



Congestion Pricing for Tel Aviv Plans and Travelers' Response Modeling

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Outline

- Studying congestion
- Congestion Pricing Alternatives
 - Geographical coverage
 - Type and time of day
- Methodology
 - Why tour-based approach
 - The survey
- Results
 - Main findings of the survey
 - Model estimation results
 - Initial scenarios analysis



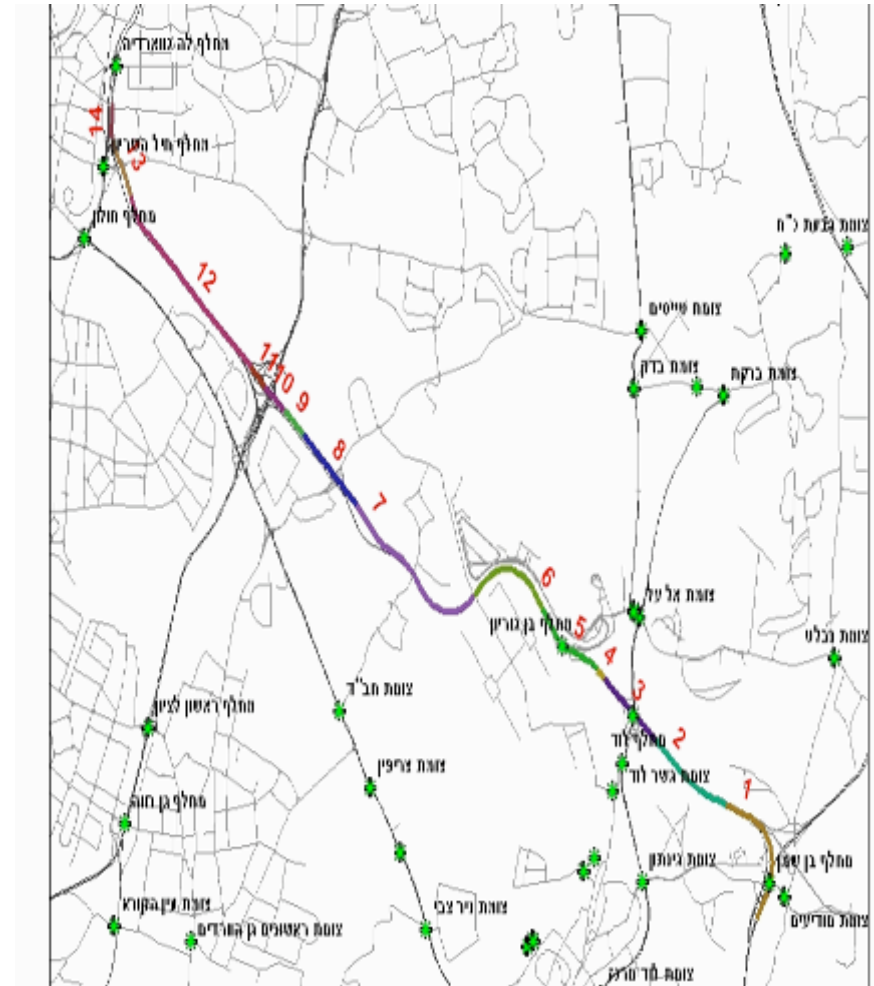
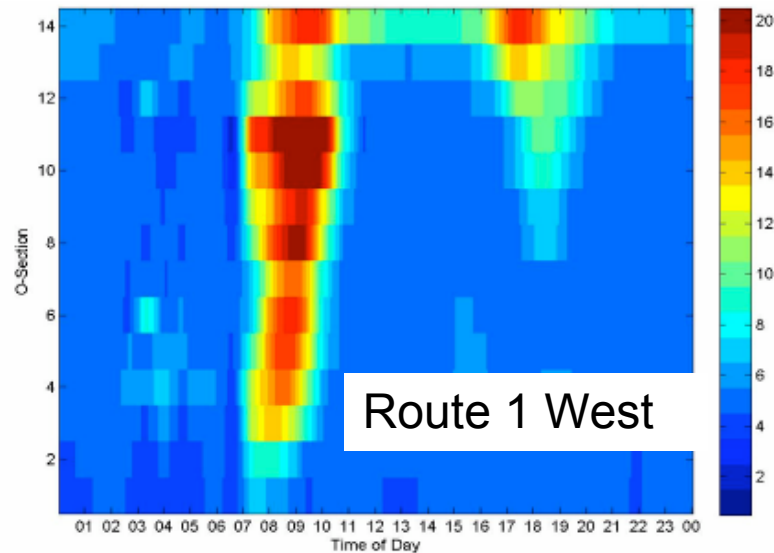
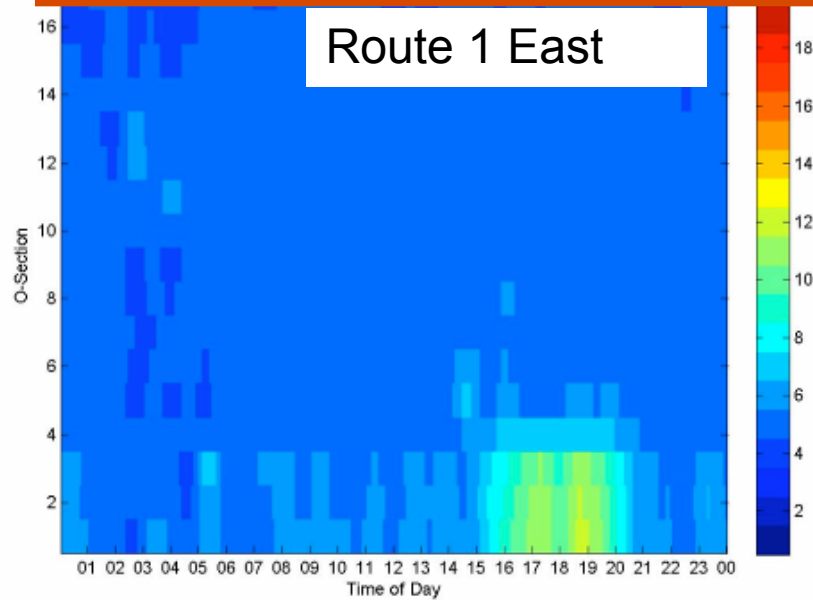
Studying Congestion

- Initial Speed Survey
 - Floating vehicle method
- Identifying the main congested roads
- Measuring speeds by ITIS using data from cell phones
 - Following moving vehicles as they move along the road
 - It is possible to calculate speed and density on each road by calibrating to ground count data



