Travel demand for the regional rail service on the lines Verona-Rovigo-Adria-Chioggia e Adria-Mestre

DELIVERABLE

Project Partner:

Analysis and elaboration:

Oggetto	Piano delle Indagini
Commessa	C181
Versione	001
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Emissione	10/11/2018
Riferimento	C181-3-001-181109-cba-deliverable_domanda_EN.doc

Indice

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1 LOCAL CONTEXT

1.1 Introduction

The railway network managed by Sistemi Territoriali is composed by 3 different operation lines:

1. Rovigo-Adria-Chioggia
2. Adria-Mestre
3. Verona-Rovigo

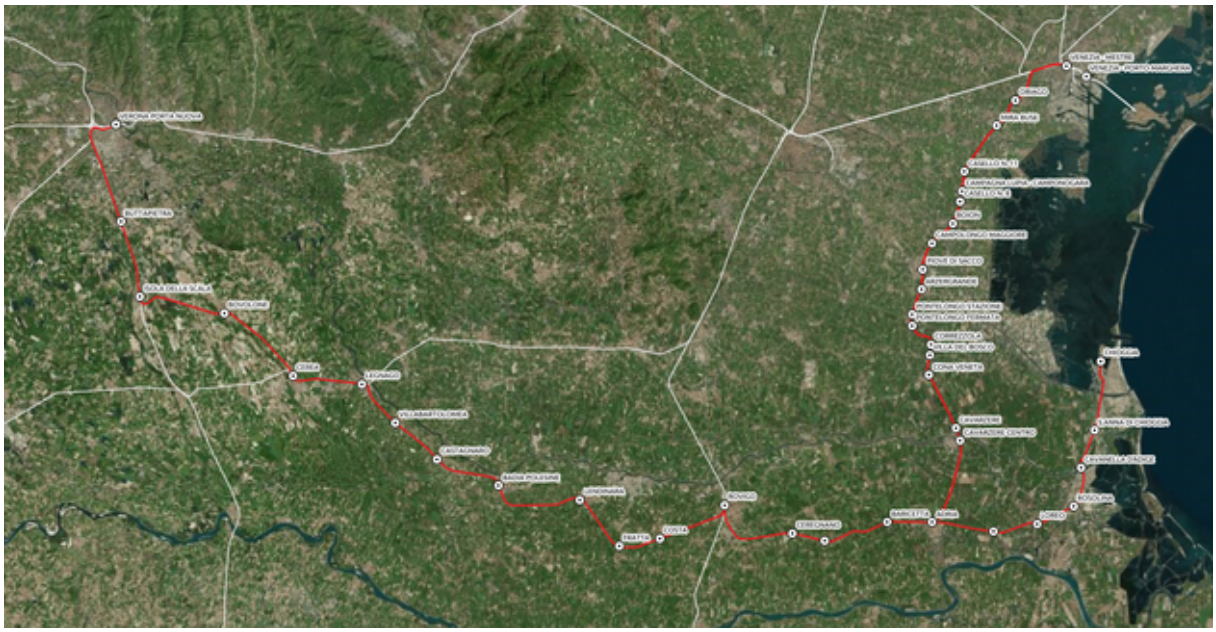

Figure 1: General overview of the network

The districts (*provincia*) of Rovigo, Venezia and Verona make up the local system of the rail network. The passenger service operated along the lines isn't structured on a hierarchical timetable: each train stops at every station and traveltime don't vary along the day.

1.2 Attractiveness area of the stations

In order to identify and characterize the so-called ***attractiveness area*** of each station, hence of the entire network, where the potential travel demand is located, the following method has been followed:

1. geospatial conversion of the entire road network of the area in a graph;
2. geospatial extraction of the demo data (ISTAT 2011);
3. geospatial association of the closest road node to each station;

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4. evaluation of the isochronic lines at 5 minutes steps enclosing the attractiveness areas of each station, considering the real traveltime along the road network during the peak (congested) hour;
5. evaluation of the population living inside each area.

This method is based on the hypothesis that the majority of people reaches the closest station by car o by foot/bike: this assumption is usually applicable for rail lines at service of smaller towns or less populated areas. The result is shown in figure 2 pag. 6.

Data displayed in table 1 pag.5 show that some stations have an large potential demand living inside the 10 minutes attractiveness area, but the behavior changes with regards to the extended area: this result depends on the one hand on the local territorial configuration of the surroundings and its road network, on the other on the proximity of stations along the same line, that "erode" the station's attractiveness area.

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Stazione	0-10 min	TOT (20 min)
ADRIA	14,276	32,556
Cavarzere F.ta	2,872	4,332
Cavarzere St.ne	8,524	10,960
Cona Veneta	3,586	10,305
Pontelongo F.ta	159	159
Arzergrande	7,012	14,569
PIOVE DI SACCO	19,929	60,529
Campolongo M.re	9,224	18,139
Bojon	7,473	7,970
Casello 8	5,487	5,487
Campagna L./Camponogara	3,585	3,585
Casello 11	32,625	86,664
Mira Buse	15,064	16,474
Oriago	31,626	93,232
Buttapietra	12,098	34,591
Isola della Scala	10,929	33,959
Bovolone	17,759	30,394
Cerea	24,589	35,543
LEGNAGO	26,256	46,315
Villabartolomea	4,880	5,012
Castagnaro	5,648	9,724
Badia Polesine	13,500	25,764
Lendinara	12,766	19,849
Fratta	5,037	11,628
Costa	4,228	8,054
ROVIGO	44,438	76,272
Ceregnano	7,588	8,901
Lama	4,563	7,384
Baricetta	2,922	4,459
Loreo	14,271	16,266
Rosolina	4,250	12,899
Cavanella Adige	2,887	4,040
S.Anna di Chioggia	3,509	4,229
CHIOGGIA	42,065	46,480

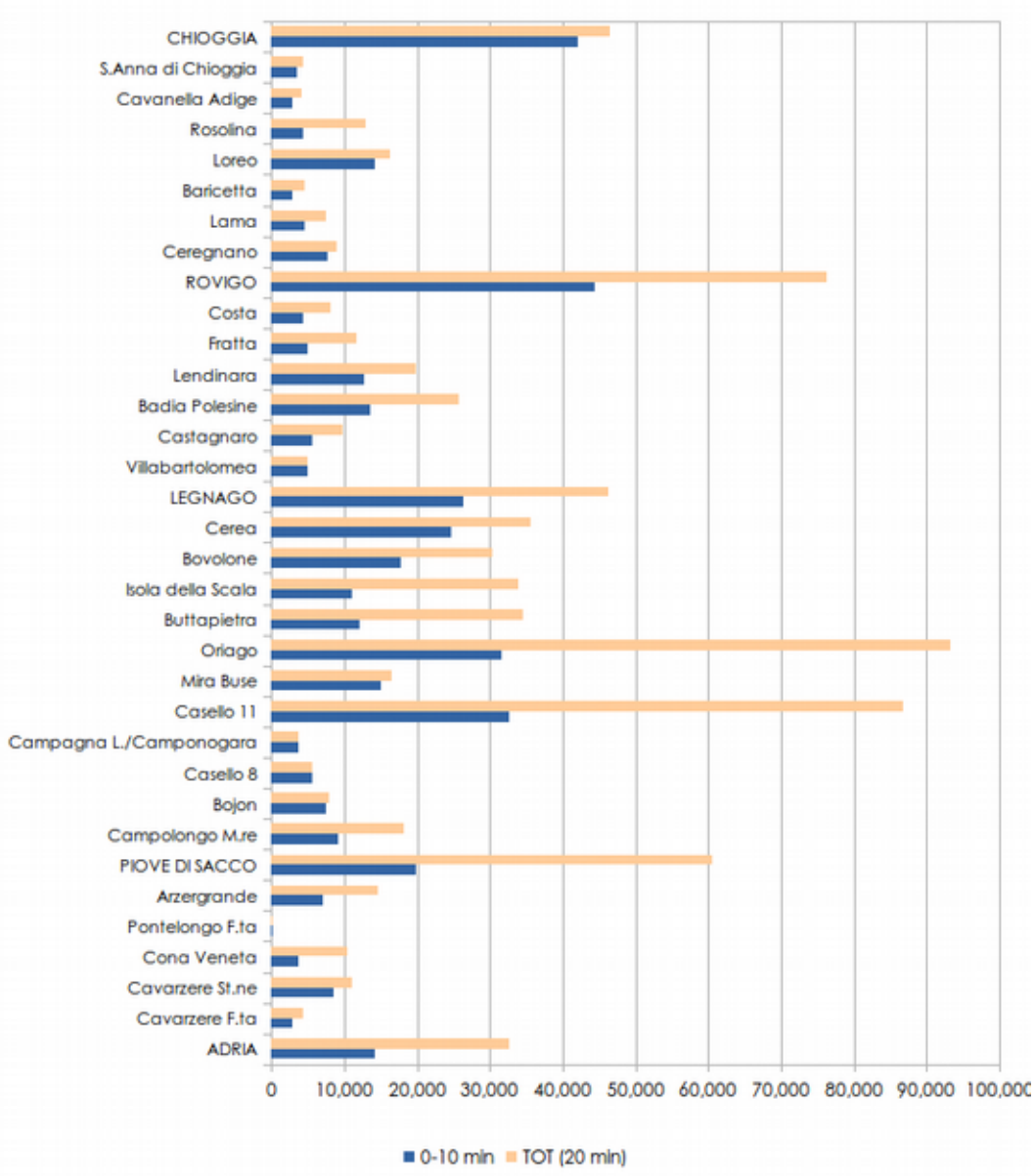


Table 1: Population(source: ISTAT 2011) in the attractiveness areas of all the stations of the Sistemi Territorili ral network

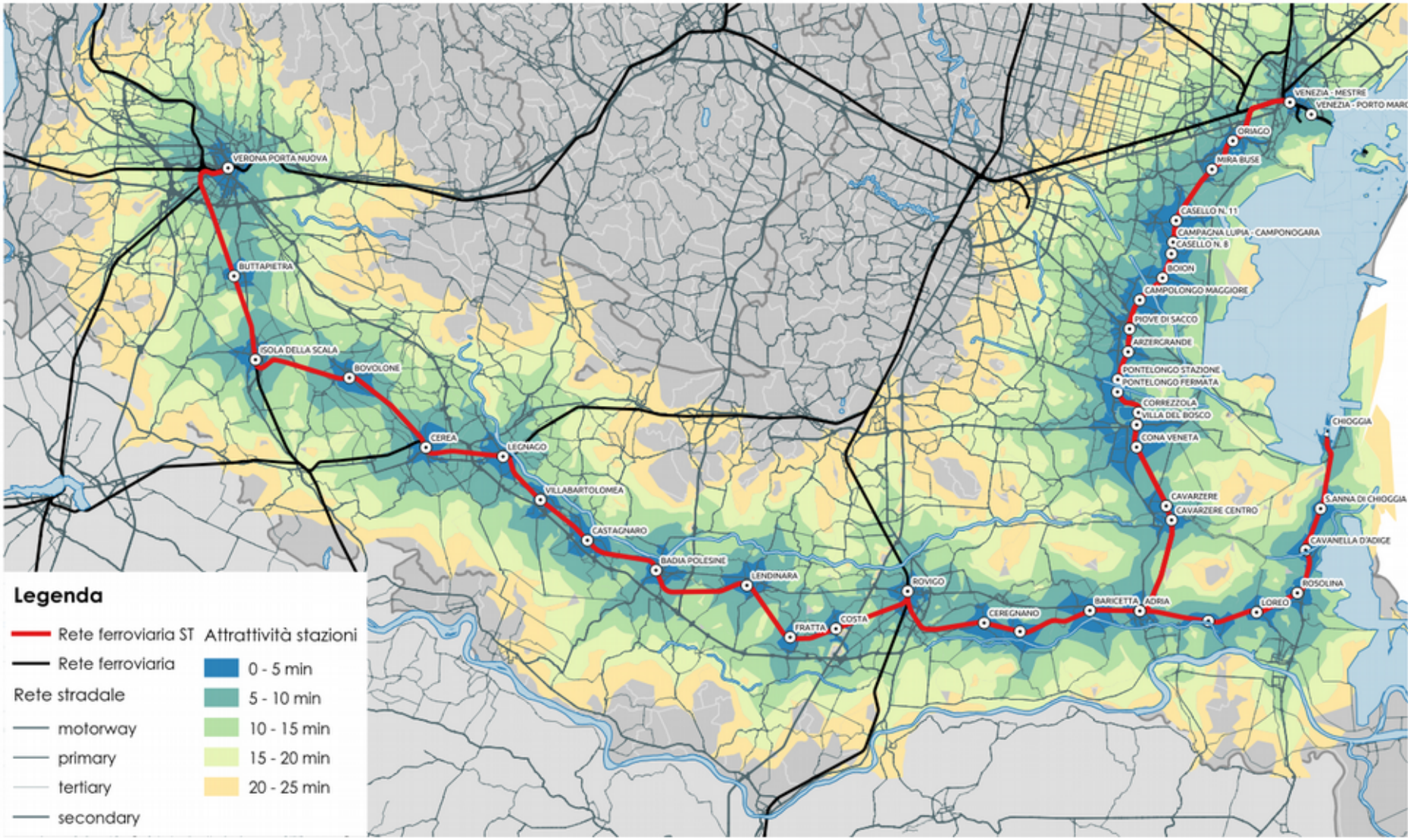


Figure 2: Overall attractiveness area of the Sistemi Territoriali rail network, classified by traveltime to the closest station along the raod network

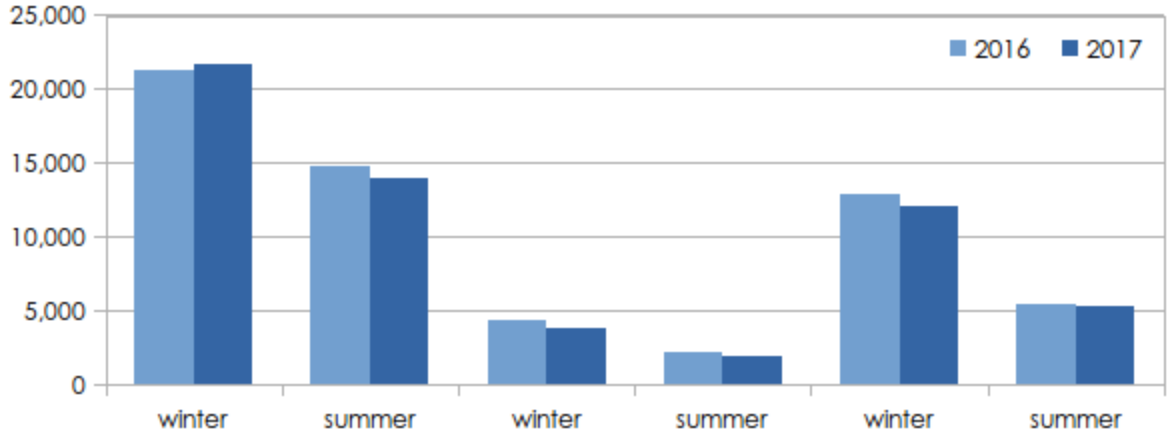
2 TIME SERIES ANALYSIS

2.1 Introduction

Every year Sistemi Territoriali carries on a complete survey in order to investigate how many people use the passengers services in different time of the year (March/April – July – November)and along the week. The survey is based on a complete count of passengers boarding/alighting at each station for each train.

These data constitute historical time series; they are complete especially for the period 2016-2017.

Graph 1: Average total of the weekly boarding passengers, divided per time of the year



2.2 Boardings: line analysis

The Adria – Venezia Mestre line counts the larger demand; during school season (from now on defined: *winter time*) each week the line serves more than 20.000 passengers.

Year	2016									
Adria Mestre										
	Monday	Tuesday	Wednes.	Thursday	Friday	avg working	Saturday	Sunday	working/holiday	week
April	3,456	3,536	4,392	3,659	3,778	3,764	2,307	1,340		22,468
November	3,784	3,372	3,716	3,587	2,604	3,413	2,144	948		20,155
average winter	*3,620*	*3,454*	*4,054*	*3,623*	*3,191*	***3,588***	*2,225*	*1,144*	*32%*	***21,311***
July (Summer)	2,245	2,708	2,427	2,223	2,597	**2,440**	1,546	1,010	*41%*	**14,756**
summer/winter						*68%*	*69%*	*88%*		*69%*
Chioggia Rovigo										
	Monday	Tuesday	Wednes.	Thursday	Friday	avg working	Saturday	Sunday	working/holiday	week
April	684	778	563	689	564	656	396	376		4,050
November	849	921	831	950	510	812	404	202		4,667
average winter	*767*	*850*	*697*	*820*	*537*	***734***	*400*	*289*	*39%*	***4,358***
July (Summer)	316	379	245	354	352	**329**	304	266	*81%*	**2,216**
summer/winter						*45%*	*76%*	*92%*		*51%*
Rovigo Verona										
	Monday	Tuesday	Wednes.	Thursday	Friday	avg working	Saturday	Sunday	working/holiday	week
April	1,741	1,554	1,761	1,819	1,927	1,760	1,018	440		9,682
November	2,059	2,089	2,021	1,901	1,528	1,920	759	441		10,480
average winter	*1,900*	*1,822*	*1,891*	*1,860*	*1,728*	***1,840***	*1,828*	*1,829*	*99%*	***12,859***
July (Summer)	1,041	1,016	856	1,013	915	**968**	443	315	*33%*	**5,471**
summer/winter						*53%*	*24%*	*17%*		*43%*
Year	**2017**									
Adria Mestre										
	Monday	Tuesday	Wednes.	Thursday	Friday	avg working	Saturday	Sunday	working/holiday	week
March	3,637	3,541	3,886	3,808	3,803	3,735	2,357	1,066		22,098
November	2,428	3,619	3,807	3,923	3,687	3,493	2,514	1,310		21,288
average winter	*3,033*	*3,580*	*3,847*	*3,866*	*3,745*	***3,614***	*2,436*	*1,188*	*33%*	***21,693***
July (Summer)	2,021	2,365	2,445	2,147	2,192	**2,234**	2,247	606	*27%*	**14,023**
summer/winter						*62%*	*92%*	*51%*		*65%*
Chioggia Rovigo										
	Monday	Tuesday	Wednes.	Thursday	Friday	avg working	Saturday	Sunday	working/holiday	week
March	704	734	513	798	680	686	469	227		4,125
November	382	647	695	672	578	595	307	247		3,528
average winter	*543*	*691*	*604*	*735*	*629*	***640***	*388*	*237*	*37%*	***3,827***
July (Summer)	196	224	326	393	369	**302**	334	98	*32%*	**1,940**
summer/winter						*47%*	*86%*	*41%*		*51%*
Rovigo Verona										
	Monday	Tuesday	Wednes.	Thursday	Friday	avg working	Saturday	Sunday	working/holiday	week
March	1,738	1,748	1,622	1,586	1,621	1,663	856	676		9,667
November	1,776	1,750	1,931	1,690	1,890	1,807	935	736		10,509
average winter	*1,757*	*1,749*	*1,777*	*1,638*	*1,756*	***1,735***	*1,731*	*1,727*	*100%*	***12,130***
July (Summer)	847	827	952	1,031	984	**928**	697	353	*38%*	**5,347**
summer/winter						*53%*	*40%*	*20%*		*44%*

Table 2: Average total boardings for each survey period

The comparison of total boardings in 2016 and 2017 shows that travel demand has increased on the Adria-Mestre line in winter season up to 10% in the weekend; in summer the trend is negative on Sunday, when the surveyed volume has decreased by 40%, while on Saturday it is the opposite (+45%).

