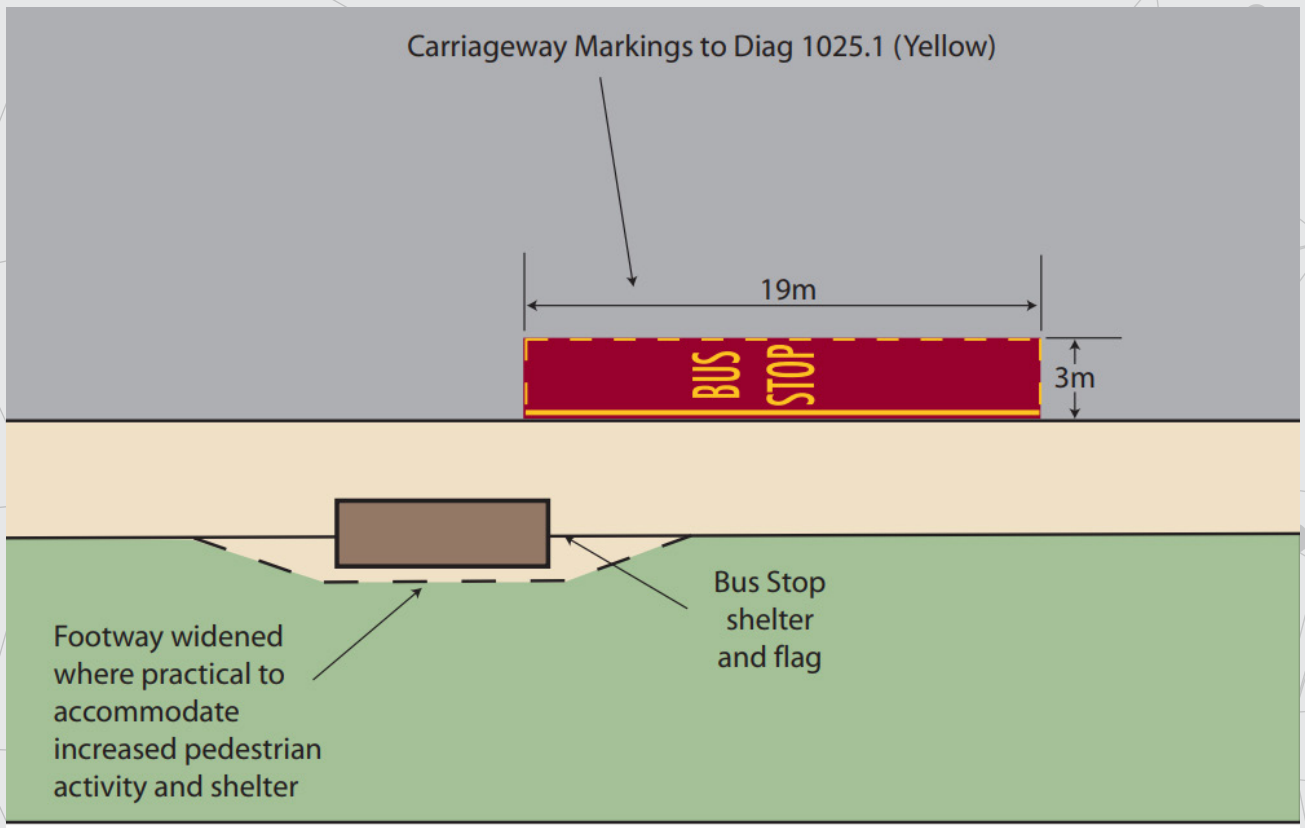

Diagram 8m – Low-usage kerbside bus stop

In a mid-block situation, that is away from junctions and traffic signals, and where parking is permitted, the minimum requirement for the length of a bus bay is 37m which comprises of 13m clearance for entry, 15m for stopping and 9m for exit (see Diagram 8n).

The length of kerb reservation required may be reduced by placing the bus stop close to a junction (See Diagram 8o), thereby using the width of the junction to keep the entry clear. Similarly, a bus stop immediately following a pedestrian crossing, will allow the 'zigzag' marking to keep the entry clear (See Diagram 8p).

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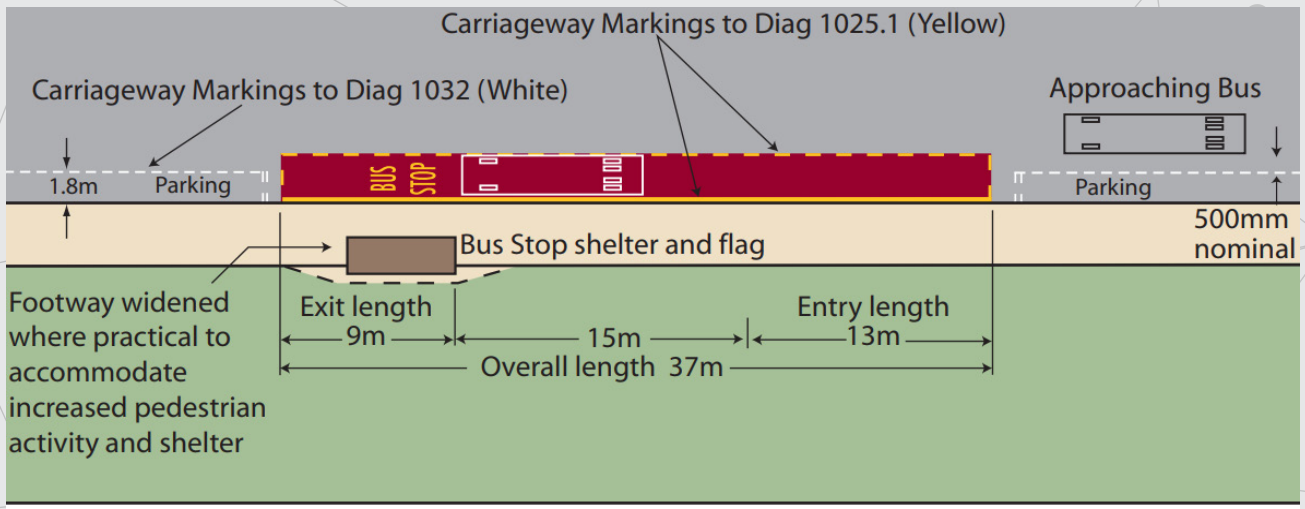

Diagram 8n – Standard mid-block kerbside bus stop

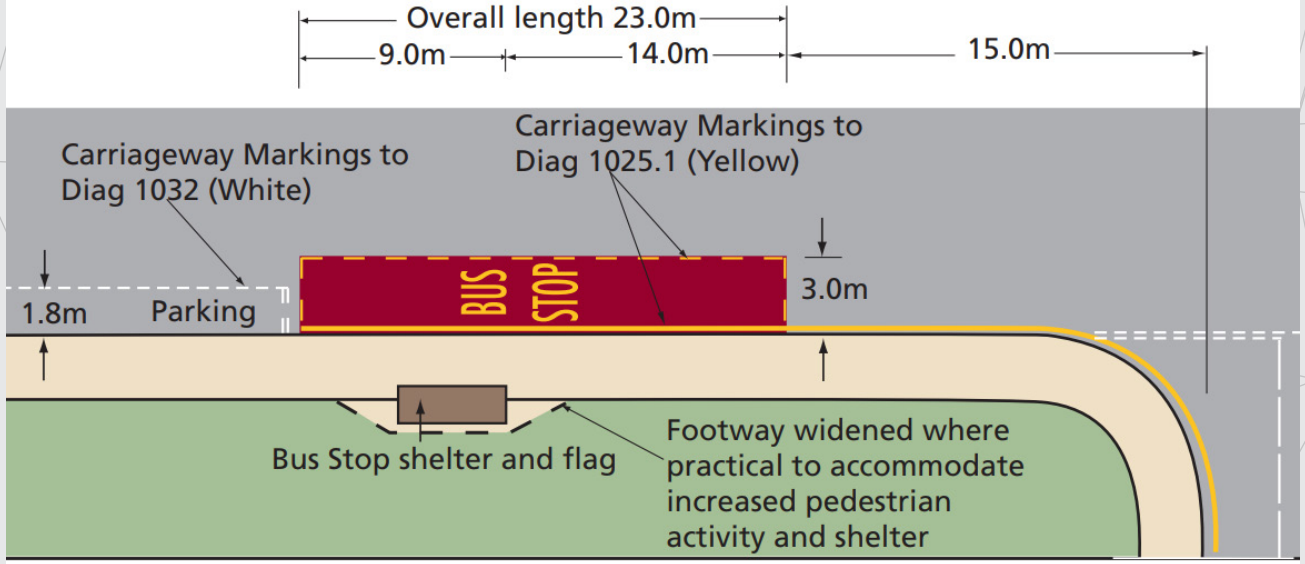

Diagram 8o– Kerbside stop on exit side of junction

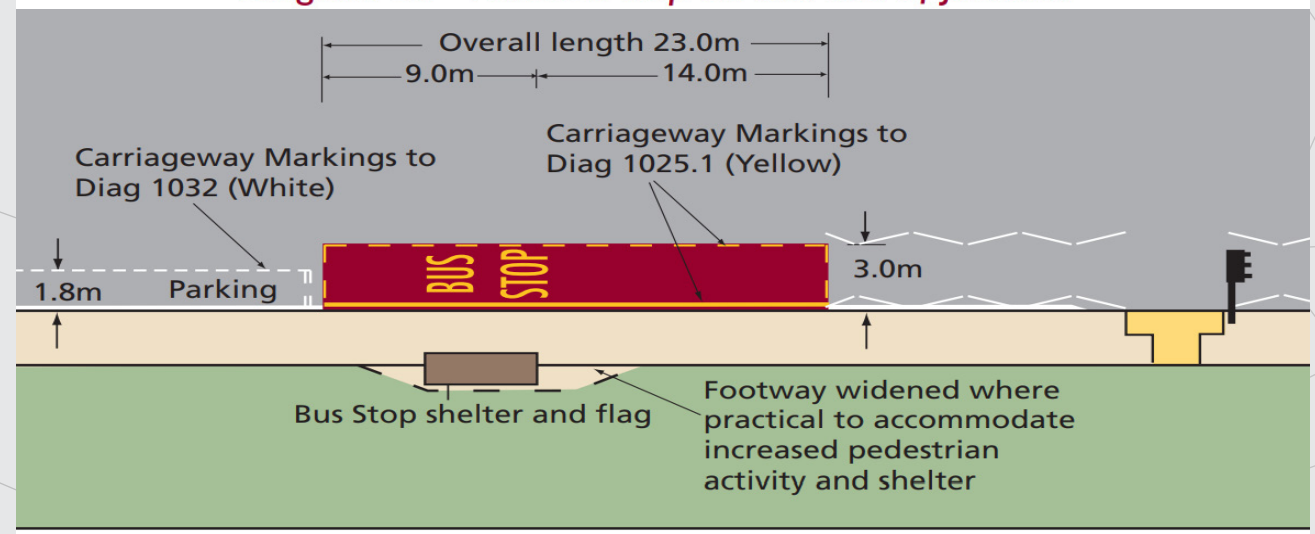

Diagram 8p– Kerbside stop on exit of pedestrian crossing

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A combination arrangement will be appropriate where the bay is extended for use for other purposes e.g. as a parking bay or left turning lane (See Diagram 8q).

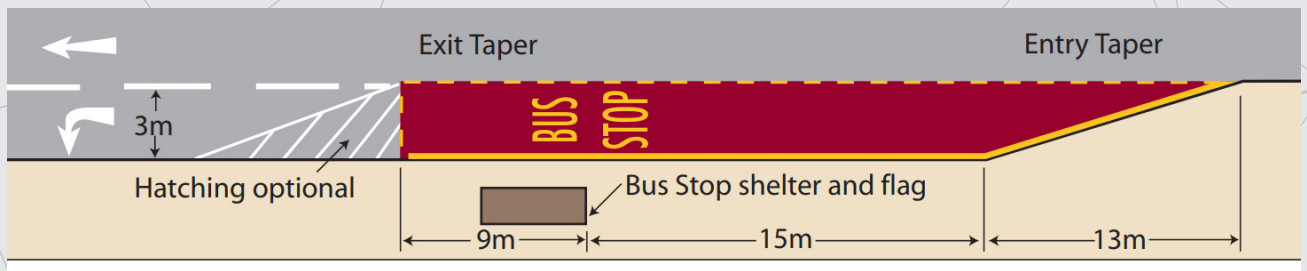

Diagram 8q – Combination bus bay

A variation of this concept will allow one bus stop to be located in a lay-by, while another can make effective use of the build out that exists.The stop in the lay-by may be used for urbantype services, for setting down and picking up, while the stop on the build-out might be reserved for express or longer distance services. In this way, minimum disruption is caused to traffic flow, (See Diagram 8r).This design may be particularly appropriate where the running lane is a peak hour bus lane.

