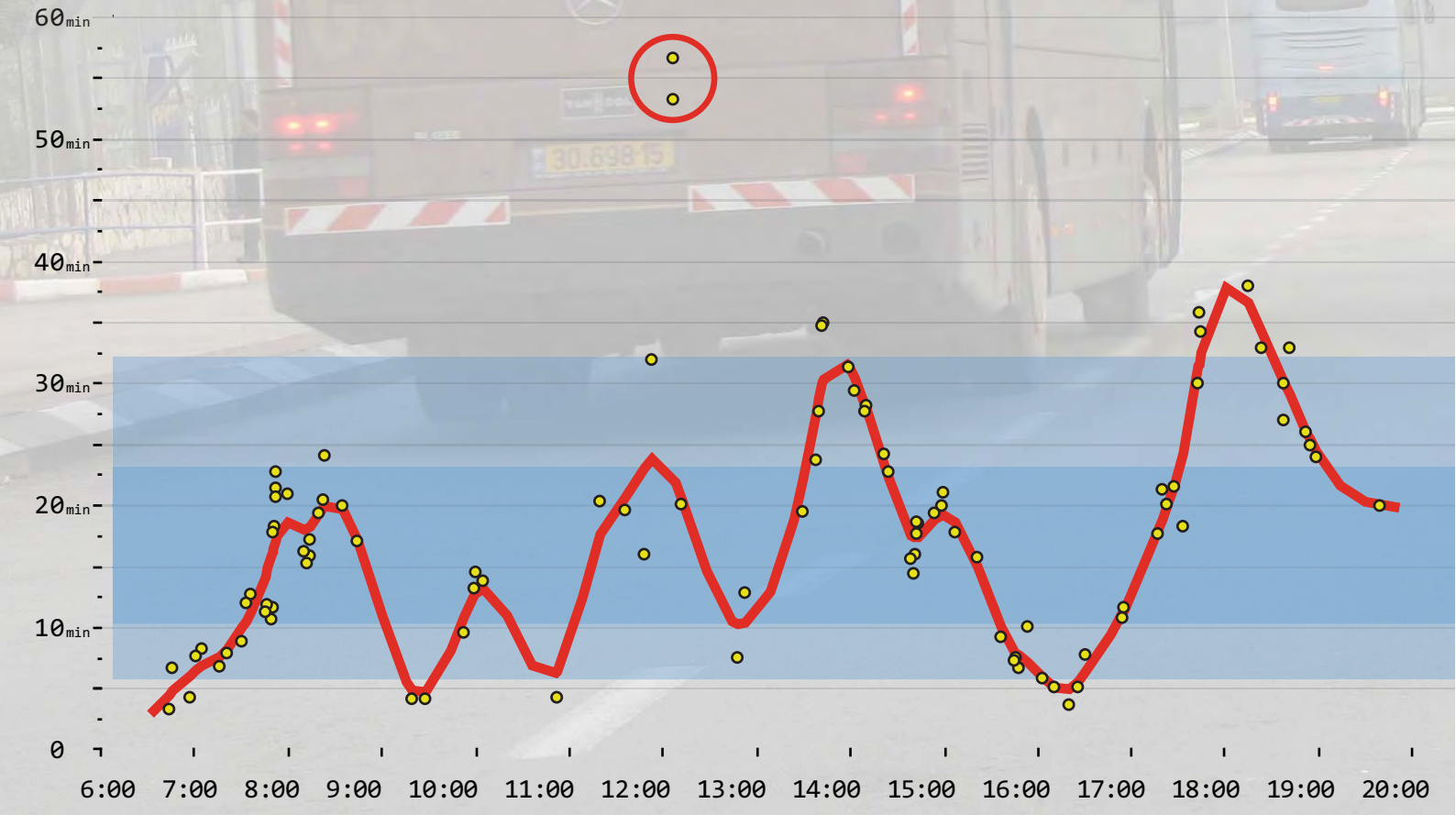
TOUR BUS TRAFFIC

at the Gilo-Bethlehem checkpoint

Bethlehem to **Jerusalem** crossing time over course of day
(Sunday Feb. 21, 2010)



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Tour bus traffic at the Gilo/Bethlehem checkpoint

Results of a survey conducted in February 2010

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Report contents

Executive summary

This goal of this survey was to provide accurate information on the volumes and transit times of tour buses passing through the Gilo/Rachel's Tomb checkpoint between Bethlehem and Jerusalem. Two day-long surveys (6 AM to 8 PM) were conducted, during which all tour bus approaches to and crossings over the checkpoint were logged, and crossing times reconstructed based on the matching of license plate numbers, available for over 97% of the sightings.

The number of sightings of buses approaching/departing the crossings in either direction was 549 on the Sunday survey and 614 on the Saturday survey, generated by 168 and 176 unique buses respectively. The sightings were more or less evenly distributed in their location (Jerusalem or Bethlehem side) and direction (departing or arriving) on each of these days. The distribution of approaches varied over time differently over each day, reaching peak flows of over 20 and 25 approaches an hour in each direction on the Sunday and Saturday respectively. Most (78 to 92%) of the buses sighted approaching the checkpoint passed through. Over 90% of the buses crossing toward Bethlehem did so in less than 10 minutes, with 50% taking between 1-4 minutes. In the Jerusalem direction, 90% of the buses crossing did so in less than 33 minutes, with 50% taking 11-24 minutes. A common trip pattern was a round trip from Jerusalem to Bethlehem and back, with median times of 4 minutes in transition to Bethlehem, 143 minutes in Bethlehem, and 22 minutes in passage back.