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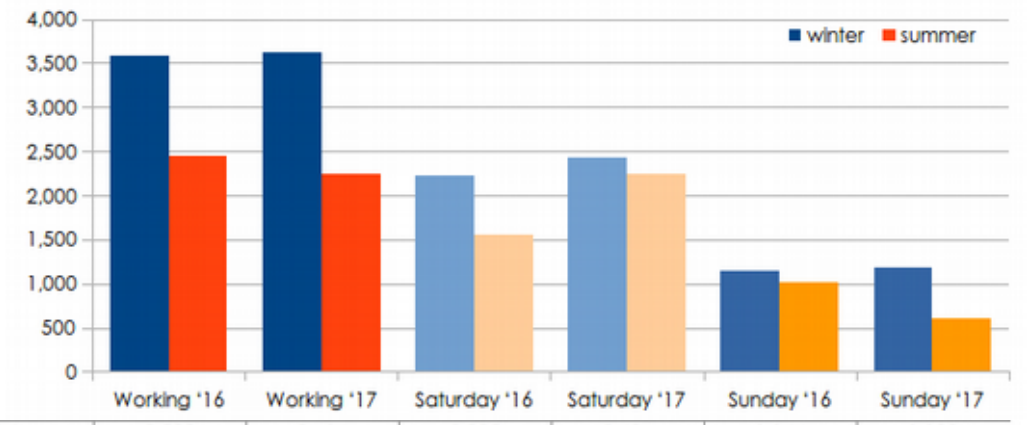
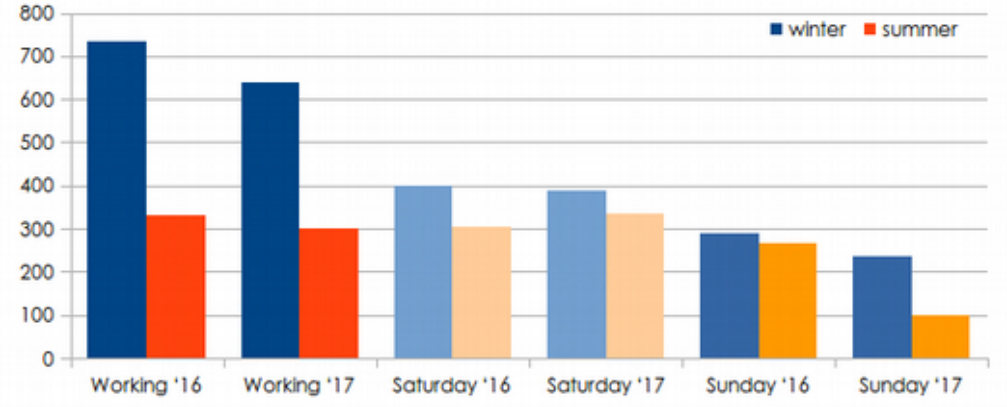


	Working '16	Working '17	Saturday '16	Saturday '17	Sunday '16	Sunday '17
winter	3,588	3,614	2,225	2,436	1,144	1,188
summer	2,440	2,234	1,546	2,247	1,010	606

Table 3: Total average boardings on the Adria-Mestre line

With regards to the Chioggia-Rovigo line, surveys in 2017 have registered a volume of passengers lower (*-13%*) than 2016 during working days (Monday-Friday), a stable situation on Saturday and another significant decrease on Sunday (- 64%).



	Working '16	Working '17	Saturday '16	Saturday '17	Sunday '16	Sunday '17
winter	734	640	400	388	289	237
summer	329	302	304	334	266	98

Table 4: Total average boardings on the Chioggia-Rovigo line

The service along the Rovigo-Verona has been used on 2017 by fewer passengers during winter. With regards to this line, it has to be pointed out the lack of variability among working days and the weekend during the winter time.

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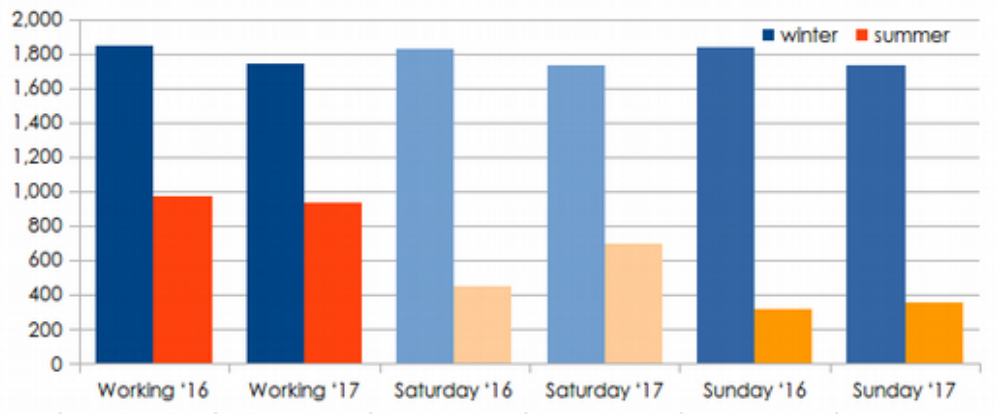
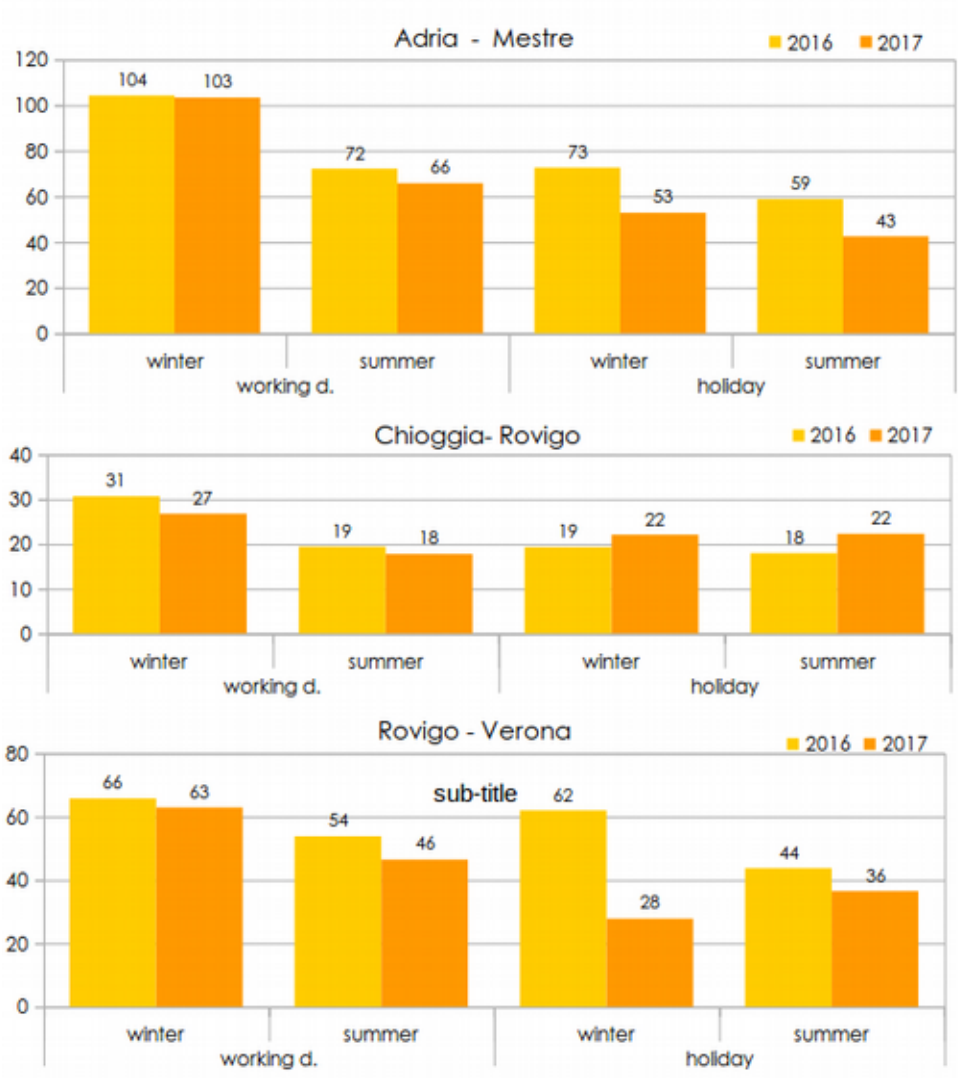


	Working '16	Working '17	Saturday '16	Saturday '17	Sunday '16	Sunday '17
winter	1,840	1,735	1,828	1,731	1,829	1,727
summer	968	928	443	697	315	353

Table 5: Total average boardings on the Rovigo-Verona line

The best KPI for evalluating the effectiveness of each train service in a timetable is the average number of total passenger boarding on a train.

Graph 2: Total average boardings on each train



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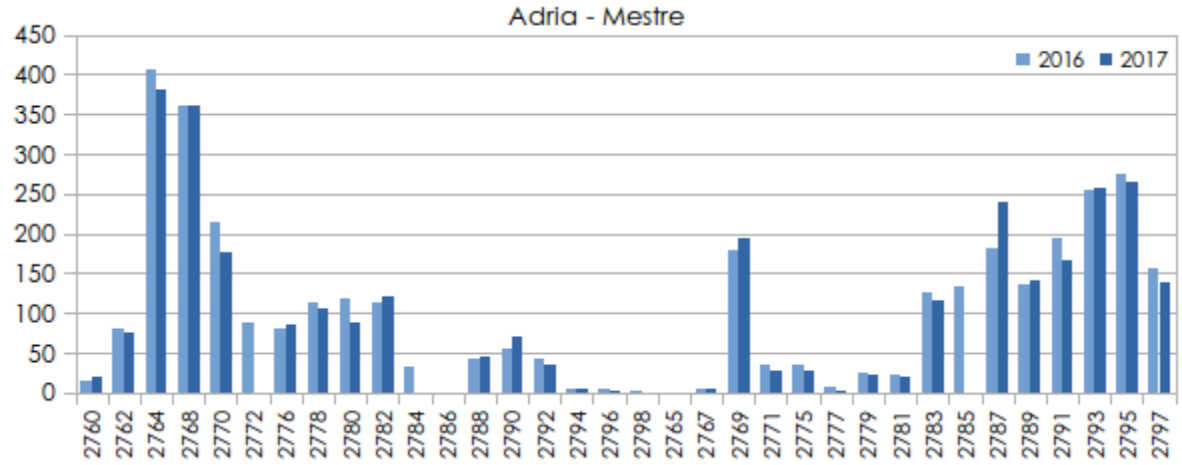
As expected, the volume of passengers using a train is greater during working days in winter and it has registered a stable tren in 2017 with regards to 2016: this results points out that trains serve mostly commuters (workers and students).

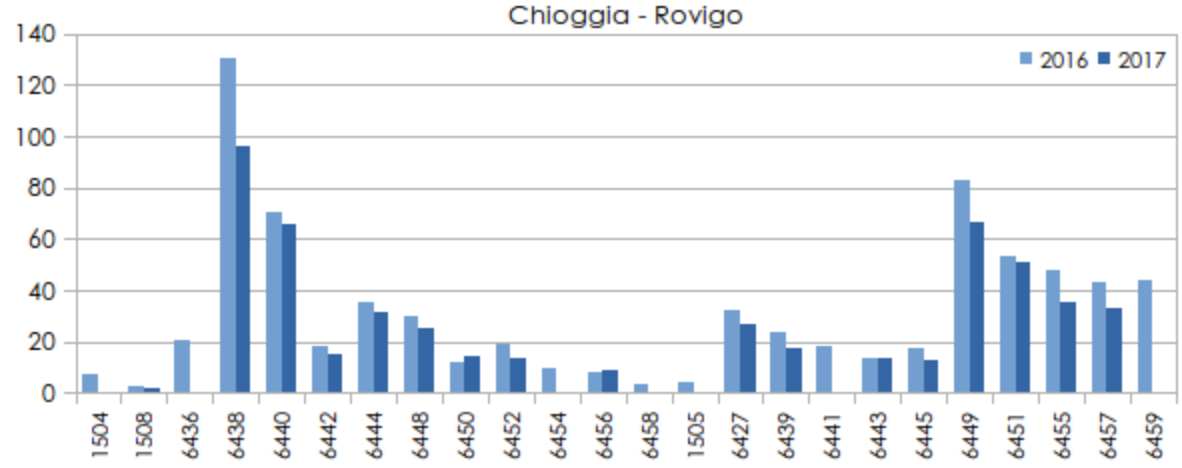
Anyhow, average values doesn't show clearly the daily trend: they result from peak demand values usually double than volumes during off-peak hours, especially in working days.

Graph 3: Line Adria-Mestre: average boardings for each train; winter – working days



Trains 2764 and 2768 on the Adria – Mestre (leaving from Adria on 6:10 and 7:10) are used by more than 350 passengers, while on average boardings on trains towards Venezia (which are indicated by even numbers) are nearly 100. Towards Adria (odd trains) the peak is distributed among more trains, leaving from Venezia in the evening between 16:19 and 18:19 and carrying 200-250 passengers each.

Graph 4: Line Chioggia-Rovigo: average boardings for each train; winter – working days



With regards to the service along the Chioggia-Rovigo line, the conclusion is the same: the morning peak towards Rovigo concerns only one train, which leaves Chioggia at 06:35 and reaches Rovigo at 07:45; in the evening passengers aren't gathered, but they use all the trains from 13:15 (6449) until 17:15 (6457).

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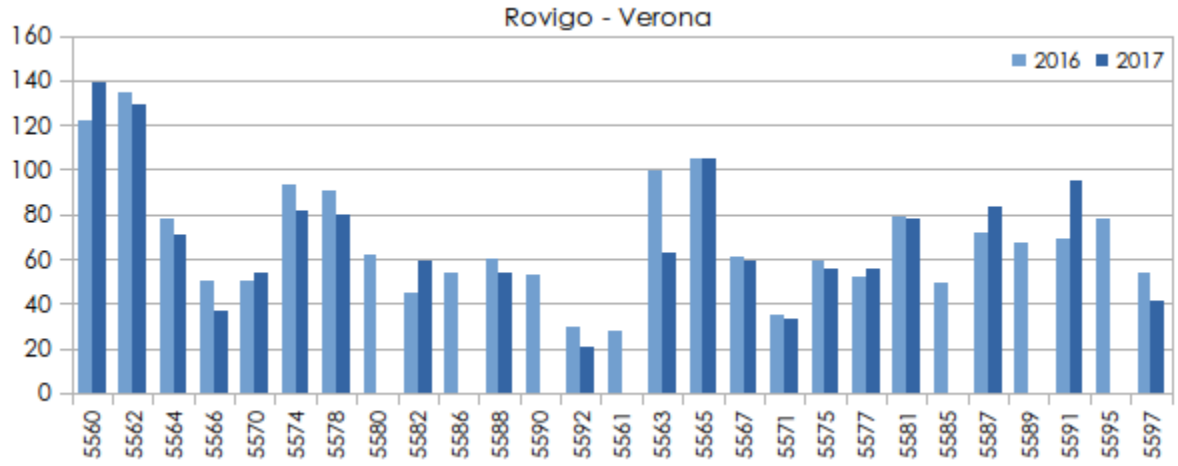
Graph 5: Line Rovigo-Verona: average boardings for each train; winter – working days



The analysis of data collected on the train of the Rovigo-Verona line shows a different behavior: the difference among peaks and the other trains is smaller, even if some trains still attract more than the double volume of passengers than the others.

Data shows a local variability too for every line. The following graphs show boardings/alighting at the different stations, registered in working days during winter season.

Volumes of passengers at the stations of the major towns represent the main portion of the travel demand for each line, while smaller places collect less than 100 passengers (alighting + boarding) in the representative day.

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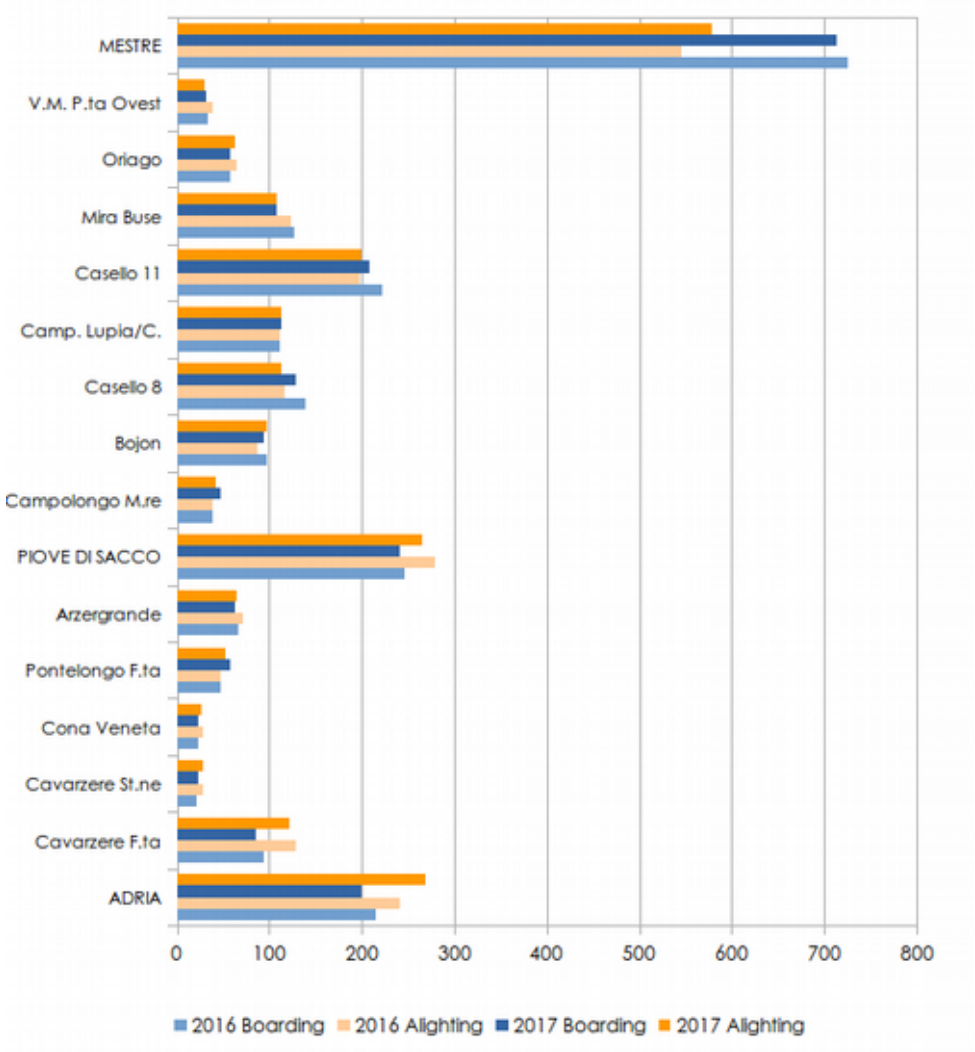
Graph 6: Line Adria- - Mestre: average daily passengers at each station; winter – working days