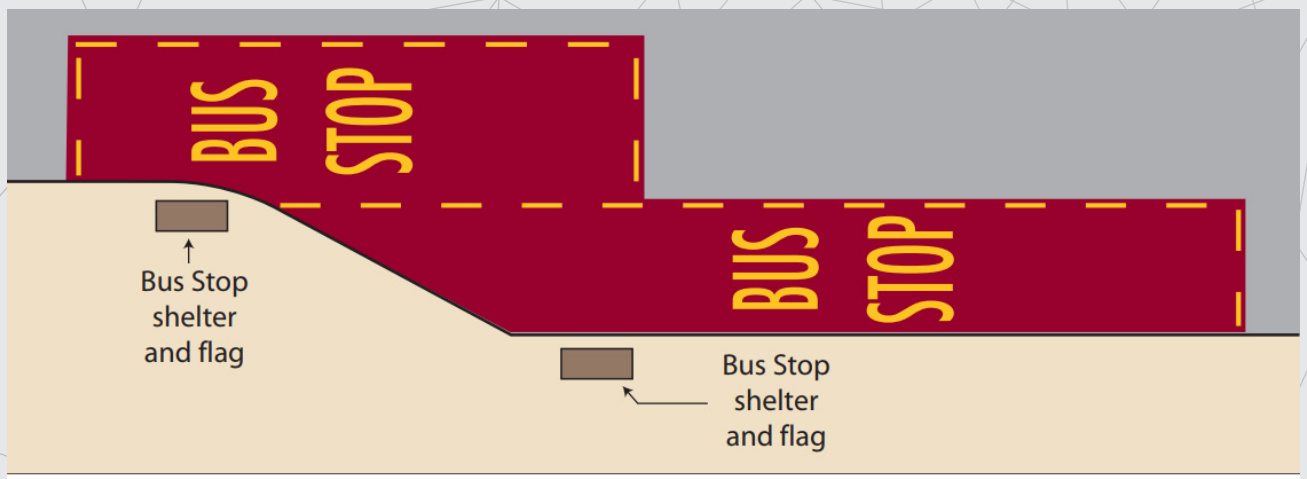

Diagram 8r – Extended markings

Where a bus stop is provided on a major road constructed with hard shoulders, bus bays should be laid on the hard shoulder, replicating in marking material the shape and dimensions of a bus stop lay-by.Added emphasis can be made by hatching the shoulder

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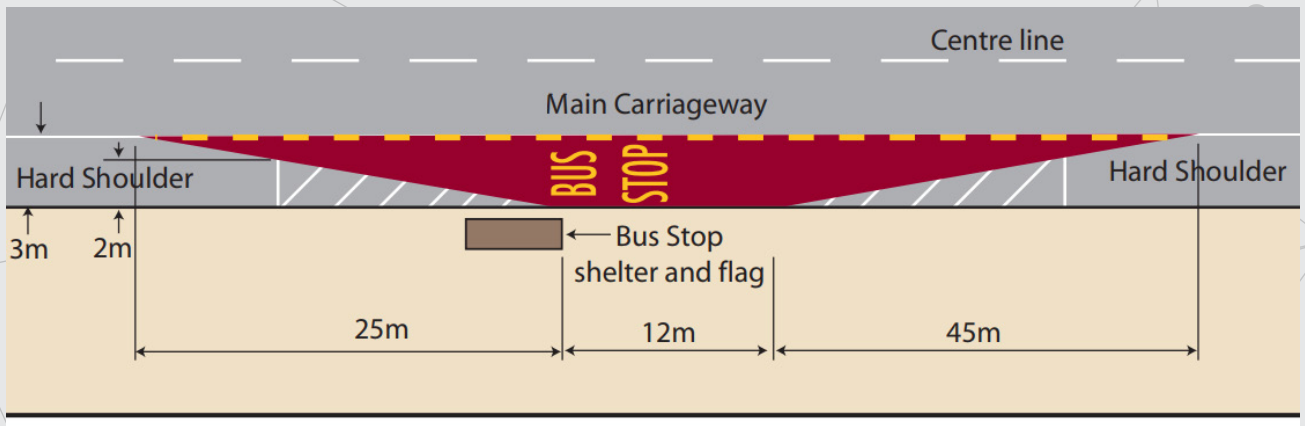

Diagram 8s - Bus bay on hard shoulder

Provision of a bus bay with the carriageway markings specified above makes it an offence for any other vehicle to stop within the marked area. It should be emphasised to enforcement agencies that this is for safety and convenience of passengers and no exceptions (e.g. for goods vehicles) are permitted.

Where two or more bus stops are provided in adjacent positions to allow segregation of boarding for buses on different services or routes the carriageway markings may be extended in length. Sufficient space must be allowed for the entry and exit of successive buses (See Diagram 8t).The kerbside line, if appropriate, should be extended between the stops and additional hatching may also be added to define the entry/exit length.

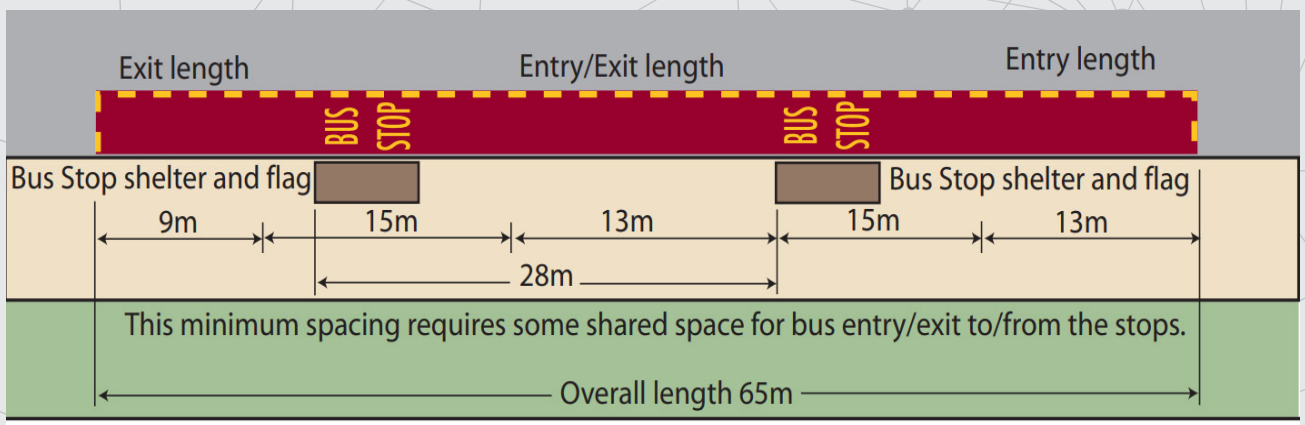

Diagram 8t – Extended markings for double bus stop

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It may be that, subject to adequate enforcement, in the long term every bus stop should be protected by carriageway markings prohibiting stopping by other vehicles. In the short term, priority should be given to bus stops which are frequently obstructed, such as locations with commercial frontages, certain residential areas with restricted off street parking and locations around the circumference of parking control zones. It must be a consideration in locating such markings that enforcement is necessary, as experience has shown that a lack of enforcement can bring all such bus bays into disrepute.

Summary of dtimension:

Bus stop walking distances:

Maximum distance to stop 400m*

Average walking distance from majority of dwellings 200m*

Maximum distance for elderly and mobility impaired 100m*

* = With gradients – reduce distances by 10m for every 1m rise or fall

Bus stop spacing:

General spacing between stops 250 – 300m

Bus stop separation:

Minimum separation between opposite stops (tail to tail distance) 36m

Bus stop signs:

Minimum height to bottom of sign 2.5m

Minimum sign width 450mm

Minimum sign height 620mm

Maximum sign height 780mm

Minimum area of sign that requires TAS check 0.3m2

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Display panels:

Distance above ground level Between 0.9 and 1.8m

Maximum height above ground level 1.9m (1.7m average)

Shelters:

Minimum width of footway past shelter 1.8m

Minimum clearance between shelter and kerb 0.5m

Depth of tonally contrasting visibility band 140 - 160mm

Height of contrasting band above ground level 1.5m

Minimum dimensions for cantilever style shelter 1.5 x 4.0m

Minimum dimensions for enclosed shelter 2.0 x 4.0m

Height of 'perch' rail above ground level 700mm

Height of seats above ground level 450mm

Height of arm rests above seat level 200mm

Footways and hard standings:

Standard kerb height 125mm

Easy access kerb height 160mm

Length of easy access kerbing at lightly used stops 4m

Length of easy access kerbing at standard single stop 8m

Length of easy access kerbing at double stop 16m

Length of easy access kerbing at double stop used by articulated buses 28m

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Bus boarders:

Minimum length of boarder 3 - 5m

Minimum length of boarder where footway width is limited 10m

Desirable length of boarder where footway is limited 12m

Width of full width boarder 2m

Width of half width boarder 1m

Height of reflectorised bollards 1m

Bus LAY-BYS:

Entry taper to lay-by 1 in 5

Exit taper from lay-by 1 in 4

Overall length of standard bus lay-by 53m

Length of entry taper to standard bus lay-by 20m

Length of exit taper from standard bus lay-by 15m

Bus BAYS:

Permitted width 3m

Minimum permitted length 19m

Length of standard 'mid-block' bus bay 37m

Length of bus bay on exit side of junction 23m

Minimum distance between bus bay and junction 15m

Length of bus bay on exit side of pedestrian crossing 23m

Length of bus bay for double bus stop 65m

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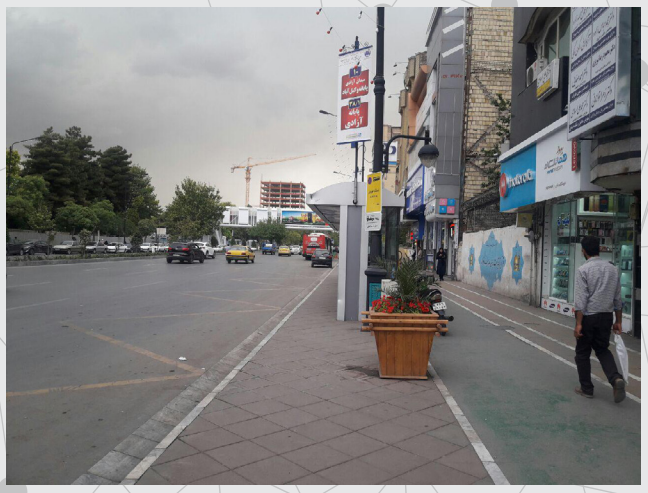
Eighthsection:The main idea,Process, and Formation of the project

Current status of stations:

As we analayzed the station in the before parts, the bus stations of Mashhad is composed : the main structure that we can see with the black color and tow composite aluminum layer on the structure with color of gray and dark gray and simple glass without nothing the sun's protector, two wood benches and a home LCD that not suitable for the station and in pavement without sign for disable people.