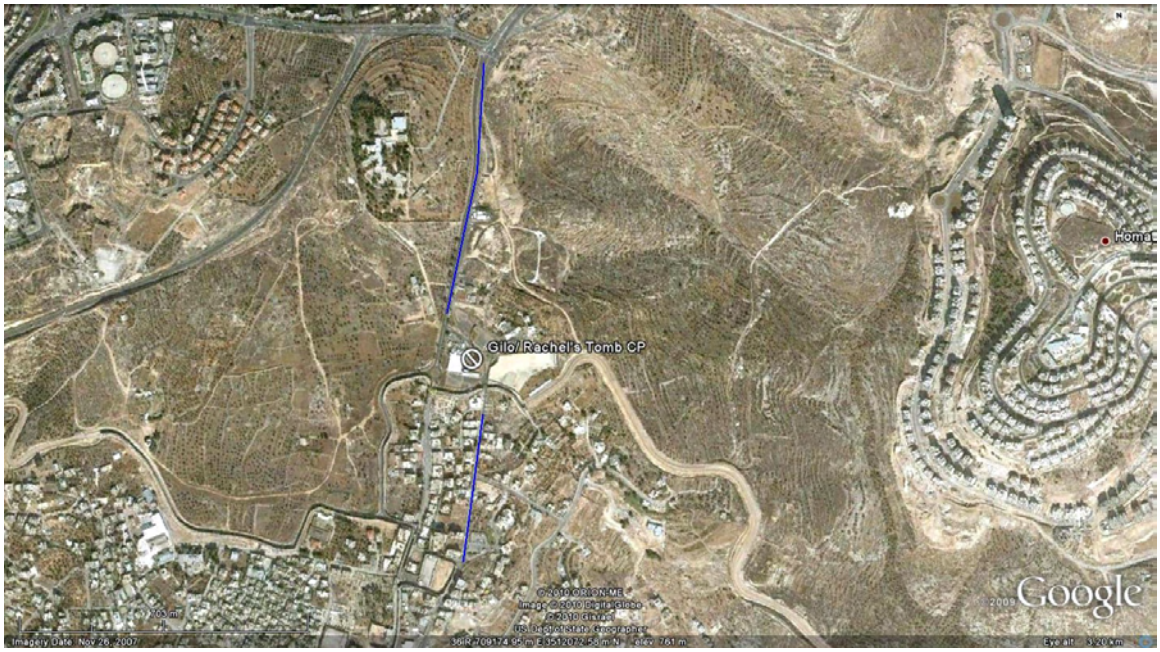
In both directions, there were a few outliers of an hour or more. The timing of these outliers did not seem to be related to overall or directional load on the checkpoint. In fact, passage times from Bethlehem to Jerusalem had a distinct time-related pattern, periodically rising and falling between a low of 10-15 minutes to a peak of 30 minutes or more. Thus, for the most part, crossing times from Bethlehem did not seem to be a function of factors related to the bus itself, but to the passage time of the preceding and following buses. The reason for these patterns would be best clarified through interviews with operators and users of the checkpoint.

Goal of the study

The goal of this survey was to provide accurate information on the volumes and transit times of tour buses passing through the Gilo/Rachel's Tomb checkpoint between Bethlehem and Jerusalem.

Surveying points and procedures

A team of surveyors conducted observations on each side of the crossing, within the two areas marked in blue (the northward stretch is the Jerusalem side, the southern stretch the Bethlehem side). Observations were made from 6 AM to 8 PM on both Sunday, Feb. 21, 2010, and the following Saturday, Feb. 27. These days were chosen in order to cover one Sunday (requested in the terms of reference), and an additional day (Saturday) on which higher visitation was expected due to the arrival of buses from a cruise ship.



Gilo-Bethlehem checkpoint and location of surveyors (blue line)

The surveyors documented all buses (primarily tour buses, but also the much rarer large passenger vans) sighted approaching or coming from the checkpoint. In most cases, this documentation took the form of digital time-stamped photographs that included the bus license plates. License plates numbers of almost all sightings were successfully extracted from the photographs. During a small portion of the observation periods photography was precluded by low light or strong rain, in which case license plate numbers and times were noted manually. Data from both photographs and written datasheets were merged, and in all cases the origin of the observation and other metadata preserved. License plates were available for over 97% of sightings on both survey days.

This data was entered into a sophisticated visual database and analyzed using a set of techniques developed specifically for the analysis of vehicle movement. This allowed us to match the license plates of buses, and then perform interactive querying and extraction of subsets of data based on search criteria, and the statistical analysis of their characteristics and visualization of the results. Thus, sightings could be linked to particular buses, enabling us to measure vehicle volumes and transit times and how these varied over time, as well as reconstruct trajectories over the course of the day, queuing behavior, and other travel patterns. The capacity to move back and forth between overall statistical analysis and visual examination of specific vehicles allowed us to improve the reliability and accuracy of identification, and also to examine outlying cases in more detail.

While license plates were used in matching, these are kept confidential and only aggregate information is reported in the body of this report. The confidential appendices contain the names of tour operators using the crossing in general, and those with exceptionally long passage times in particular, so as to allow qualitative follow-up with them.