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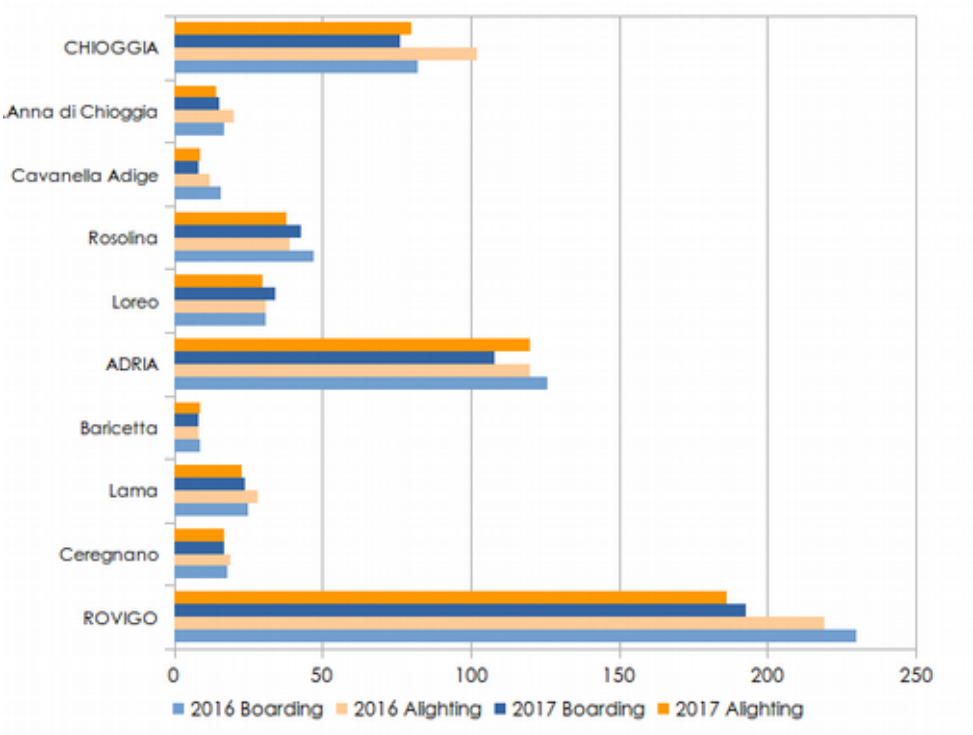
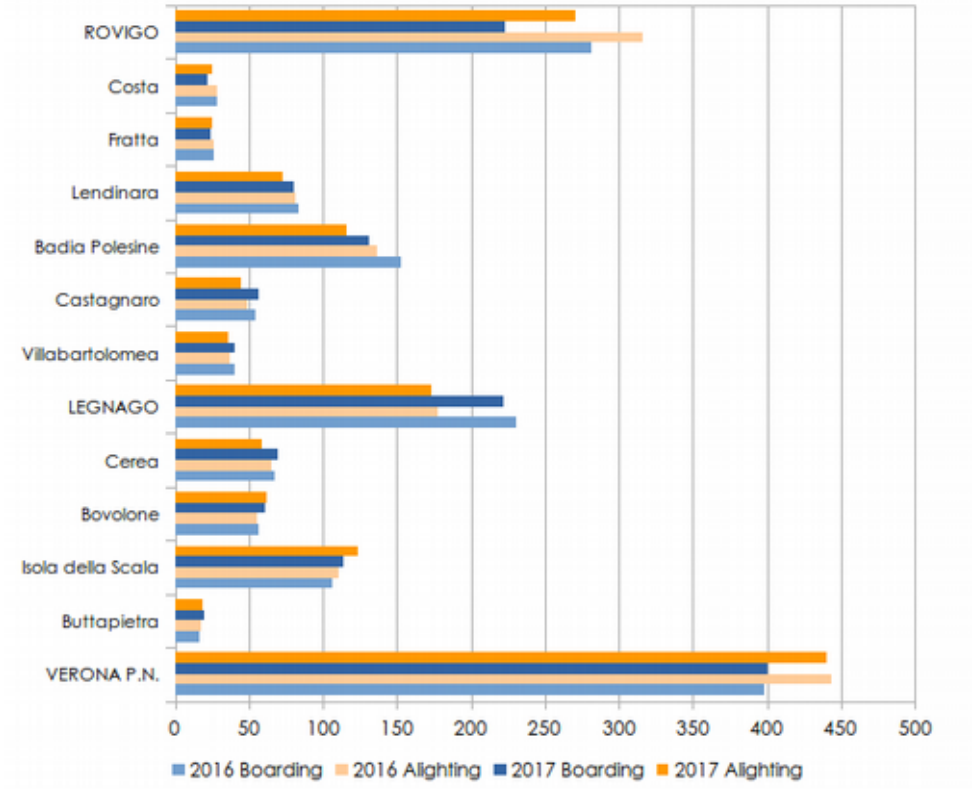
Graph 7: Line Chioggia - Rovigo: average daily passengers at each station; winter – working days



Graph 8: Line Rovigo - Verona: average daily passengers at each station; winter – working days



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3 TRAVEL DEMAND SURVEY CAMPAIGN

3.1 Sample survey campaign of travel demand

Surveys on the 3 lines have been carried out before and during school season, but after the beginning of September, given that along the Rovigo-Chioggia the service is interrupted in summer and buses are used instead, but the characteristics of the service are completely different in terms of traveltime and comfort.

Summer campaign: 3 - 9 September 2018.

Winter campaign: 14 – 20 October 2018.

With regards to the statistics significance of the campaign, the sampling rate is shown in table for each line and period.

Table 6: Sampling rate

Season	winter						summer					
	weekdays			holidays			weekdays			holidays		
	Total trains	Trains surveyed	Sampling rate	Total trains	Trains surveyed	Sampling rate	Total trains	Trains surveyed	Sampling rate	Total trains	Trains surveyed	Sampling rate
Rovigo – Chioggia	20	**10**	50%	12	**4**	33%	18	**8**	44%	12	**4**	33%
Adria – Mestre	26	**14**	54%	10	**6**	60%	22	**12**	55%	10	**6**	60%
Verona – Rovigo	24	**13**	54%	12	**6**	50%	16	**11**	69%	12	**6**	50%

The rate depends on the following base principles:

1. minimum sampling rate for each period: 30%;
2. average sampling rate of peak hour in weekday-winter: 50%;
3. priority to the observation of the same train in different periods, in order to ease comparisons and the future evaluation of modeling expansion coefficients.

3.2 Surveys results overview

An overview of data collected in terms of total passengers boarding on each train is displayed In the following tables and graphs, divided per line and direction and ordered per departure time at the first station.

Given that timetables aren't the same in winter and summer and in the weekend, a complete comparison among the data isn't possible. When the same train has been surveyed in different period, data are shown side by side, in order to highlight the variation.

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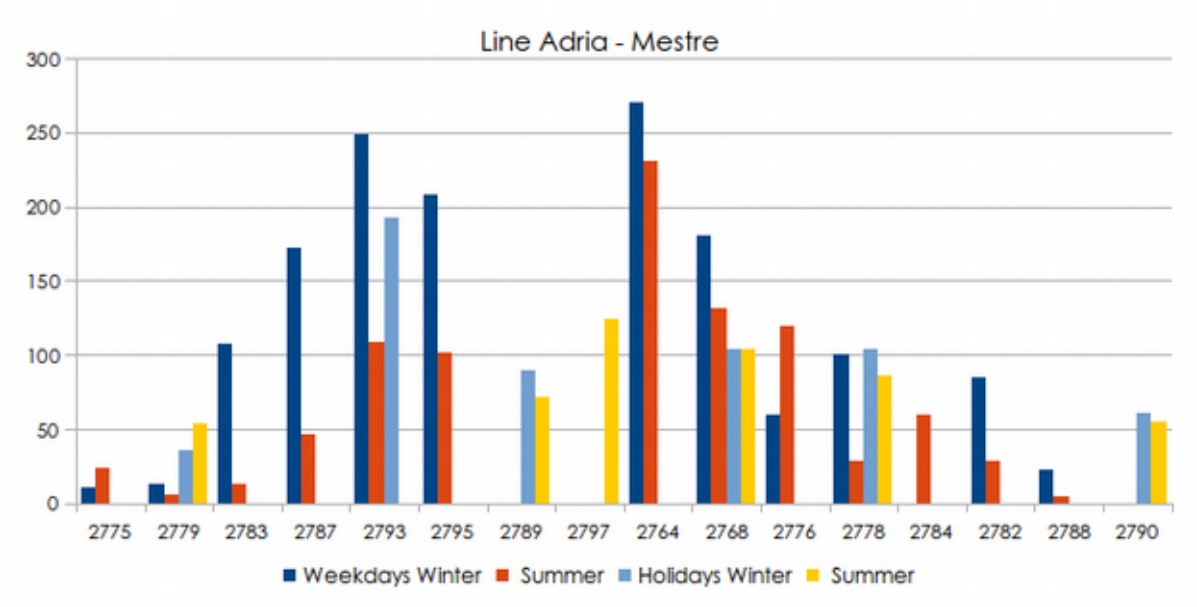
Direction	Train	Leaving at	Weekdays			Holidays		
			Winter	Summer	summer/ winter	Winter	Summer	summer/ winter
odd	**2775**	08:30:00	11	24	218.18%	NR	NR	
odd	**2779**	09:30:00	13	6	46.15%	36	54	150.00%
odd	**2783**	12:30:00	107	13	12.15%	NR	NR	
odd	**2787**	14:03:00	172	46	26.74%	NR	NR	
odd	**2793**	17:30:00	249	109	43.78%	192	NR	
odd	**2795**	18:30:00	208	102	49.04%	NR	NR	
odd	**2789**	15:19:00	NR	NR		89	72	80.90%
odd	**2797**	19:30:00	NR	NR		NR	124	
even	**2764**	06:10:00	270	231	85.56%	NR	NR	
even	**2768**	07:10:00	181	131	72.38%	104	104	100.00%
even	**2776**	10:01:00	59	120	203.39%	NR	NR	
even	**2778**	12:10:00	100	29	29.00%	104	86	82.69%
even	**2784**	12:32:00	NR	60		NR	NR	
even	**2782**	14:10:00	85	29	34.12%	NR	NR	
even	**2788**	16:10:00	22	4	18.18%	NR	NR	
even	**2790**	12:10:00	NR	NR		61	55	

Table 7: Surveys data: line Adria – Mestre



Direction	Train	Leaving at	Weekdays			Holidays		
			Winter	Summer	summer/ winter	Winter	Summer	summer/ winter
odd	**6443**	08:15:00	17	14	82.35%	NR	NR	
odd	**6449**	13:15:00	56	19	33.93%	NR	NR	
odd	**6455**	16:15:00	55	21	38.18%	NR	NR	
odd	**6427**	19:15:00	NR	15		NR	NR	
odd	**6441**	07:15:00	NR	NR		9	8	88.89%
odd	**11503**	07:15:00	NR	NR		16	11	68.75%
odd	**6453**	15:15:00	NR	NR		24	19	79.17%
odd	**6459**	18:15:00	53	NR		NR	NR	
even	**6438**	06:35:00	110	17	15.45%	NR	NR	
even	**6444**	09:35:00	NR	15		NR	NR	
even	**6448**	14:35:00	32	19	59.38%	NR	NR	
even	**6452**	17:35:00	16	17	106.25%	32	18	56.25%
even	**6442**	09:35:00	38	NR		20	27	135.00%
even	**6446**	13:35:00	NR	NR		36	37	102.78%

Table 8: Surveys data: line Chioggia - Rovigo

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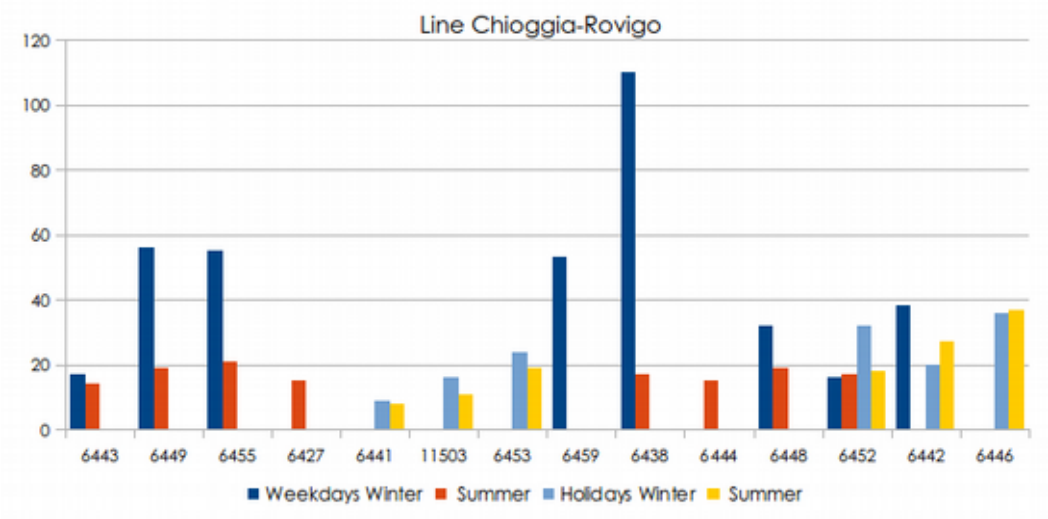
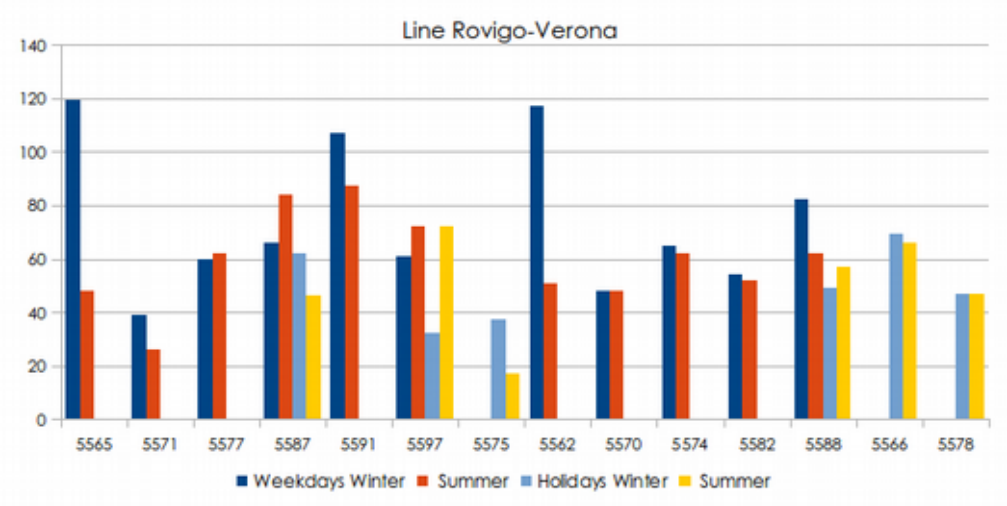


Train	Leaving at	Weekdays			Holidays		
		Winter	Summer	summer/ winter	Winter	Summer	summer/ winter
5565	06:56:00	119	48	*40.34%*	NR	NR	
5571	08:56:00	39	26	*66.67%*	NR	NR	
5577	12:56:00	60	62	*103.33%*	NR	NR	
5587	15:56:00	66	84	*127.27%*	62	46	*74.19%*
5591	17:56:00	107	87	*81.31%*	NR	NR	
5597	19:56:00	61	72	*118.03%*	32	72	*225.00%*
5575	11:56:00	NR	NR		37	17	*45.95%*
5562	06:38:00	117	51	*43.59%*	NR	NR	
5570	09:38:00	48	48	*100.00%*	NR	NR	
5574	12:38:00	65	62	*95.38%*	NR	NR	
5582	15:38:00	54	52	*96.30%*	NR	NR	
5588	17:38:00	82	62	*75.61%*	49	57	*116.33%*
5566	08:38:00	NR	NR		69	66	*95.65%*
5578	13:38:00	NR	NR		47	47	*100.00%*

Table 9: Surveys data: line Rovigo – Verona



In general, summer volumes are lower that winter ones, both on weekdays and holidays: with special regards to weekdays and in particular to the lines Adria-Mestre and Rovigo-

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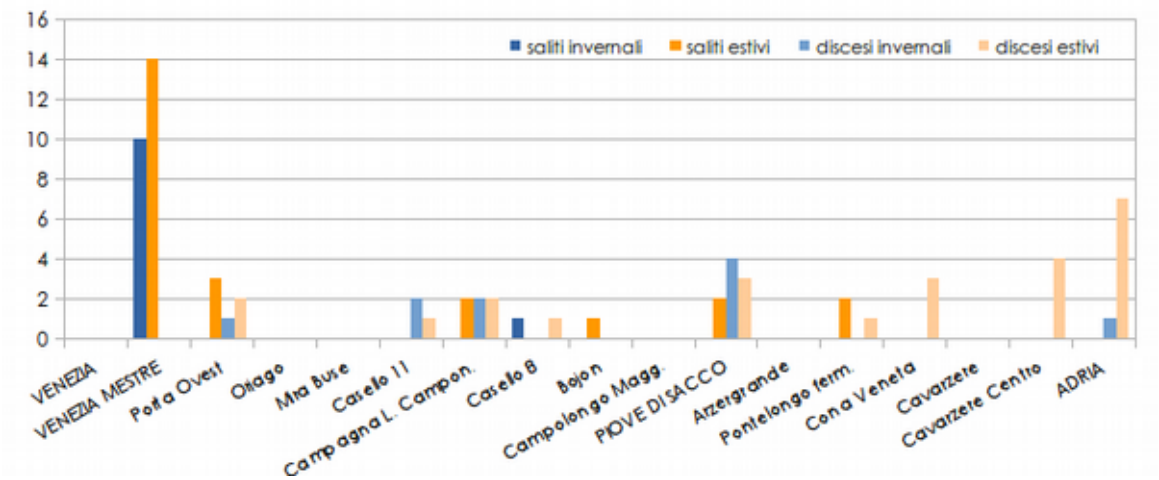
Chioggia, the difference is on average greater than 30% (the average rate summer/winter is respectively 69% and 56%), while on Rovigo-Verona the variation is less evident and on average it counts 13% (average summer/winter 86%).

3.3 Detailed results for weekdays

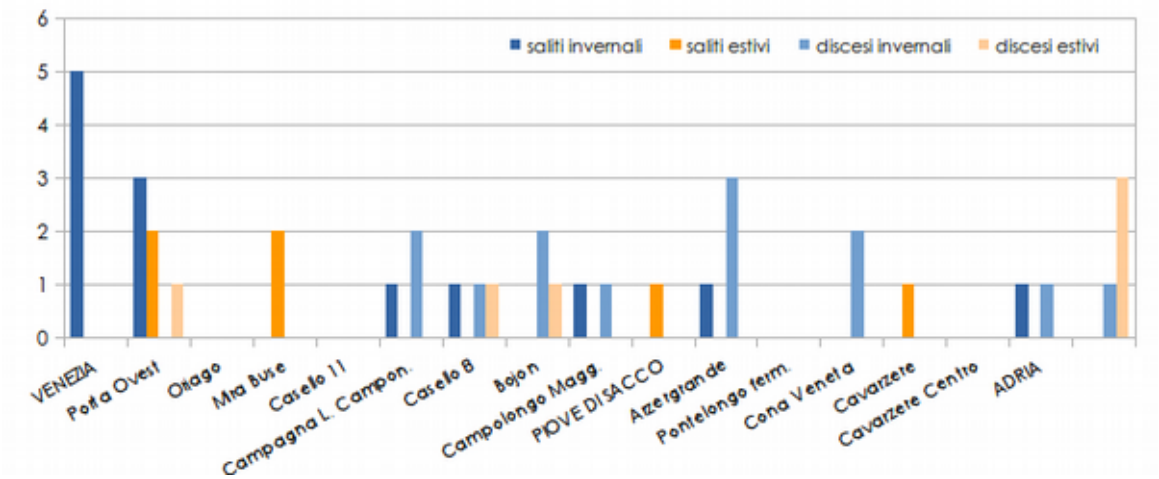
In the following paragraphs a complete overview over data per each train surveyd is reported.