Studying Congestion



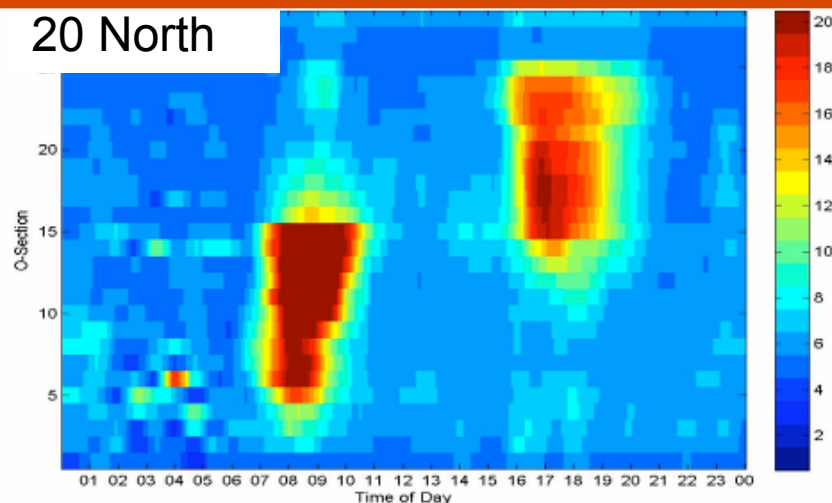




Studying Congestion

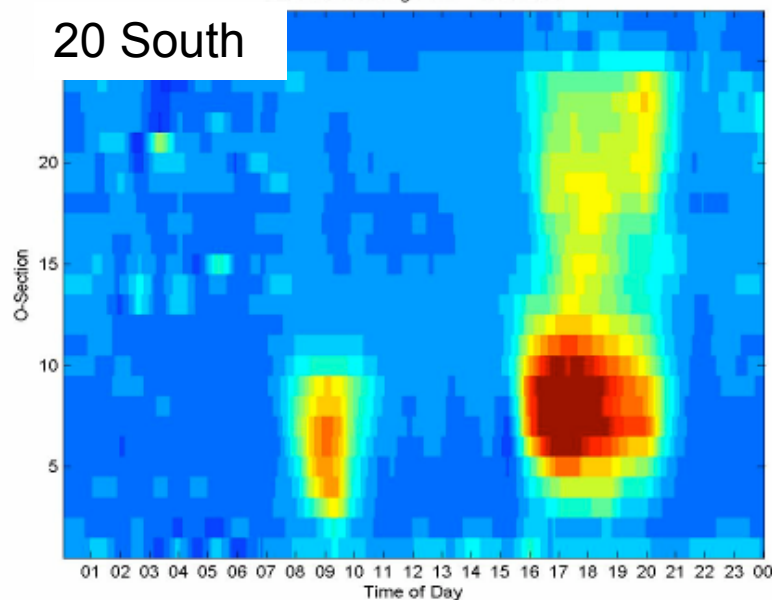


20 North



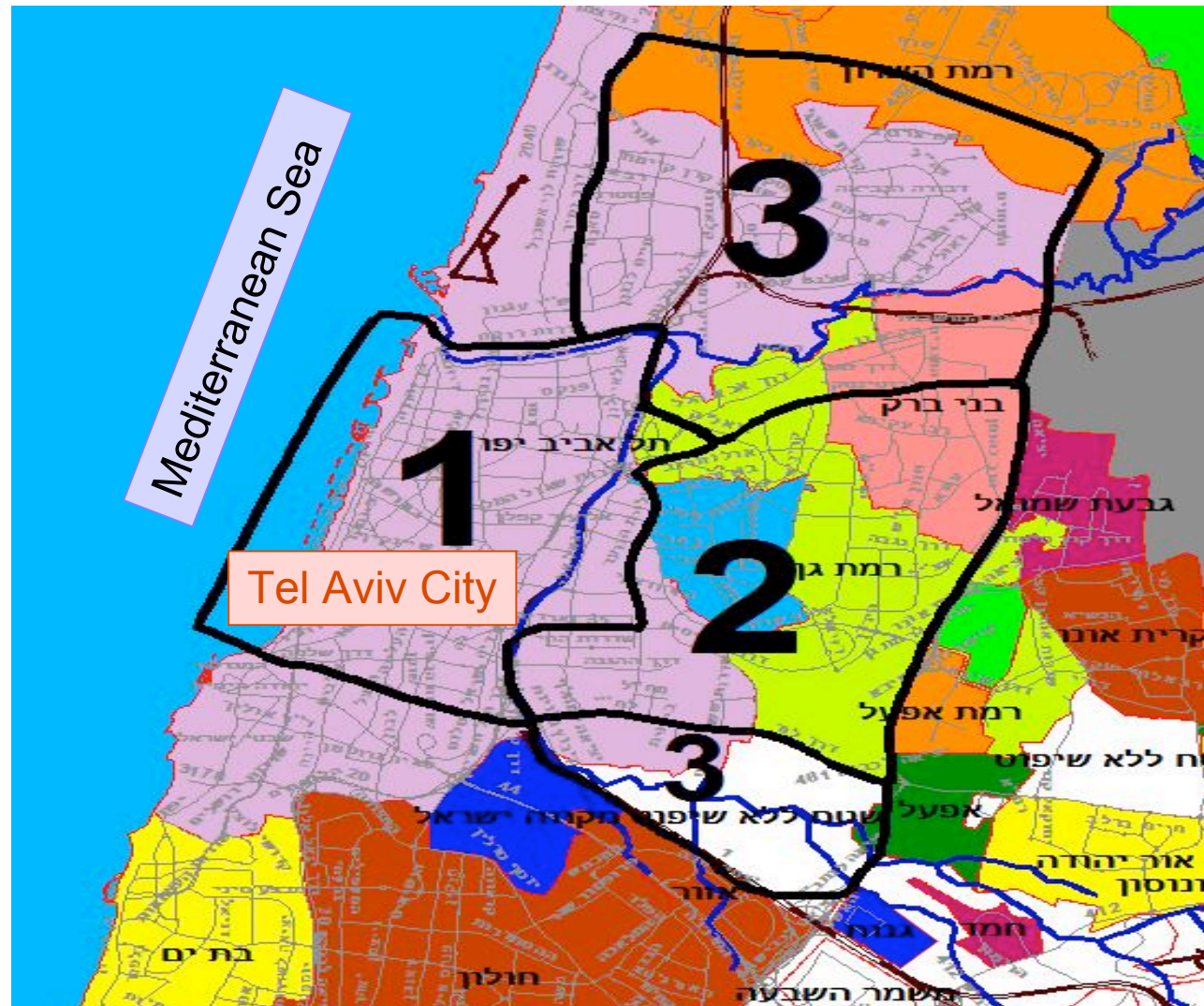
O-Section Average NTT - Road 20S

20 South





Congestion Pricing Area





Congestion Hours



Daily Hours
06:30-19:00



Morning Peak Hours
06:39-09:30



Morning Peak Hours
Afternoon Peak Hours
06:30-09:30
16:00-19:00





Congestion Pricing Alternatives

- 3 Geographical areas
- 3 Time of day periods
- 2 Types
 - Cordon
 - Area (discount for Tel-Aviv residents)
- 3 Price level
 - 10, 20, and 30 NIS
 - 1 Euro = 5.5 NIS



Congestion Pricing Alternatives

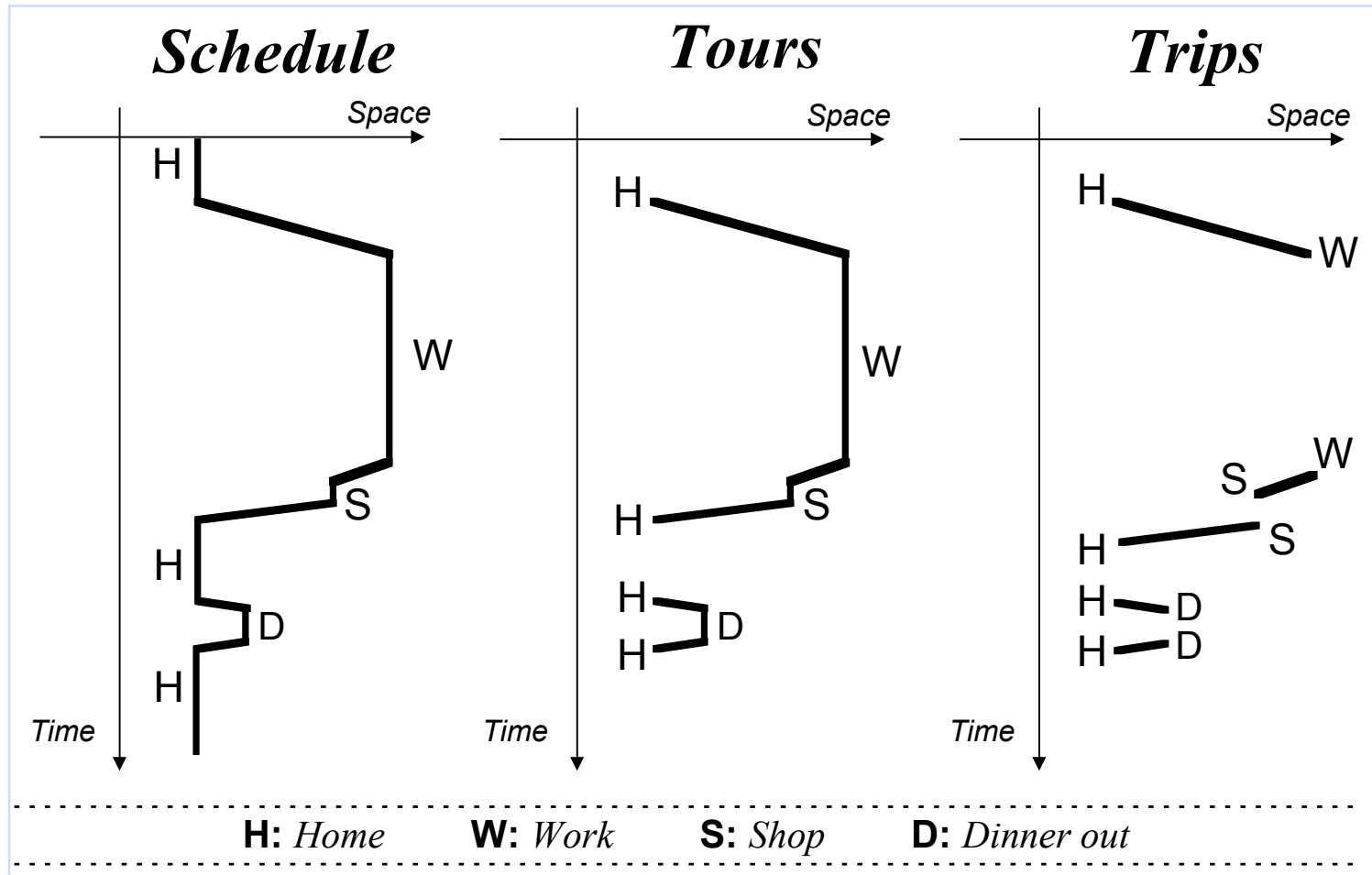
Alternative	Affected Travelers Morning Peak Hour 2010
1 – Small Ring	49,300
2 – Medium Ring	69,000
3 – Large Ring	72,900
4 – Additional Small Area	7,300
5 – Additional Medium Area	19,400
6 – Additional Large Area	28,000

