
European Transport Conference 08/10/03

**Speeding Up Public Transport
- A Practical Approach -**

Dipl.-Wirtsch.-Ing. Rainer Schneider

- Early arrivals/departures
- Time loss at stops
- Time loss on the route

- Lack of data to react

- Unsatisfied passengers
- No economical operation of drivers and vehicles

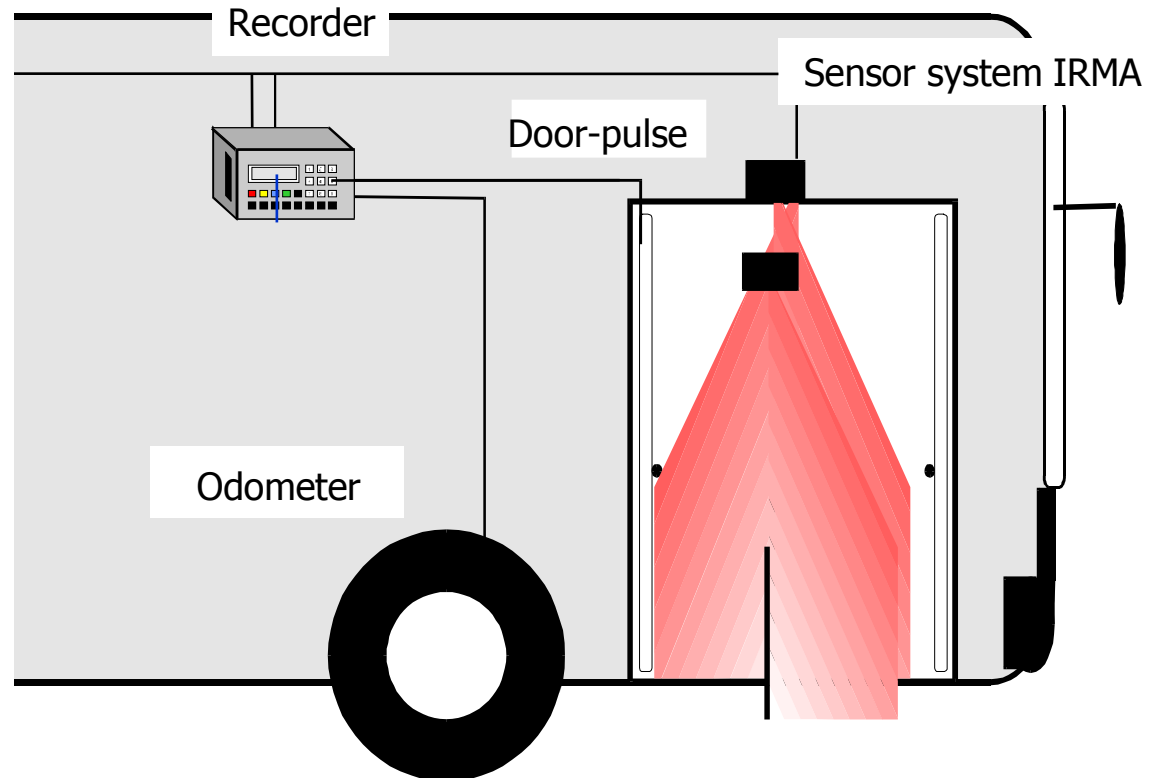
Work programme for 10 urban and suburban bus lines in Kiel

- Data acquisition and interpretation
- Malfunction analysis
- Development of a catalogue of measures
- Evaluation of measures in reference to benefits and costs
- Recommendation



Automatic Data Collection

- Boardings/Alightings [number of passengers]
- Distance [meter]
- Status of door [opened, closed]
- Time [seconds]
- Line
- Course
- Direction
- Stop



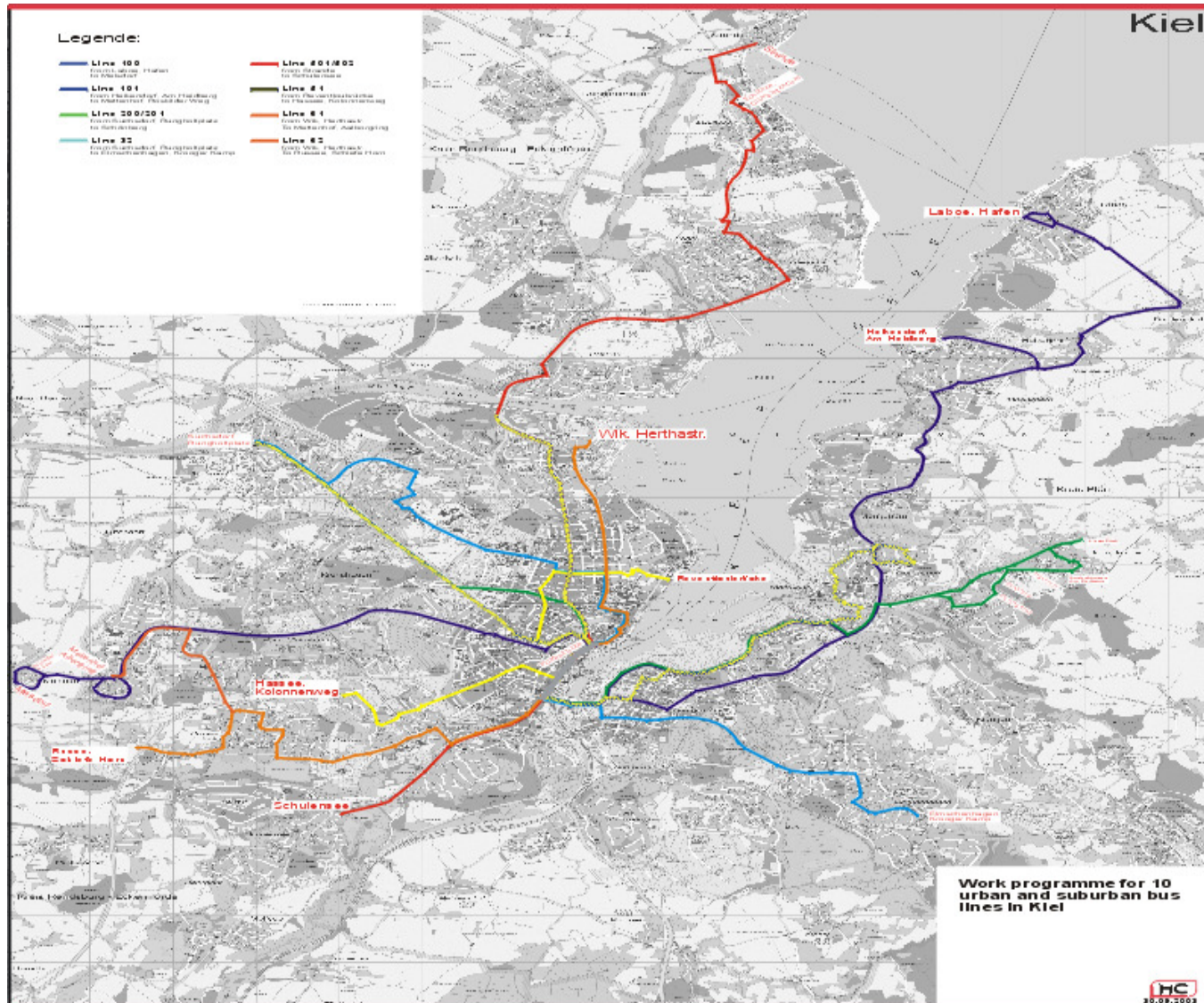
Evaluation of Data by the PLANFAHRT software:

- Travel times and speeds,
- Schedule deviation,
- Times of door opening,
- Duration of regular stops,
- Delays and standing times in areas of
 - intersection (with or without traffic lights) and on
 - routes,
- Boardings and alightings with vehicle occupancy

Data Acquisition: The Lines

Line	Direction	Number of measured courses
11	Pilauer Straße – Wik Kanal	35
11	Wik Kanal - Pillauer Straße	35
12	Pilauer Straße – Rungholtplatz	26
12	Rungholtplatz – Pilauer Straße	26
32	Rungholtplatz – Krooger Kamp	71
32	Krooger Kamp – Rungholtplatz	87
51	Kolonnenweg – Reventloubücke	105
51	Reventloubücke – Kolonnenweg	105
61	Aalborgring – HerthasträÙe	10
61	HerthasträÙe – Aalborgring	17
62	Schiefe Horn – HerthasträÙe	43
62	HerthasträÙe – Schiefe Horn	54
100	Roskilder Weg- Laboe Hafen	23
100	Laboe Hafen – Roskilder Weg	21
101	Roskilder Weg - Am Heidberg	29
101	Am Heidberg – Roskilder Weg	30
200	Rungholtplatz –Schönberg Strand	34
200	Schönberg Strand – Rungholtplatz	25
501	Flintbek Parkplatz – Olympiazentrum	24
501	Olympiazentrum – Flintbek Parkplatz	24

Bus Lines in Kiel



Data interpretation: Line Properties

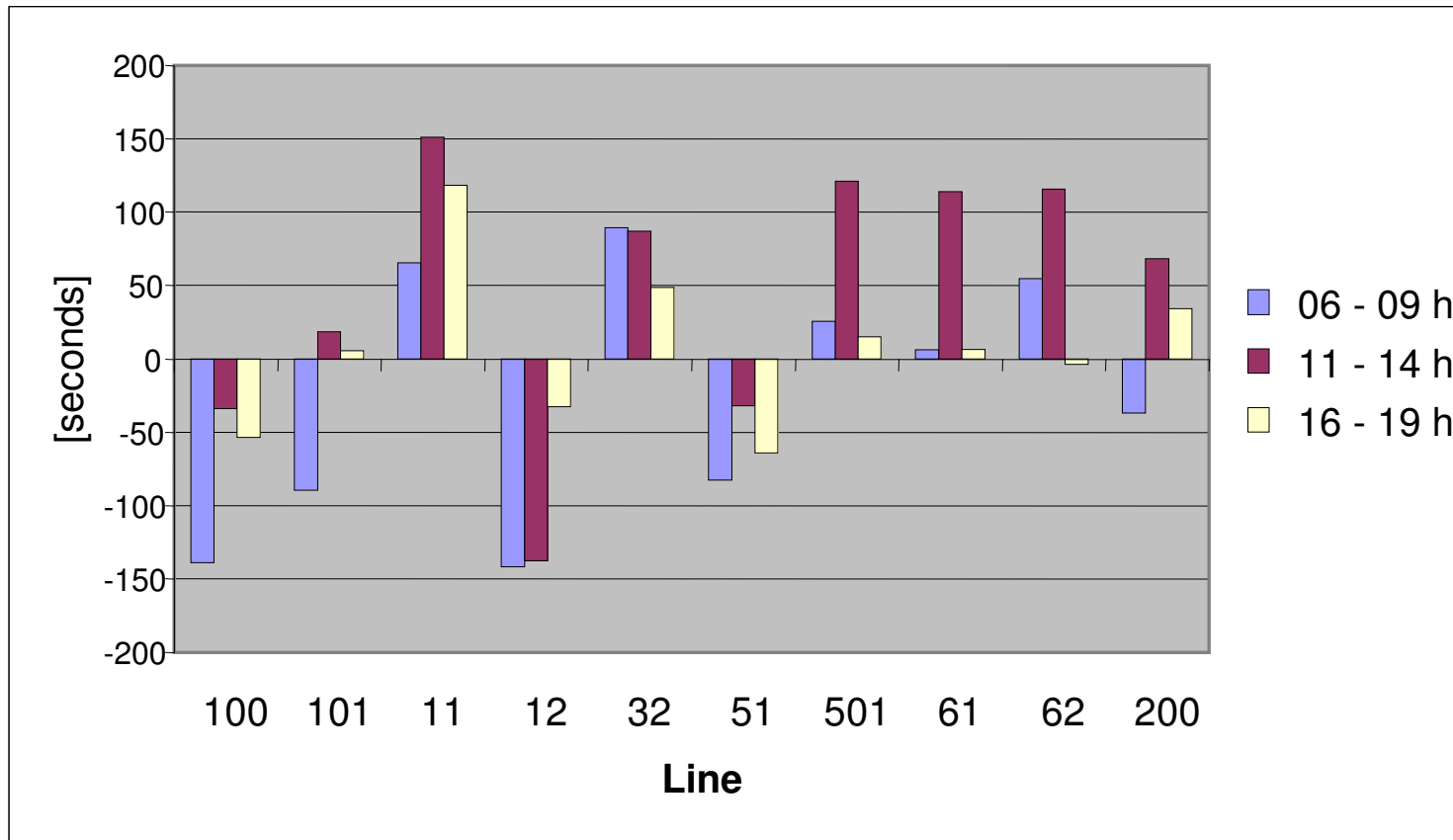
Line	Operator	Direction	Line length [km]	Number of stops	Travel time [min]	Average speed [km/h]
11	KVG	Pillauer Straße - Wik Kanal	14,5	34	49	17,8
11	KVG	Wik Kanal - Pillauer Straße	14,4	34	49	17,6
12	KVG	Pillauer Straße - Rungholtplatz	16,0	36	53	18,2
12	KVG	Rungholtplatz - Pillauer Straße	15,9	35	54	17,7
32	KVG	Rungholtplatz - Krooger Kamp	17,0	35	49	20,9
32	KVG	Krooger Kamp - Rungholtplatz	17,1	34	52	19,7
51	KVG	Kolonnenweg - Reventloubrücke	8,9	20	34	15,6
51	KVG	Reventloubrücke - Kolonnenweg	8,7	20	34	15,4
61	KVG	Aalborgring - Herthastraße	16,3	40	48	20,4
61	KVG	Herthastraße - Aalborgring	16,5	41	50	19,8
62	KVG	Schiefe Horn - Herthastraße	14,4	34	43	20,1
62	KVG	Herthastraße - Schiefe Horn	14,6	35	45	19,4
100	KVG	RoskilderWeg - Laboe Hafen	28,2	50	70	24,2
100	KVG	Laboe Hafen - RoskilderWeg	28,0	49	71	23,7
101	KVG	RoskilderWeg - AmHeidberg	23,3	42	61	22,9
101	KVG	Am Heidberg - RoskilderWeg	23,4	41	62	22,6
200	VKP	Rungholtplatz - Schönberger Strand	39,3	57	83	28,4
200	VKP	Schönberger Strand - Rungholtplatz	39,5	56	86	27,5
501	KVG/AK	Flintbek Parkpl. - Olympiazentrum	31,6	50	84	22,6
501	KVG/AK	Olympiazentrum - Flintbek Parkpl.	27,2	50	68	24,0