Line Adria – Mestre

Graph 9: Passenger trend on train 2775. Departure time from Venezia at 08:30



Graph 10: Passenger trend on train 2779. Departure time from Venezia at 09:30



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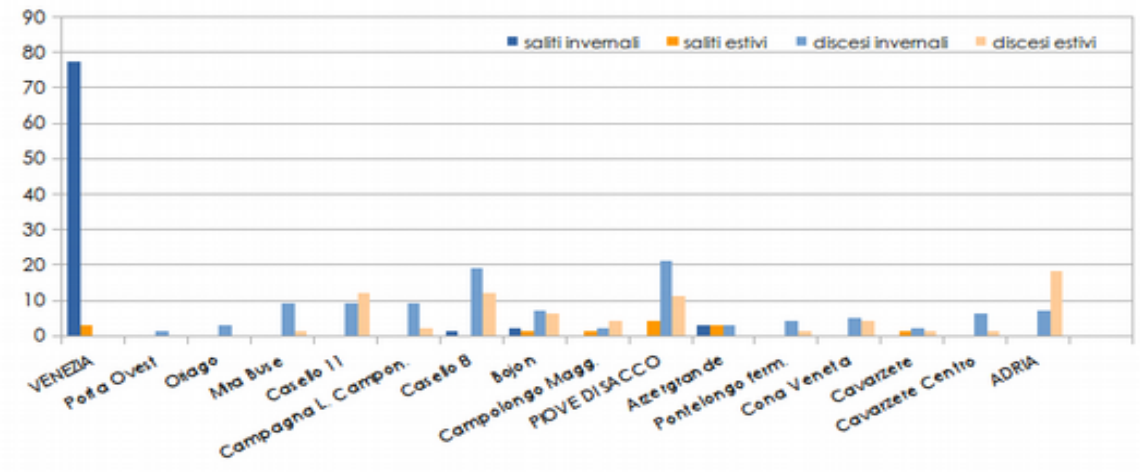
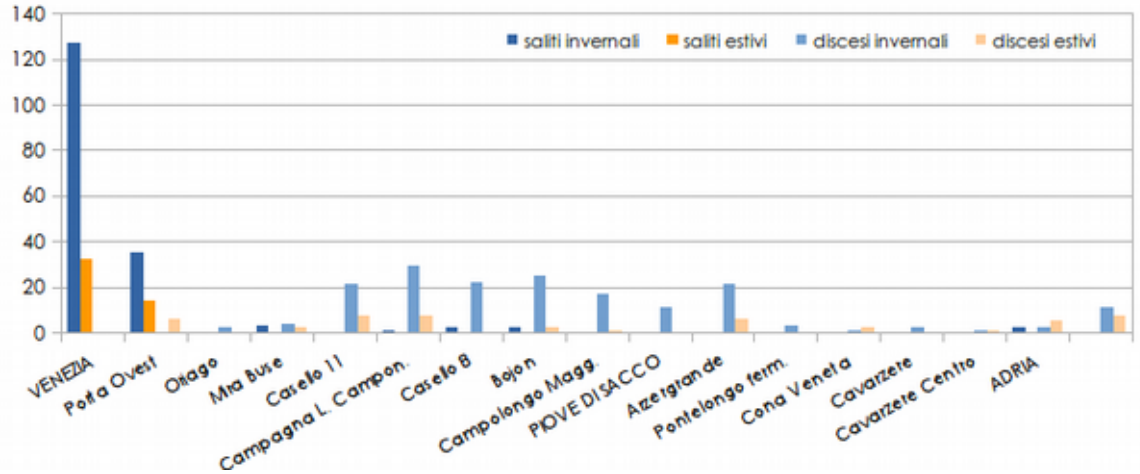
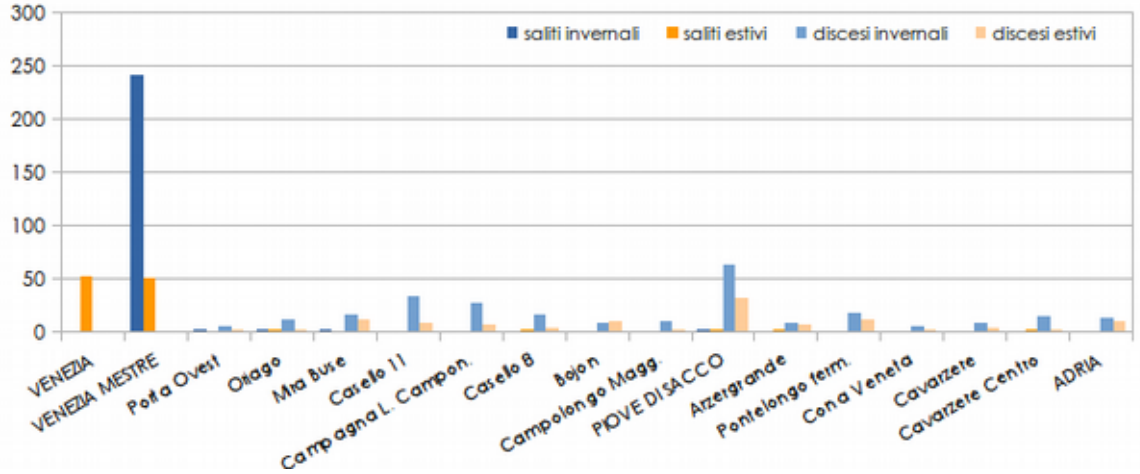
Graph 11: Passenger trend on train 2783. Departure time from Venezia at 12:30



Graph 12: Passenger trend on train 2787. Departure time from Venezia at 14:30



Graph 13: Passenger trend on train 2793. Departure time from Venezia at 17:30



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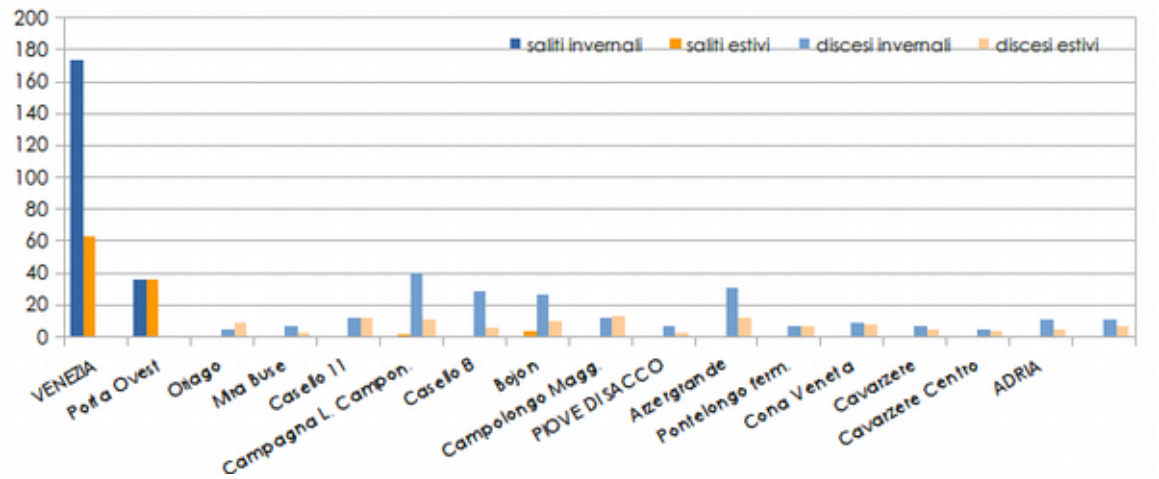
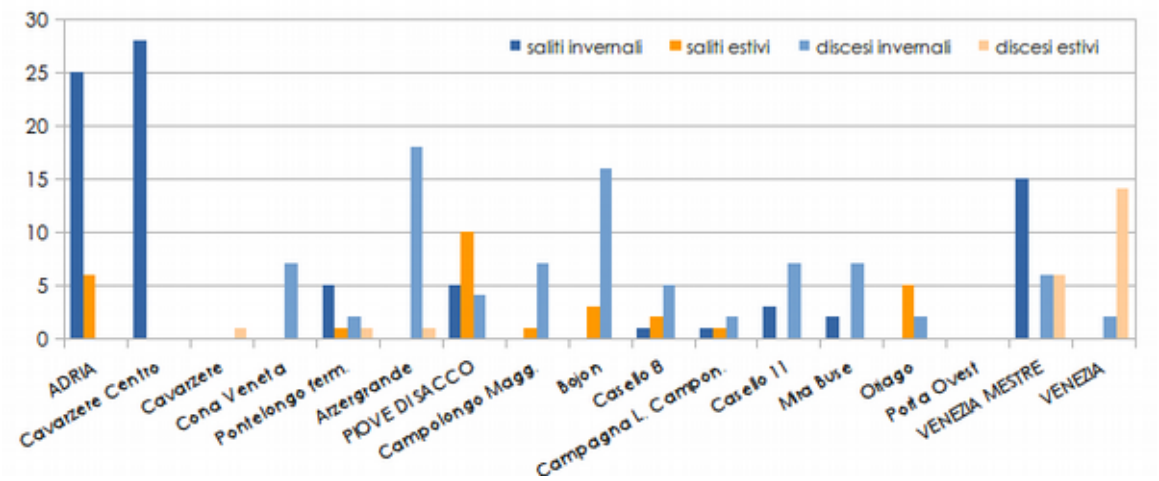
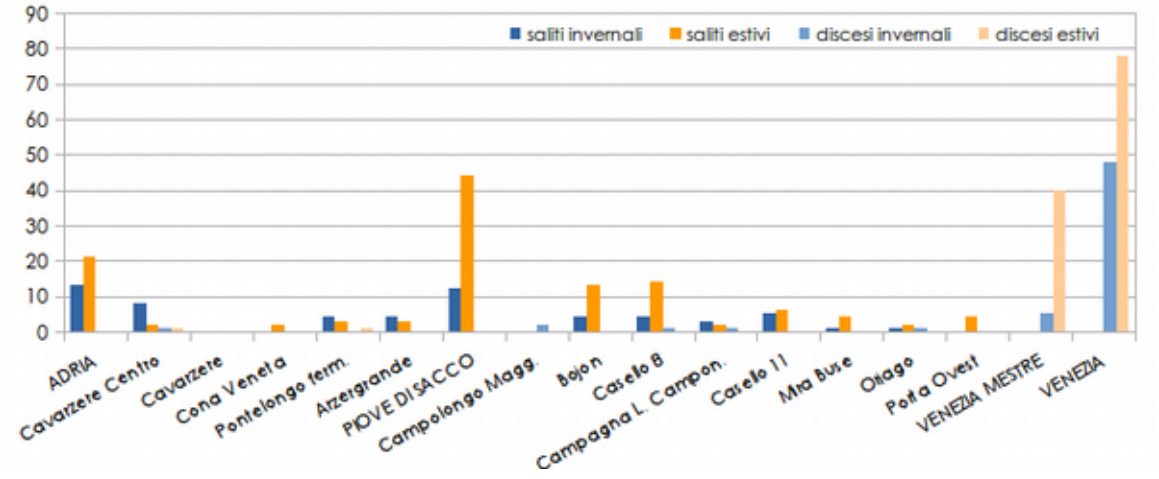
Graph 14: Passenger trend on train 2795. Departure time from Venezia at 18:30



Graph 15: Passenger trend on train 2768. Departure time from Adria at 07:10



Graph 16: Passenger trend on train 2776. Departure time from Adria at 10:10



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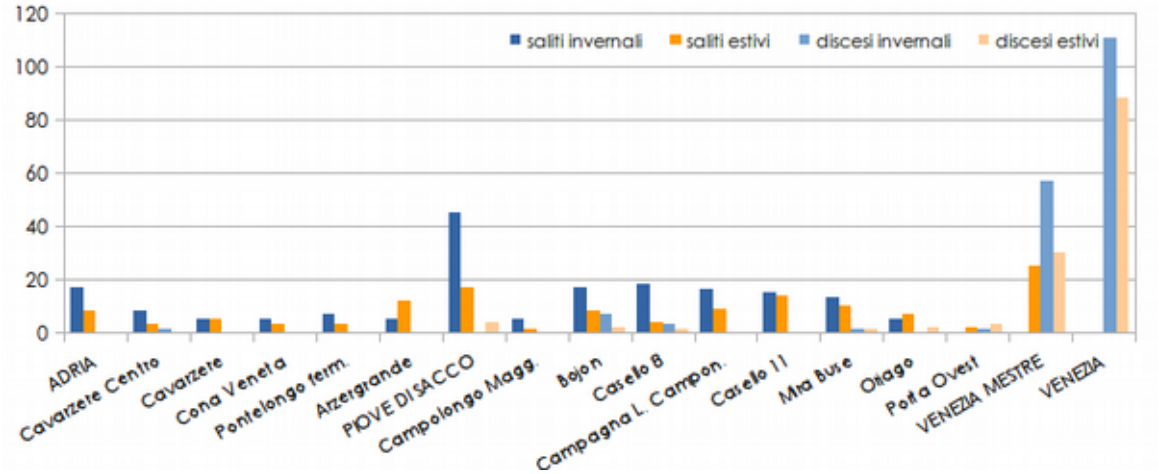
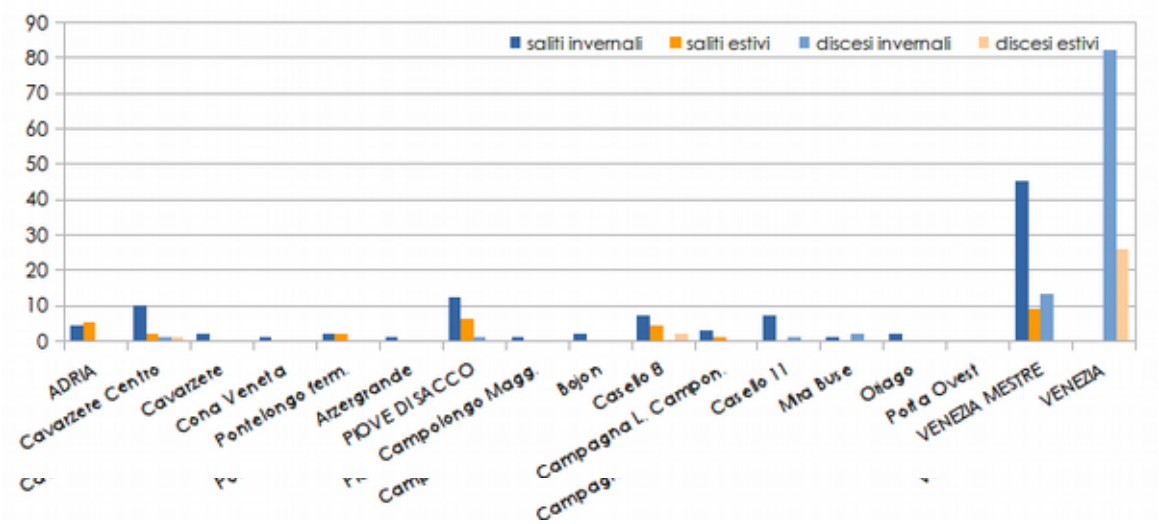
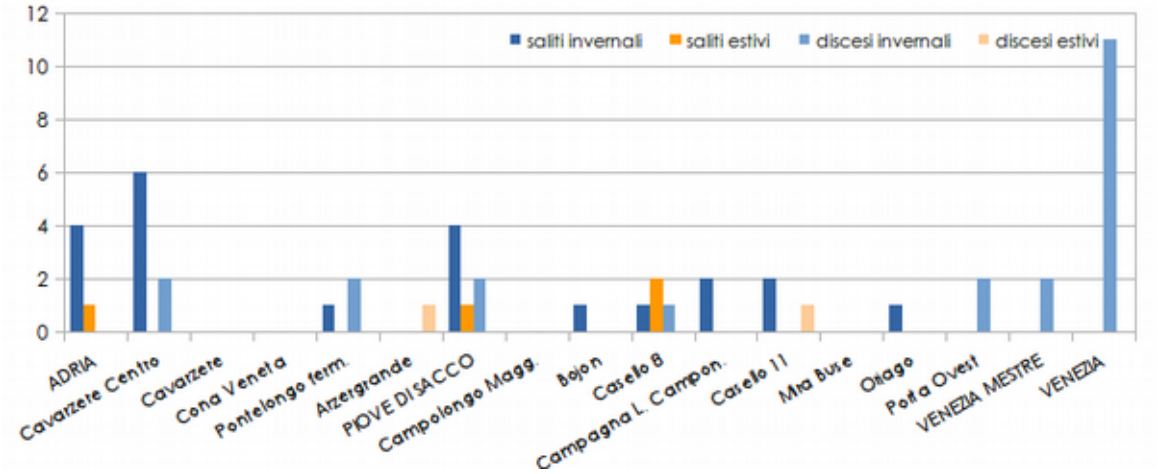
Graph 17: Passenger trend on train 2778. Departure time from Adria at 12:10



