

ORGANISATION OF PUBLIC TRANSPORT

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Sustainable Transportation within the Framework of Green Deal - SPHERE

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Frequency and Headway Determination

Plan

- Definitions
- Maximum Load Method (Point-Check Method)
- Load Profile Method (Ride-Check Method)
- Conclusion

Definitions

Term	Meaning
Frequency	The number of buses operating on a route within one hour. For example: 6 buses/hour .
Headway	The time interval between two consecutive buses. For example: 10 minutes .
Passenger load	The number of passengers inside the bus.
Maximum load point	The section or stop-to-stop segment of the route where the highest number of passengers is observed.
Load factor	The level of utilization of the bus capacity.
Ride-check method	A method of counting passengers by riding inside the bus and recording the number of passengers boarding and alighting at each stop.
Point-check method	A method of observing bus passenger load at a designated point or stop.

Key concepts: frequency, headway and passenger load

Frequency = F

The number of buses operating on a route within one hour.

Headway = H

The time interval between two consecutive buses.

Passenger load

The number of passengers inside the bus or the passenger flow along the corridor.

Logical relationship



Two Methods for Measuring Passenger Load

Point-check provides a quick assessment, while ride-check shows the profile along the entire route.

Point-check

The observer stays at one point and records the number of passengers inside the bus as it passes.

Result: the load at the most heavily loaded point.

Ride-check

The observer travels inside the bus and records the number of passengers boarding and alighting at each stop.

Result: the load profile along the entire route.

Both methods provide initial data for calculating service frequency and headway. The difference is that one shows the “most heavily loaded point”, while the other shows the “load dynamics along the entire route.”

Point-check method: load at a single observation point

It is used at the busiest stop, intersection, or entry section to the city center.

What data are recorded?

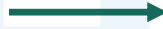
Bus arrival time

Route number

Number of passengers inside the bus

Bus capacity

Load level



Result

The maximum load is identified for all buses passing during one hour. This value is used to revise the schedule and headway.

Limitation

It does not show how many passengers board and alight at each stop. Therefore, a complete load profile along the route cannot be obtained.

Ride-check method: observation inside the bus

Passenger boarding and alighting at each stop are counted, and a load profile along the route is developed.

1. The observer boards the bus

The observer travels in the same bus from the beginning to the end of the trip.

2. Records data at stop

The number of boarding passengers, alighting passengers, and the time are recorded.

3. Load calculation

After each stop, the number of passengers inside the bus is determined.

Example of a calculation table

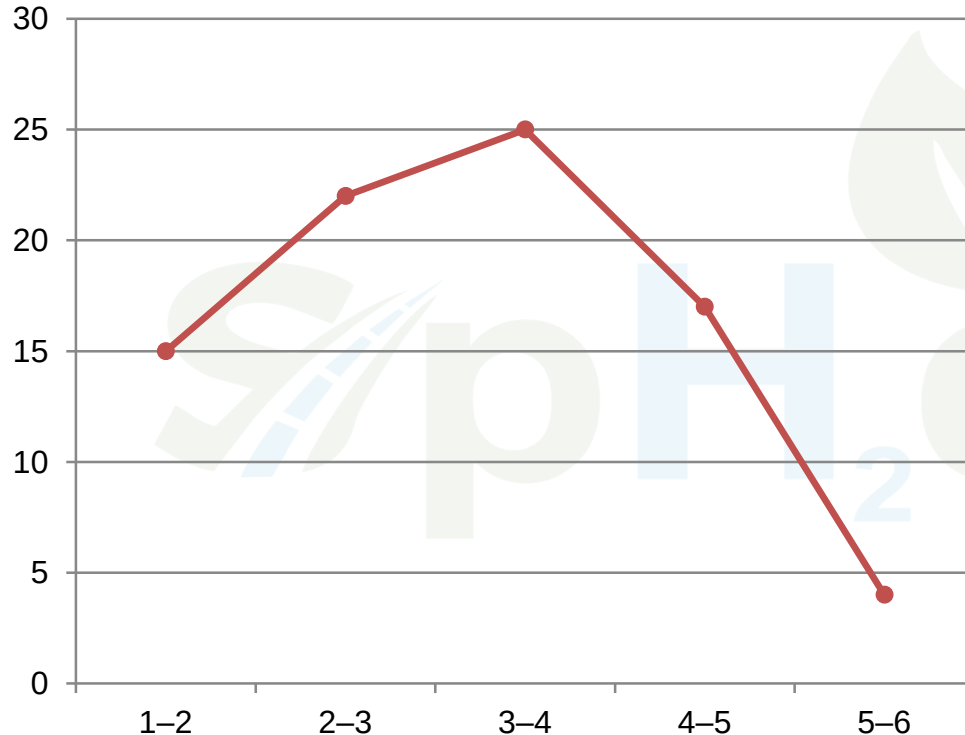
Stop	Boarded	Alighted	On board
1	15	0	15
2	10	3	22
3	8	5	25
4	4	12	17
5	2	15	4

$$L_i = L_{i-1} + B_i - A_i$$

L_i — load after the stop;
 B_i — boarding passengers;
 A_i — alighting passengers.

Ride-check results: load profile

The load profile shows which section is the busiest.



Maximum load point

The highest value in the graph is between stops **3-4: 25 passengers**.