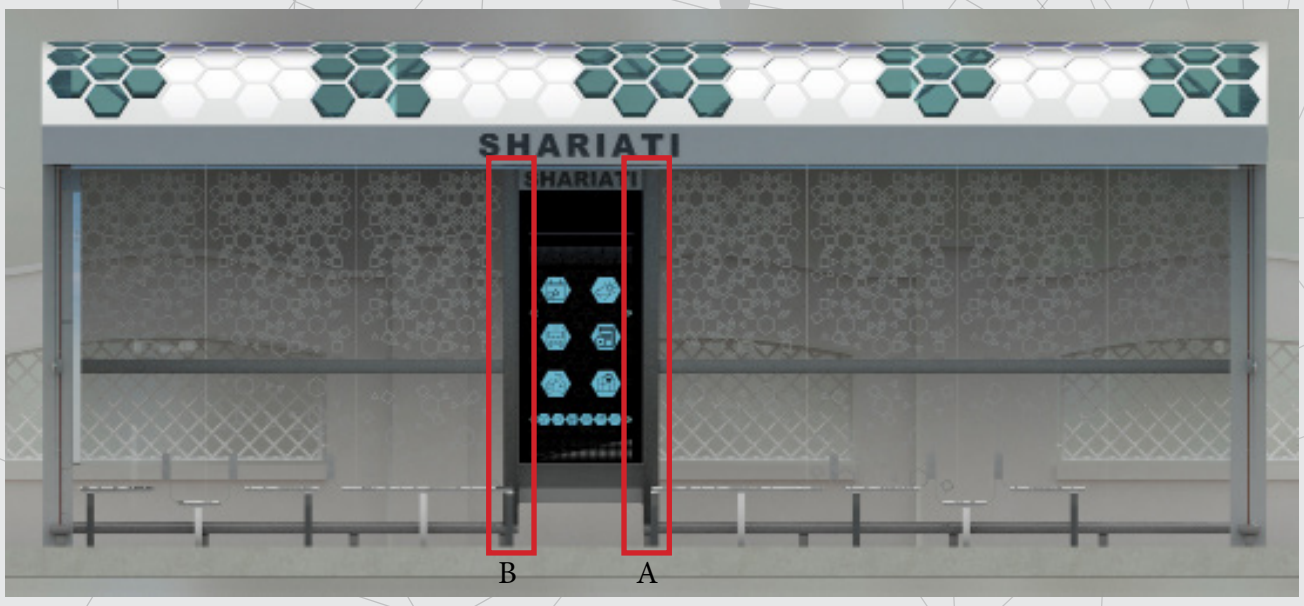


Ninth section: The main idea, Process, and Formation of the project

Changes in the structure, facilities and equipments:

Changes in the structure:

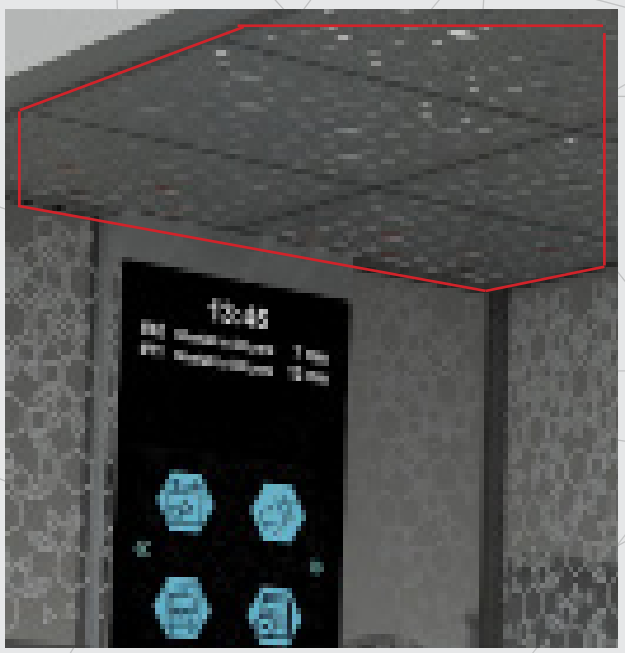
In this project added a vertical iron profile to the current structure to protecting the middle touch-screen.

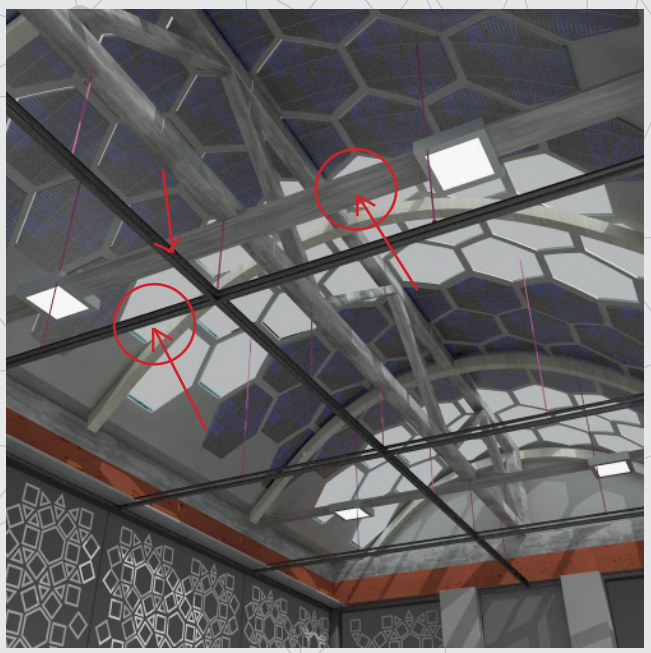


Ninth section: The main idea, Process, and Formation of the project

Changes in the structure:

in the part of the roof, the protector of tiles has been removed and I design a new protector with two rows and with new panels with a slamic patterns that they have been pierced for passing sun light in the day and in the nights that they have been hidden in the back part of tiles. and I removed the current light and put them on the plate in the back side of title for The Prevent Vandalism and to give a soft light in the night to bus stop.





Ninth section: The main idea, Process, and Formation of the project

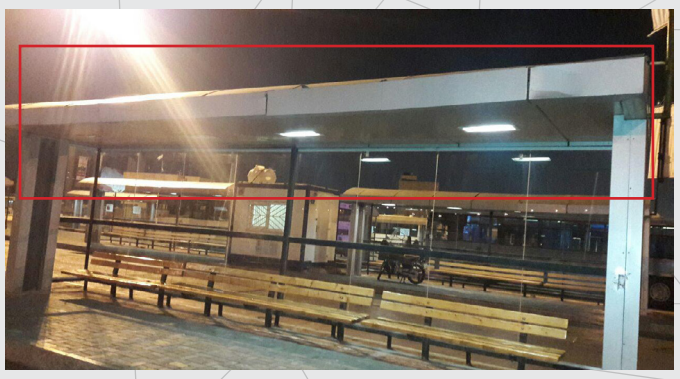
Changes in the equipments:

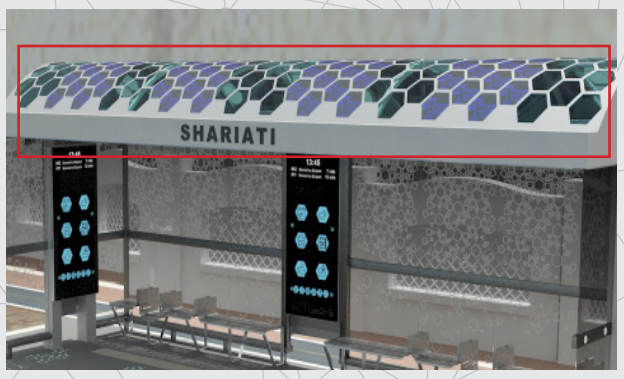
- Touchscreen

in part of the equipment, I removed the current LCD and I designed two big touch screens that it includes two part: arrival time and information for users.

- Photovoltaic panel

I put the 4 hexagonal photovoltaic panels on the curve part of the second roof due to provide electrical energy from the sun to make a sustainable bus stop without the need for urban electricity.



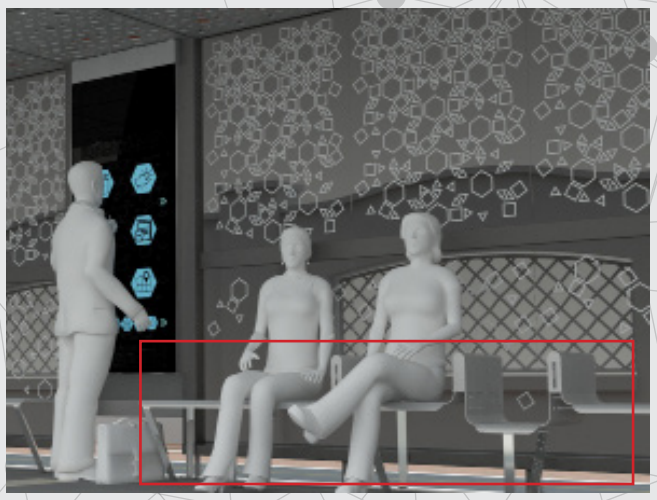


Ninth section: The main idea, Process, and Formation of the project

Changes in the equipments:

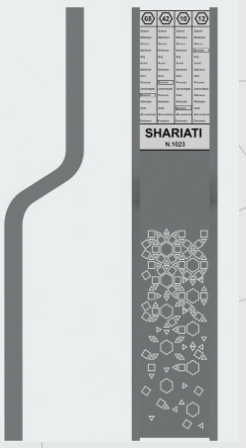
- Benches

I removed all of benches and design two new metal benches from aluminum and steel with capacity of 5 persons,4 adult person and one child and with ability to charge cellphone for 4 users at the same time.



- Pole

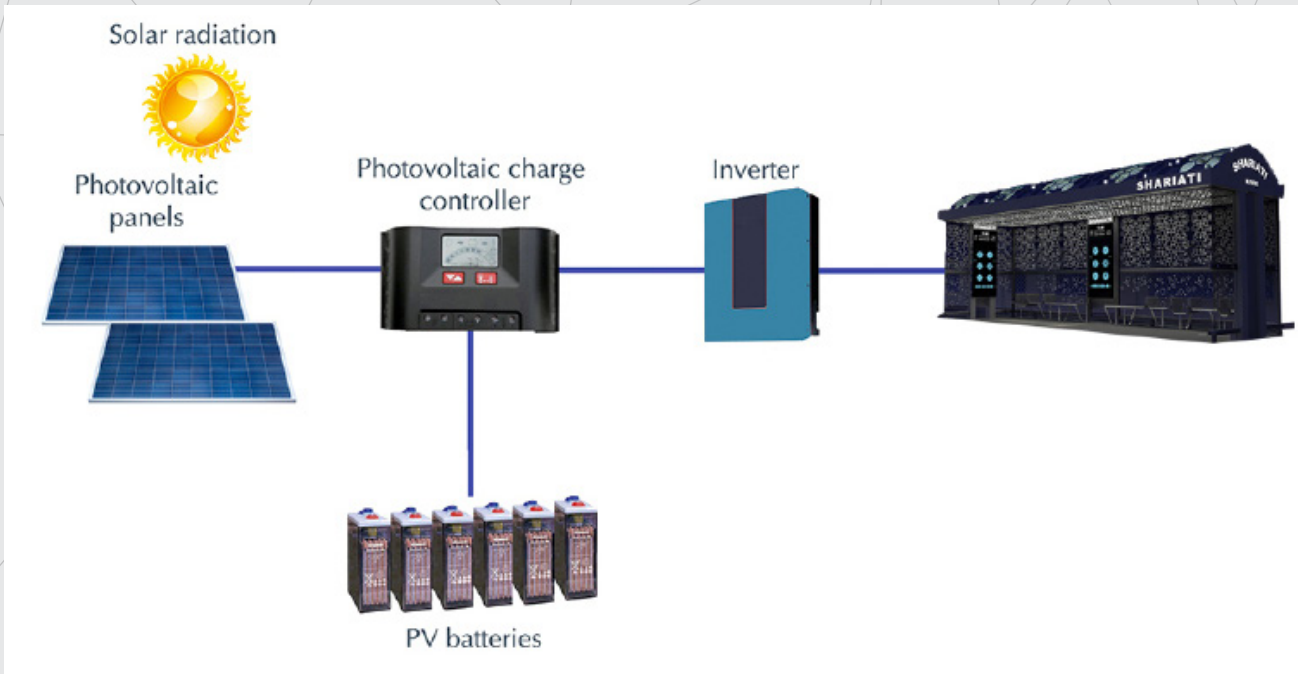
I removed the current pole and designed new pole with an attractive form and ability to see in the night with the backlight in the part of the information and soft light the part of transparent glass to give beauty and use Islamic pattern on its glass to join more pole and the bus stop together.

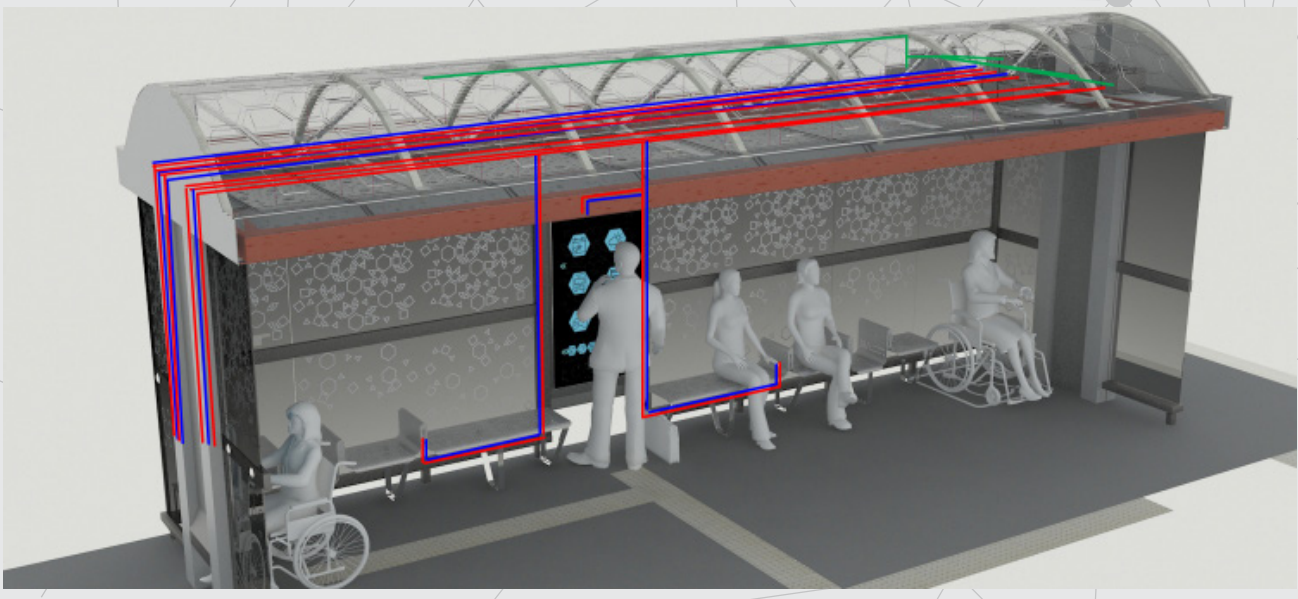


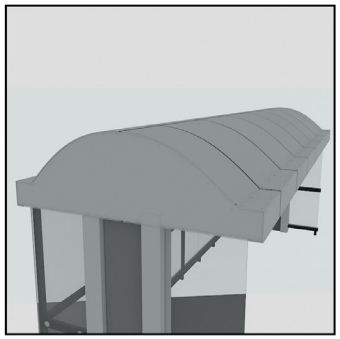
Ninth section: The main idea, Process, and Formation of the project