- early arrivals/departures
- standing at stops with closed doors,
- opened doors without boarding and alighting,
- delays at intersections without or with traffic light,
- delays between intersections and stops.



Data Interpretation: Early arrivals and Delays

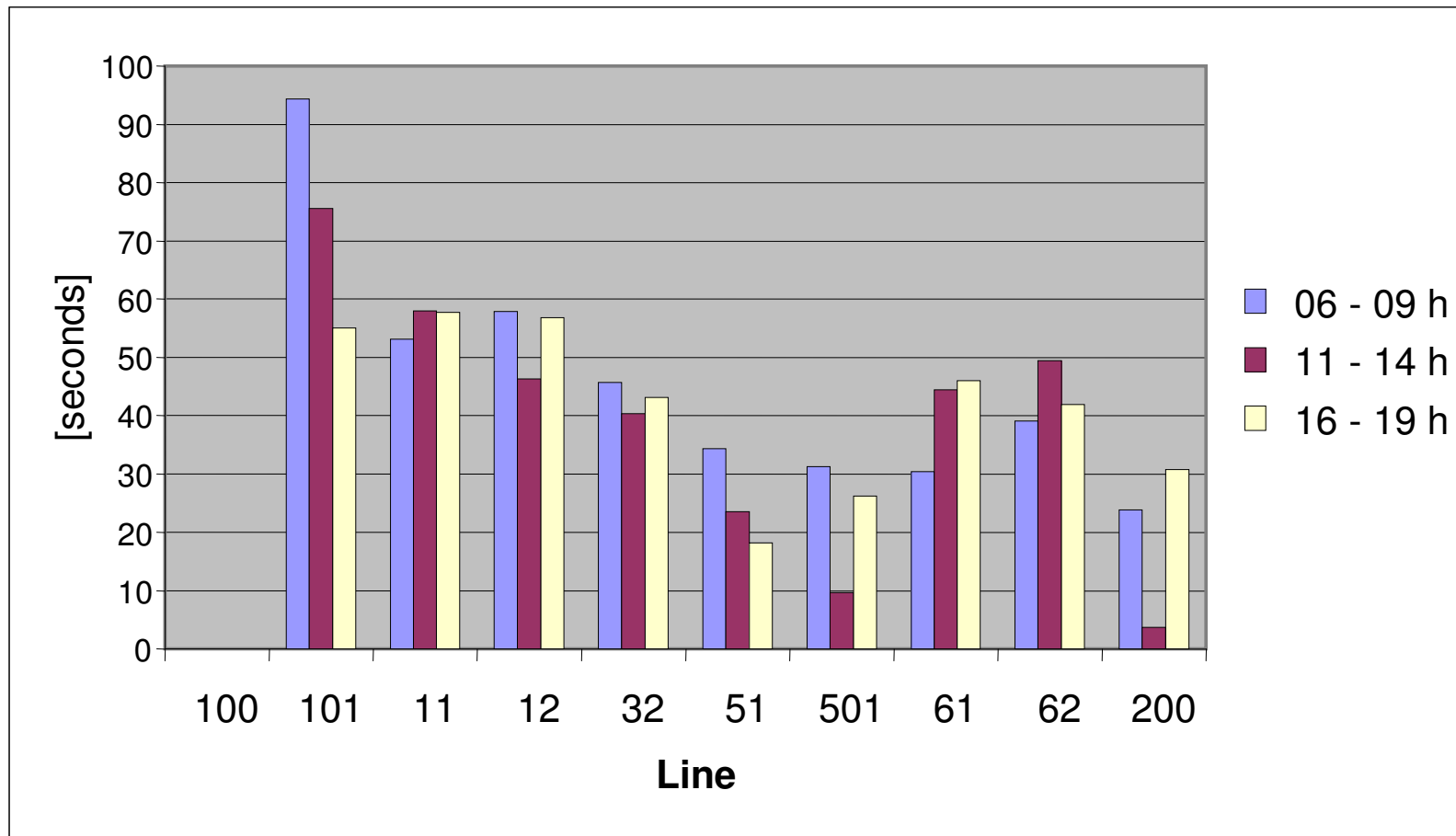
From city centre in direction to suburbs [average values for one-way journeys]