Graph 18: Passenger trend on train 2782. Departure time from Adria at 14:10



Graph 19: Passenger trend on train 2768. Departure time from Adria at 16:10



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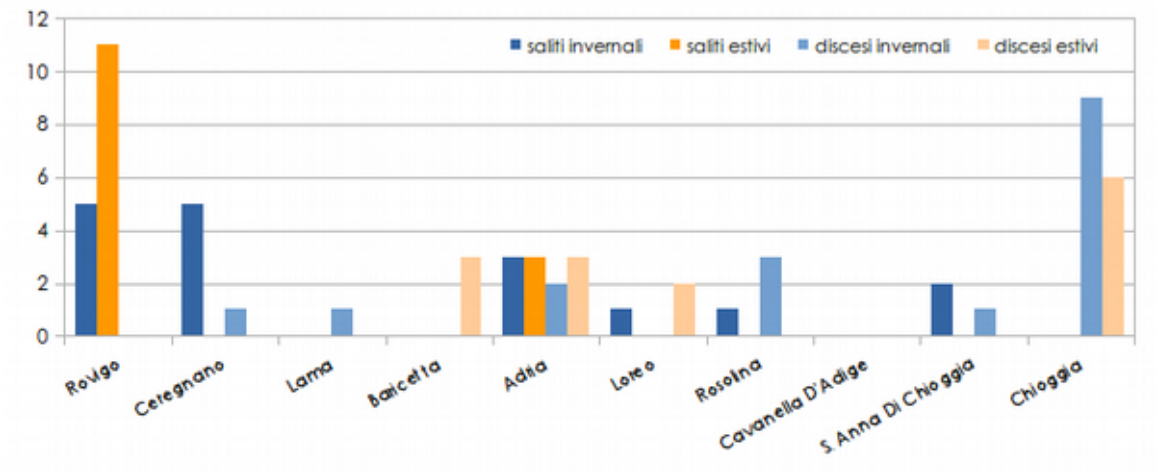
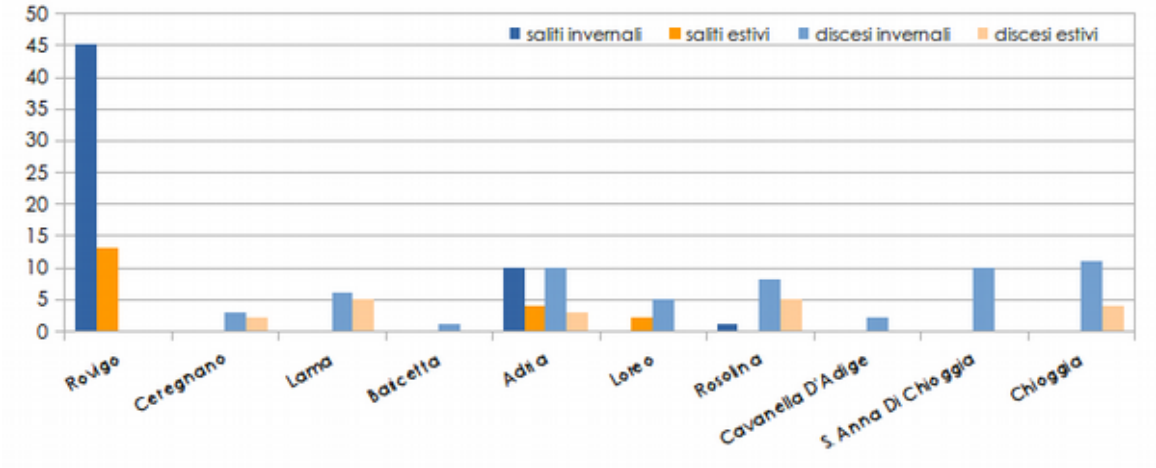
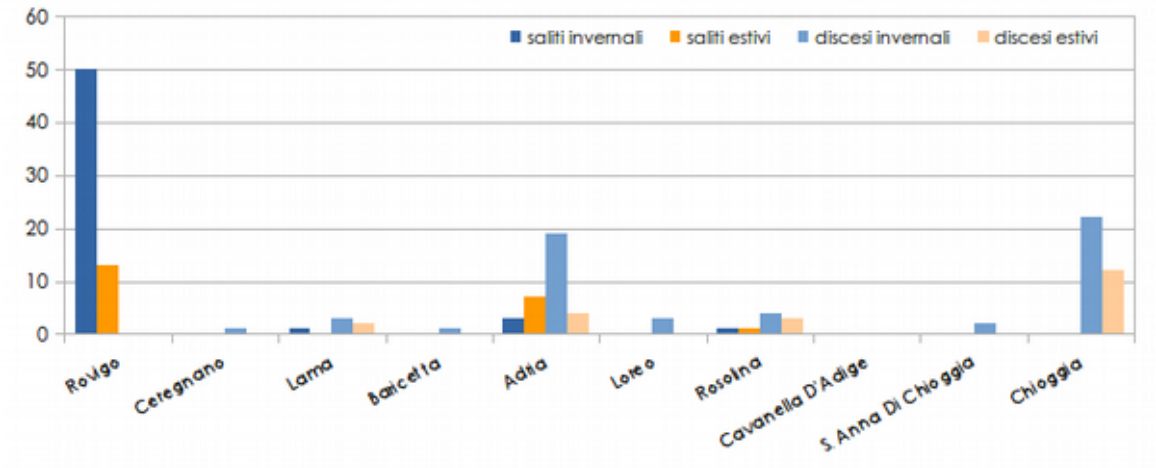
Line Chioggia - RovigoGraph 20: Passenger trend on train 6443. Departure time from Rovigo at 08:15



Graph 21: Passenger trend on train 6449. Departure time from Rovigo at 13:15



Graph 22: Passenger trend on train 6455. Departure time from Rovigo at 16:15



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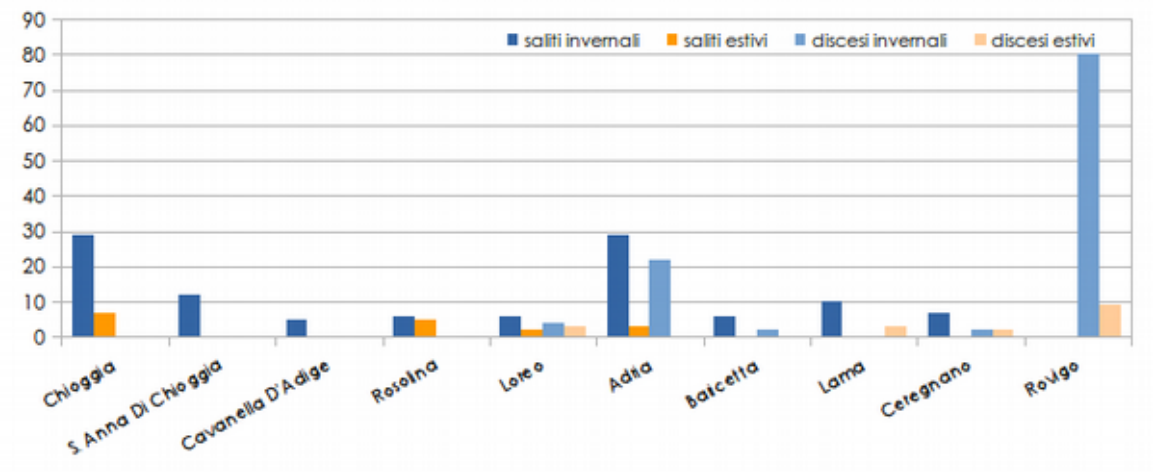
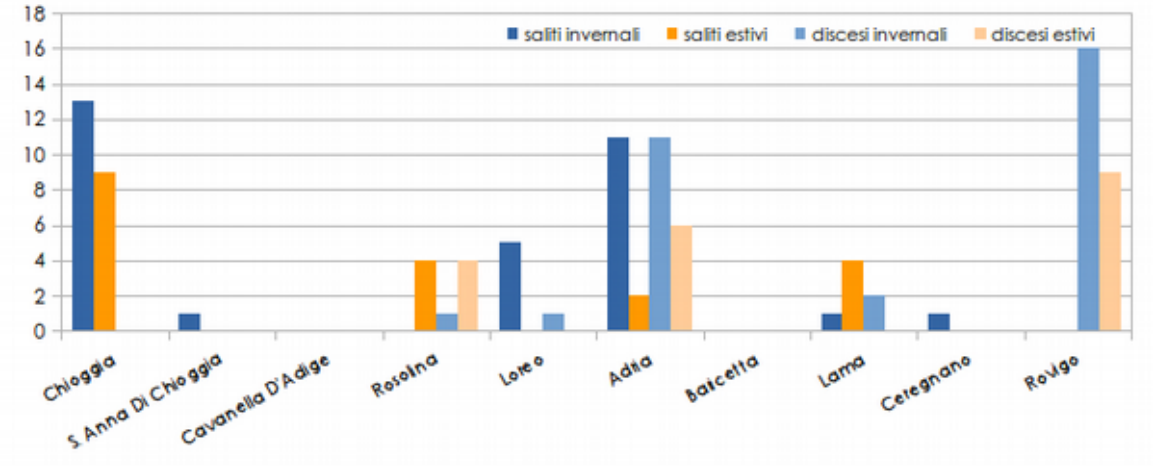
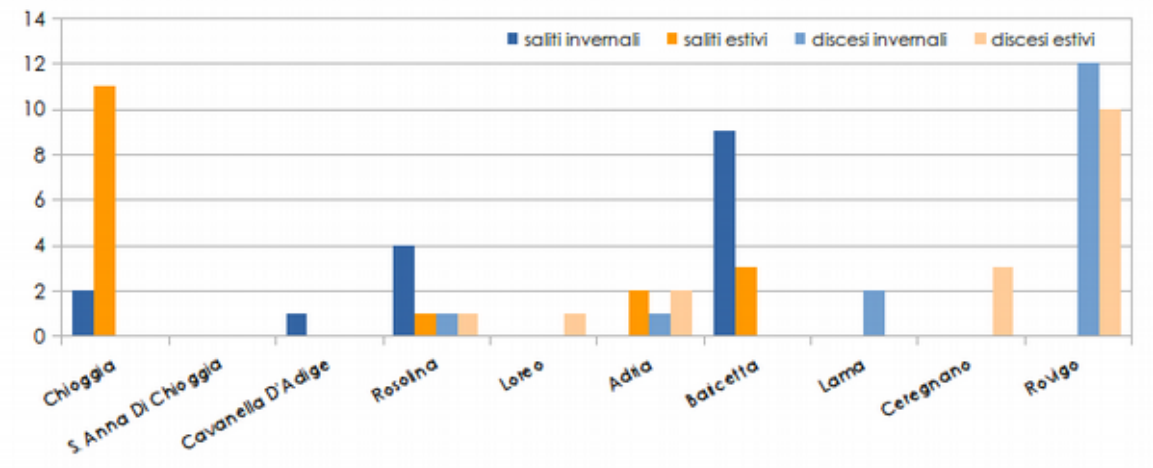
Graph 23: Passenger trend on train 6438. Departure time from Chioggia at 06:35



Graph 24: Passenger trend on train 6448. Departure time from Chioggia at 14:35



Graph 25: Passenger trend on train 6452. Departure time from Chioggia at 17:35



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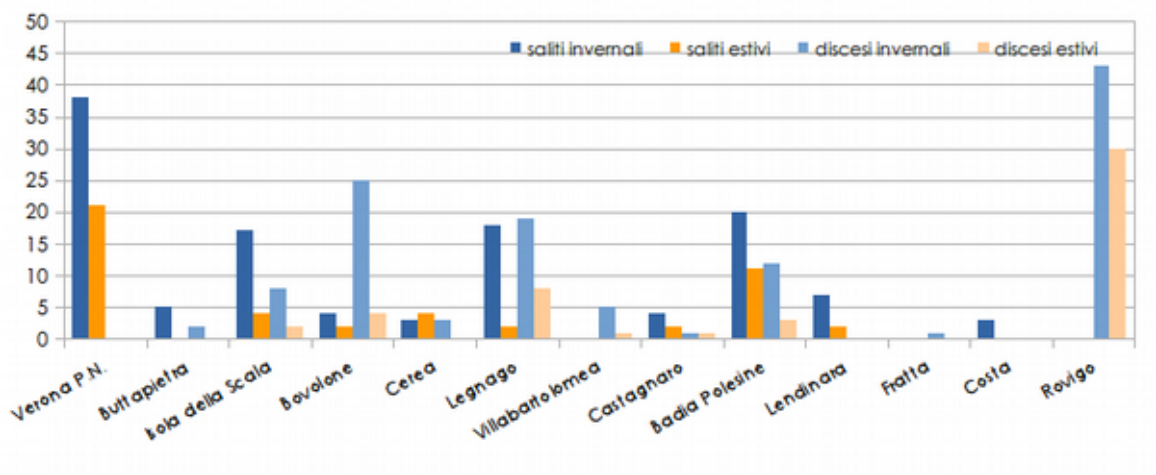
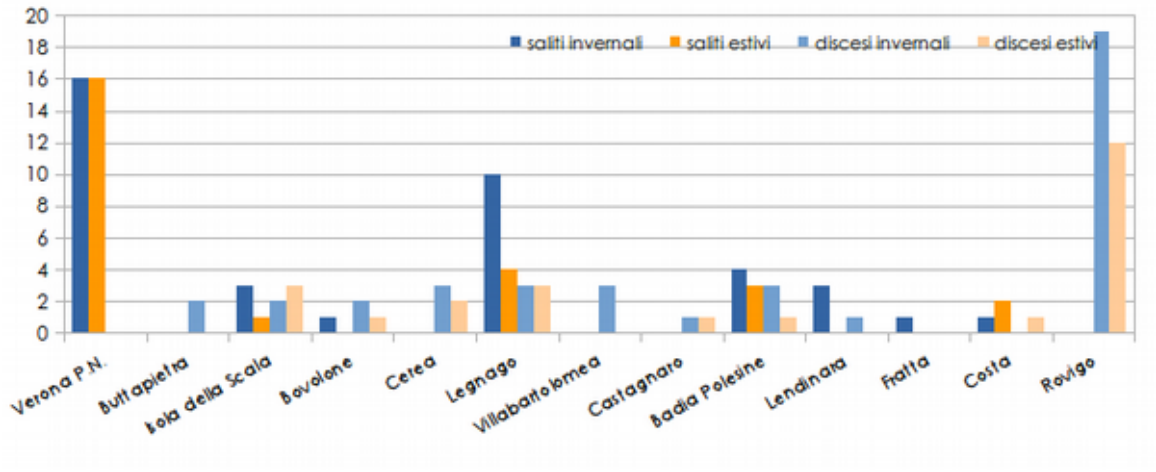
Line Verona - Rovigo

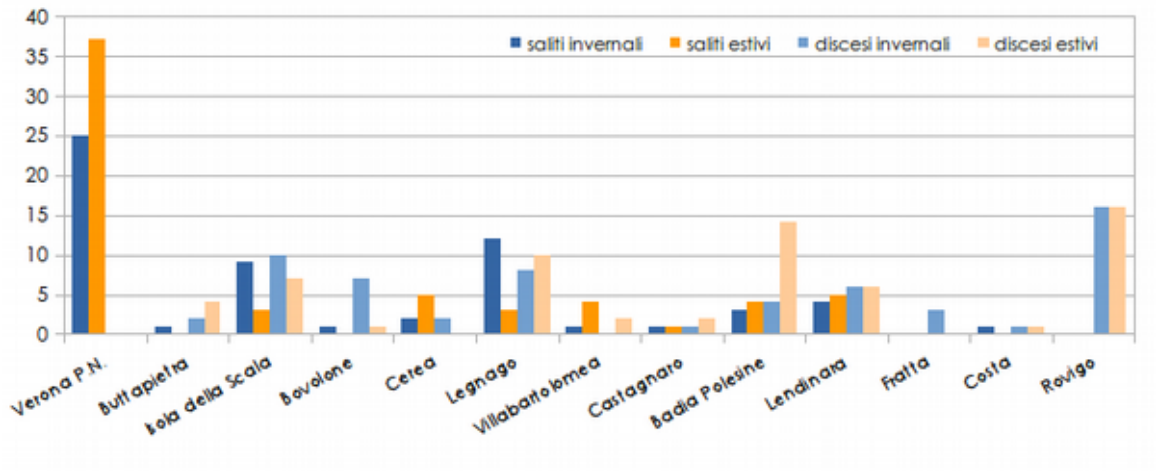
Graph 26: Passenger trend on train 5565. Departure time from Verona at 06:56



Graph 27: Passenger trend on train 5571. Departure time from Verona at 08:56



Graph 28: Passenger trend on train 5577. Departure time from Verona at 12:56



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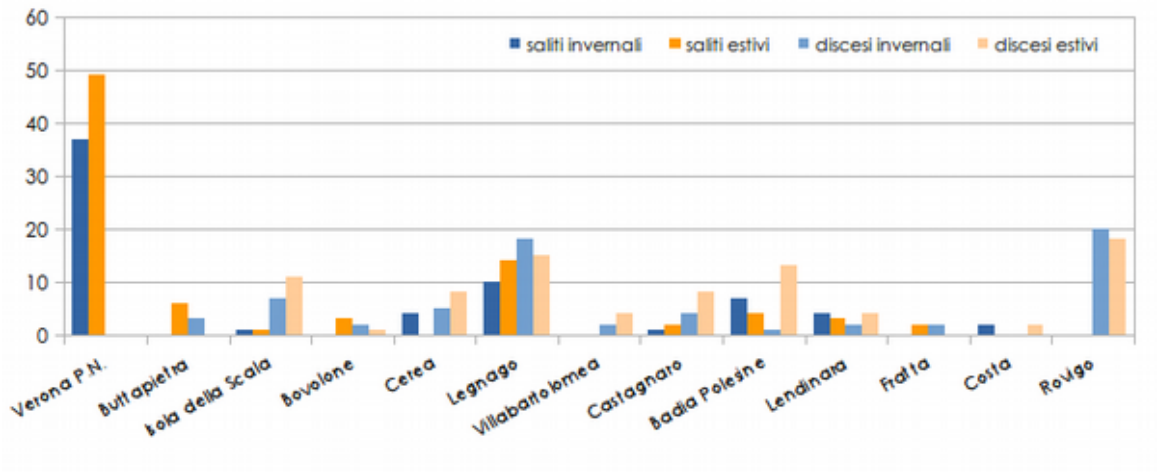
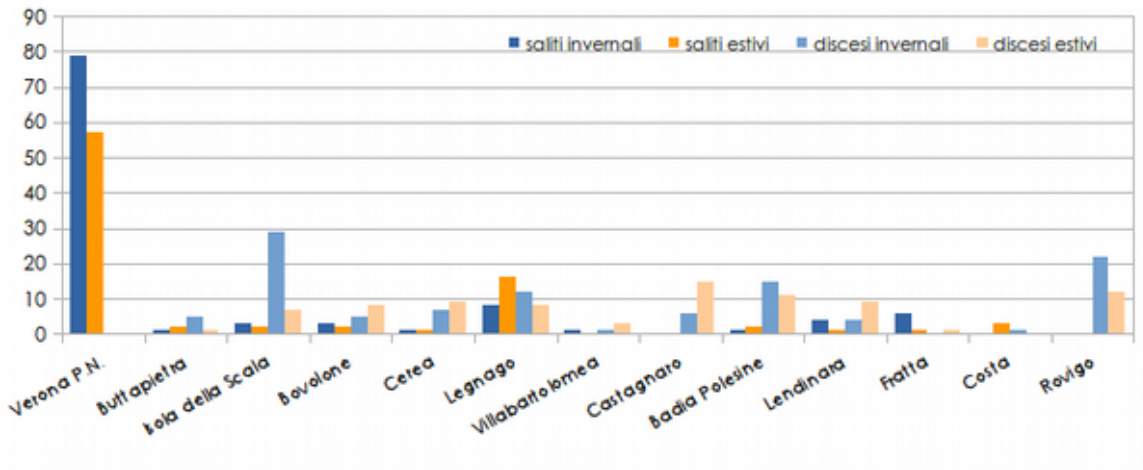
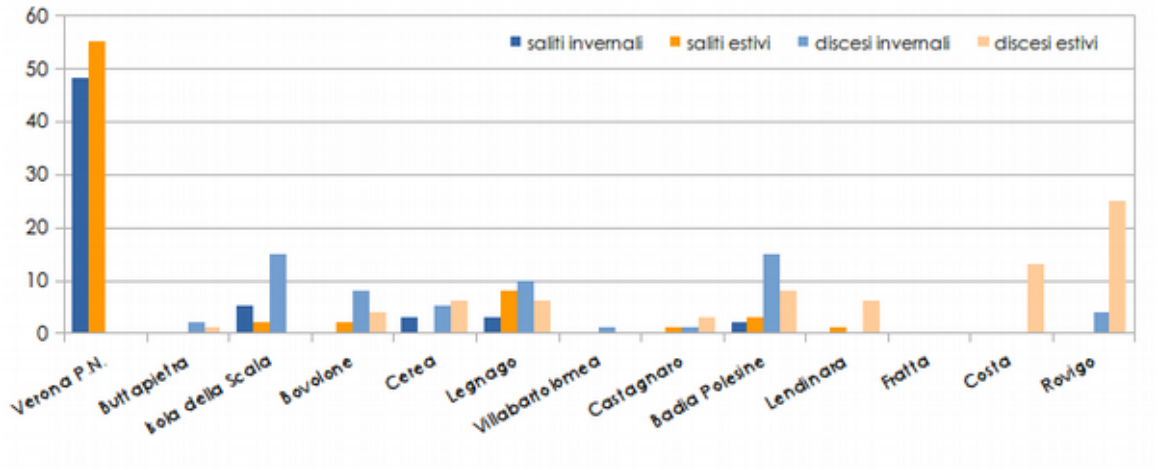
Graph 29: Passenger trend on train 5587. Departure time from Verona at 15:56