Electrical part of project:

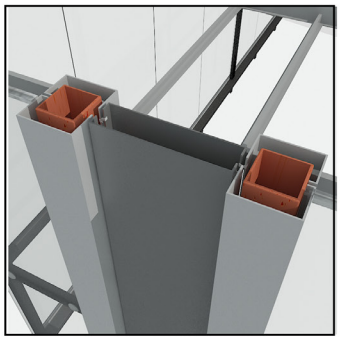
in this render, I show how to supply the energy of touchscreen and outlet from photovoltaic panels. photovoltaic panel attracts the sunlight and change it to electricity and it goes to charge controller that this adjusts the voltage and output current from the panel to the battery and protects the battery from overcharging and discharging, which increases battery life and then some part of energy that bus stop need goes to invertor to converts DC electricity generated by solar panels into AC power consumption of AC loads and then goes to bus stop for consuming and some part goes to batteries for storing.



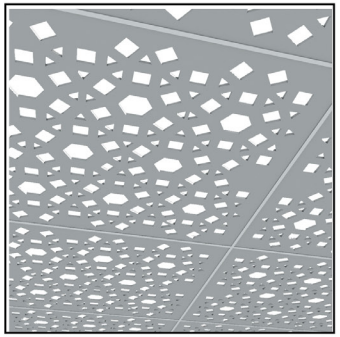




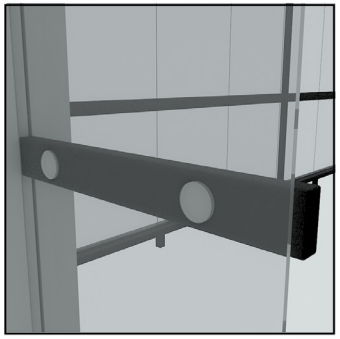
1-Shell of shelter
Material:
aluminium
Finishing:
color coating
Trasformation:
bending,folding,cut
Junction:
Riveting



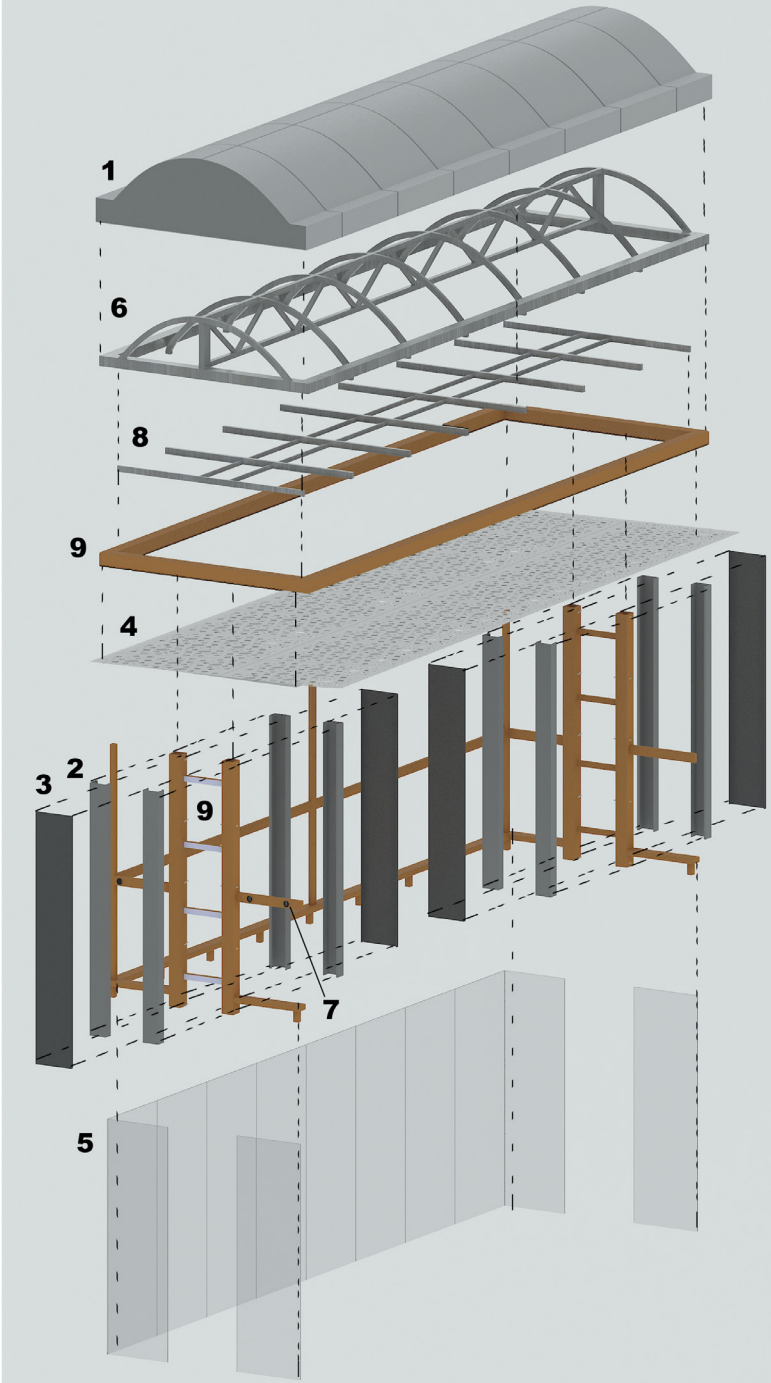
2,3-Shell of columns
Material:
aluminium
Finishing:
color coating
Trasformation:
folding,cut
Junction:
Riveting,Screw



4-Roof
Material:
aluminium
Finishing:
color coating
Trasformation:
cut
Junction:
Riveting

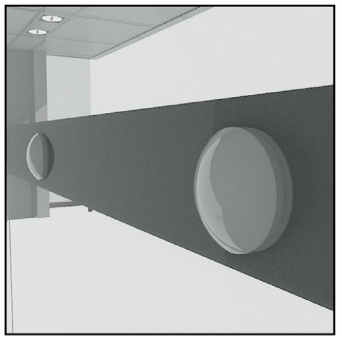


5-Shell of body
Material:
Tempered glass
Finishing:
light gray color
Trasformation:
Glass Clamps
junction:
Screw, aluminum frame

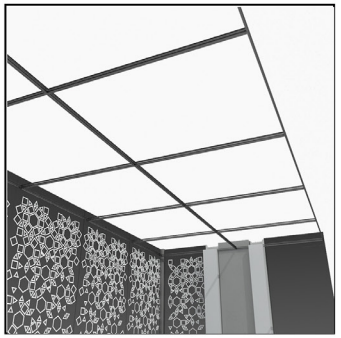


6-Structure of shelter
Material:
aluminum
Finishing:
color coating
Trasformation:
bending,folding,cut
junction:
welding

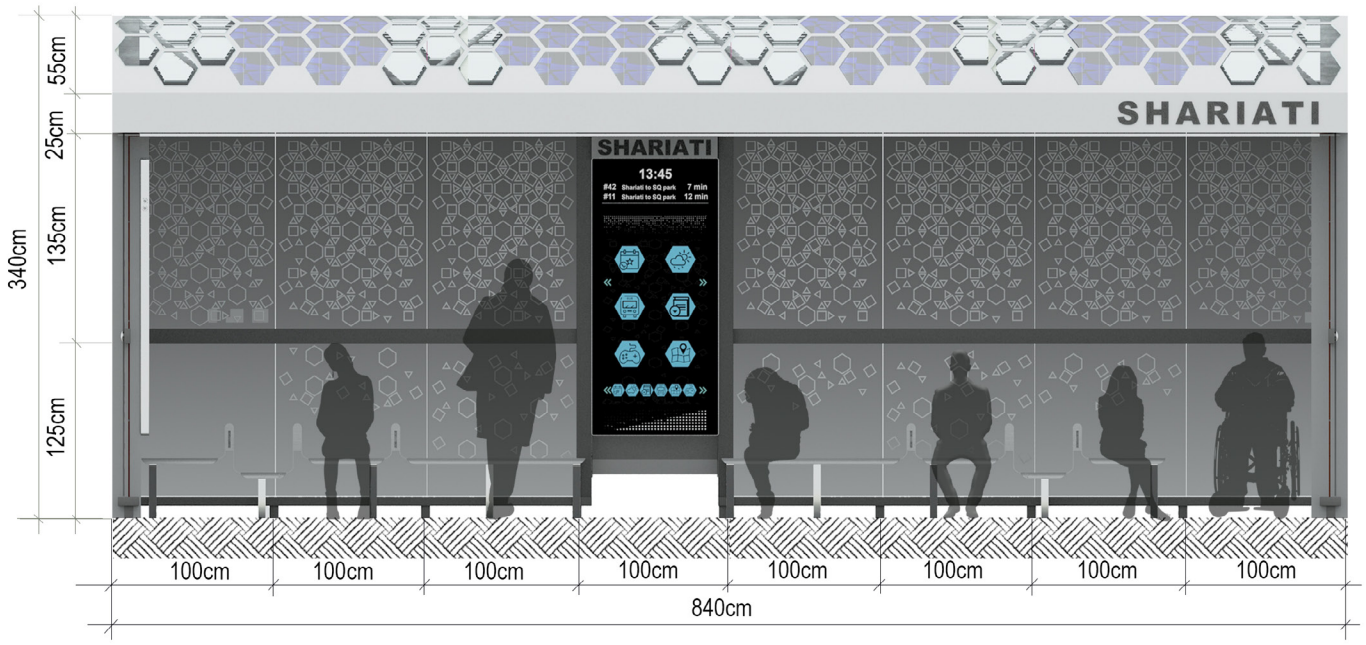
7-Glass Clamps
Material:
steel
Finishing:
stainless steel
Trasformation:
ready from market
junction:
bolts



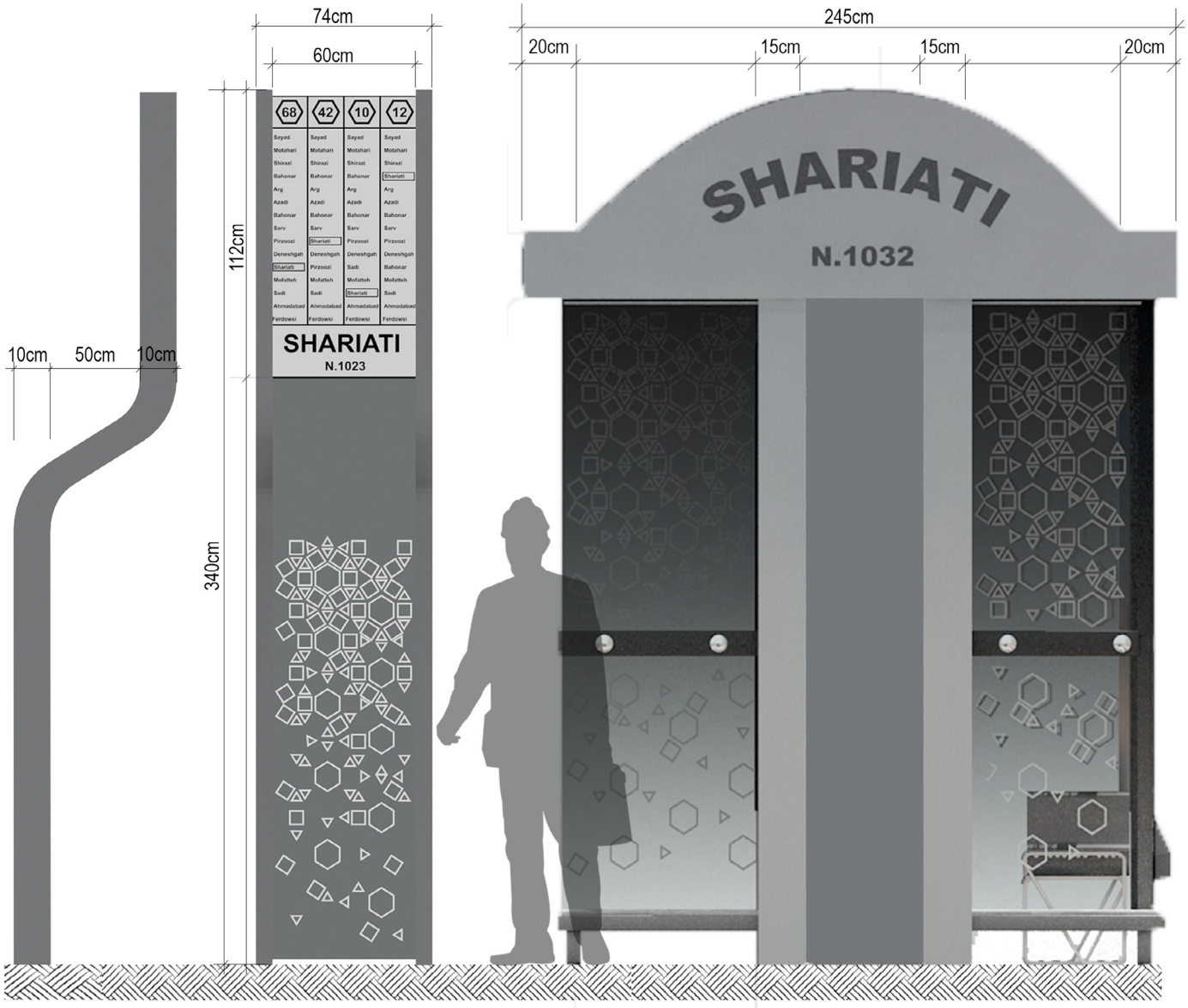
8-supporter of roof
Material:
aluminium
Finishing:
color coating
Trasformation:
cut,folding
junction:
welding,Riveting