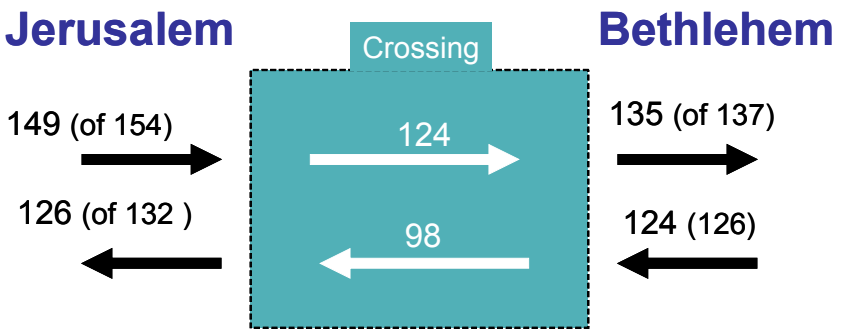
Approaching versus crossing

In order to assure that the normal behavior of the Gilo crossing was observed, the survey was done without the knowledge of or coordination with the authorities operating the crossing. This precluded capturing the buses at the moment of passage itself; monitoring was of their approach to and from the crossing in the blue areas of the map. A few of the buses approaching the checkpoint did not pass through to Bethlehem, but dropped off or picked up passengers who crossed over by foot, to or from another bus on the other side. Thus all the buses approaching the checkpoint in the departing direction did not necessarily depart or, even, carry departing tourists. This distinction generated, in effect, two datasets: one of approaches to the crossing, and a second smaller subset, extracted from the first using license matching, of the vehicles that actually crossed (that is, they were seen in sequence on one then the other side). Since approaching buses that did not cross are likely to carry passengers that do cross, adding to the load on the checkpoint, the volume and patterns of these approaches are considered as well.

As illustrated diagrammatically below, for the Sunday Feb. 21 survey, of the 149 license-identified buses (from 154 total) that approached the checkpoint on the Jerusalem side traveling toward Bethlehem, and the 135 license-identified buses (of 137 overall) that came from the checkpoint toward Bethlehem on the Bethlehem side, 124 were seen shortly after or before on the other side. That is, 83% of the buses approaching the checkpoint in Jerusalem passed through it to the Bethlehem side and 92% of the buses coming from the checkpoint on the Bethlehem side were seen departing from Jerusalem prior to this. More than 90% of these 124 passages took under 10 minutes.

Similarly, 98 buses made a transit from Bethlehem to Jerusalem, constituting 79% of the 124 license-identified Jerusalem-ward approaches to the checkpoint in Bethlehem and 78% of the license-identified Jerusalem-ward departures from the checkpoint in Jerusalem were, indeed, passages. More than 90% of these crossings took less than

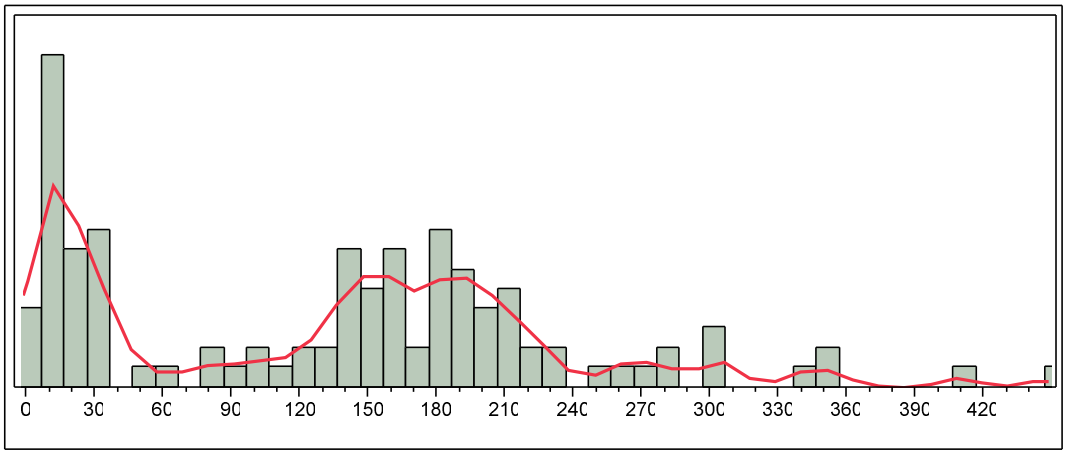
32 minutes. These numbers are summarized below (numbers in parentheses are total buses, while the others refer to the sightings in which license plates were fully identified).



Approaches to and crossings of the Gilo-Bethlehem Checkpoint (Sun. Feb. 21, 2010)

Thus, the overwhelming majority of the approaches to the checkpoint on either side were for the purpose of crossing. Between 6 AM and 8 PM, 222 buses crossed the checkpoint in both directions, comprising between 86% of the license-verified buses observed approaching or departing the crossing on the Bethlehem side, and 81% of those on the Bethlehem side.

The approaches that did not cross (<20%) were probably for dropping off and picking up passengers, and, possibly, on the Bethlehem side, turned back or were simply approaching in order to access shops near the crossing. The different kinds of approaches can be seen in the histogram below of the time between sightings of the same buses on the Jerusalem side. This is bimodal, with one peak of buses entering and exiting the facility with too short of a gap to be a crossing (under 40 minutes) and another more diffuse peak of between 2 and 4 hours. There are some intermediate times, as well as a long right tail of over four hours.