Graph 30: Passenger trend on train 5591. Departure time from Verona at 17:56



Graph 31: Passenger trend on train 5597. Departure time from Verona at 19:56



Graph 32: Passenger trend on train 5562. Departure time from Rovigo at 06:38

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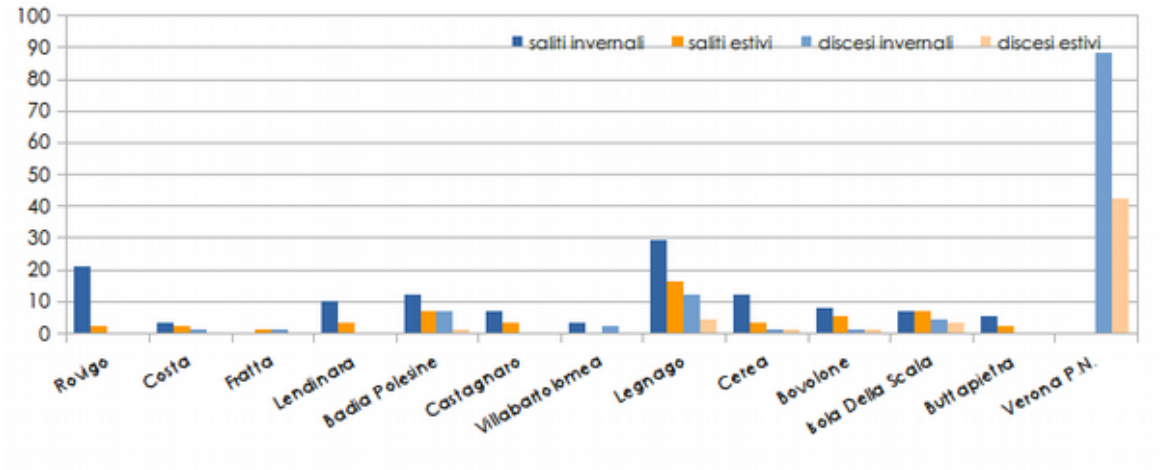
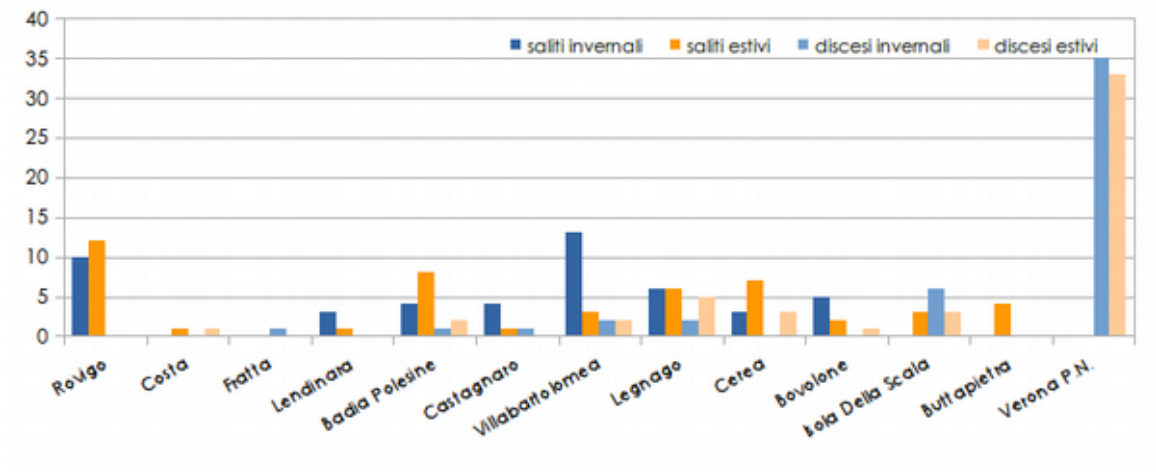
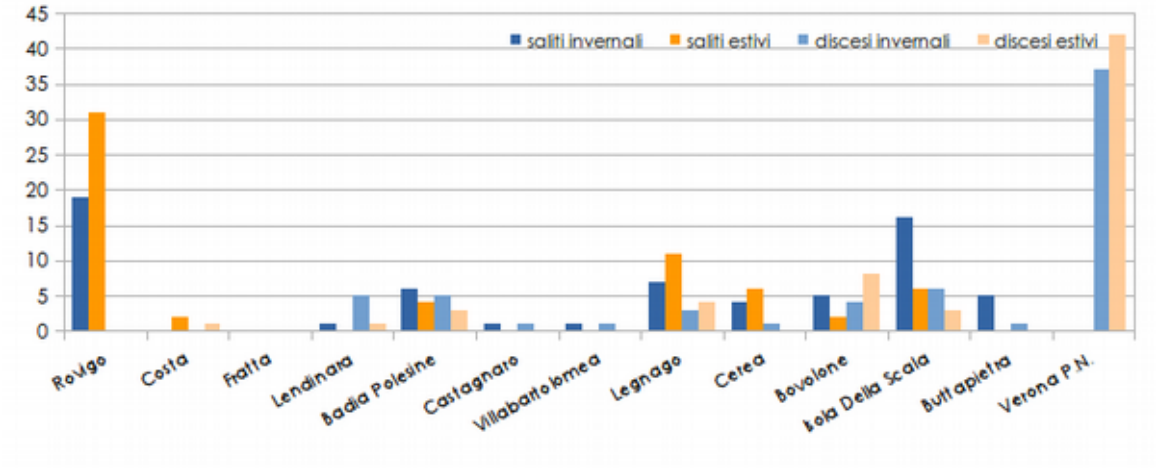


Graph 33: Passenger trend on train 5570. Departure time from Rovigo at 09:38



Graph 34: Passenger trend on train 5574. Departure time from Rovigo at 12:38



Graph 35: Passenger trend on train 5582. Departure time from Rovigo at 15:38

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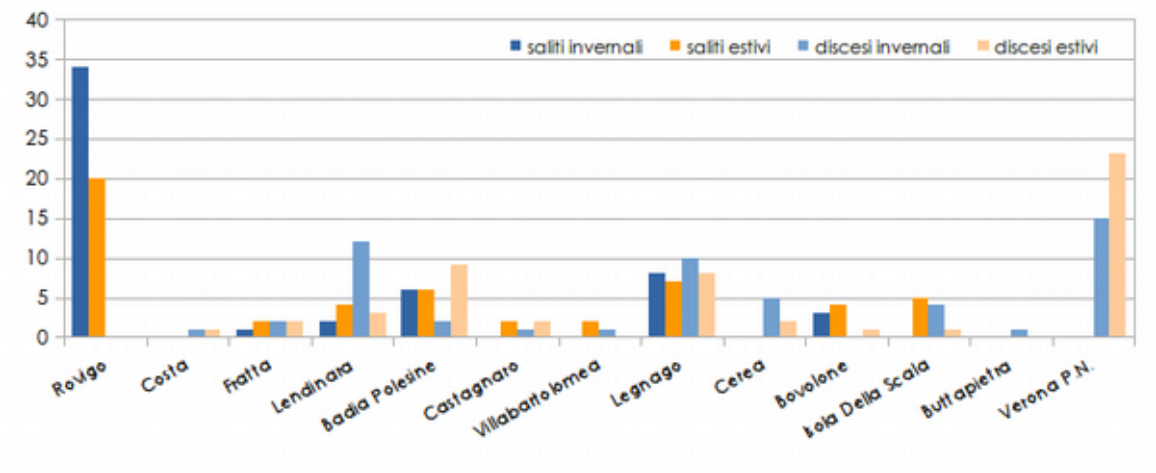
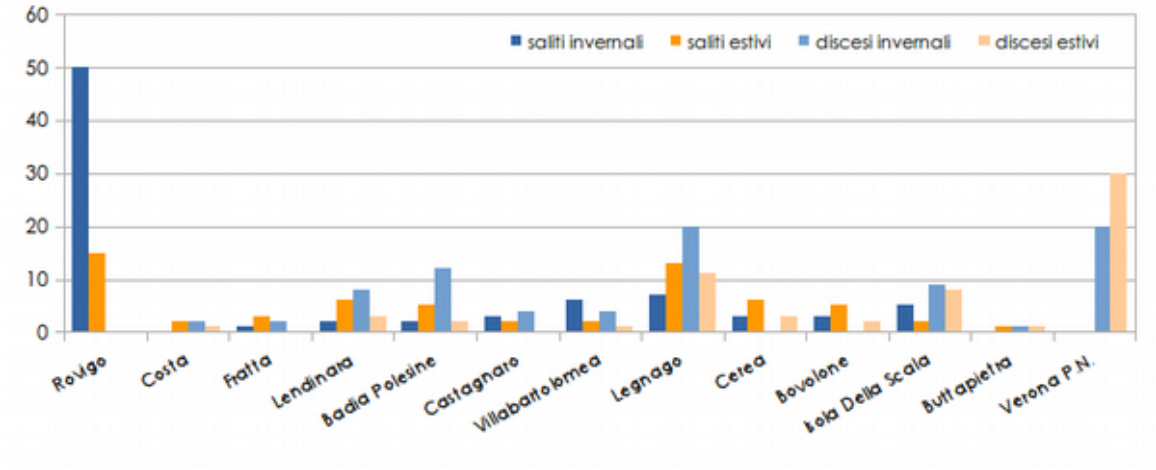


Graph 36: Passenger trend on train 5588. Departure time from Rovigo at 17:38



3.4 Comparison among surveys and historical data series

A comparison among the surveys and historical data can be performed, in order to understand the evolution of travel demand on the Sistemi Territoriali network and for the evaluation of expansion rate useful for making it possible to use the new data for future elaboration. The comparison bases the association between the two datasets on the train number: given that the timetable can have been modified in the last 3 years, not all the train codes find a match in the two datasets.

For each comparison, the season/day has been highlighted in order to ease the differences among different periods. Moreover, the GEH has been calculated together with the increase-decrease rate evaluated between the surveyed value and the average 2016-2017. This statistic indicator is used in traffic engineering, traffic forecasting, and traffic modeling to compare two sets of traffic volumes. Using the GEH Statistic avoids some pitfalls that occur when using simple percentages to compare two sets of volumes, because the traffic volumes in real-world transportation systems vary over a wide range: hence, the GEH statistic is non-

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linear. A GEH of less than 5.0 is considered a good match between the modelled and observed volumes.

train	season	day	data		surveys	surveys/data		GEH
			2016	2017	2018	diff2016	diff2017	
2764	winter	weekdays	407	381	270	66%	71%	7
2768	summer	weekdays	335	277	131	39%	47%	12
2768	summer	holidays	135	77	104	77%	136%	0
2768	winter	weekdays	362	360	181	50%	50%	11
2768	winter	holidays	156	125	104	67%	83%	3
2775	summer	weekdays	26	28	24	94%	85%	1
2775	winter	weekdays	35	27	11	31%	40%	4
2776	summer	weekdays	99	68	120	121%	176%	4
2776	winter	weekdays	81	85	59	73%	69%	3
2778	summer	weekdays	66	104	29	44%	28%	7
2778	summer	holidays	67	65	86	129%	133%	2
2778	winter	weekdays	114	105	100	88%	95%	1
2778	winter	holidays	77	87	104	135%	120%	2
2779	summer	weekdays	24	19	6	25%	31%	4
2779	summer	holidays	90	23	54	60%	235%	0
2779	winter	weekdays	25	23	13	53%	58%	2
2779	winter	holidays	42	34	36	86%	105%	0
2782	summer	weekdays	43	32	29	68%	92%	1
2782	winter	weekdays	112	120	85	76%	71%	3
2783	summer	weekdays	98	77	13	13%	17%	11
2783	winter	weekdays	126	115	107	85%	93%	1
2787	summer	weekdays	127	114	46	36%	40%	8
2787	winter	weekdays	182	239	172	95%	72%	3
2788	summer	weekdays	48	42	4	8%	10%	8
2788	winter	weekdays	42	45	22	53%	49%	4
2789	summer	holidays	108	44	72	67%	166%	0
2789	winter	holidays	76	76	89	117%	117%	1
2790	summer	holidays	85	172	55	65%	32%	8
2790	winter	holidays	66	57	61	93%	107%	0
2793	summer	weekdays	197	188	109	55%	58%	7
2793	winter	weekdays	255	258	249	98%	97%	0
2793	winter	holidays	127	211	192	152%	91%	2
2795	summer	weekdays	213	183	102	48%	56%	8
2795	winter	weekdays	275	266	208	76%	78%	4
2797	summer	holidays	123	95	124	101%	131%	1
						73%	84%	

Table 10: Comparison for line Adria - Mestre

In the case of the Adria-Mestre line, it can be easily noticed that the travel demand volume registered highly differs from historical data for 10 over 32 train surveyed (in ~30% of cases GEH>5); mostly all of them are summer-weekdays surveys, when the number of passengers registered is extremely lower than the historical ones.

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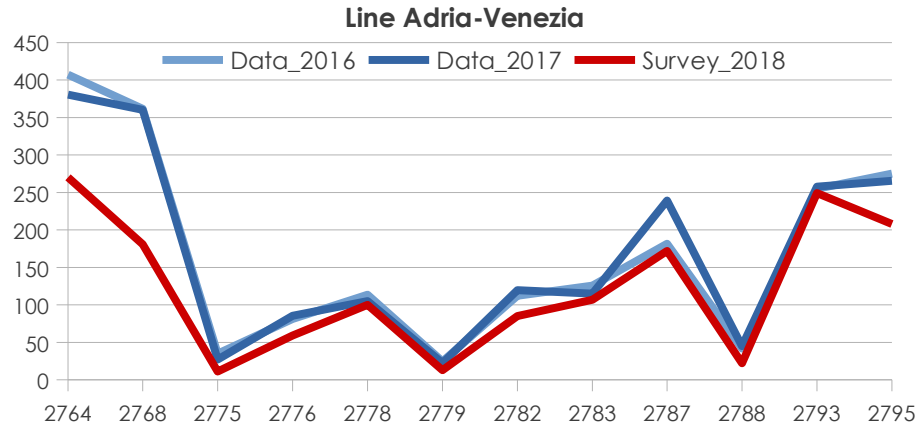
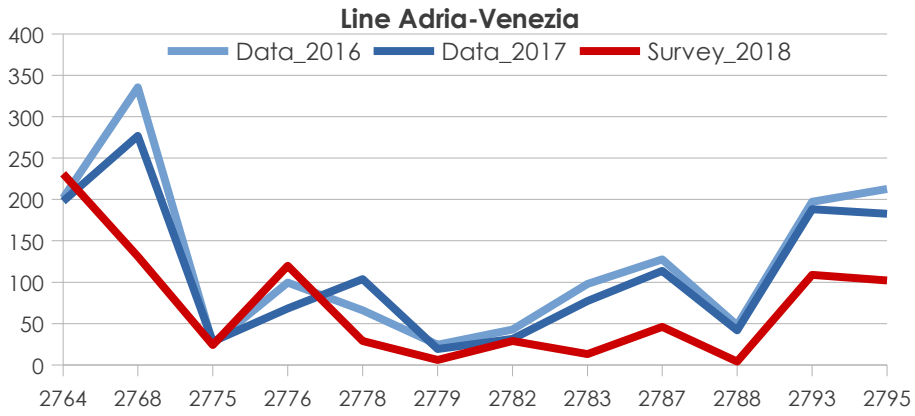
Graph 37: Comparison among historical series and surveys. Line Adria-Mestre, winter workdays



Graph 38: Comparison among historical series and surveys. Line Adria-Mestre, summer workdays



This result on summer weekdays may depend on two causes:

1. the different months of the surveys (July vs. September);
2. a real increase of travel demand on this line.

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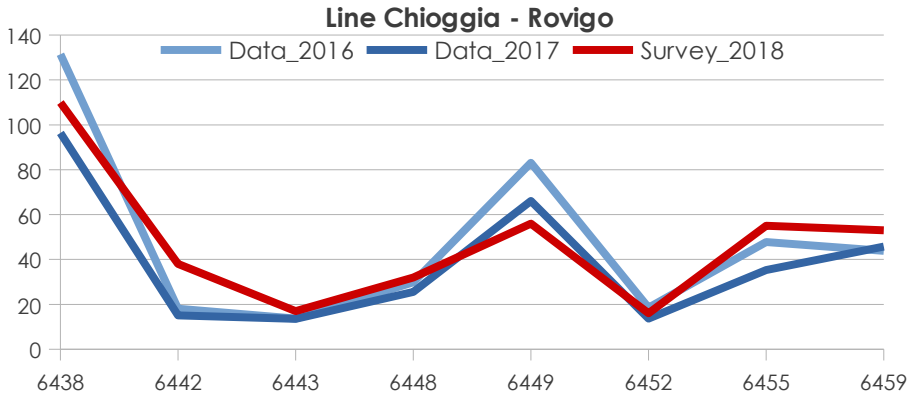
train	season	day	data		surveys	surveys/data		GEH
			2016	2017	2018	diff2016	diff2017	
6427	summer	weekdays	25	18	15	60%	85%	1
6438	summer	weekdays	30	21	17	57%	81%	2
6438	winter	weekdays	131	96	110	84%	114%	0
6441	summer	holidays	10	0	8	80%		1
6441	winter	holidays	13	9	9	68%	100%	1
6442	summer	holidays	12	0	27	225%		5
6442	winter	weekdays	18	15	38	210%	252%	4
6442	winter	holidays	17	24	20	116%	85%	0
6443	summer	weekdays	23	16	14	61%	85%	1
6443	winter	weekdays	14	14	17	124%	125%	1
6444	summer	weekdays	22	20	15	68%	76%	1
6446	summer	holidays	17	NULL	37	218%		4
6446	winter	holidays	24	18	36	150%	206%	3
6448	summer	weekdays	14	21	19	140%	92%	0
6448	winter	weekdays	30	26	32	107%	125%	1
6449	summer	weekdays	32	28	19	59%	69%	2
6449	winter	weekdays	83	66	56	67%	85%	2
6452	summer	weekdays	36	28	17	47%	62%	3
6452	summer	holidays	40	0	18	45%		0
6452	winter	weekdays	19	14	16	86%	117%	0
6452	winter	holidays	26	38	32	124%	84%	0
6453	summer	holidays	10	0	19	190%		4
6453	winter	holidays	17	27	24	139%	91%	0
6455	summer	weekdays	22	21	21	94%	98%	0
6455	winter	weekdays	48	35	55	115%	156%	2
6459	winter	weekdays	44	46	53	121%	116%	1
11503	summer	holidays	26	0	11	43%		1
11503	winter	holidays	11	19	16	145%	84%	0
						109%	109%	

Table 11: Comparison for line Chioggia - Rovigo

In the case of the Chioggia-Rovigo line, GEH values calculated are acceptable for all trains except one in the summer-holidays period: surveys are consistent with historical data and the historical trend is confirmed.