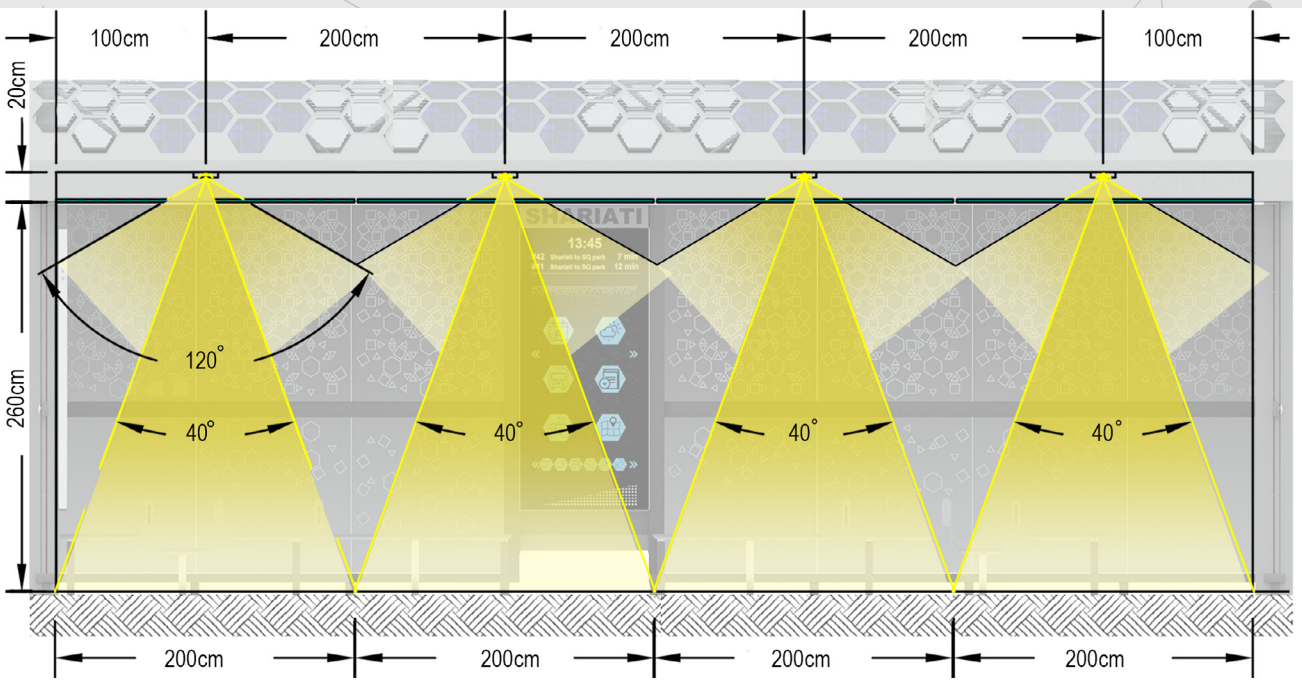
9-Main structure
Material:
iron
Finishing:
color coating
Trasformation:
cut, folding
junction:
welding



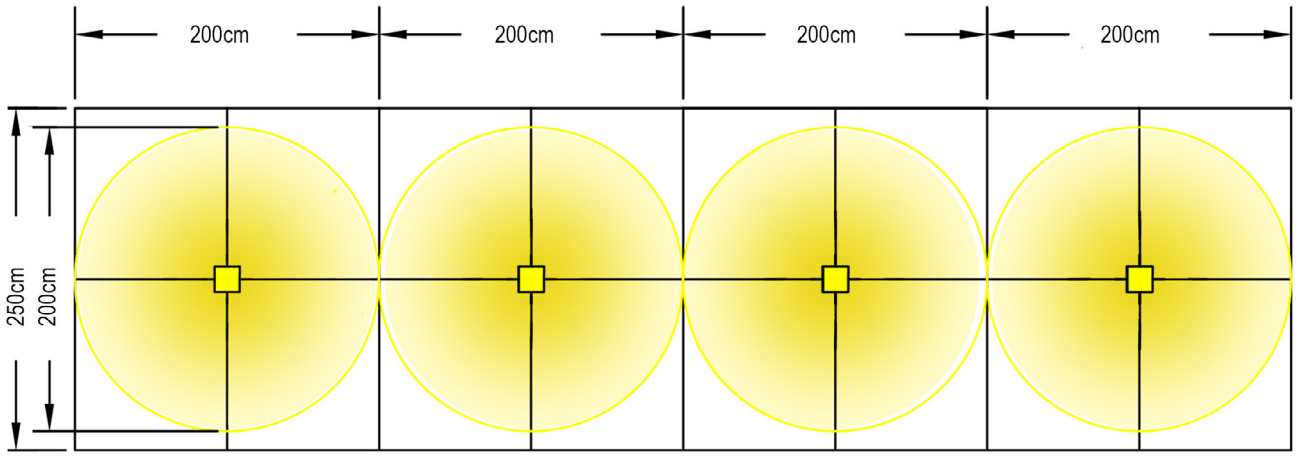
Front Elevation



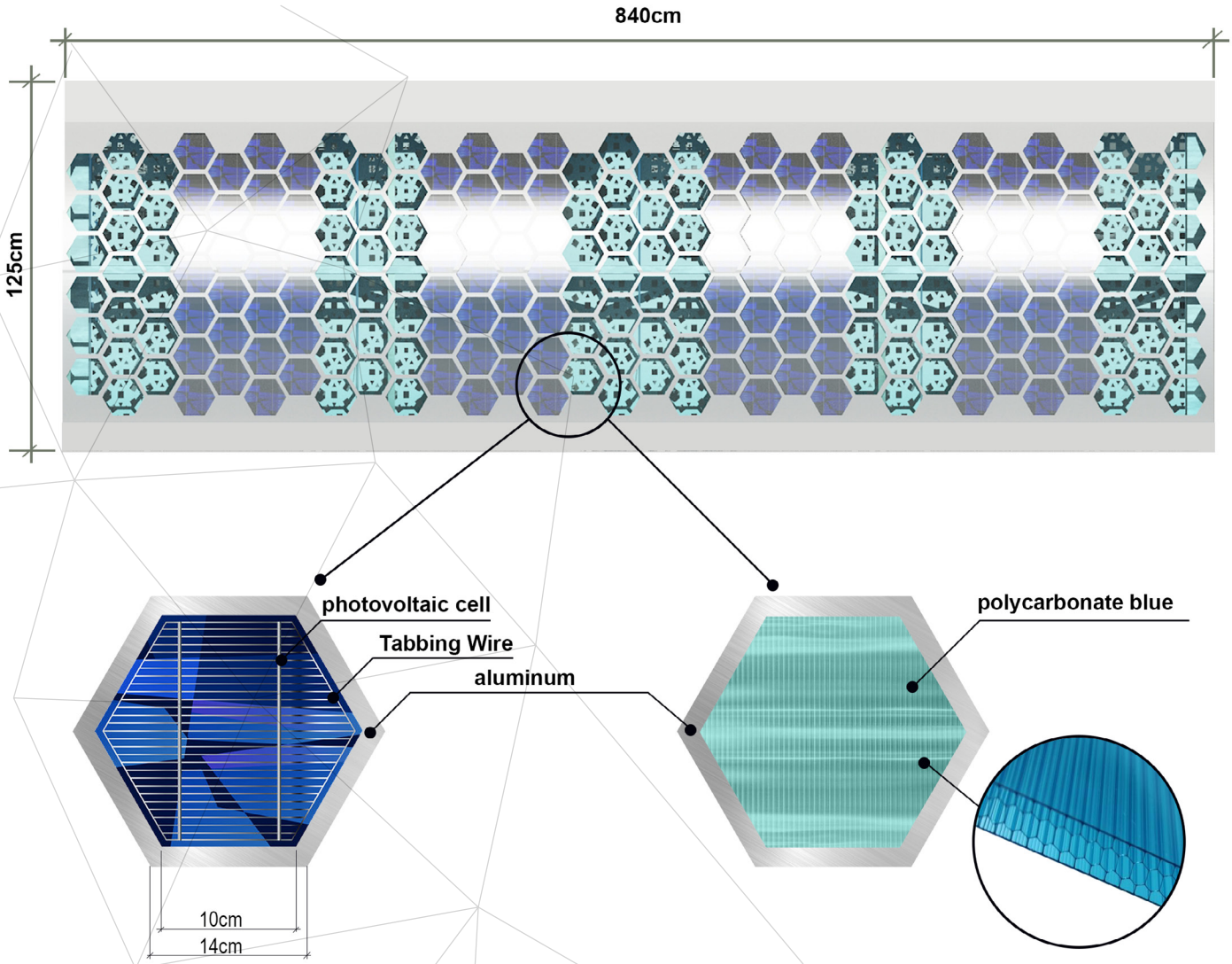
Left Elevation **Front Elevation** **Left Elevation**



Front Elevation



Plan



the main objevtives of choosing photovoltaic panel for this project are reduce pollution in city, using a sustainble energy and no need to take electericity from urban electricity.

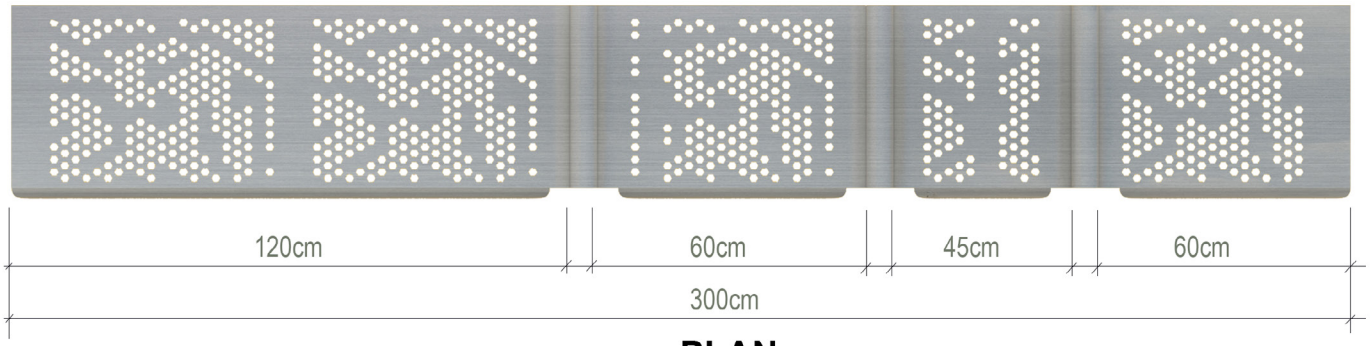
according to components that I designed in the bus stop and calculations I choose 4 panels with the power of 330W it panels includes 26 Hexagonal cells that each cell provides around 12.5 W. so total power will be 1320W.

according the iranian's historical plan that is used a lot in ancinet houses' window decorative i use the form of Hexagonal for cells.