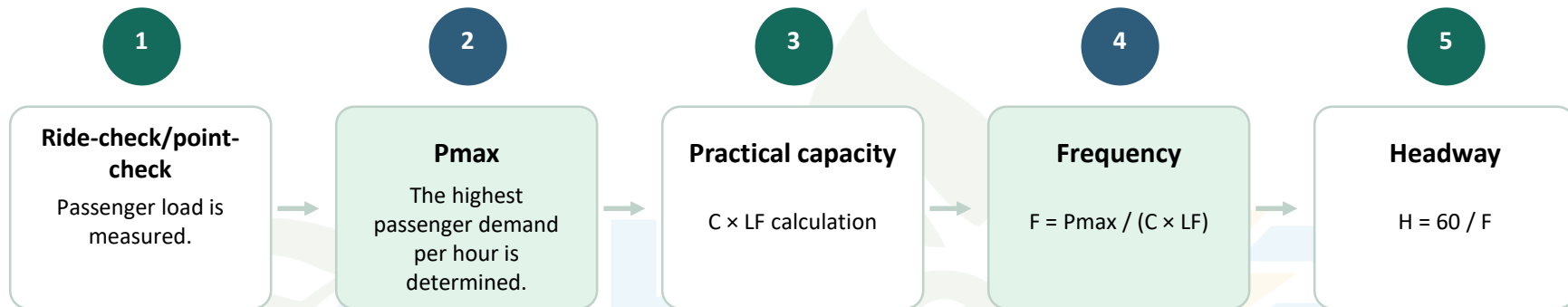
The schedule should be adjusted according to the demand in this section.

Why is it important?

If only the initial stop is considered, the actual passenger load in the inner part of the route may remain unnoticed.

Moving from the Most Loaded Segment to the Service Plan

The schedule is determined not by the “average” demand, but by the most critical load point.



Planning principle: The “most loaded segment” determines the required number of buses, because service quality is tested exactly at that point.

Frequency Calculation

When demand is high, service frequency increases; when bus capacity is larger, the required frequency decreases.

$$F = P_{\max} / (C \times LF)$$

F — avtobus/soat; P_{max} — eng yuqori yo'lovchi oqimi; C — avtobus sig'imi; LF — ruxsat etilgan yuklanish koeffitsiyenti.

Rounding rule

The value of **F** is usually rounded up.
For example: **6.3 buses/hour → 7 buses/hour.**

Indicators in the formula

P_{max} passengers/hour

C passengers/bus

LF Load factor

C×LF practical capacity

Practical note

If **F** is selected too high, buses may become underutilized; if it is selected too low, operating costs may increase.

Headway Calculation

After the frequency is determined, the headway is calculated using a simple formula.

$$H = 60 / F$$

H — interval between buses, minutes;
F — number of buses per hour.

Example

If F = 6 buses/hour:

$H = 60 / 6 = 10$ minutes
 $H = 60 / 6 = 10$ minutes
Therefore, buses should arrive every **10 minutes**.

Timeline example



Note

In a real schedule, bus round-trip time, driver break time, congestion, and reserve vehicles are also taken into account.

Calculation example: 410 passengers/hour

The schedule is calculated based on the most loaded segment during the morning peak period.

Given data

Indicator	Value
P_{max}	410 passengers/hour
C	80 passengers
LF	0.85
C × LF	68 passengers

$$F = 410 / 68 = 6.03 \rightarrow 7$$

Required frequency: 7 buses/hour

$$H = 60 / 7 = 8.57$$

Recommended headway: approximately 8–9 minutes

Result: During the morning peak period, buses on the route should operate at an interval of **8–9 minutes**.

Results into Operational Decisions

The calculation is not just a number; it becomes the basis for practical management decisions.

Reduce headway

Reduce passenger waiting time during peak periods.

Use higher-capacity buses

Increase capacity on corridors with high **P_{max}**.

Short-turn service

Provide additional service only on the most loaded segment.

Improve stops

Reduce boarding and alighting time.

Traffic signal priority

Reduce public transport delays.

Monitoring

Control GPS data and trip performance.

Practical recommendation:

The **point-check** method quickly evaluates service capacity, while the **ride-check** method provides a more accurate basis for rescheduling.

Comparison of Point-check and Ride-check

The choice of method depends on the research objective, time, and available resources.

Criterion	Point-check	Ride-check
Observation location	one point or stop	entire route
Result	maximum load point	load profile
Accuracy	average	high
Cost	low	higher
Application	quick monitoring	full schedule planning

Selection rule

If a quick assessment of the situation is needed — use **point-check**.

If the schedule, headway, and capacity need to be reviewed in detail — use **ride-check**.

Conclusion

Frequency and headway directly determine the quality of public transport service.

1. Measuring demand

If passenger flow is not measured accurately, the headway cannot be set correctly either.

2. The most loaded segment

The schedule should be adjusted according to the maximum load point.

3. Formula and practical decision

The formulas $F = P_{\max} / (C \times LF)$ and $H = 60 / F$ provide the result, but in real conditions, round-trip time, reserve vehicles, and congestion are also taken into account.

Main rule: In public transport, headway is not just a schedule number; it is a balance between passenger demand, capacity, comfort, and cost.

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Thank you for your attention!