Data Interpretation: Standing at Stops

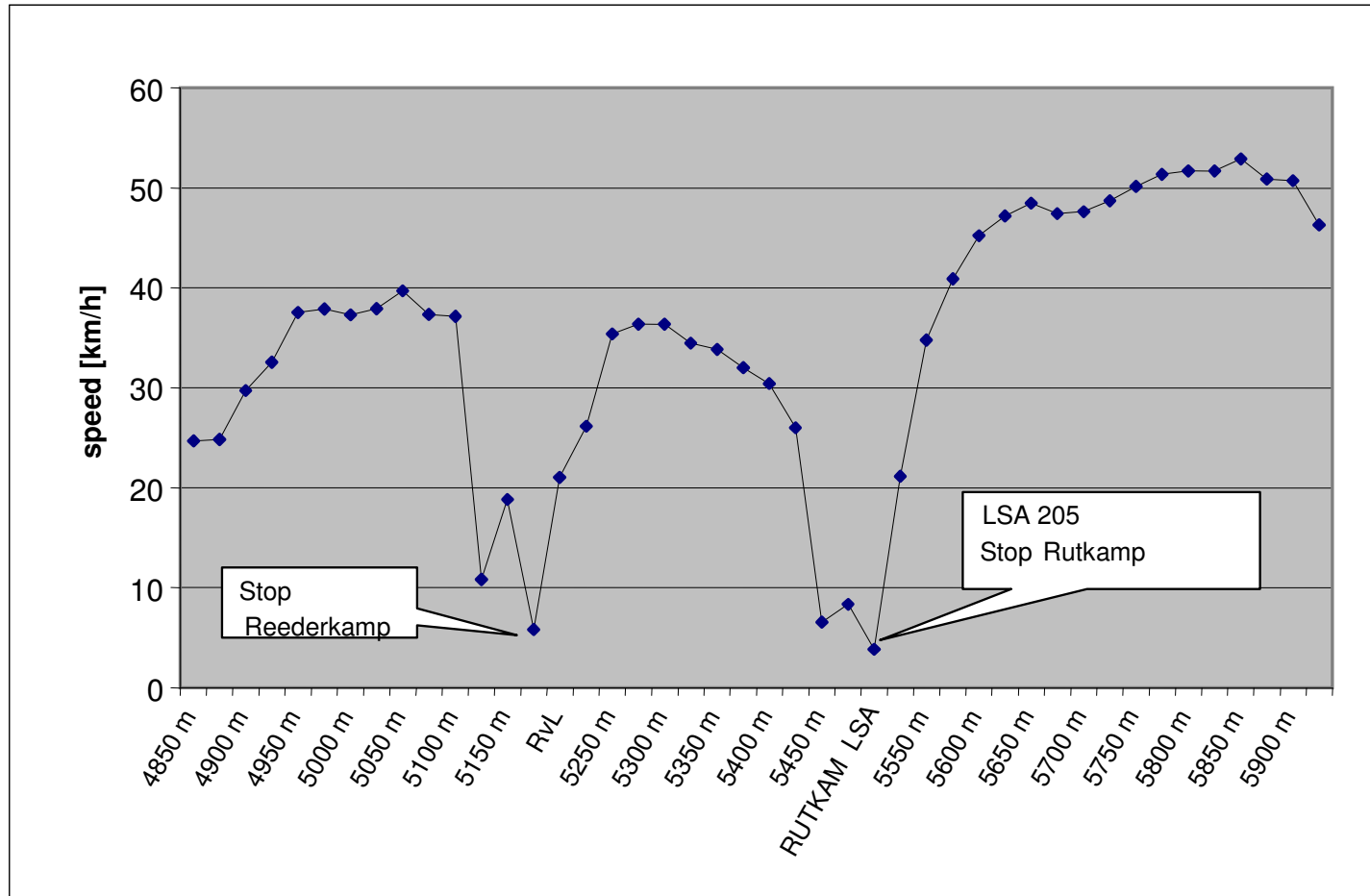
with Closed Doors in the City Centre

[average value for one-way journeys]