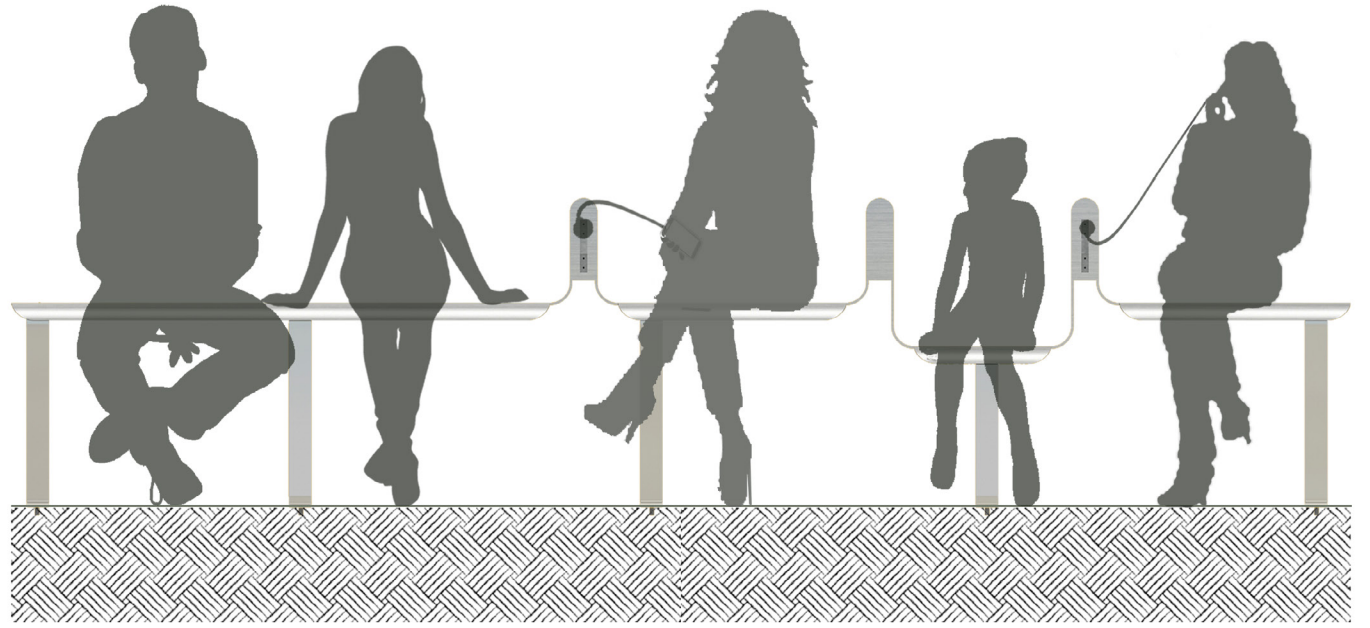
The main aims of choosing Polycarbonate material for the roof are the ability to pass the daylight and create a color shadow in the pavement of bus stop that its idea is taken from Iranian' traditional architecture and the lightness of the material and low cost of this material are another reasons that I chose this material.

the color of polycarbonate is light blue that is one of important color in Iranian architecture

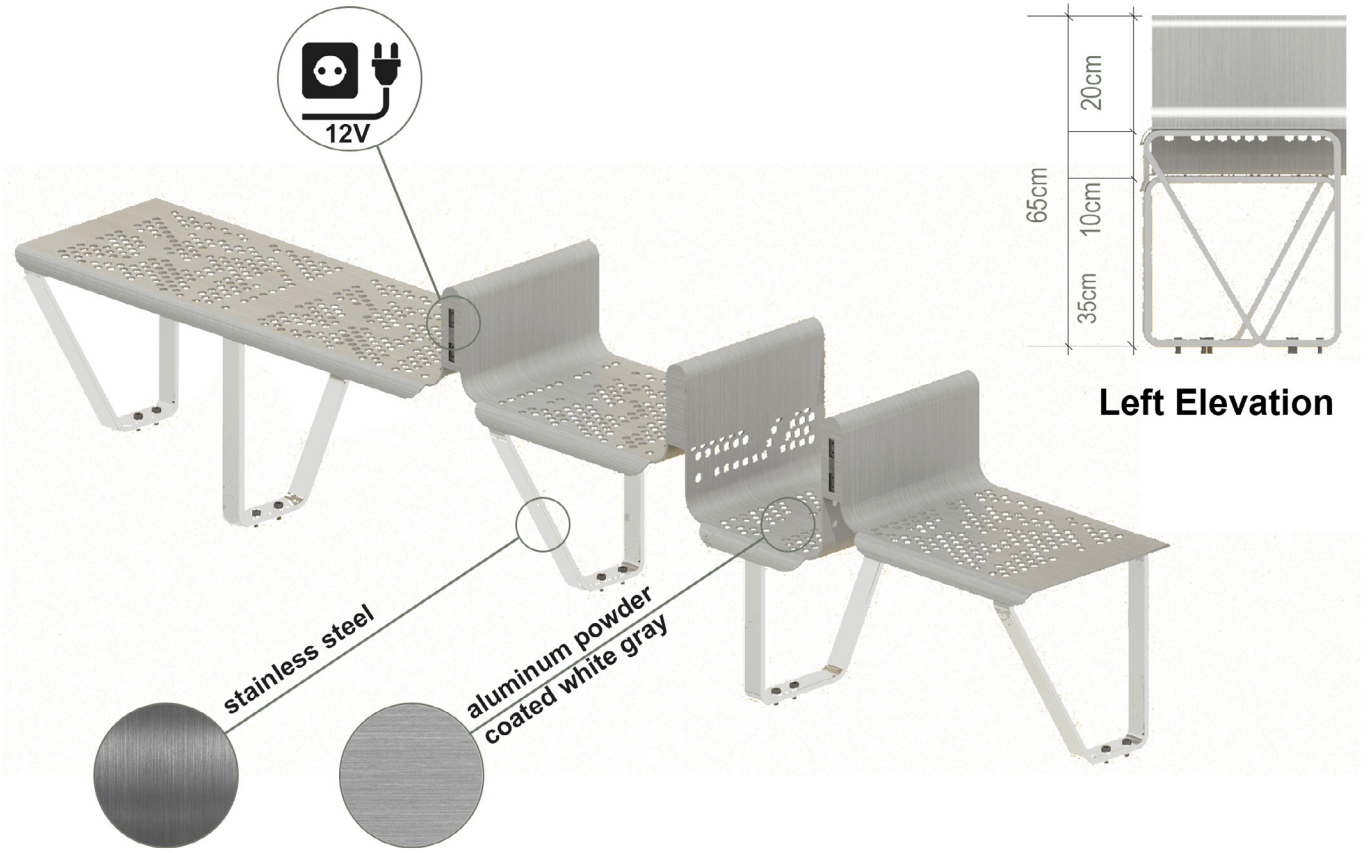
according to Hexagonal cell and give a beauty to roof I design the shape of polycarbonates ecaxtly like Hexagonal cell.



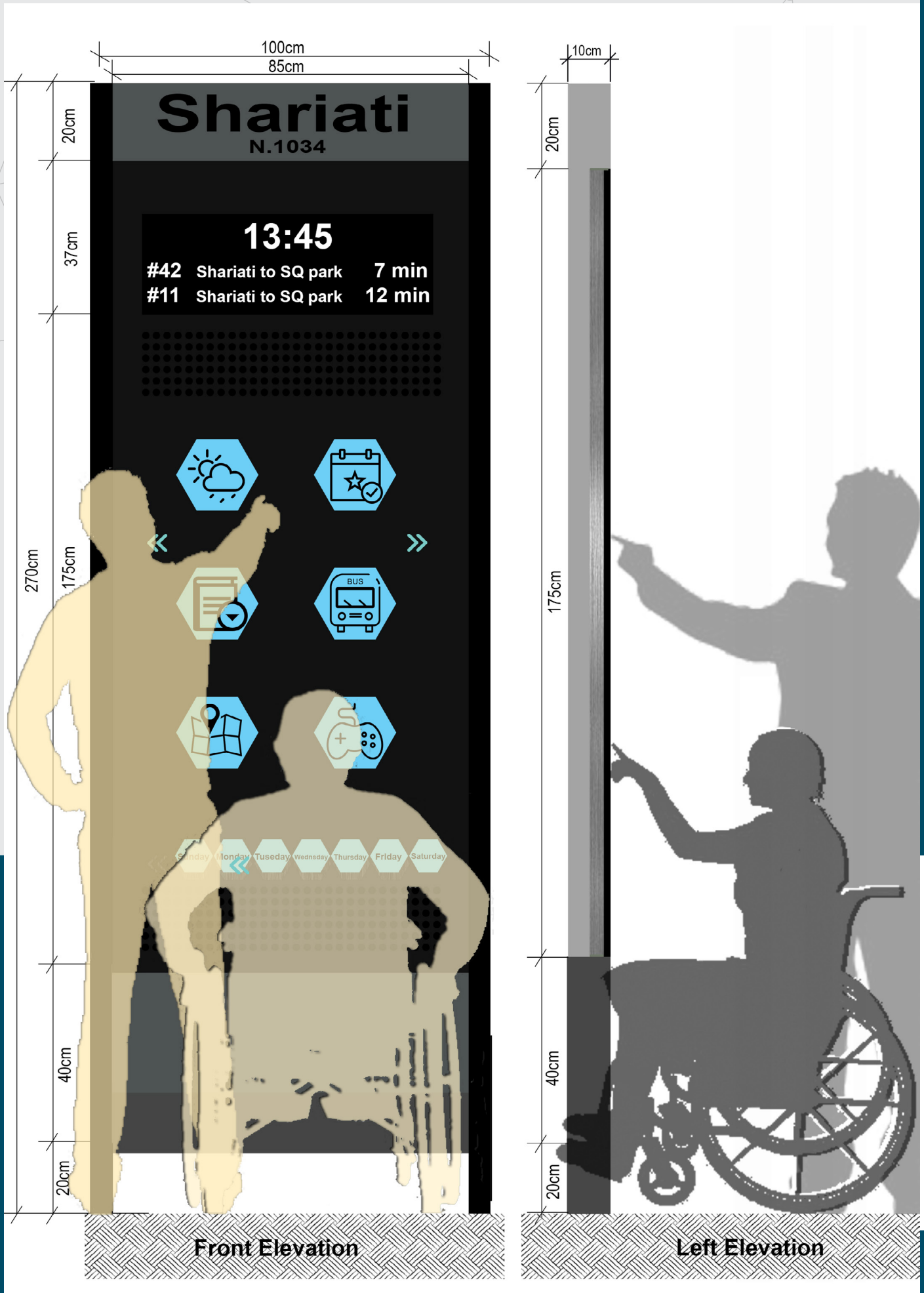
PLAN

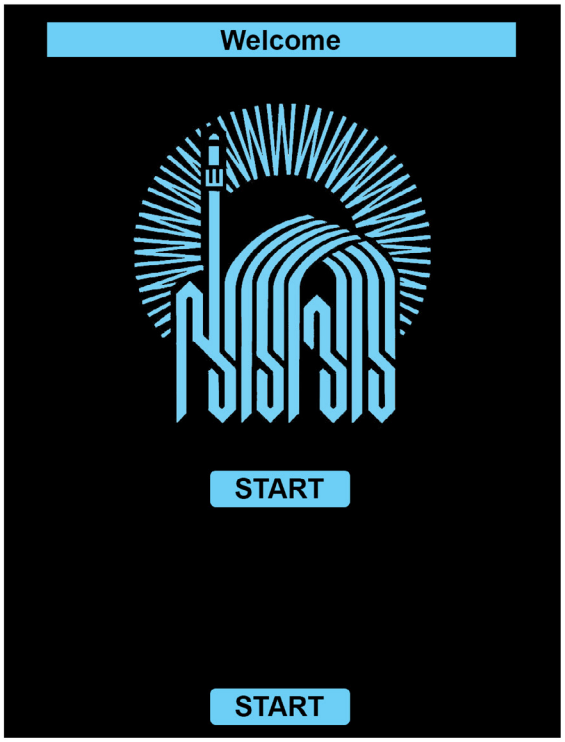


Front Elevation



Left Elevation

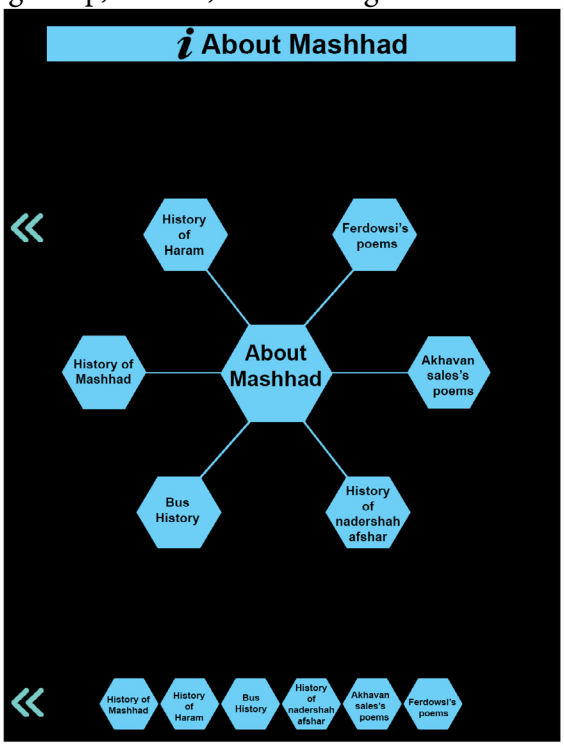

100cm
85cm
Shariati
N.1034
13:45
#42 Shariati to SQ park 7 min
#11 Shariati to SQ park 12 min
BUS
Sunday
Monday
Tuseday
Wednsday
Thursday
Friday
Saturday
270cm
20cm
37cm
175cm
40cm
20cm
Front Elevation
10cm
20cm
175cm
40cm
20cm
Left Elevation