Limited number of trips within the small area

Limited number of additional trips entering the large ring vs. the medium ring



Why Tour-Based Approach?







Stated Preference Survey

- ❑ **Limited Surveys Done in Tel Aviv area or Israel.**

- ❑ **Current Stated Preference Survey:**
 - Purpose: Collect Data for Model Estimation.

 - Operation: Web-Based Survey

 - Data Collection: 4130 responded to Survey.
800 Entered the Congestion Zone.



Stated Preference Survey

❑ Data Asked in the Survey:

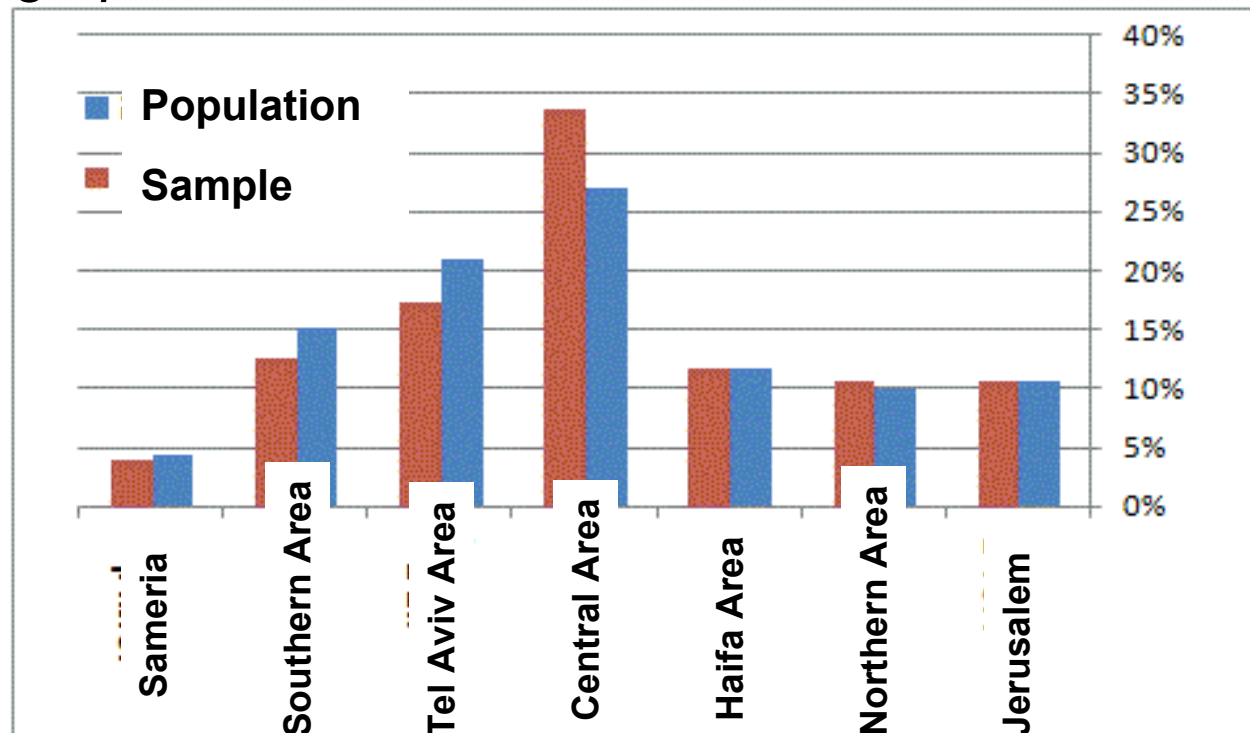
- Socioeconomic: Age, Gender, Work Status, ...etc.
Who Pays for the Toll, Parking and Gas.
- Travel & Activity Behavior: Tours Done by Person.
- Congestion Scenarios:
The various alternatives
from 5 – 35 Shekel Toll
- Congestion Acceptance:
Views of Respondents on Congestion Toll.



Survey Statistics

□ Main Findings in the Survey:

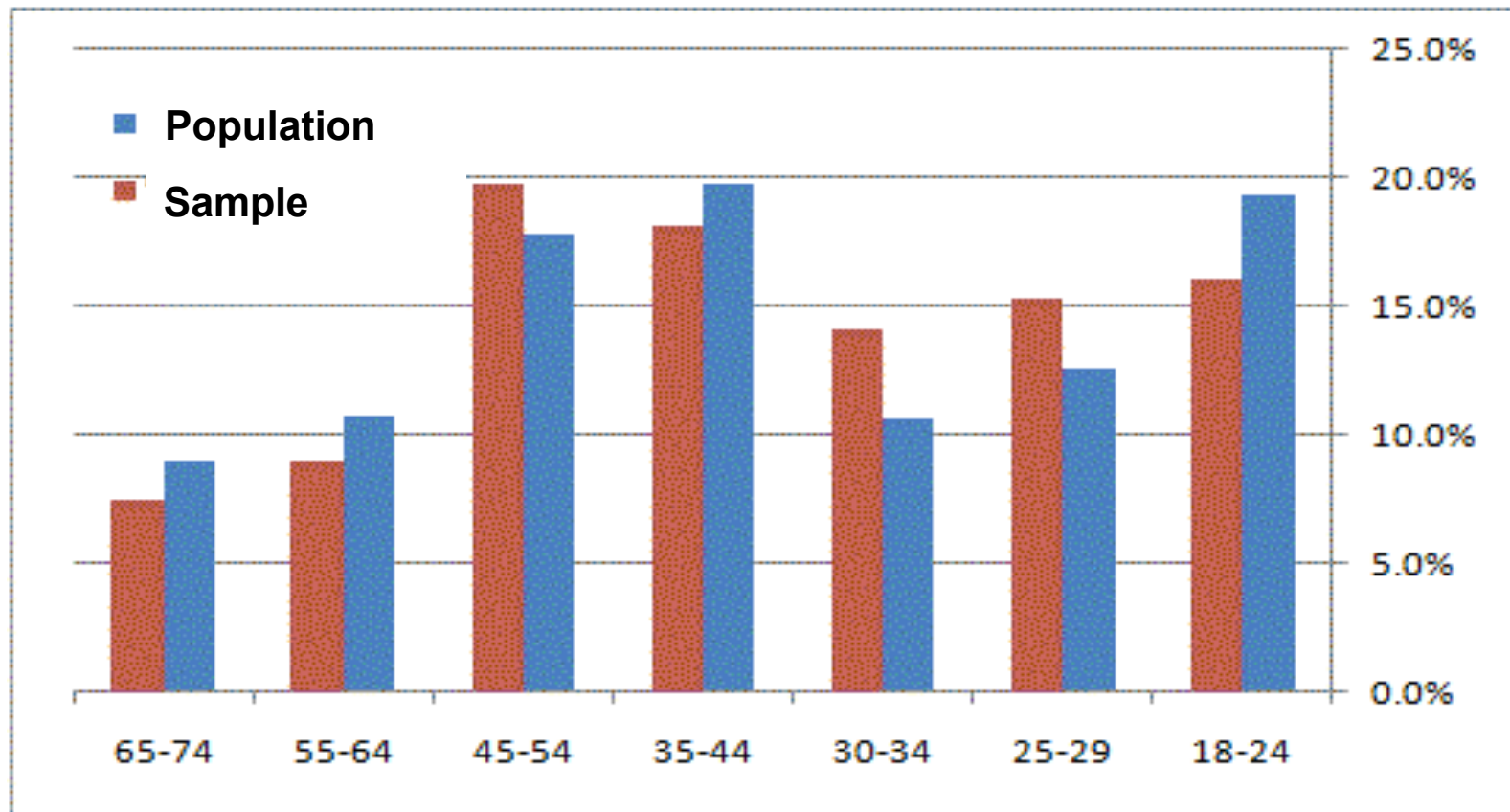
- Gender: 52.5% of the Respondents were Women.
50.5% is their Share in the Israeli Society.
- Geographical Distribution:





Survey Statistics

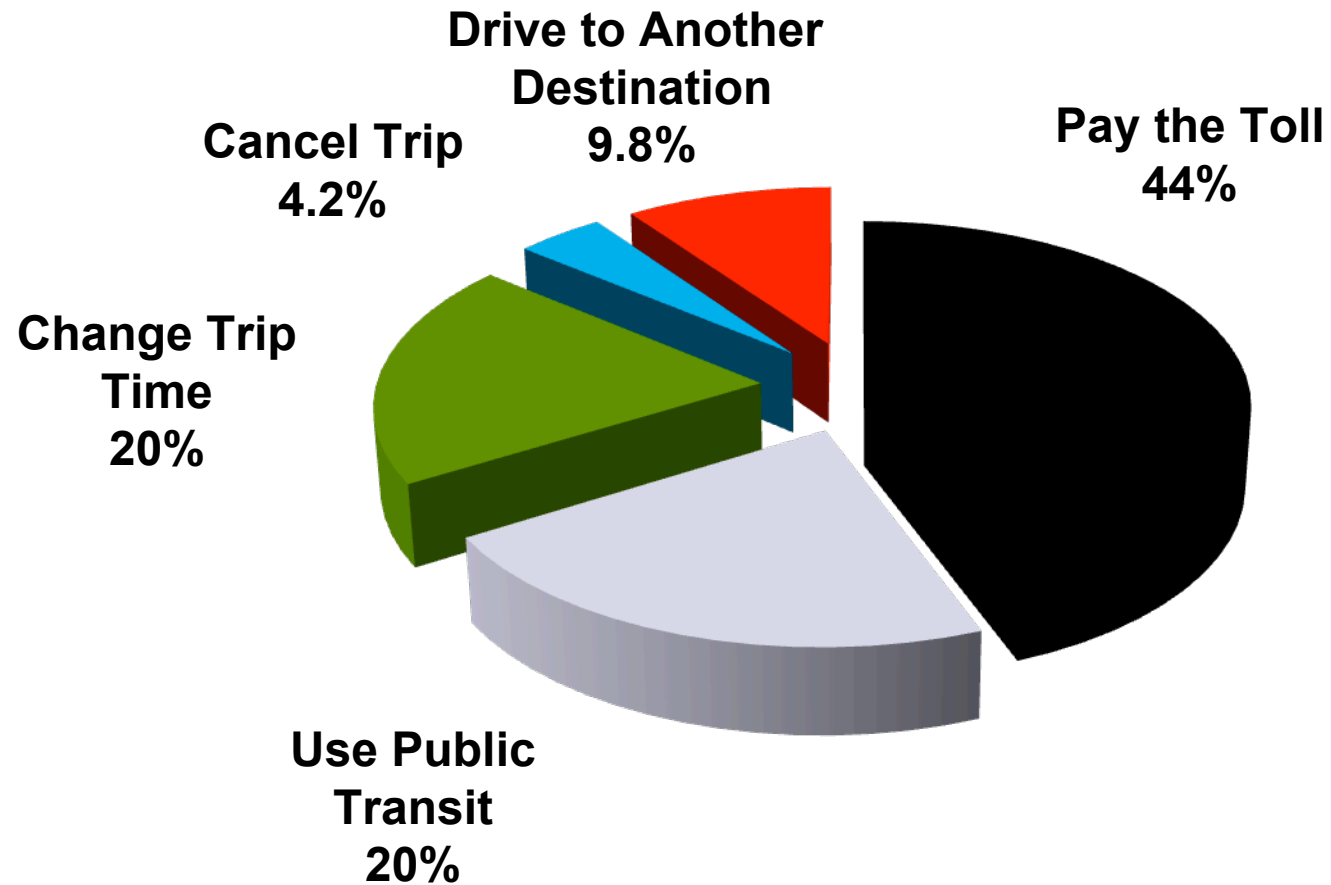
- Age Distribution:





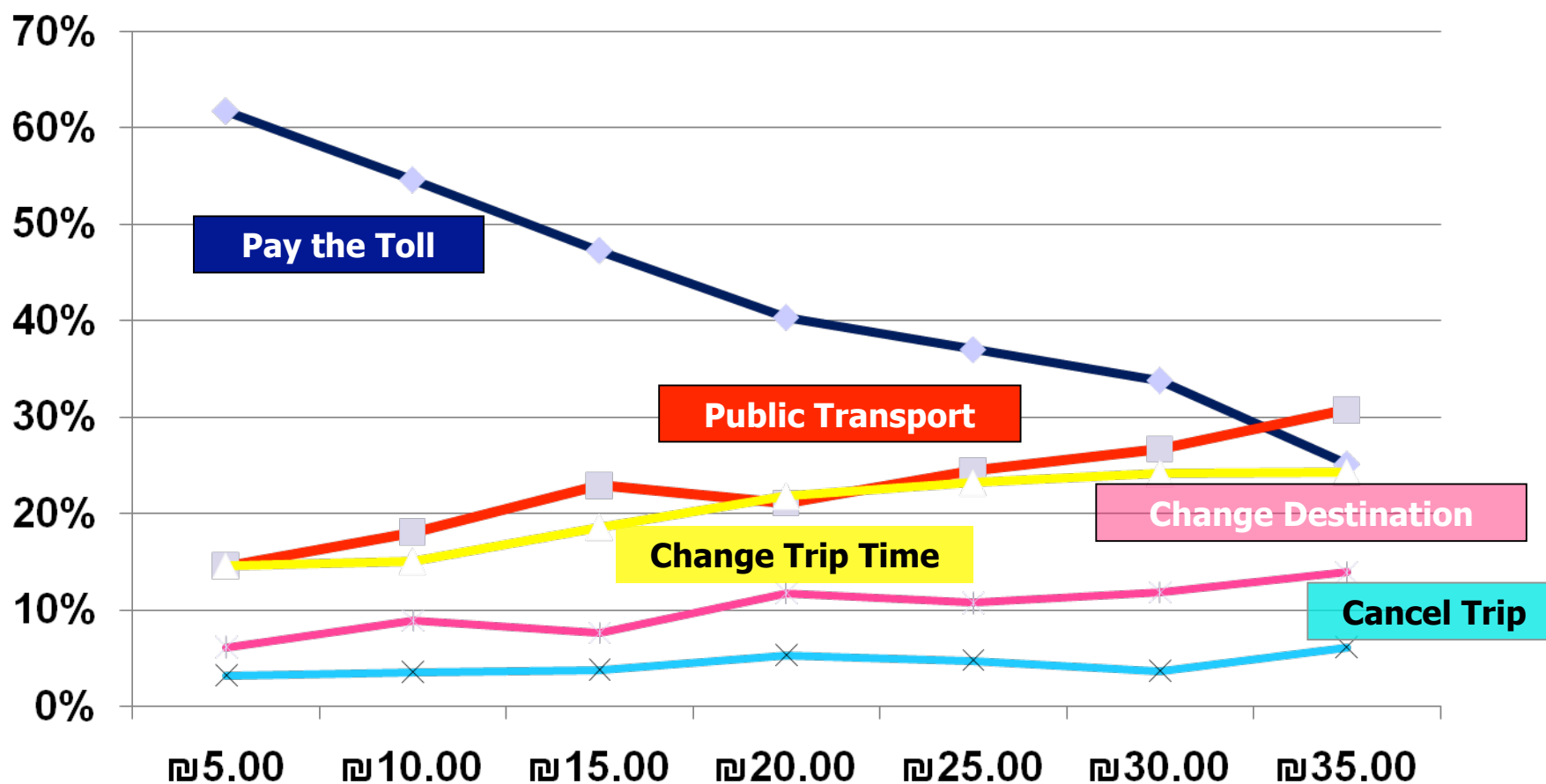
Response to Congestion Pricing

- **Choice Distribution:**





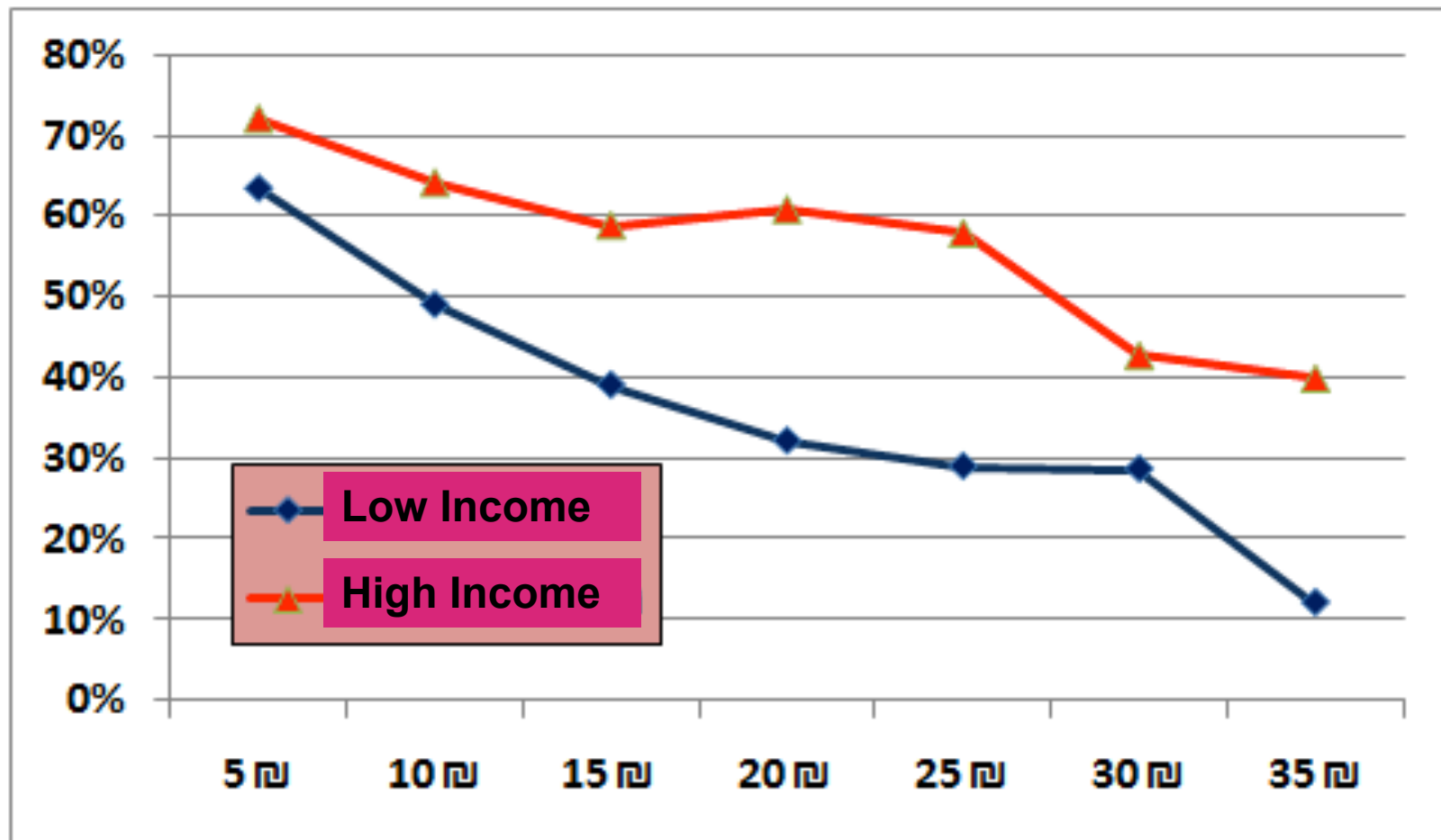
Response by toll level





Response by Income Level

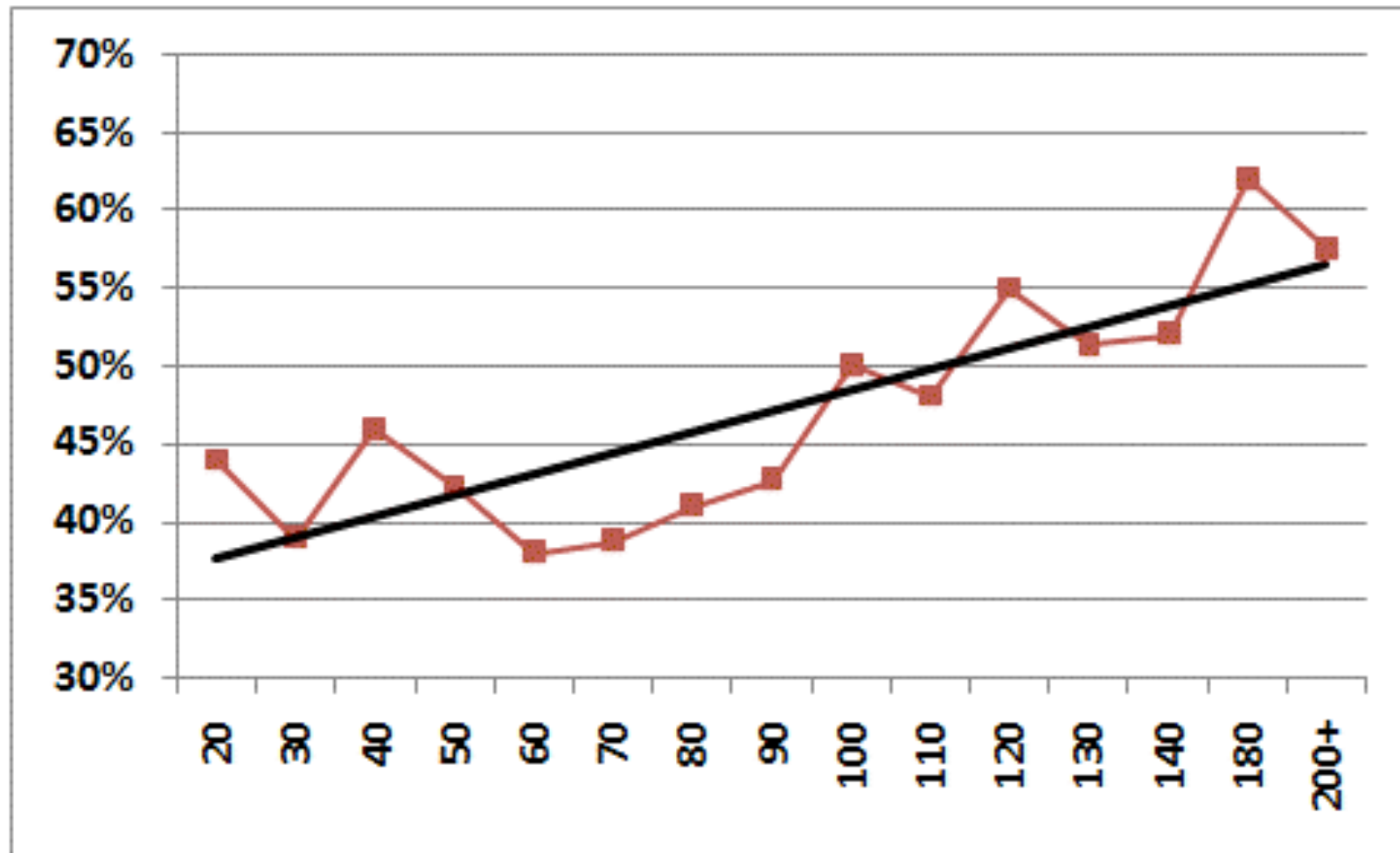