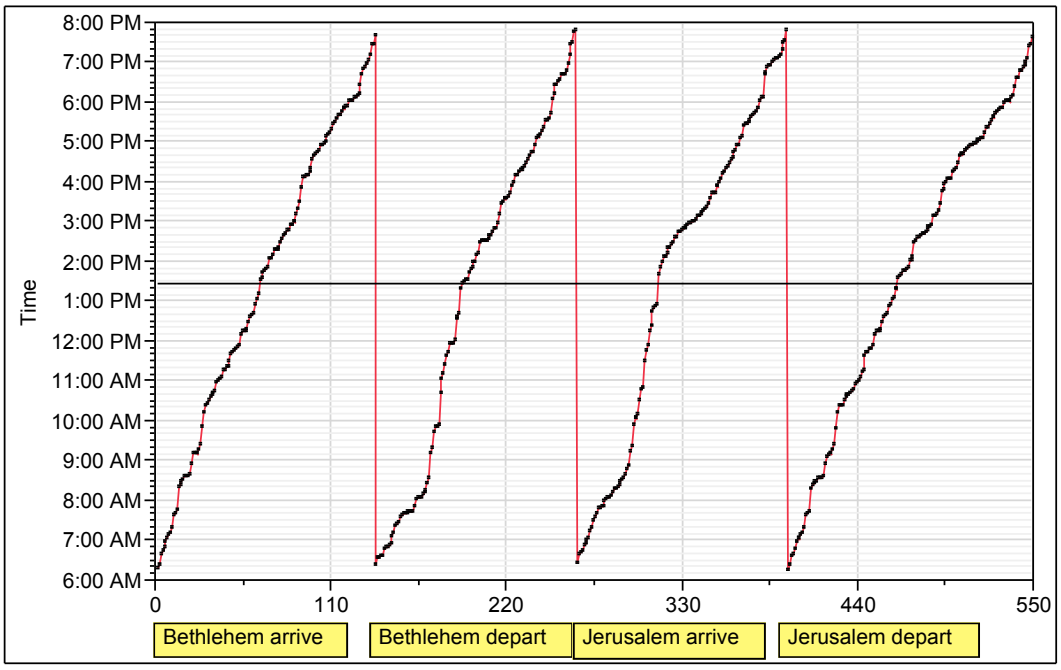
Distribution of times between repeat sightings of same bus on the Jerusalem side

The following sections report on the findings for vehicles approaching the checkpoint, vehicles crossing the checkpoint, and overall travel-patterns for vehicles over the course of the day. Since patterns on both surveys were similar, and in order to avoid repetition, in most cases the analysis is more extensive for the first survey (Feb. 21).

Analysis of approaches to the checkpoint

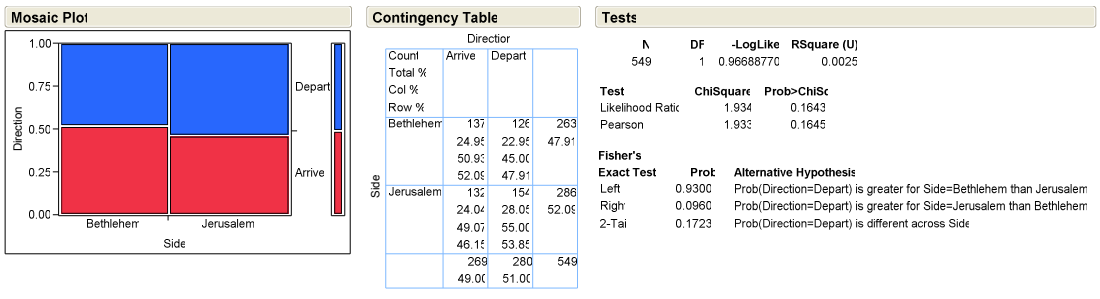
On Sunday, Feb. 21, a total of 549 buses were observed approaching the crossing. A total of 426 buses were captured on film, with a time stamp to an accuracy of one second, and subsequently their license numbers were transcribed. In low light conditions of early morning and evening, buses a total of 124 were not photographed but their license numbers were collected by hand, and the time noted to a resolution of one minute. a total of 124 buses. Of these 549 sightings, license plate numbers could be completely identified in all by 15 (under 3%) of the buses observed.

All the 549 observations are below (the X axis is simply the observation number).