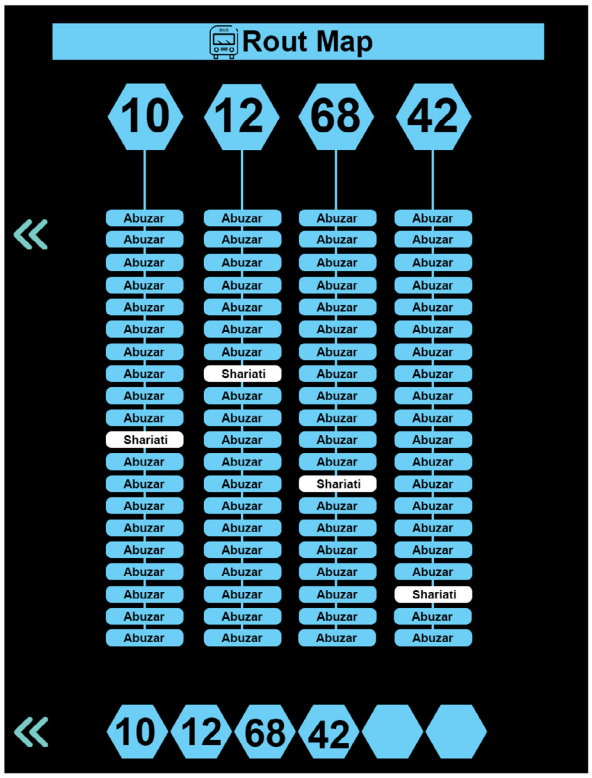
It is the first page of touch screen. when a passsenger want to access to items, she or he has to select on the START. the icone is the symbole of Mashhad that it is taken from Holy shrine of Imam Reza.

After selecting on the start this page will appear and this page includes 8 items: Nearby me,information, Transportation, route map,attractions,-googlemap,weather, and mini-games.

In this part, users can observe all of the information about the weather forecast of one week and temperature. users can choose each day of the week with the down tab.

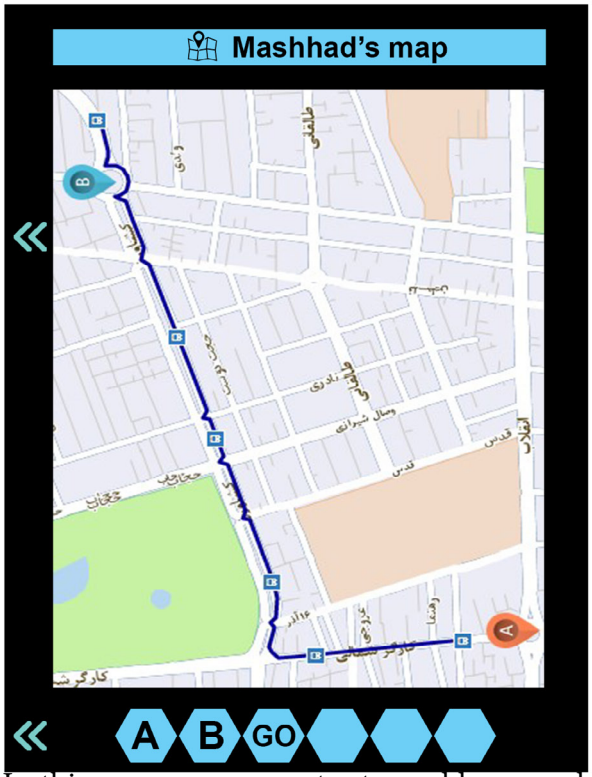


In this page users or passengers can earn a breif information about history of mashhad,history of Great luminaries in Khorasan like Ferdowsi and to parts to read some part of him poems.

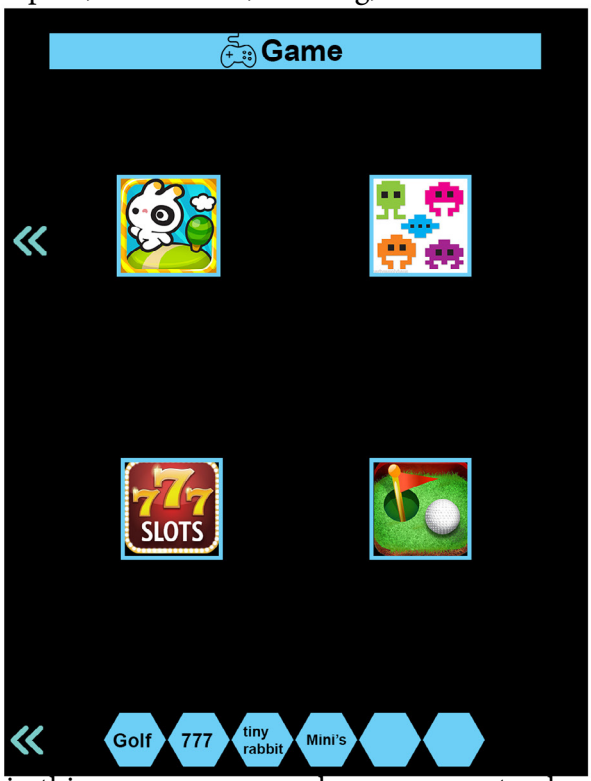


In this page, users can found all of stop of each line with selecting on the numbers and the name of the current bus stop is defined by white color.

In this page users can search about 4 items such as : Historical places, parks, promenades in around the city and entertainment places in city or around it like pool,Water Parks,Laser tag, Paintball.

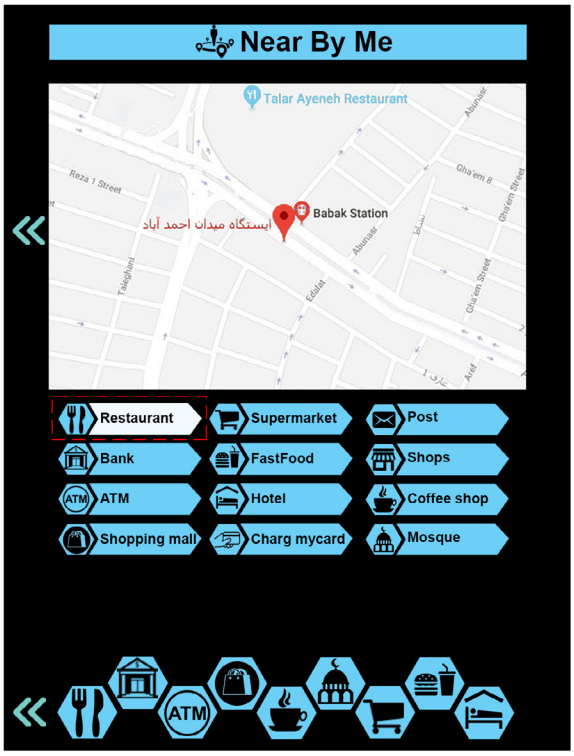


In this page user can enter two addrress and scelet the GO to get way of bus from point A to B.



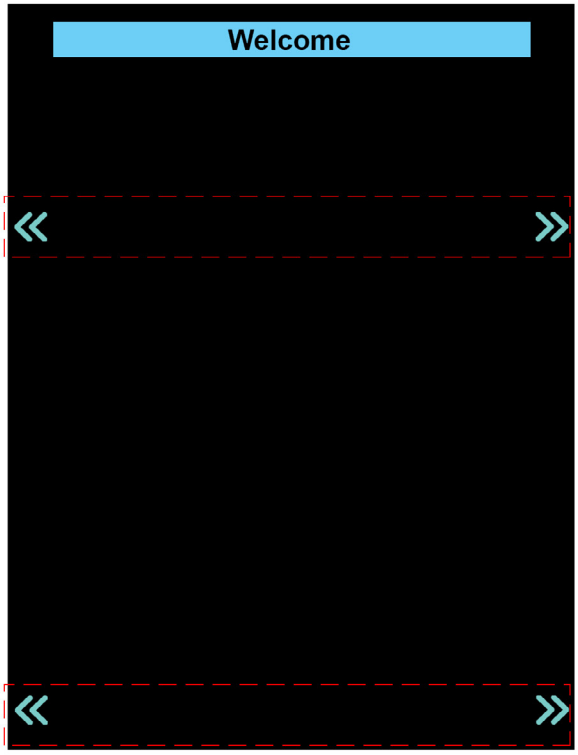
in this page passengers choose a game to play for passing time to arrive bus.

In this page, users can find different routes to arrive 4 maintain destination in the city such as: airport, train station, bus stations to another city and the paths of metro.



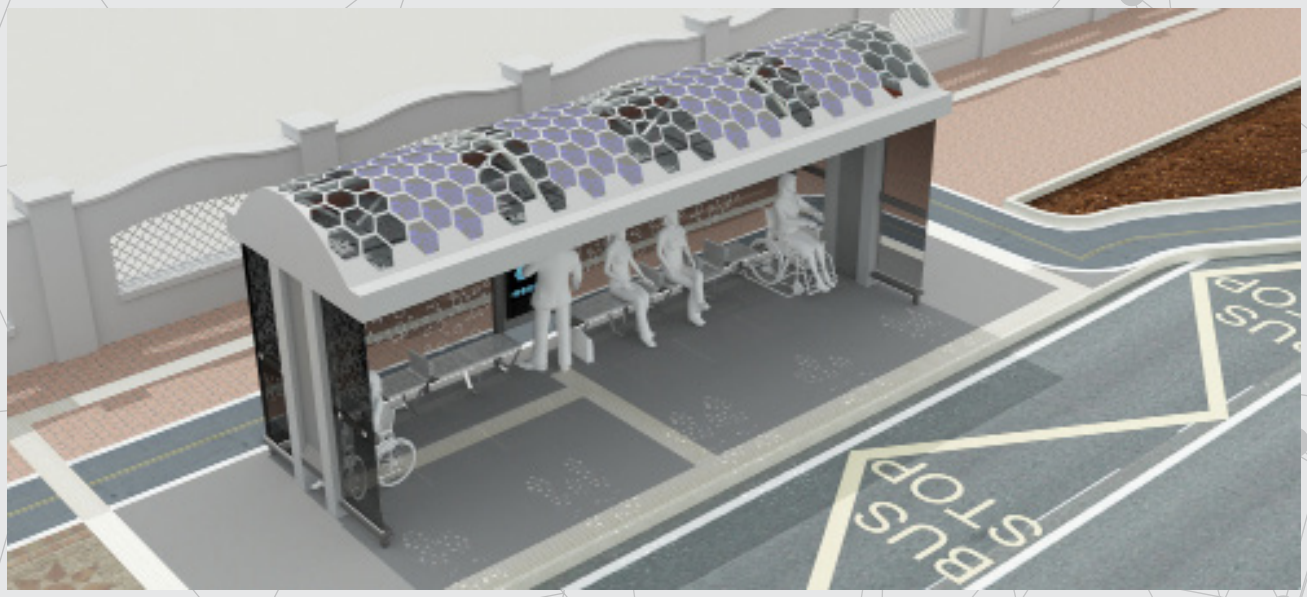
In this page users can find importing place in radius of 300 meters around of the bus stop. it includes:shoppingmalls,mosques,ATM,restaurants,Bank,ice-cream shop and supermarkets.