- Pay Toll Distribution





Response by Travel Time

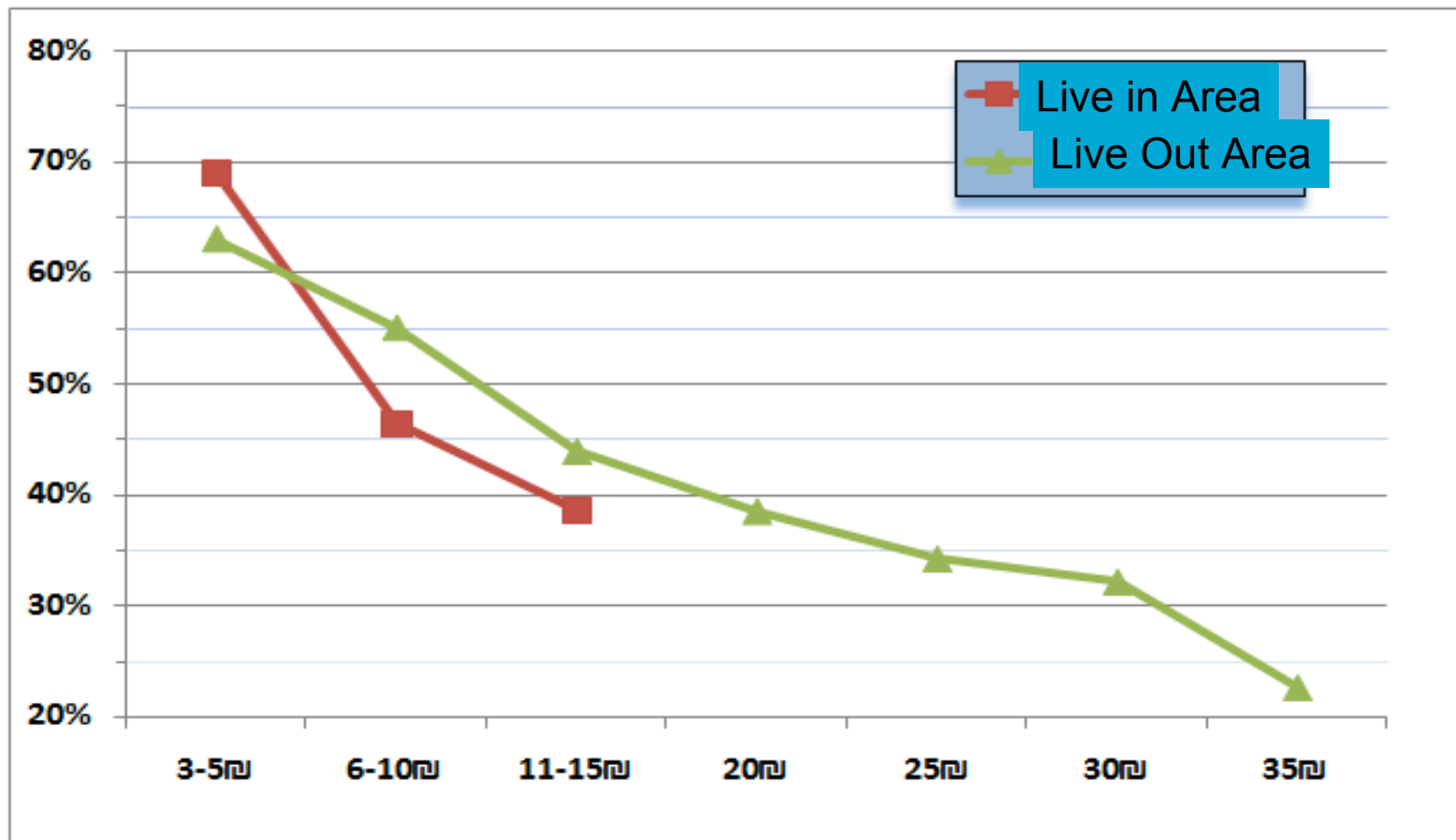
- Pay Toll Distribution





Response by Live In/Out Tolloed Area

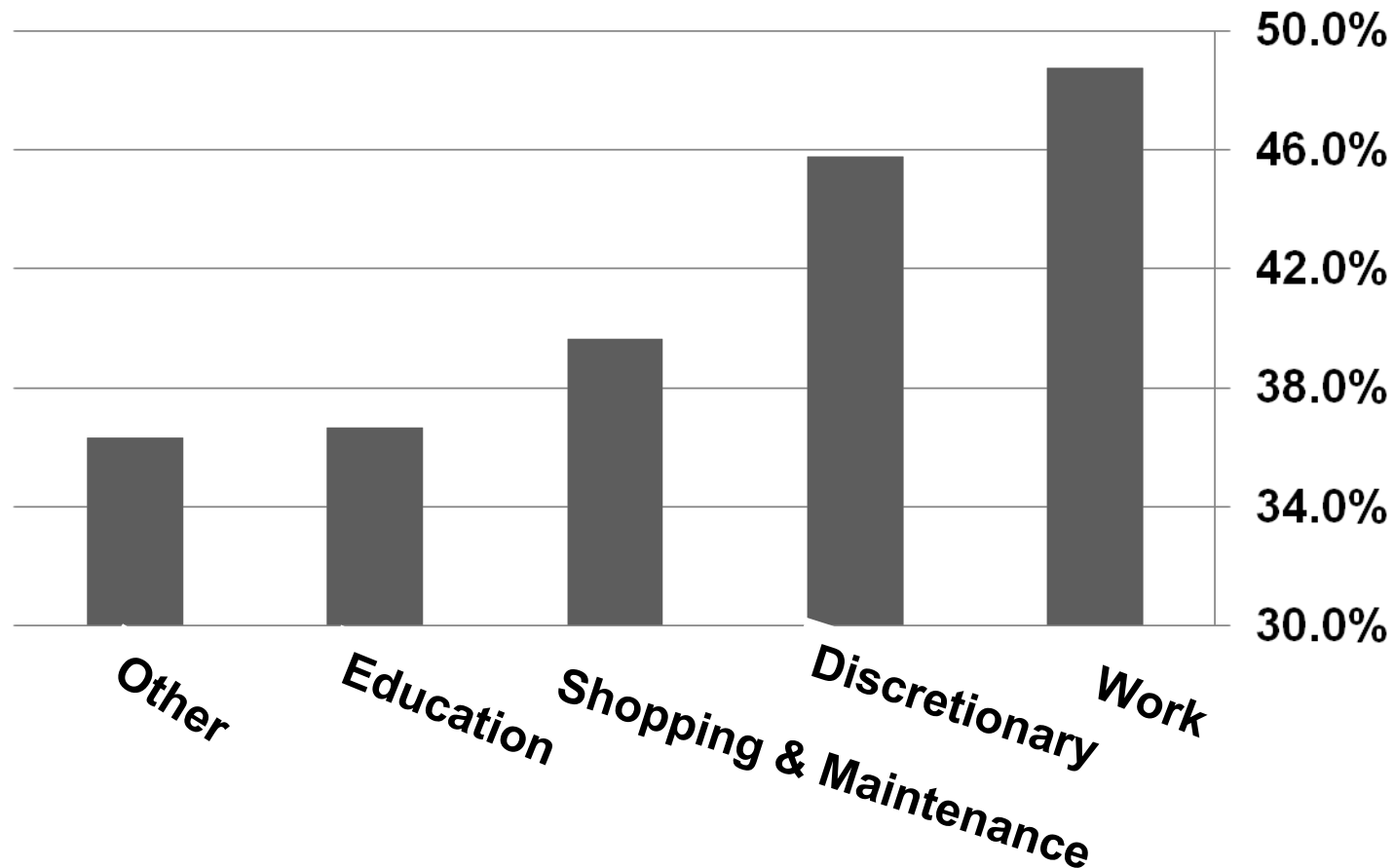
- Pay Toll Distribution vs. Toll:





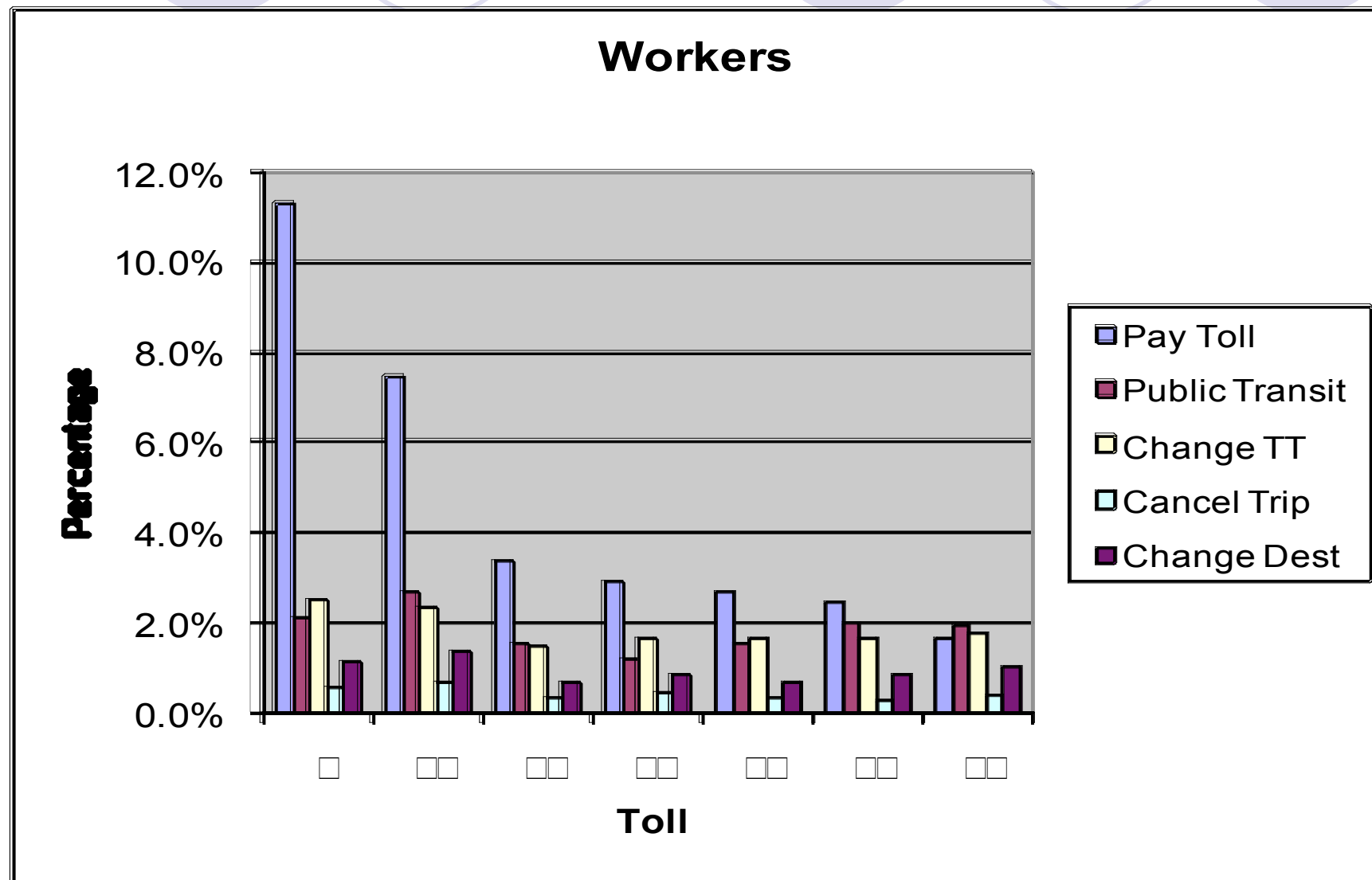
Response by Main Activity

- Pay Toll Distribution vs. Purpose:



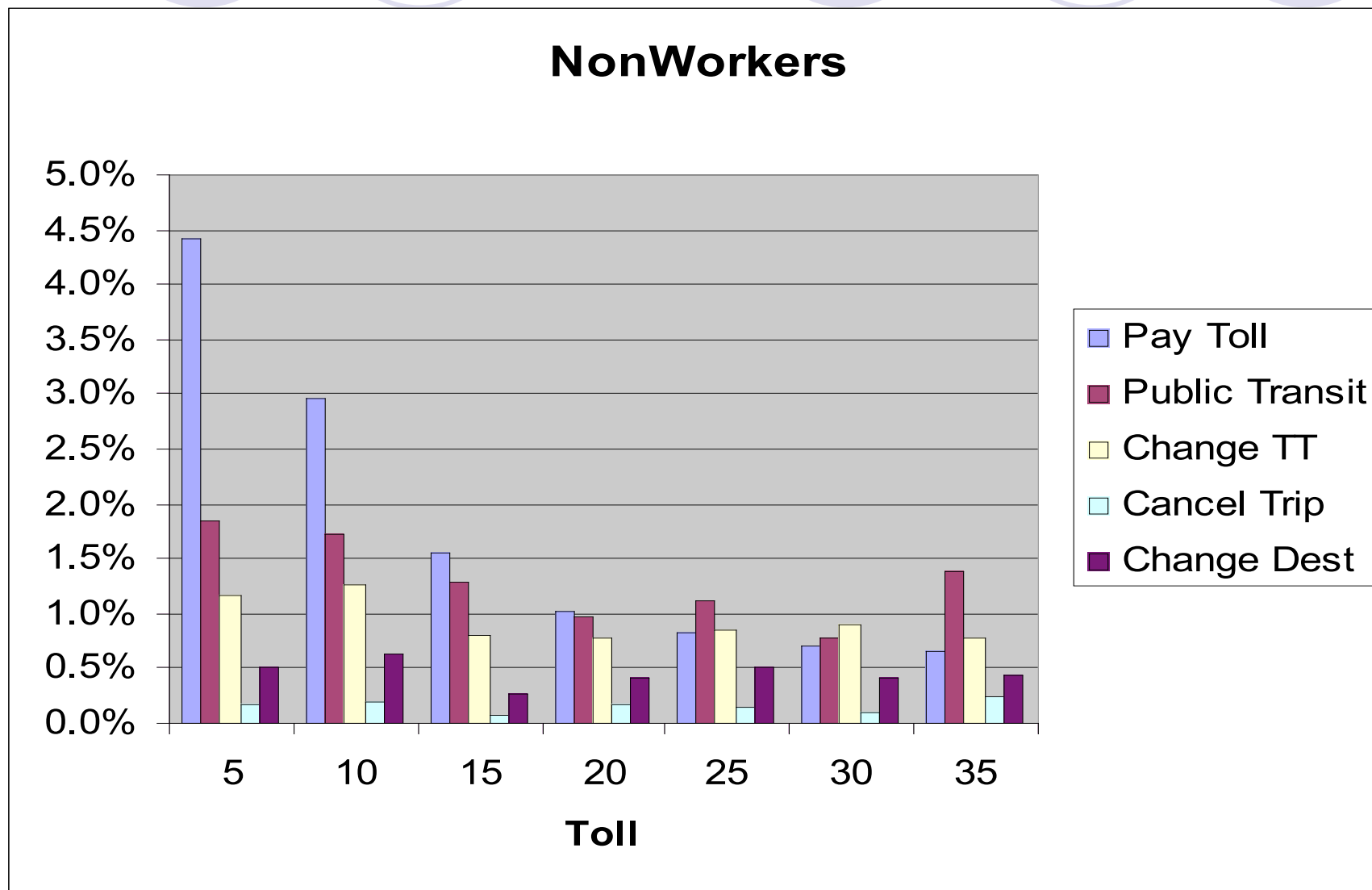


Workers' Responses





Non-Workers' Responses





Agreement with the Toll

- 3 segments
 - Living in the toll area
 - Commute to the toll area
 - Little travel to the toll area
- 6 alternatives
 - By area
 - Ring vs. Area
- 3 Time Periods
 - Morning only
 - Morning and afternoon
 - Daily