Graph 39: Comparison among historical series and surveys. Line Chioggia-Rovigo, winter workdays



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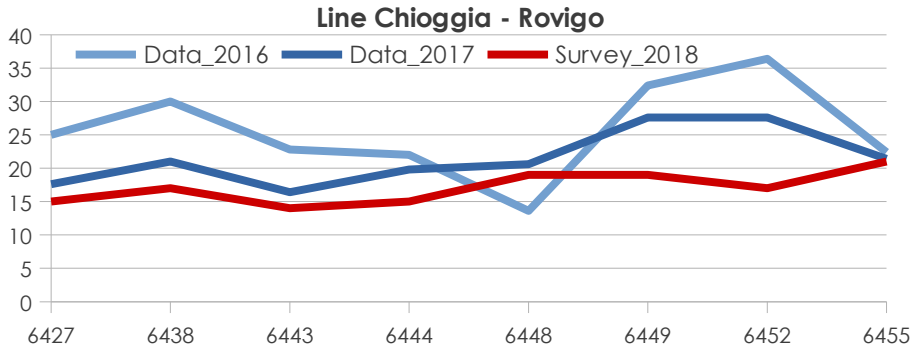
Graph 40: Comparison among historical series and surveys. Line Chioggia-Rovigo, summer workdays



train	season	day	data		surveys	surveys/data		GEH
			2016	2017	2018	diff2016	diff2017	
5562	summer	weekdays	81	78	51	63%	66%	4
5562	winter	weekdays	134	128	117	87%	91%	1
5565	summer	weekdays	52	44	48	92%	109%	0
5565	winter	weekdays	105	105	119	113%	114%	1
5566	summer	holidays	50	40	66	132%	165%	3
5566	winter	holidays	72	31	69	96%	226%	2
5570	summer	weekdays	56	63	48	85%	76%	2
5570	winter	weekdays	50	54	48	96%	90%	1
5571	summer	weekdays	21	36	26	124%	73%	0
5571	winter	weekdays	35	34	39	112%	116%	1
5574	summer	weekdays	50	54	62	123%	116%	1
5574	winter	weekdays	94	81	65	70%	80%	3
5575	summer	holidays	36	27	17	47%	63%	3
5575	winter	holidays	46	22	37	81%	172%	1
5577	summer	weekdays	40	47	62	155%	131%	3
5577	winter	weekdays	52	55	60	115%	108%	1
5578	summer	holidays	35	59	47	133%	80%	0
5578	winter	holidays	63	73	47	75%	64%	3
5582	summer	weekdays	53	61	52	99%	86%	1
5582	winter	weekdays	45	59	54	119%	91%	0
5587	summer	weekdays	68	79	84	124%	106%	1
5587	summer	holidays	38	28	46	122%	164%	2
5587	winter	weekdays	72	84	66	92%	79%	1
5587	winter	holidays	56	60	62	111%	103%	1
5588	summer	weekdays	63	43	62	99%	146%	1
5588	summer	holidays	41	48	57	139%	120%	2
5588	winter	weekdays	60	54	82	137%	153%	3
5588	winter	holidays	56	47	49	88%	104%	0
5591	summer	weekdays	83	86	87	104%	101%	0
5591	winter	weekdays	69	95	107	154%	113%	3
5597	summer	weekdays	70	46	72	102%	157%	2
5597	summer	holidays	67	83	72	108%	87%	0
5597	winter	weekdays	54	41	61	113%	150%	2
5597	winter	holidays	66	63	32	48%	51%	5
						105%	110%	

Table 12: Comparison for line Rovigo - Verona

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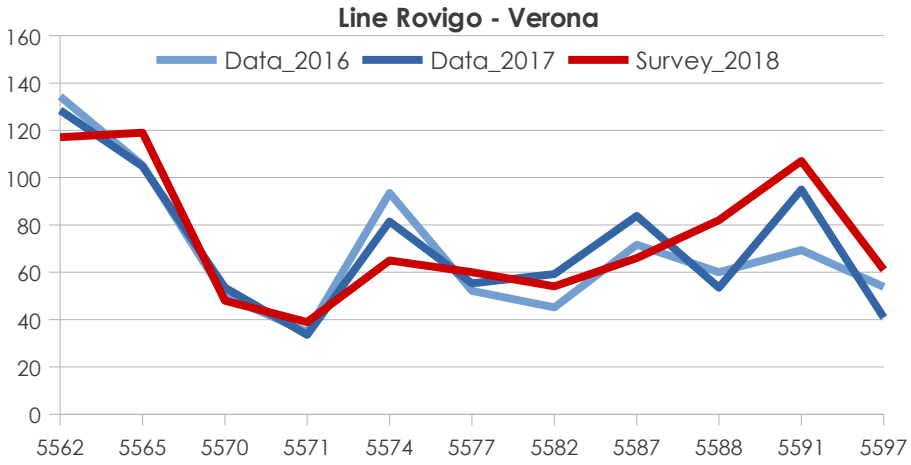
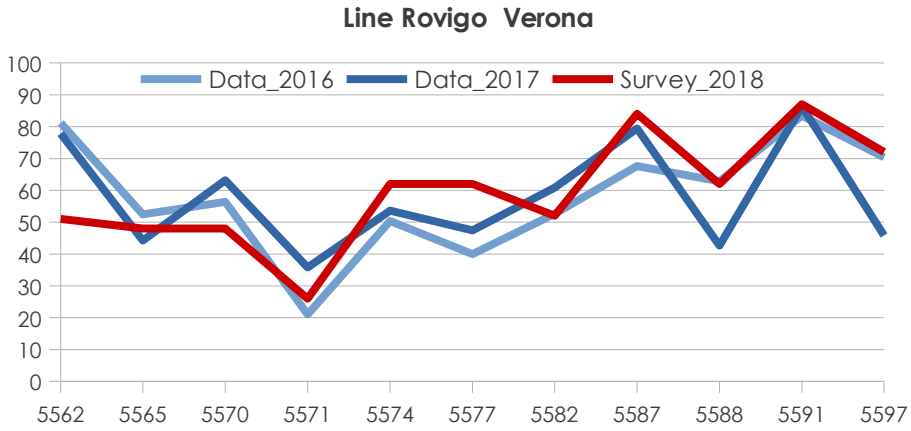
In the case of the Rovigo - Verona line, GEH values calculated are acceptable for all trains except one in the summer-holidays period: surveys are consistent with historical data and the historical trend is confirmed.

Graph 41: Comparison among historical series and surveys. Line Rovigo-Verona, winter workday



Graph 42: Comparison among historical series and surveys. Line Rovigo-Verona, summer workday



Matching data makes it possible to use historical series to expand the surveys, in order to complete the universe. This step is based on the findings of the previous comparison and it results in a smaller universe 2018 total for the Adria-Mestre line and in comparable ones for the other lines.

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line	season	day	Data_2016	Data_2017	Value_2018	Survey/Tot	Samplig rate
Adria – Venezia	summer/ estivo	workday	2460	2234	1411	60%	55%
		holiday	1772	1487	1492	67%	60%
	winter/ invernale	workday	3658	3614	2660	56%	54%
		holiday	2364	1852	2181	73%	60%
Chioggia – Rovigo	summer/ estivo	workday	329	302	229	60%	44%
		holiday	543	409	997	88%	33%
	winter/ invernale	workday	747	647	753	50%	50%
		holiday	611	609	691	80%	33%
Rovigo – Verona	summer/ estivo	workday	968	928	973	67%	69%
		holiday	905	772	928	67%	50%
	winter/ invernale	workday	1840	1765	1891	57%	54%
		holiday	1245	853	950	69%	50%

Table 13: Expansion of 2018 survey data

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4 CUSTOMER SATISFACTION

4.1 Introduction

A customer satisfaction survey has been distributed among passengers during the travel demand counts campaign. The survey has been conceived in order to:

1. investigate the satisfaction level;
2. collect data useful for a modal split model calibration;
3. identify the composition of the users.

The same questionnaire has been used on all the lines, in order to make It possible a comparison.

4.2 Questionnaire

1 Train number (written by the interviewer)

2 Which is your departure station?

3 Which is your arriving station?

4 How have you reached the departure station?

- By foot
- by bike
- by motorcycle
- Drive my car
- By bus
- With another train
- Dropped off (car, taxi)
- other

5 *if train: from which departure station?*

6 How will you leave the destination station?

- By foot
- by bike
- by motorcycle
- Drive my car

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- By bus
- With another train
- Dropped off (car, taxi)
- other

7 *if train: from which departure station?*

8 Why are you doing this transfer?

- work (usual transfer from home to the school/university)
- study (usual transfer from home to the job place)
- business
- personal reason/hobby
- tourism
- back home from work
- back home from study
- other

9 How often do you use this train?:

- >=5 days/week
- <3 days/week
- <5 times/month
- few times per year

10 Have you got a pass?

11 Globally, are you satisfied by the service? (6 is the pass mark)

12 Why are you using the train?

- Environmental reason
- Unavailability of other options
- for the traveltime
- for the price (= it's cheaper)
- for its comfort

13 Please, could you give a mark (1-10) to the following characteristics of the service:

- punctuality
- reliability

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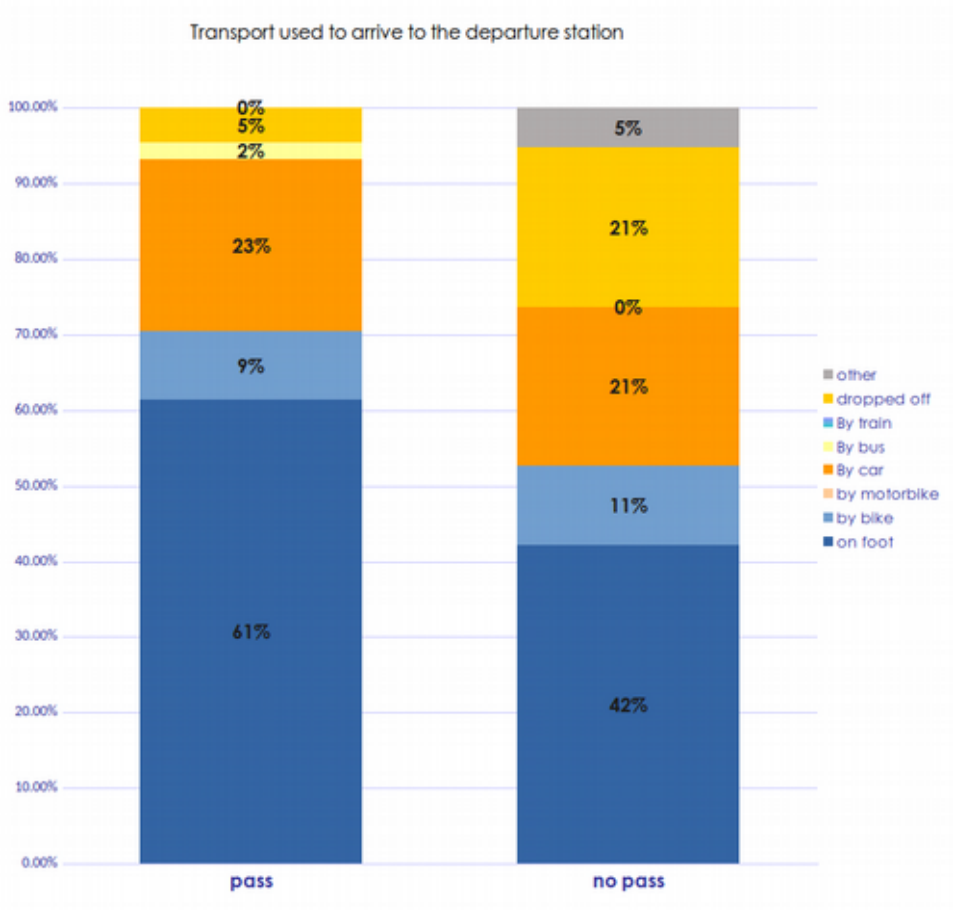
- comfort and cleaning of trains
- timetables
- travel time
- price
- crowding
- safety on board
- staff kindness
- information to users

14 Any suggestion? (optional; free answer)

4.3 General results on the Adria-Mestre line

69% of passengers interviewed owns a pass.

How have you arrived to the departure station?



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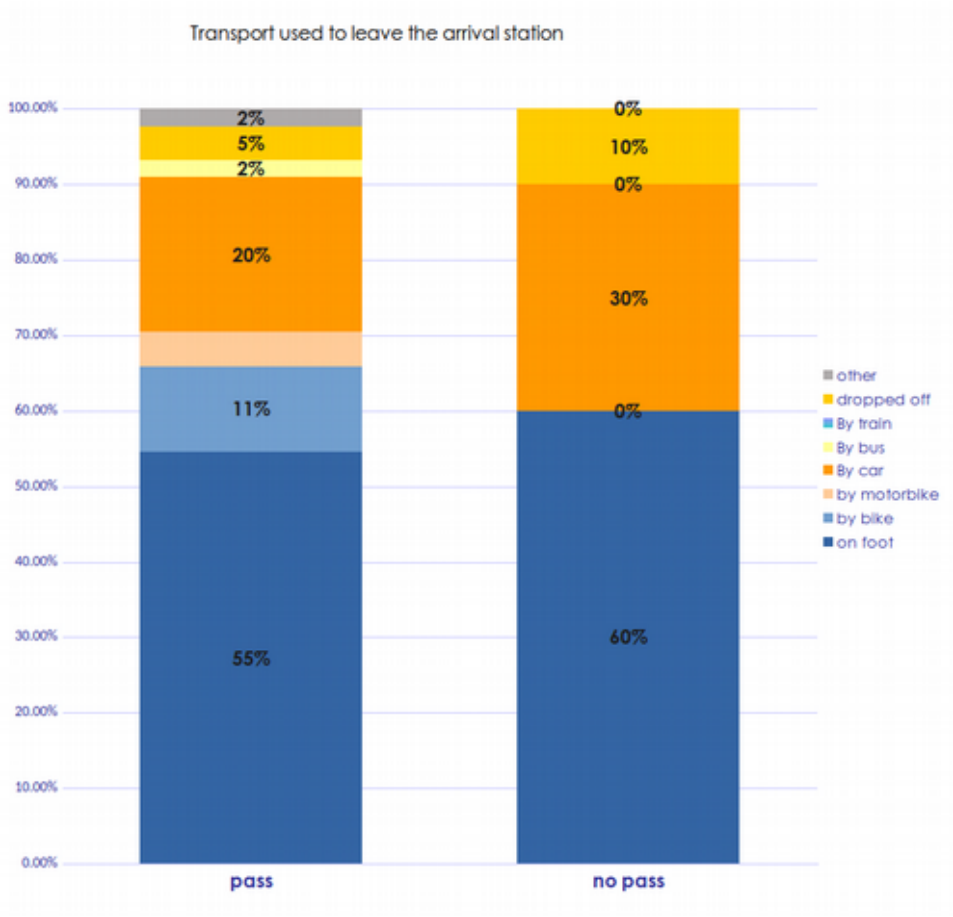
How will you leave the arrival station?



Answers show that the majority of passengers use the train as the main mean of transport of a transfer, which is completed by foot in destination by more than 50% of them, followed by the car as second option. For arriving to the departure station, walking or biking are the main choices, but nearly the 20% uses its own car. Being dropped off by car by another person is more common among non-systematic users.

Why are you doing this transfer?

The reason for the transfer is one of the typical systematic reason in case of pass users: more than 95% of them have been interviewd in the transfer from home to school or to work (or backwards); the rest has declared that the reason was personal.

No-pass users are travelling mainly for personal reason and leisure, but 40% of them were using the for transferring from home to school/work or backwards. 15% of the no-pass users interview has declared to be tourists.

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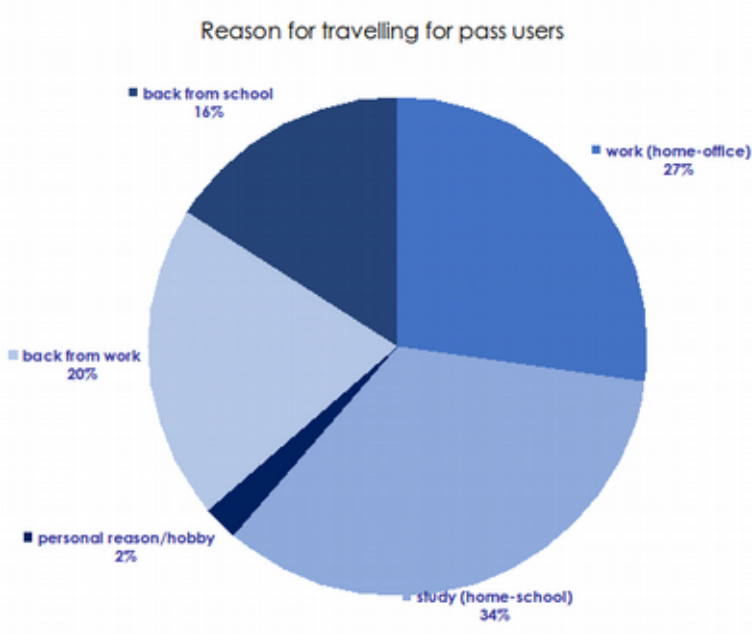

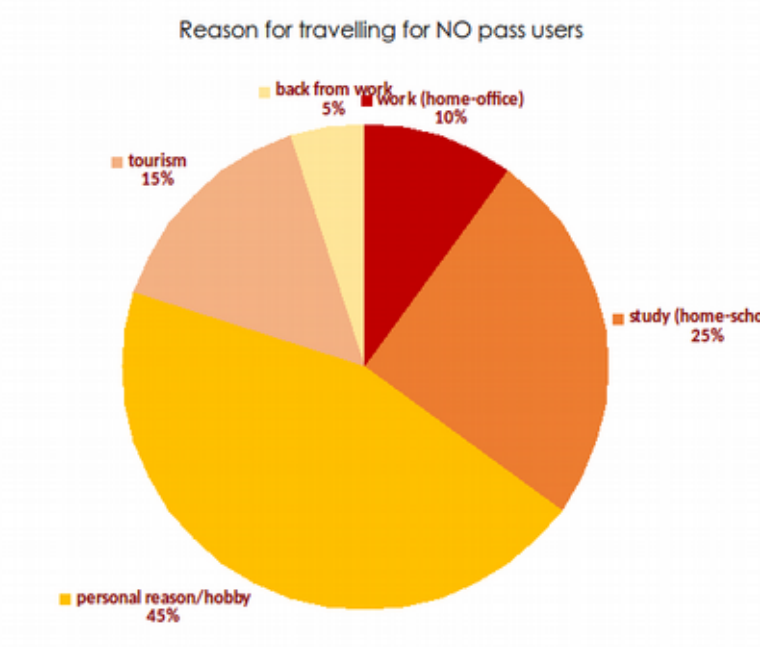

How often do you use this train?

As expected, more than 90% of users owning a pass uses the same train 5 days a week. 45% of no pass passengers uses the same train less than 5 times in a month, which means that there's a certain habit in this choice.