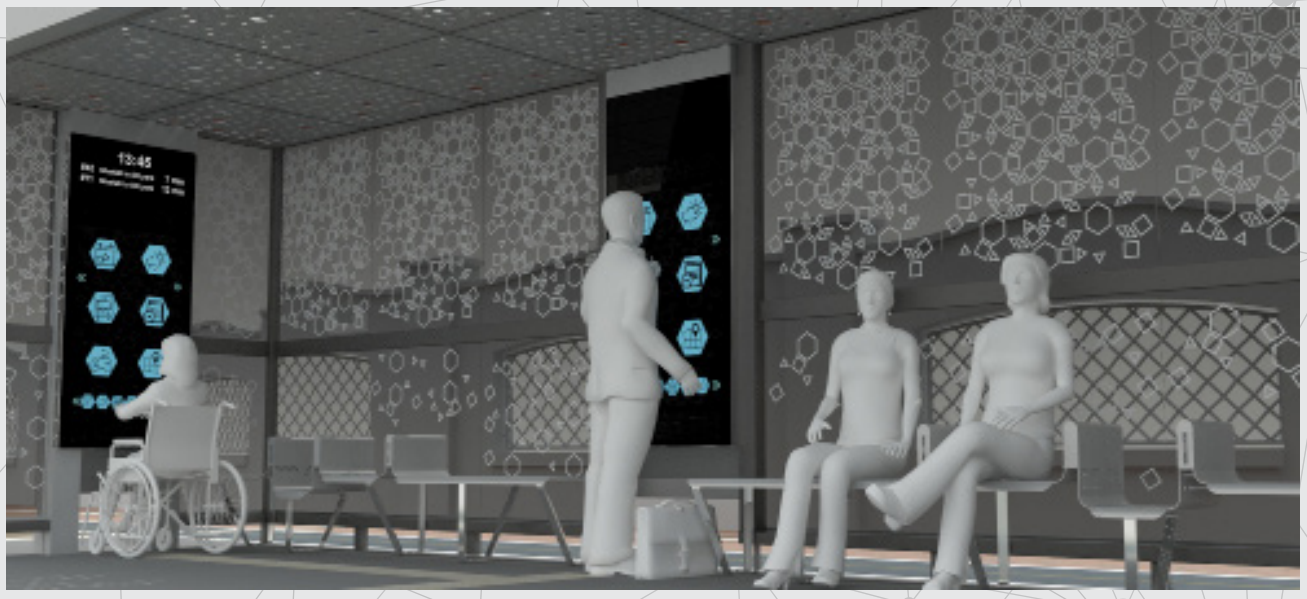
This tab is designed for wheelchair people to work easily with a touchscreen.even one pair of BACK and FORWARD is designed around it for wheelchair people, children and People with shorter height.

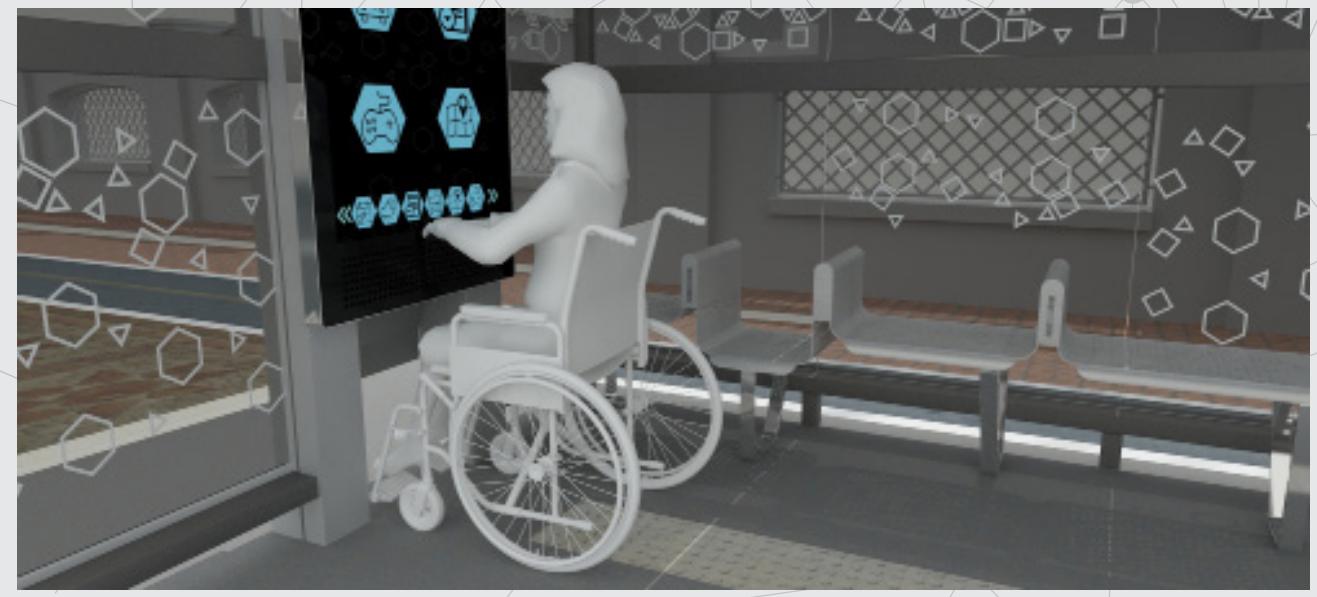


there are two pairs BACK and FORWARD: one in the above and another pair in the down part of the touch screen for wheelchair people, children and People with shorter height.

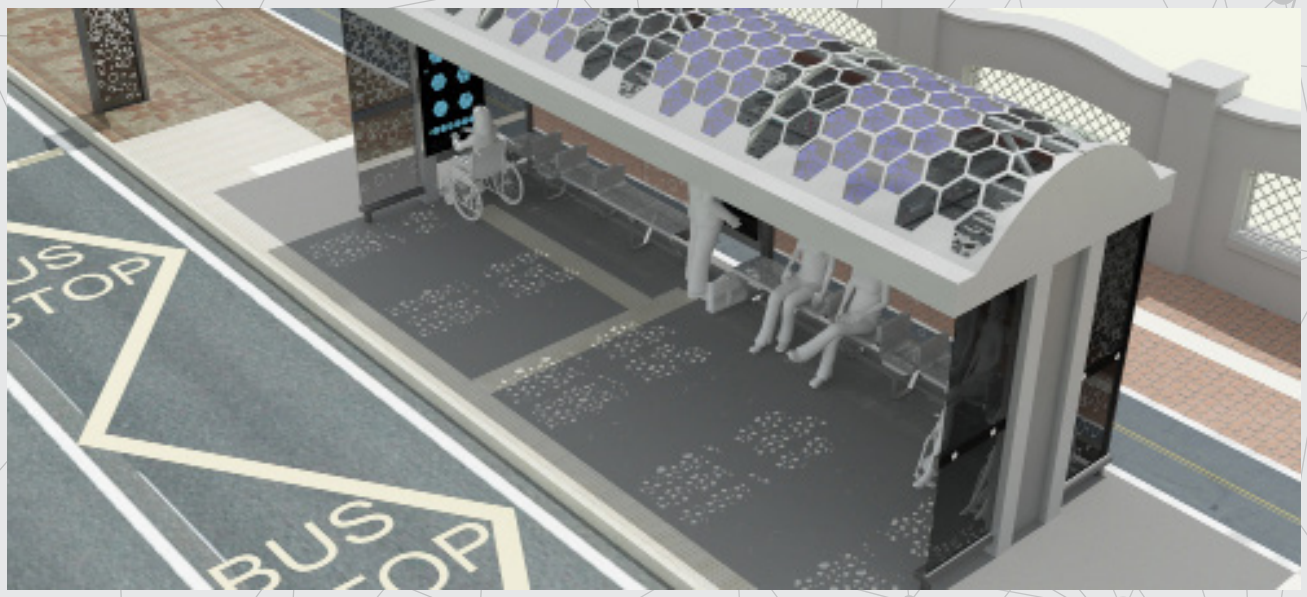
Renders:

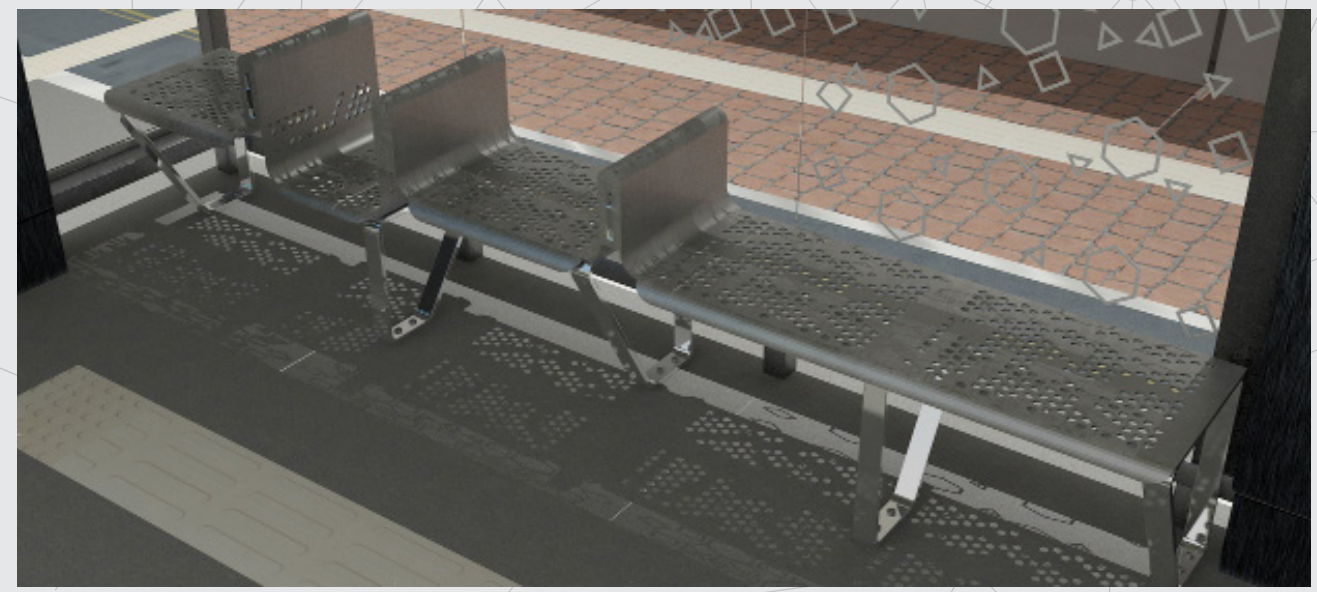


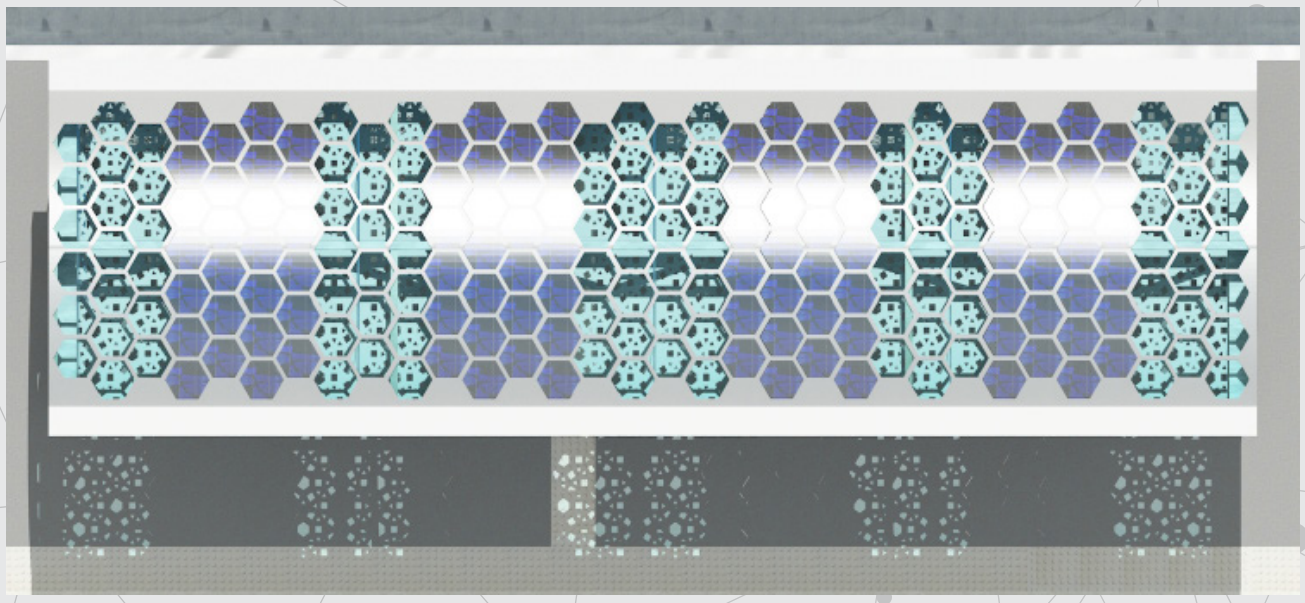




Renders:








SHARIATI
SHARIATI
13:45


SHARIATI
SHARIATI
N-1032
SHARIATI
SHARIATI

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Soviet Bus Stops: 2 2017