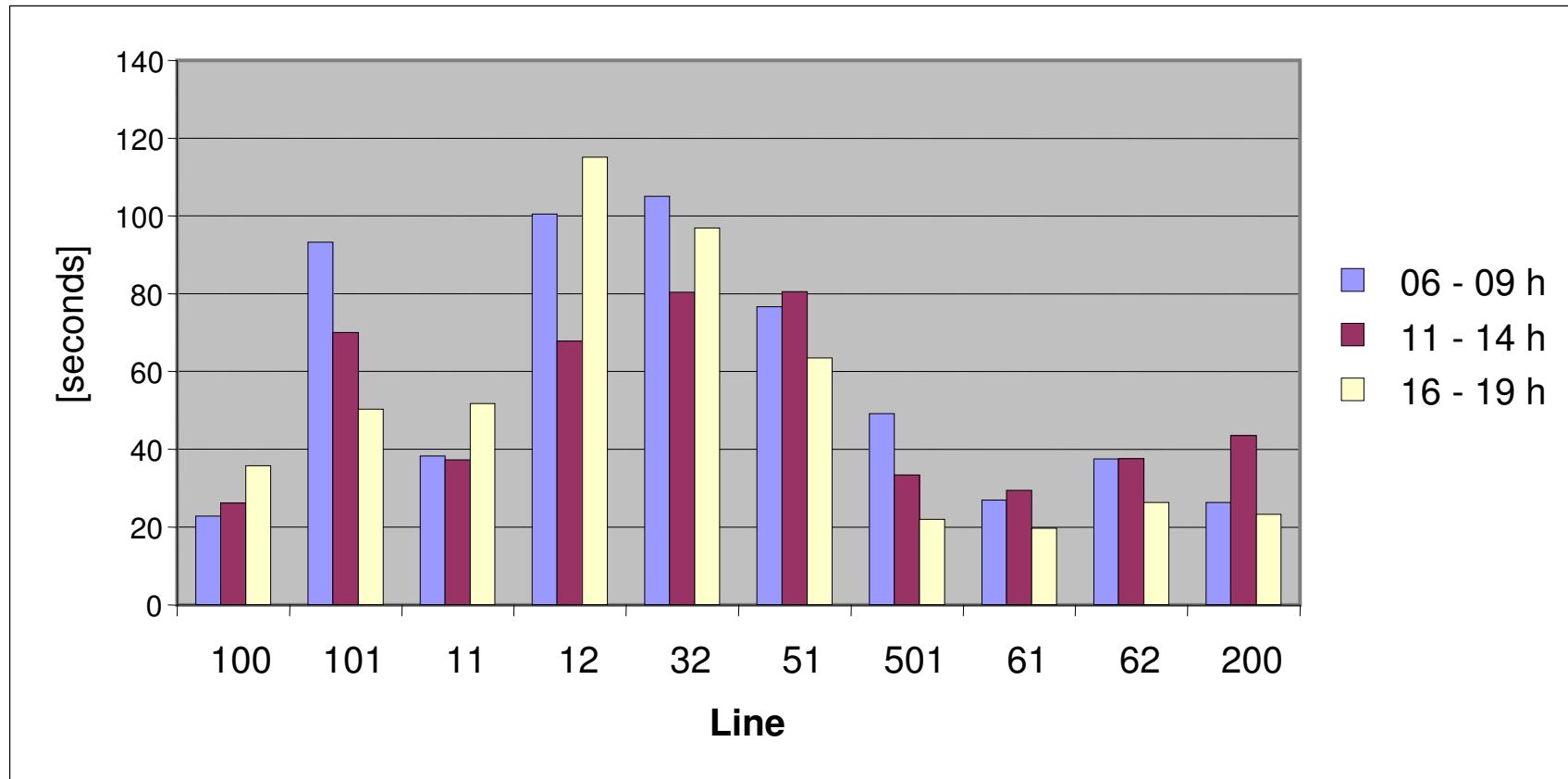
Data Interpretation: Speed Profile

Line 61



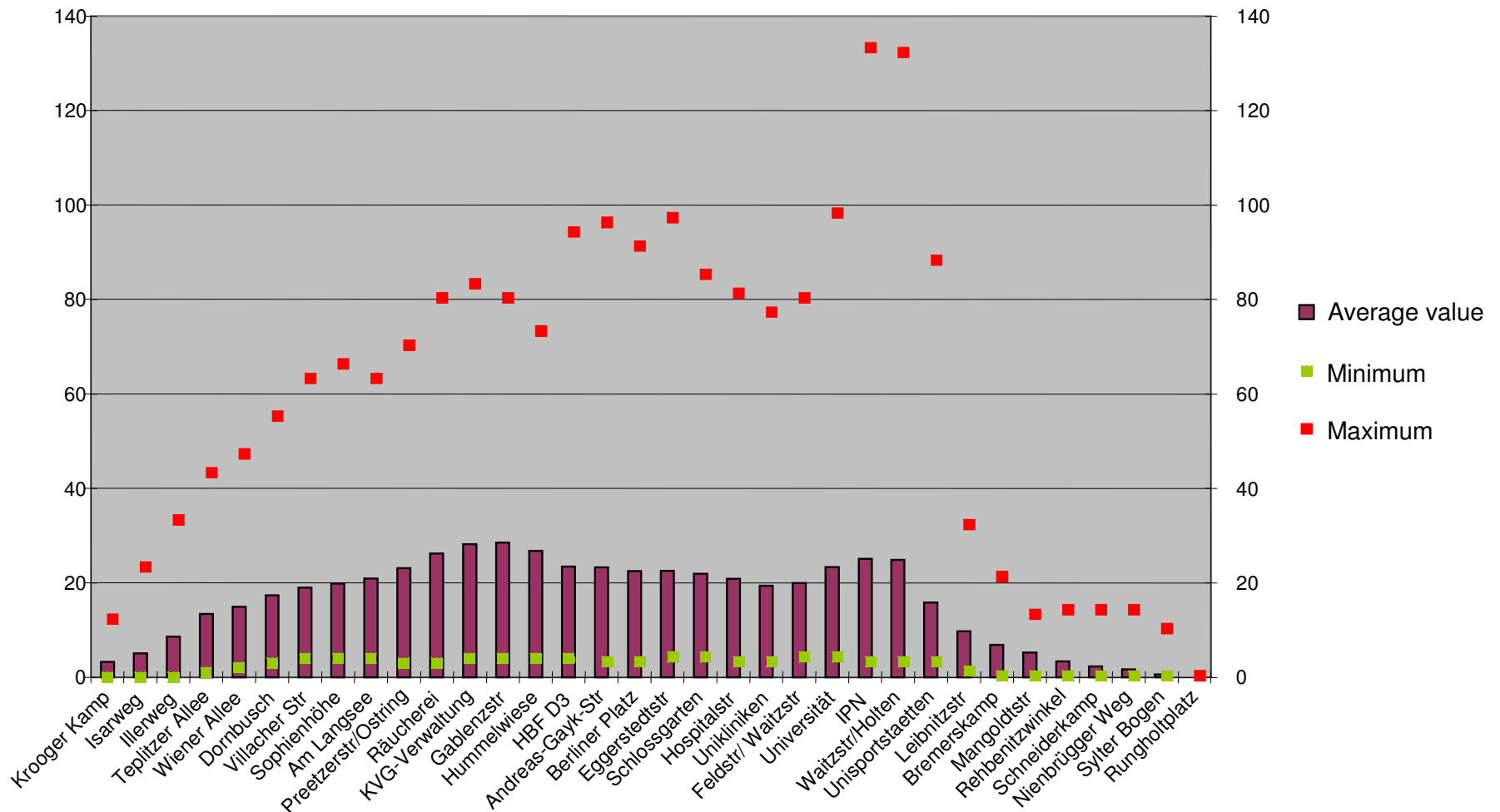
Data Interpretation: Delays at Traffic Lights

City Centre [average values for one-way journeys]