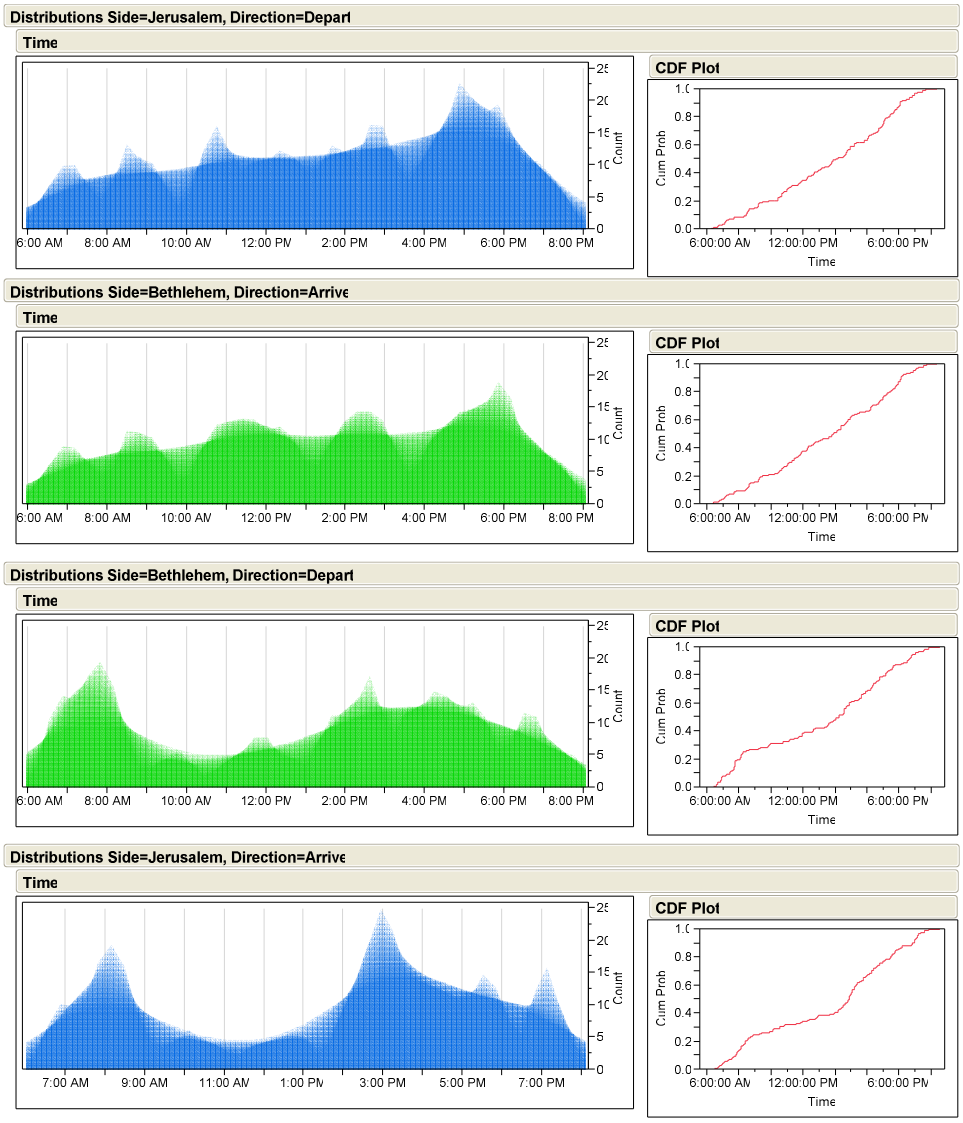
Overall sightings, both sides both directions, Sunday Feb. 21

The numbers of sightings on each side and their directions of travel were fairly evenly balanced, as shown in the mosaic plot and table below. (The statistical test simply says that there is no association between direction and location of the bus at the 0.05 confidence level).



Mosaic plot and contingency table of sightings by side and direction (Feb. 21)

The rate of approaches varied over the course of the day differently. As shown on the following page, the approaches to the checkpoint from Jerusalem on the Jerusalem side ("Jerusalem Departures") and the vehicles moving toward Bethlehem on the Bethlehem side of the checkpoint ("Bethlehem Arrivals") increased at a fairly even rate over the course of the day, from 6 AM to 6 PM, dropping rapidly after 6 PM. (Arrival and Departure are in inverted commas, above, in order to make the distinction between **approaches for departure** versus **actual departure**, constituting about 80+% of these approaches, as described in the previous section.) The Bethlehem arrival, of course, is somewhat lagged from the Jerusalem departure times. It also reflects slightly lower peaks since not all approaches resulted in a crossing (=arrival). The hourly rates of approaches appear on the Y axis, showing the rates rising from about 5 vehicles an hour to over 15 at the end of the day. Travel in the other direction, from Bethlehem to Jerusalem, has a sharp peak (close to 20 vehicles an hour) for morning departures and a more subdued afternoon peak, with the Jerusalem arrivals lagged, of course, after the Bethlehem departures.