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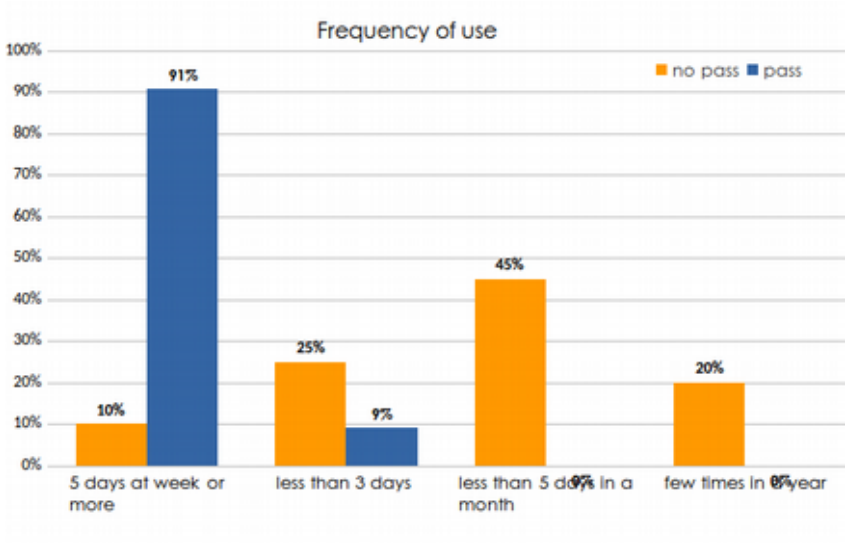
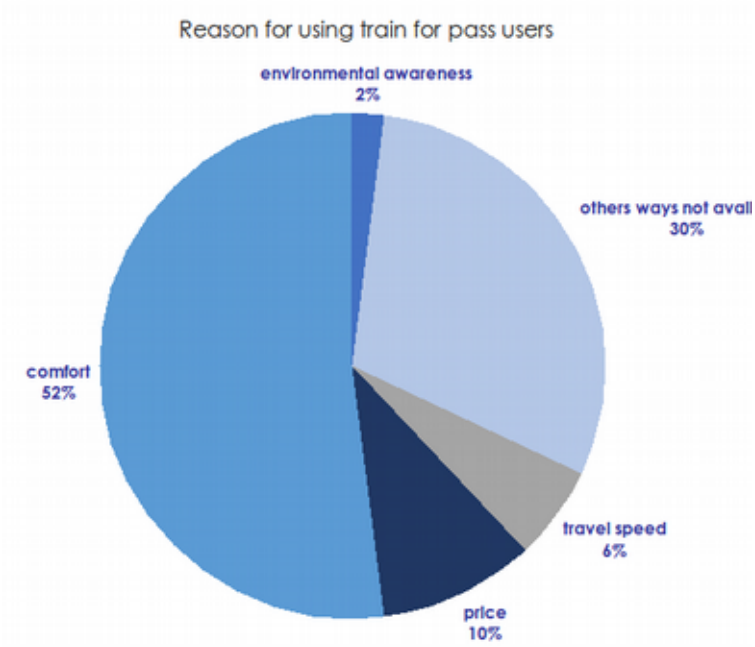


Why are you using the train?



The comfort, conceived in general the comfort of the modal solution, is the main reason why people choose it (52% for pass users, 61% of no-pass users): this answer should be related to the one about the modal chain, which has made it clear that most of the passengers can walk to and from the stations.

The unavailability of other means of transport is the second reason, while price is an answer only for passengers woning a pass.

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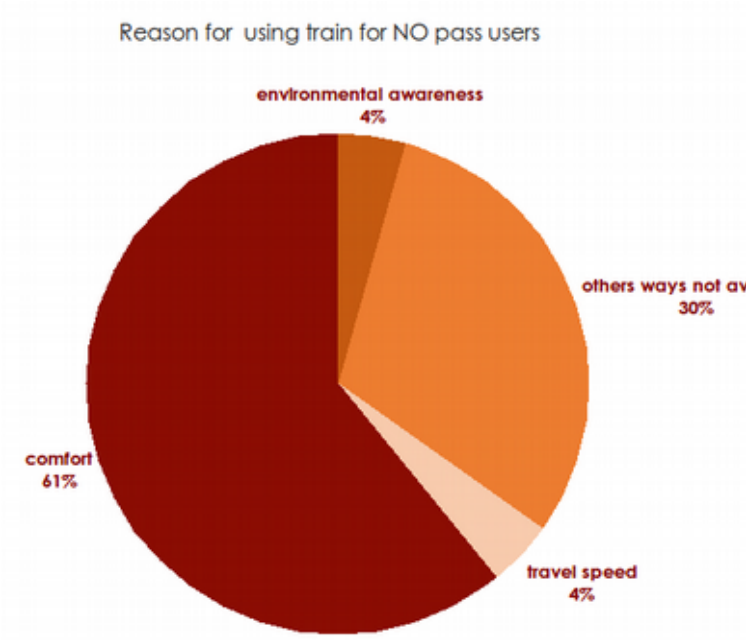

Evaluation

Evaluation (0 - worst mark; 10- best mark)	pass	no pass	TOT.
punctuality	4	7	5
reliability	6	7	6
comfort/cleanliness	7	8	7
schedule	6	8	6
travel time	5	7	6
price	7	7	7
crowding	6	7	6
security on board	7	8	7
staff kindness	8	8	7
informations for users	6	7	6
global satisfation	5	7	6

Globally, passengers are sufficiently satisfied, but the threshold of 6 is reached thanks to no pass users. Punctuality and traveltime condition this result. On average, passengers reward the staff and the security on board.

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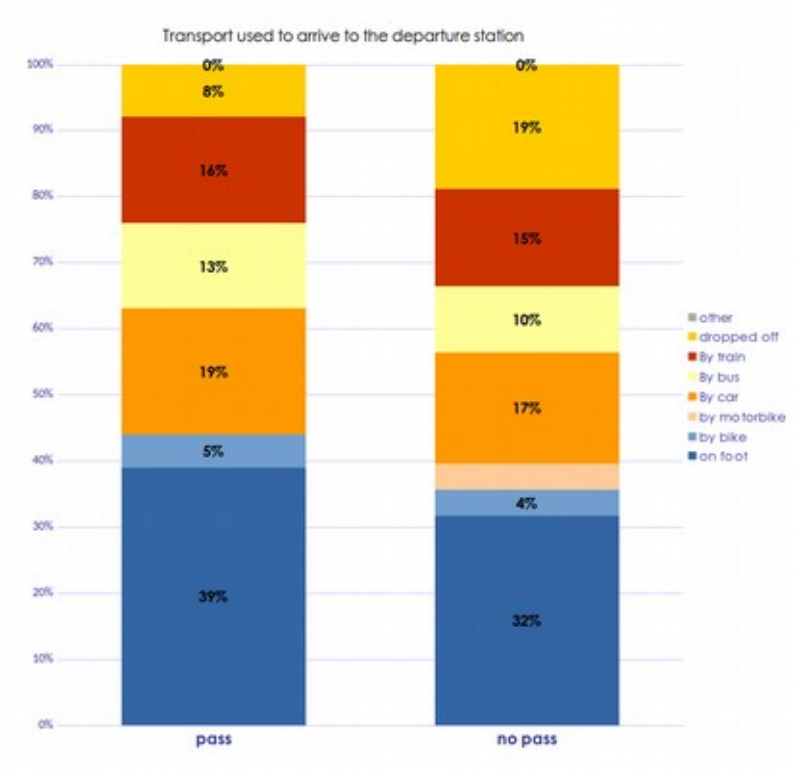
4.4 General results on the Verona-Rovigo line

53% of passengers interviewed owns a pass.

How have you arrived to the departure station?

Answers show that the majority of passengers use the train as the main mean of transport of a transfer, which is completed by foot more than 30% of the times, followed by the car as second option. Transferring from a train to another is more common on this line: this answer can be easily explained, because in Verona many national and long-distance trains stop.



How will you leave the arrival station?

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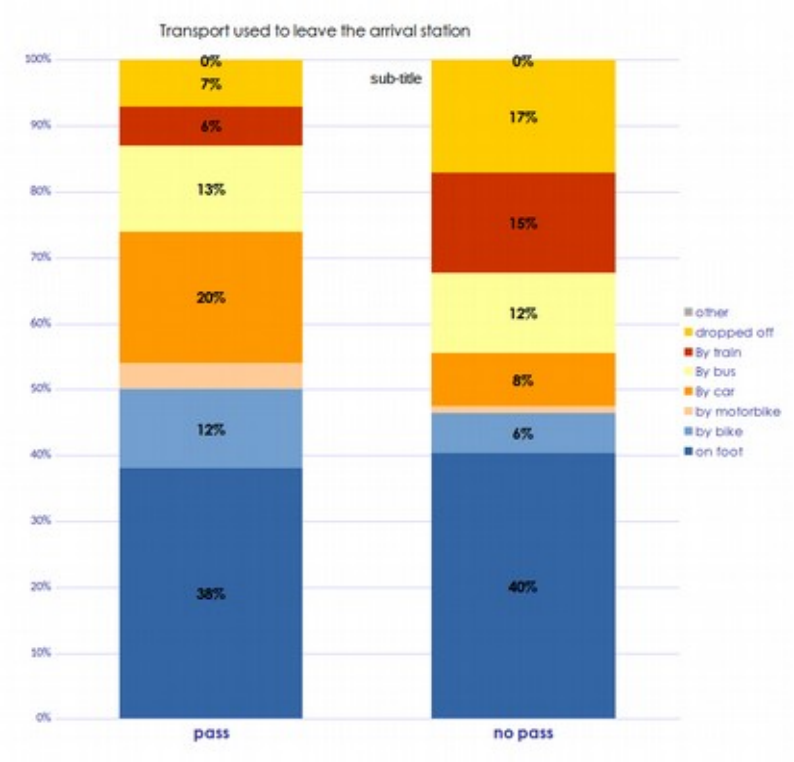
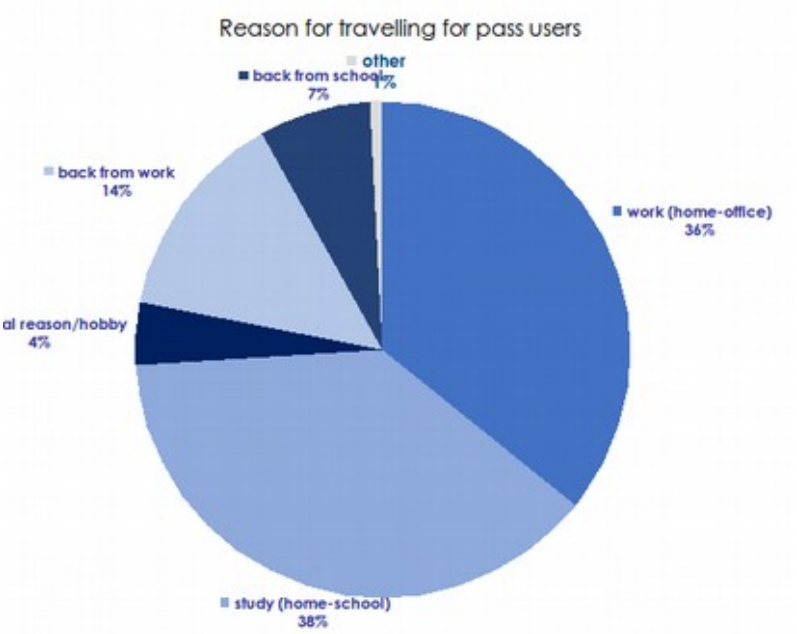


Why are you doing this transfer?

The reason for the transfer is one of the typical systematic reason in case of pass users: more than 90% of them have been interviewed in the transfer from home to school or to work (or backwards); the rest has declared that the reason was personal.



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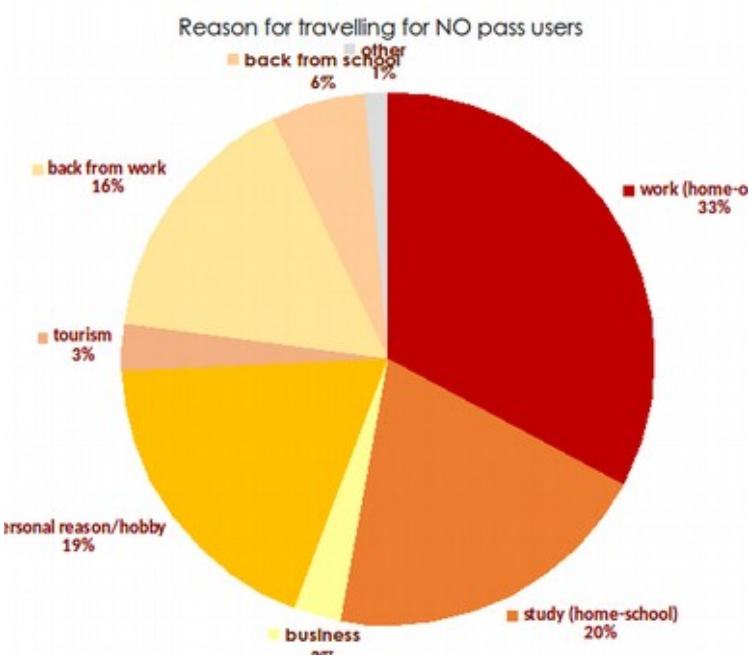
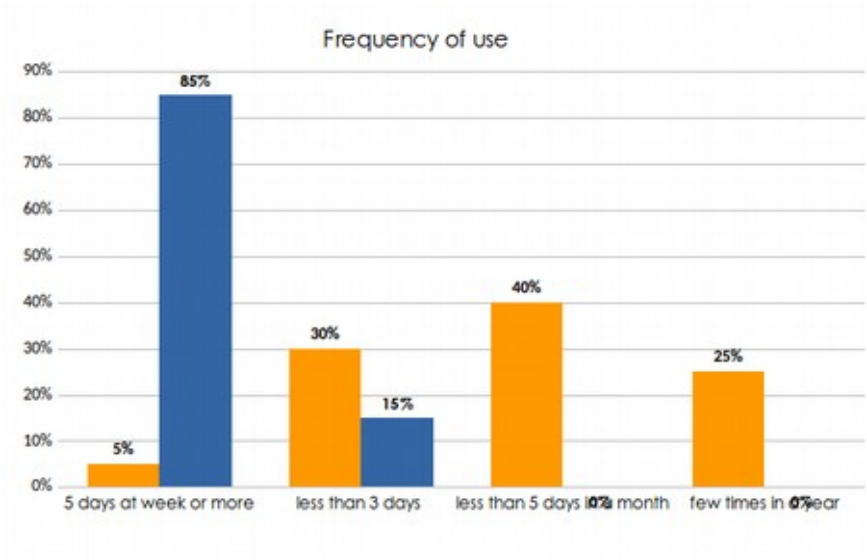
Even no-pass users are travelling mainly for the same reasons (75% systematic transfers). Passengers use the line for personal reason and leisure only in the 19% of the cases and tourists are residual.



How often do you use this train?

As expected, more than 80% of users owning a pass uses the same train 5 days a week and all of them are weekly users. 40% of no pass passengers uses the same train less than 5 times in a month, which means that there's a certain habit in this choice.



Why are you using the train?

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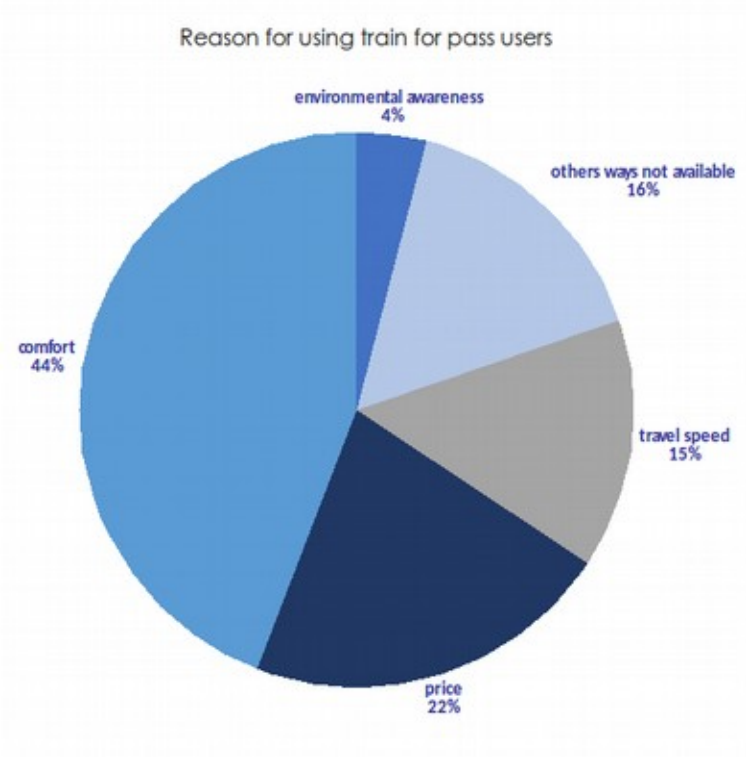

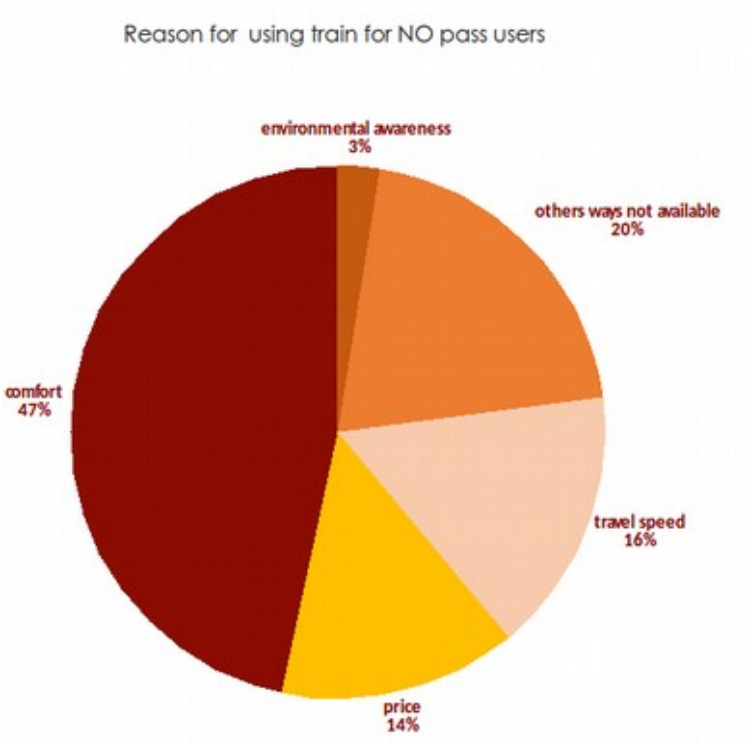

The comfort, conceived in general the comfort of the modal solution, is the main reason why people choose it (44% for pass users, 47% of no-pass users): this answer should be related to the one about the modal chain, which has made it clear that most of the passengers can walk to and from the stations.

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The price is the second reason for passengers with a pass, while for the other the unavailability of other means of transport weights more on the final choice.

Evaluation

Evaluation (0 - worst mark; 10- best mark)			
	pass	no pass	TOT.
punctuality	6	6	**6**
reliability	6	6	**6**
comfort/cleanliness	6	6	**6**
schedule	7	7	**6**
travel time	6	6	**6**
price	7	7	**7**
crowding	6	6	**6**
security on board	7	6	**6**
staff kindness	8	8	**8**
informations for users	7	7	**7**
global satisfaction	5	6	**5**

Globally, passengers aren't sufficiently satisfied, even if non of the single aspects investigated are insufficient. On average, passengers reward the staff, while all the operational characteristics (punctuality, traveltime, reliability) are just enough over 6.

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