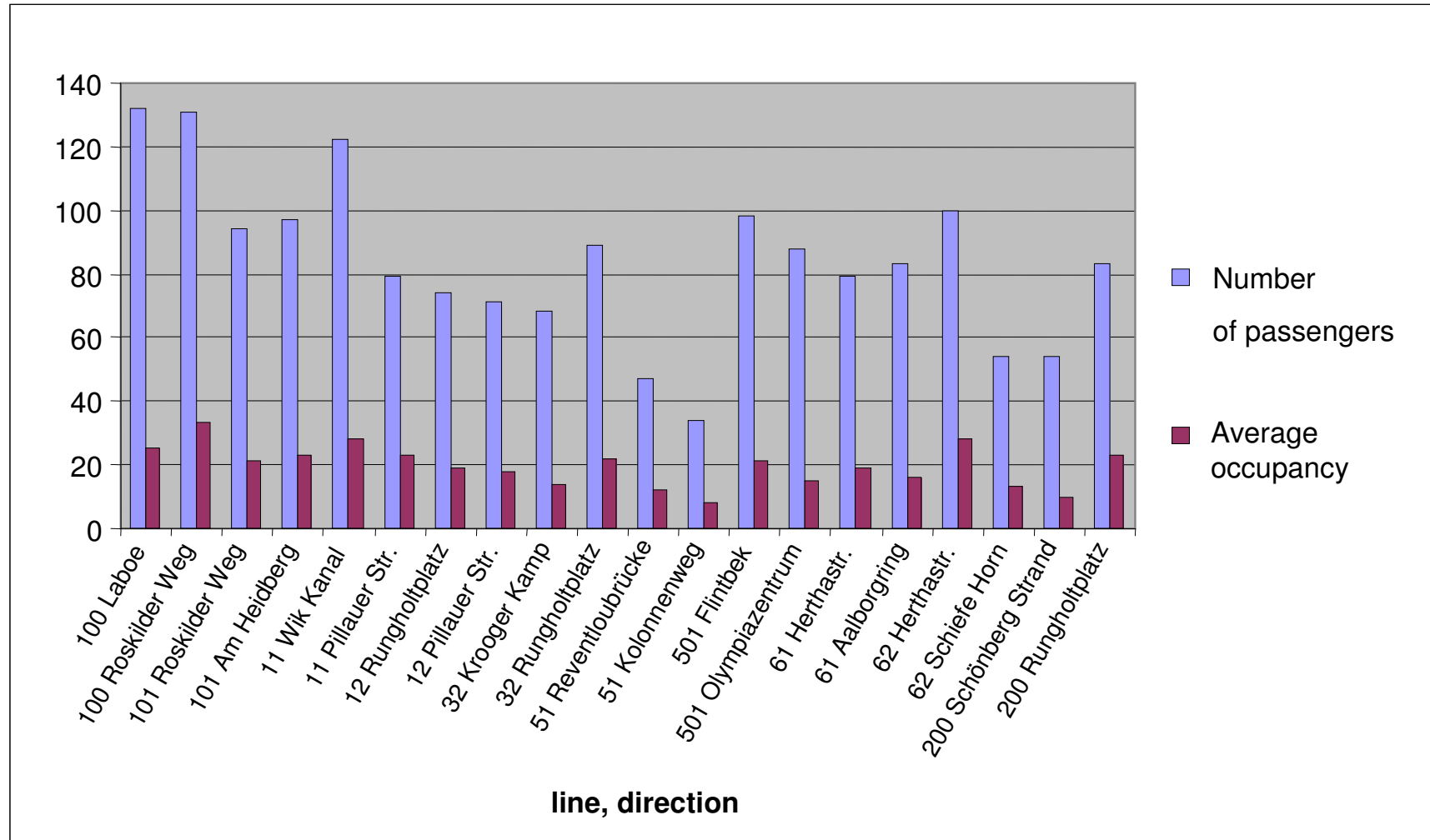
Data Interpretation: Occupation Line 32

Average values for 89 runs covering three time-periods
morning, noon and afternoon peak



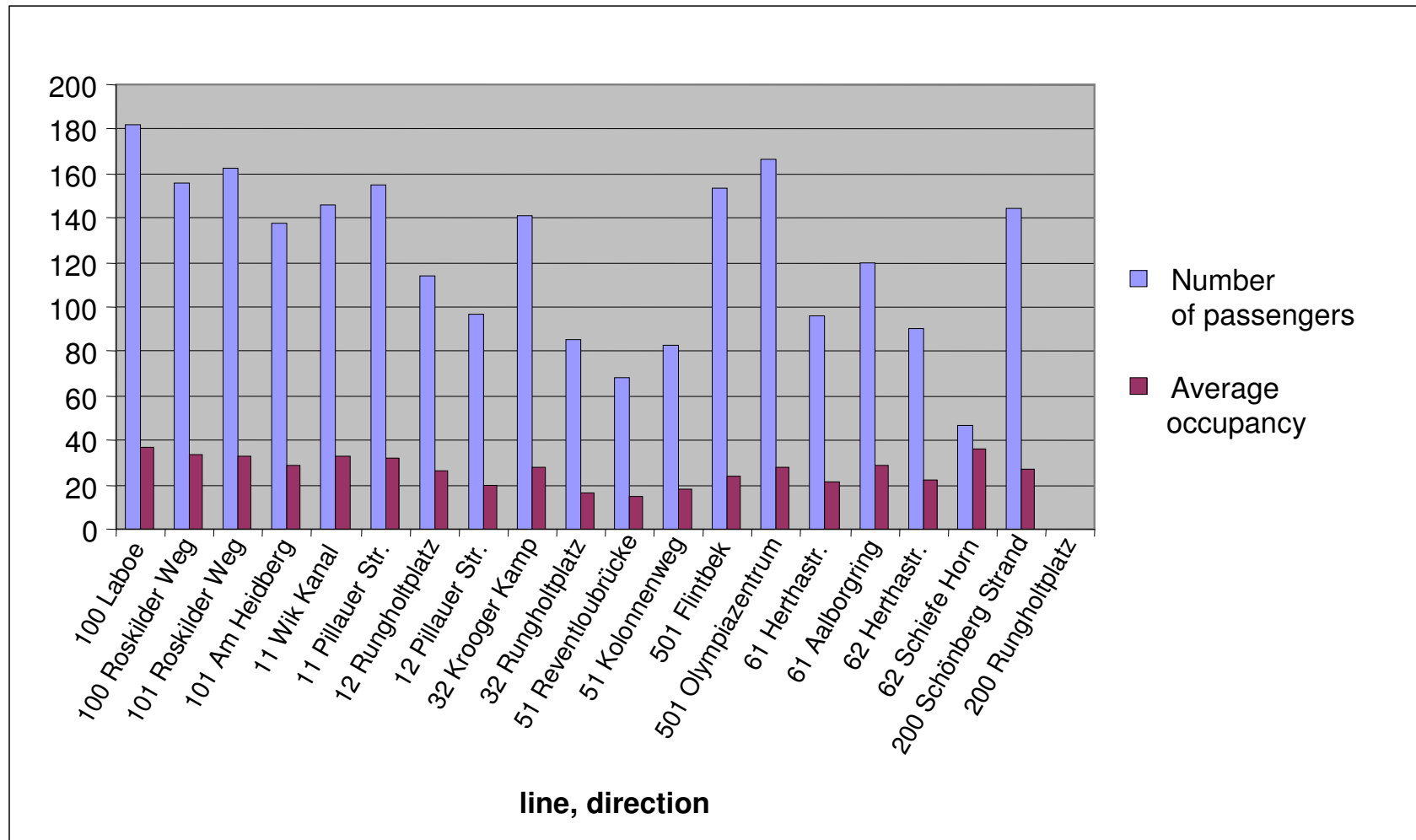
Data Interpretation: Passenger Flow

all lines between 6:00 - 9:00 h [average boarders per run]



Data Interpretation: Passenger Flow

all lines between 11:00 - 14:00 h [average boarders per run]



- Measures at bus stops
 - Conversion / Marks
 - Taking away of bus bays to ease the integration in flowing traffic
 - Equipment
 - Positioning of ticket machines and customer information to speed up boarding and alighting
 - Schedule
 - Reducing of stop-times, e.g. by avoiding stops with closed doors

- Measures at Intersections
 - Functional Test of already implemented priority signals
 - Change fixed-time signal control to public transport priority signalling

- Measures on the route
 - Constructive measures
 - Bus lanes
 - Separation of the traffic modes
 - Supervision and Controlling



Allocation of Costs to Measures

Possible measures	Cost inclusion
Speeding up without infrastructure measures	Adopting schedule: no costs
Measures at Stops	Costs to remove bus bays, marks, stop equipment, etc.
Measures at Intersections	Costs for testing already existing or for implementing new priority signals
Measures on routes	Construction costs; Supervision