Agreement with the toll





Agreement with the Toll

- Toll area residents and PT users prefer the Ring Toll on the no toll alt
- The commuters prefer the no toll alt. They are the main opposition
- The smaller the toll area, the more accepted it is
- The shorter the toll period, the more accepted it is
- The Ring alt is more accepted than the Area one
- The toll revenue should go to transportation improvement (not necessarily transit) and should not go to the municipality



Political Agreement with the Toll

City	General	Alternatives	Comments
Ramat Gan	Oppose the idea, define it is a tax	Oppose all of them	Concern about the revenue goes into the general public fund. Suggest to close the center of TA to traffic
Givatim	Oppose the general idea	The small ring is the least bad	No extra charge should be made
Hulon	Support after PT improvements	Support only the small area alt	The support in condition on some of the revenue goes to the city. Concern about Hulon being the parking garage for Rishon residents



Political Agreement with the Toll

City	General	Alternatives	Comments
Rishon	Support condition on PT improvements	Willing to try the small area alt for a limited time	Concern with public opposition. Suggests a shuttle system from Rishon to TA
Ranana	Agree with the idea and support it	Support the medium alt but believe the smaller is more feasible	Don't think the toll will affect travel behavior of Ranana residents. Think that only few businesses will move from TA to Ranana
Ramle	Oppose the idea	The small area alt is the least bad	Support equity solutions of closing areas to everybody and not only to the poor



Multinomial Logit Results:

Choice Utility

Variable	Pay Toll	Public Transit	Change Time	Cancel Trip	Change Destination
Constant [t-test]	4.5 [21.1]				
Constant [t-test]		1.96 [15.87]			
Constant [t-test]			1.63 [16.44]		
Constant [t-test]					1.1 [9.88]



Multinomial Logit Results: *Continued...*

Socioeconomic Variables

Variable	Pay Toll	Public Transit	Change Time	Cancel Trip	Change Destination
Religious Dummy (1 if Person is Not Hiloni) [t-test]		0.141 [2]	0.141 [2]	0.141 [2]	0.141 [2]
Single Dummy (1 if Status is Single) [t-test]			0.118 [1.41]		
Male Dummy (1 if Gender = Male) [t-test]	-0.217 [-3.22]				
Middle Age Person (1 If Person is 25-44 Years Old) [t-test]	0.0578 [0.85]				
Employee Dummy (1 if Employment is Employee) [t-test]	0.268 [3.25]				
Freelancer Dummy (1 if Employment is Self-Employed) [t-test]	0.387 [3.57]				



Multinomial Logit Results: *Continued...*

Scenario Variables

Variable	Pay Toll	Public Transit	Change Time	Cancel Trip	Change Destination
Car Travel Time Saved When Toll Applied [Minutes] [t-test]	0.0109 [3.15]				
High Complexity Tour Dummy (1 if Tour is not Simple i.e. S, H-P-H, H-P-O-H) [t-test]	0.139 [1.3]				
Public Transit "Bus" Cost [Shekels] [t-test]		-0.00559 [-3.09]			
Toll Paid in the Scenario for Average Income [Shekels] [t-test]	-0.0636 [-11.36]				
Toll Paid in the Scenario for High Income [Shekels] [t-test]	-0.0502 [-9.44]				
Toll Paid in the Scenario for Low Income [Shekels] [t-test]	-0.0714 [-13.67]				



Multinomial Logit Results: *Continued...*

Purpose Variables

Variable	Pay Toll	Public Transit	Change Time	Cancel Trip	Change Destination
Main Activity Work Dummy (1 if Main Tour Activity is Work) <i>[t-test]</i>	0.128 1.51	0.128 1.51			
Main Activity Discretionary Dummy (1 if Main Tour Activity is Discretionary) <i>[t-test]</i>			0.272 3.11	0.272 3.11	
Main Activity Education Dummy (1 if Main Tour Activity is Education) <i>[t-test]</i>		0.447 2.73			
Main Activity Maintenance Dummy (1 if Main Tour Activity is Maintenance) <i>[t-test]</i>				0.682 3.64	
Live in Congestion Pricing Area Dummy (1 if Person lives in Congestion Toll Area) <i>[t-test]</i>	-0.307 -3.43				



Value of Time

- High Income: 13.0 NIS/Hr
- Mid Income: 10.3 NIS/Hr
- Low Income: 9.2 NIS/Hr



Scenario Analysis

Percent Change for Morning Peak Hour, 2015, all the Metro area
toll of 15 NIS for entering, 3 NIS for residents

	Trips	Speed (base 30.5 KMH	Travel Hours	Travel KM
Small Ring	-4	+4	-7	-3
Medium Ring	-6	+6	-12	-6
Large Ring	-6	+7	-13	-7
Small Area	-5	+5	-7	-3
Medium Area	-7	+7	-13	-6
Large Area	-8	+8	-14	-7

The large ring don't' add much benefits as many of those entering the medium ring
Live in the large ring



Scenario Analysis

Speeds by Ring

	Small Ring		Medium Ring		Large Ring	
No Toll	11.9		15.4		21.0	
Small Ring	14.2	19%	21.2	38%	23.3	11%
Medium Ring	13.8	16%	22.2	44%	24.6	17%
Large Ring	13.7	15%	22.0	43%	25.2	20%
Small Area	14.5	22%	21.2	38%	23.4	11%
Medium Area	13.9	17%	23.1	50%	24.7	18%
Large Area	13.8	16%	22.1	44%	26.0	24%



Scenario Analysis – Morning Only

Period	Base Auto hourly Pass (1000s)	Base Transit Pass hourly (100s)	% Auto Change	% Transit Change
06:00-07:00	367	155	2.8	0.0
07:00-08:00	486	253	-4.9	5.0
08:00-09:30	377	155	-4.3	4.9
09:30-12:00	358	113	2.9	0.0
12:00-16:00	401	152	-0.6	0.0
16:00-19:00	451	171	-1.3	2.6
19:00-20:00	426	134	-0.3	0.0
Daily Total	5700	2180	-0.7	1.7
Daily both modes			-0.05	

Next Steps – Multi Criteria Analysis

Criteria	Weight
Travel time saving	25%
Percent shifting to public transport	5%
Initial investment	1%
Operating cost	4%
Net revenue	15%
Environmental impacts	10%
Public acceptance	15%
Political acceptance	15%
Land use impacts	10%



Conclusions

- Tour-based approach can improve explanation of response to congestion-pricing
- Response to congestion pricing vary by tour-purpose and tour-type and duration
- Socio-economic variables are also important factors in the response to congestion pricing
- Initial results suggest that the small or medium area schemes are the best
- Careful analysis should be made before implementation of congestion pricing schemes

An aerial, high-angle photograph of a severely congested city street. The road is packed with a variety of vehicles, including numerous cars, several large orange and white buses, and many motorcycles. The traffic is dense and appears to be at a standstill or moving very slowly. The perspective is from directly above, looking down the length of the road. The overall scene conveys a sense of urban gridlock and heavy traffic volume.

**Thank You
For Your Attention!**