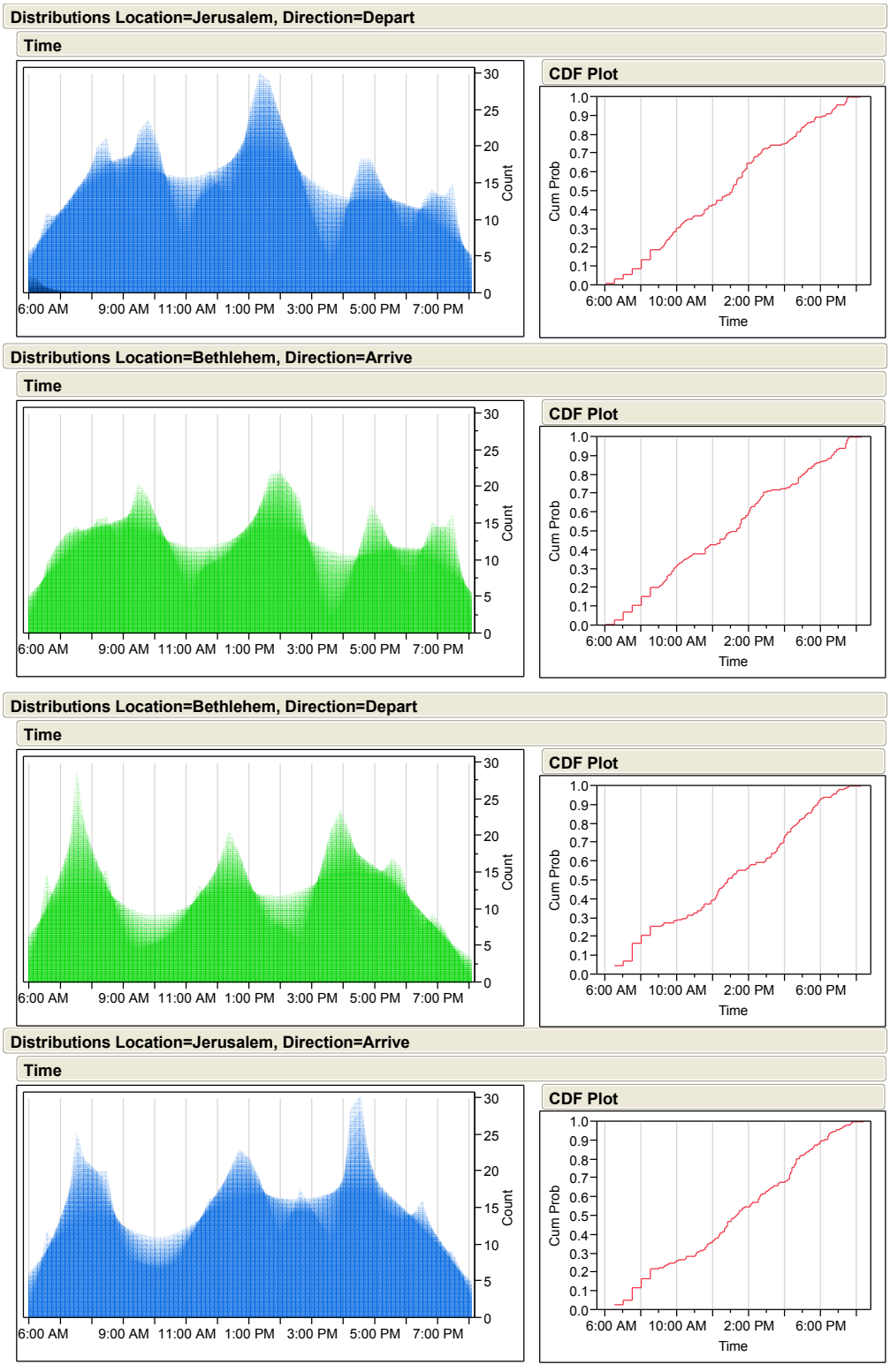
Approaches to the checkpoint over time. Sun. Feb. 21, 2010 survey.

(A technical note: Since rates would depend on the starting point and width of bins in a histogram, I have used a shadowgram, which overlays smoothed histograms across a range of bin widths, so that dominant features appear as more opaque. To the right of each shadowgram is a cumulative distribution (CDF) plot, showing the rate at which the overall amount was reached. The smooth gradual steepening of the rate on Jerusalem to Bethlehem trips is evident on these, and the sharp morning and more subdued afternoon peak in the Bethlehem to Jerusalem traffic is evident in the mid-morning plateau of arrivals on the CDF plots.)

Since most of the buses were sighted more than once, the number of unique buses was considerably less than the number of buses sighted. For example, there were a total of 168 unique buses on Feb. 21 and 176 on Feb. 27. Twenty three buses appeared in both surveys, that is 13-14% of the buses on each day respectively. Drawing on sight-resight statistical methods developed in ecology for the estimation of population sizes from the recapture rates of marked individuals, we can use the vehicle sightings to provide reliable estimates of the total size of the fleet of buses regularly using the Gilo-Bethlehem Checkpoint. A whole science has arisen for this kind of estimation, and care should be taken in assuring that certain assumptions are met regarding the "capture" conditions and the population. This can only be in a full analysis, but below I offer a crude estimation using the Peterson Method to give a *rough* estimate of the size of the "population" of tour buses using the Gilo-Bethlehem checkpoint, based on the "recapture" rate between two days (168 on day one, 176 on day two, with a "recapture of 23). This recapture rate suggests that the overall pool of buses using the checkpoint contains 2,536 buses.[1] Thus, the 344 buses we surveyed on both days represent about 14% of this pool.

On the Saturday the number of approaches was somewhat larger (614 approaches between 6 AM and 8 PM, versus 549 on Sunday). The distribution over time was quite different, with three dominant peaks over the course of the day, as shown below.

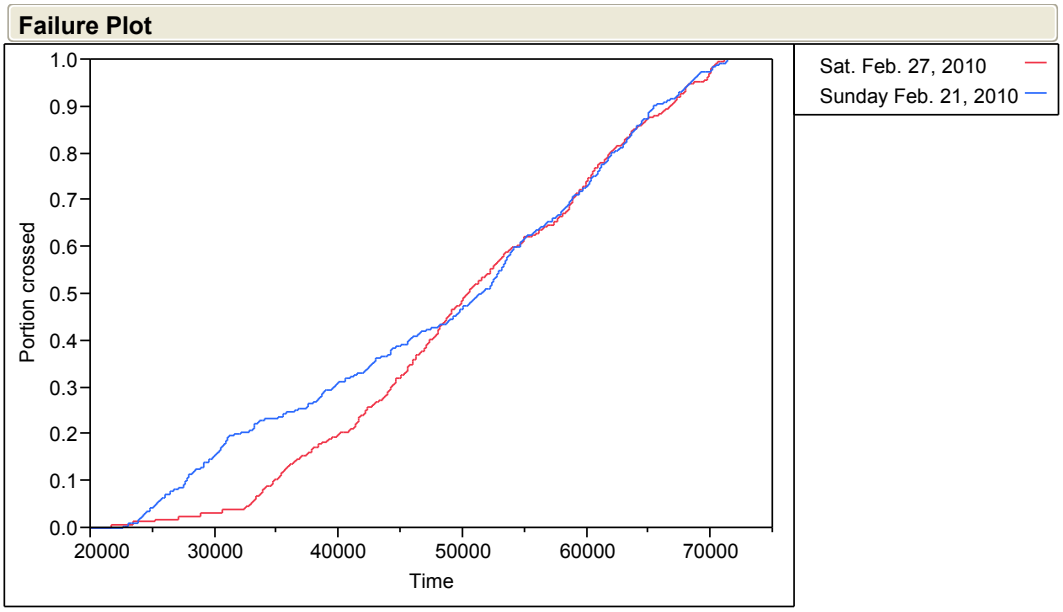
[1] This number needs adjustments for where the method's assumptions are not fully adhered to (especially regarding equal likelihood of all vehicles having the same chance of being captured in the first sample, and the small portion of licenses not deciphered in the second one). While the application of sight-resight techniques here can be refined considerably, this is probably a fairly good working estimate.