Allocation of Benefits to Measures

Benefit criteria	Running time reduction	Number of passenger
Possible measures		
Speeding up without infrastructure measures	Reducing early arrivals/departures	Vehicle occupancy after leaving stop
Measures at stops	Shortened stop time at stops in seconds	Vehicle occupancy after leaving stop
Measures at intersections	Minimum potential at intersection in seconds	Average vehicle occupancy at intersection
Measures on routes	Minimum potential on route part in seconds	Average vehicle occupancy between stops

Example Traffic Lights with high Priority



Lines	Traffic Light	Measure detail	Min. running time reduction [sec]	Average passenger number	Costs [€]	B-C-Indicator
61,62	51 Wulfsbrook	Check: too less time to turn left, approach signal needed	14	100	1.800	244
100,101	71 Sternstr.	Public transport priority implemented, success control necessary	12	87	1.800	193
100,101	32 Schülperbaum	Public transport priority implemented, success control necessary	9	120	1.800	183
100,101	159 Metzstr.	Public transport priority implemented, success control necessary	14	78	1.800	173
11,12,100	508 Wischhofstr.	To verify public transp. priority, if need optimisation effect	11	133	10.200	43
12,51,62, 200,501	7 Berliner Platz	To check Priority and coordination with TL 6 and PTL 181, if need optimisation effect	11	142	10.200	43
32,61,62	48 Hospitalstr.	To verify public. transp. priority, request is not transmitted if necessary optimisation effect	12	103	10.200	43
61,62,501	13 Rondeel	To verify public transp. priority	11	120	10.200	43
11,12,32, 100,101,501	44 Kehdenstr	To check priority an coordination with TL 6 and PTL 181 check, if need optimisation effect	10	195	10.700	41

Evaluation: Shortened Door-opening-time

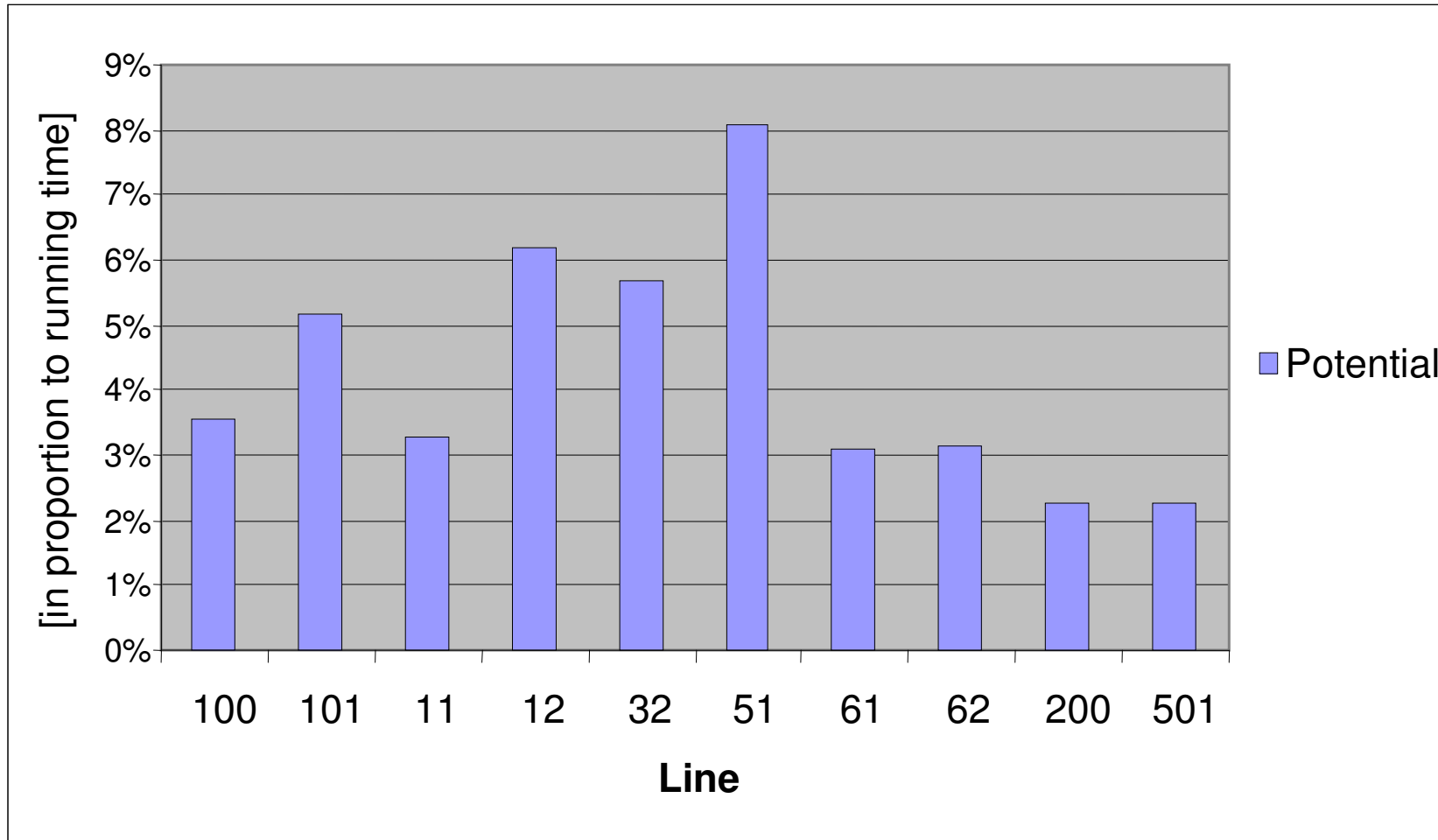
Line	Direction	Station	Min. running time reduction	Average number of passenger	Benefit-Points in total
11	Wik, Kanal	KVG/Werftstr	4	48	10
100	Roskilder Weg	KVG/Werftstr	4	40	10
200	Rungholtplatz	Holstenbrücke	5	25	9
12	Pillauer Str.	KVG/Werftstr	3	34	8
12	Rungholtplatz	Gablenzstr	3	36	8
200	Rungholtplatz	Schoenkirch. Str.	3	31	8
12	Pillauer Str.	Gr. Ziegelstr	3	26	6
32	Rungholtplatz	Gablenzstr	4	28	6
51	Reventloubbruecke	Kirchofsallee	4	26	6
200	Schönberger Stra.	Holstenbrücke	5	20	6
200	Schönberger Stra..	KVG/Werftstr.	4	27	6
11	Wik, Kanal	Gablenzstr	2	51	5
100	Roskilder Weg	Gr. Ziegelstr	1	41	5
100	Roskilder Weg	Gablenzstr	2	41	5