Approaches to the checkpoint over time. Sat. Feb. 27, 2010 survey.

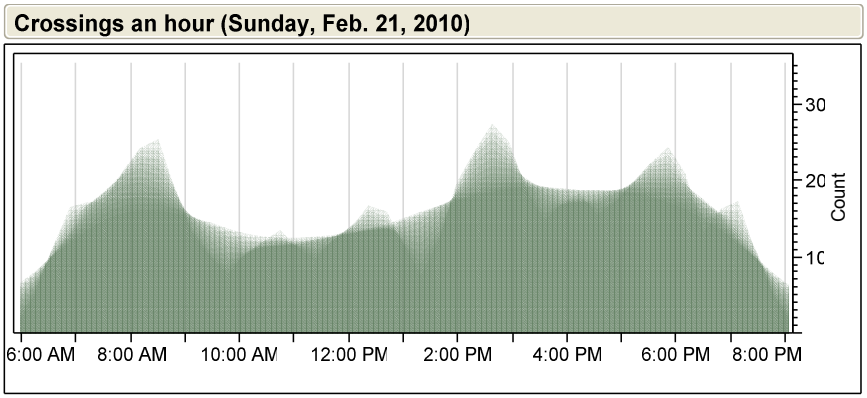
On the Saturday, the large morning wave compared with Sunday meant that a greater portion of the overall approaches was made earlier in the day, with the rate then slowing down compared with Sunday. The two lines in the "failure plot" depict what portion of the total approaches has been made up to any given point in time. (The X units are the 6 AM to 8 PM times in unfortunately arbitray units—a software

constraint for this kind of graph). We see the more rapid morning crossings on Sunday, with the lines crossing around 1:30 PM, at which point the portion of crossings for the remainder of the day proceed at more or less the same rate.



Analysis of checkpoint crossings: usual crossing times

Using license-plate matching of vehicles that were seen departing one side and arriving on the other, the vehicle approaches that resulted in a crossing were isolated, and analyzed separately. The rate of crossings in both directions is shown below



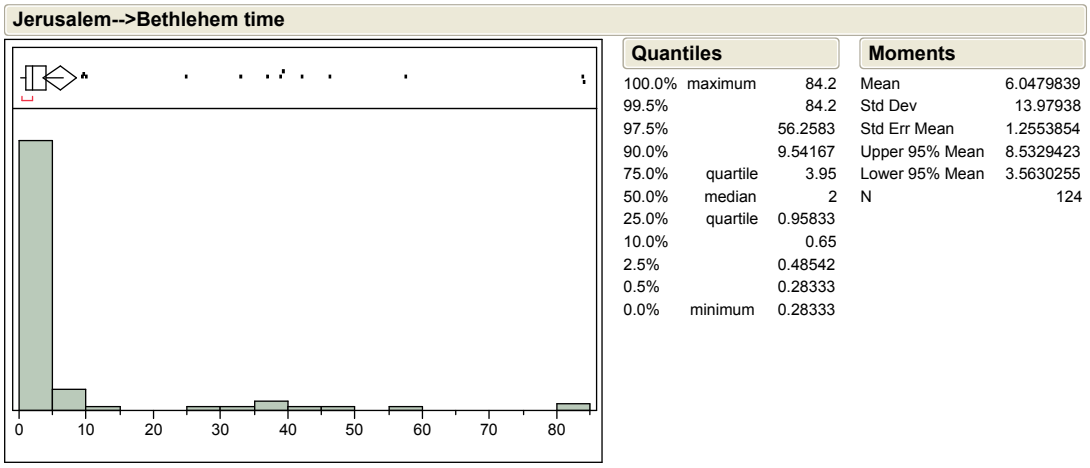
Volumes of buses crossing in both directions, Feb. 21

The checkpoint transit time was taken to be the time between the consecutive sightings on either side of the checkpoint. The distribution of these transit times is given below separately for each directions of crossing, since these differ considerably. Since outliers existed in each case, distributions are given both with and without the outliers. This section describes the crossing times experienced by the overwhelming

majority of vehicles (i.e. with outliers removed), and the next section analyzes the right outliers (exceptionally long crossing times) in greater depth.

As can be seen below, for the Sunday survey, basically almost all (80%) of the buses cross to Bethlehem in 1 to 4 minutes to and cross from Bethlehem to Jerusalem in 6 to 32 minutes. Expected times are 2 and 18 minutes respectively.