Evaluation: Potential

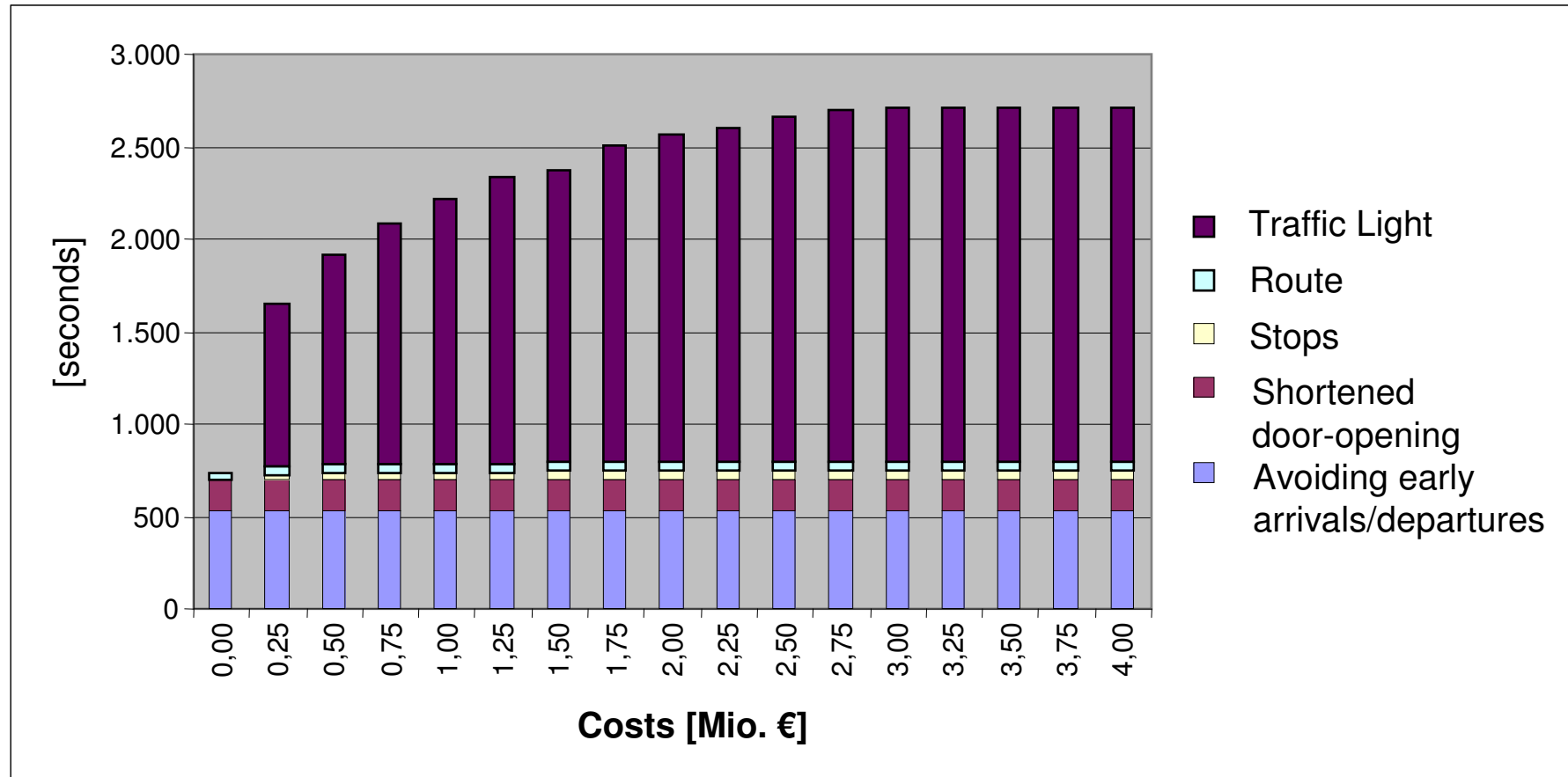
Basing on one round trip per line

Line	Schedule avoid early arrivals/ depart.[sec]	Physical measures at stops [sec]	Shortened door-opening time [sec]	Traffic Lights [sec]	Route [sec]	Total [sec]
100	124	0	12	178	0	314
101	65	9	5	292	3	374
11	0	4	9	180	0	193
12	127	14	24	226	5	396
32	13	10	8	312	0	343
51	33	0	4	289	4	330
61	4	5	6	152	16	183
62	41	13	2	101	8	165
200	135	0	51	37	0	223
501	0	1	44	152	8	205
Total	542	56	165	1.919	44	2.726

Evaluation: Potential



Evaluation: Running-Time and Costs



Round Trip Efficiency



Line	Day	Time	Freq. [min]	Run. time now	Waiting time	Round trip time	Efficiency now	Vehc. now	Run. time new (Σ Potential)	Round trip duration	efficiency- new	Δ vehc.
11/12	MF	HVZ/NVZ	15	201	54	255	78,8%	17	191	225	84,9%	-2
32	MF	HVZ/NVZ	30	99	21	120	82,5%	4	93	120	77,5%	0
51	MF	HVZ	10	68	12	80	85,0%	8	63	70	90,0%	-1
51	MF	NVZ	15	68	22	90	75,6%	6	63	75	84,0%	-1
61	MF	HVZ	20	98	22	120	81,7%	6	95	100	95,0%	-1
61	MF	NVZ	40	204	36	240	85,0%	6	198	240	82,5%	0
62	MF	HVZ	20	88	12	100	88,0%	5	85	100	85,0%	0
62	MF	NVZ	40	88	32	120	73,3%	3	85	120	70,8%	0
100	MF	NVZ	30	158	52	210	75,2%	7	153	180	85,0%	-1
100/101	MF	HVZ	20	264	56	320	82,5%	16	253	300	84,3%	-1
501	MF	HVZ	20	152	8	160	95,0%	8	149	160	93,1%	0
501	MF	NVZ	30	147	33	180	81,7%	6	144	180	80,0%	0

Recommendation for Realisation

Priority	Measure	Proportion potential	Proportion total costs
Urgent	Adopting Schedule	25 %	0 %
Immediate	Testing of existing implemented bus priority signalling (primary need)	40 %	7 %
Middle-term	Implementing bus priority signalling (secondary need)	25 %	30 %
Subordinated	Infrastructural measures	10 %	63 %

A photograph of a street scene. In the foreground, a yellow bus is driving from left to right. Behind it, several cars are visible on the road. The background features green trees and buildings. The text "Thank you for your attention." is overlaid in the center of the image.

Thank you for your attention.

Dipl.-Wirtsch.-Ing. Rainer Schneider