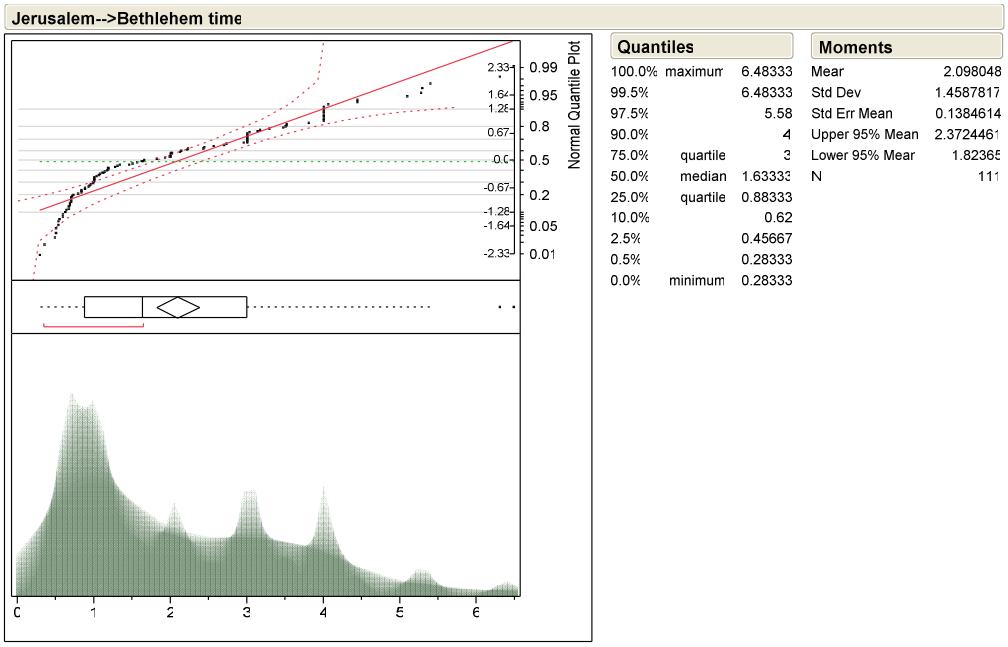
Jerusalem to Bethlehem crossings (Sunday 21 Feb.)



Quantiles		
100.0%	maximum	84.2
99.5%		84.2
97.5%		56.2583
90.0%		9.54167
75.0%	quartile	3.95
50.0%	median	2
25.0%	quartile	0.95833
10.0%		0.65
2.5%		0.48542
0.5%		0.28333
0.0%	minimum	0.28333

Moments	
Mean	6.0479839
Std Dev	13.97938
Std Err Mean	1.2553854
Upper 95% Mean	8.5329423
Lower 95% Mean	3.5630255
N	124

Full distribution



Quantiles		
100.0%	maximum	6.48333
99.5%		6.48333
97.5%		5.58
90.0%		4
75.0%	quartile	3
50.0%	median	1.63333
25.0%	quartile	0.88333
10.0%		0.62
2.5%		0.45667
0.5%		0.28333
0.0%	minimum	0.28333

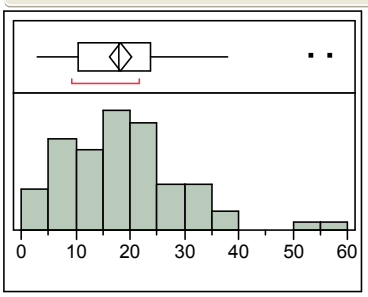
Moments	
Mean	2.098048
Std Dev	1.4587817
Std Err Mean	0.1384614
Upper 95% Mean	2.3724461
Lower 95% Mean	1.82365
N	111

Distribution with 13 outliers removed

The distribution with outliers removed is left-skewed, with the values low enough for rounding effects to the nearest minute (on the non-photographed observations) to be evident. As shown below, the distribution of Bethlehem to Jerusalem times is approximately normal (AVG: 18, STDV: 9) once two outliers of close to an hour are removed.

Bethlehem to Jerusalem crossings

Bethlehem-->Jerusalem time



Quantiles

100.0%	maximum	56.7667
99.5%		56.7667
97.5%		46.05
90.0%		32.13
75.0%	quartile	23.8
50.0%	median	17.8833
25.0%	quartile	10.5167
10.0%		5.83
2.5%		3.53375
0.5%		3
0.0%	minimum	3

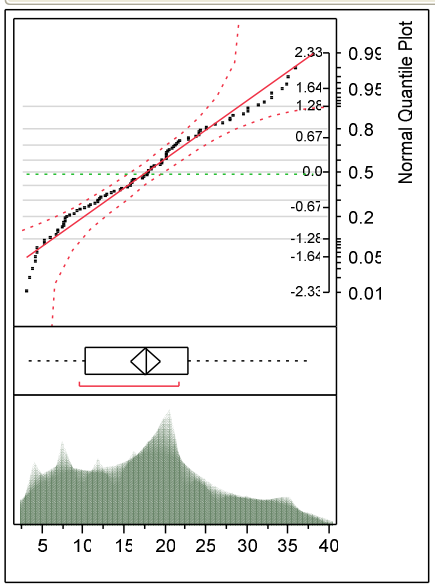
Moments

Mean	18.262585
Std Dev	10.212712
Std Err Mean	1.0316397
Upper 95% Mean	20.310104
Lower 95% Mean	16.215066
N	98

Full distribution

Distributions

Bethlehem-->Jerusalem time



Quantiles

100.0%	maximum	38
99.5%		38
97.5%		35.5054
90.0%		30.4
75.0%	quartile	22.85
50.0%	median	17.8
25.0%	quartile	10.2167
10.0%		5.69
2.5%		3.51792
0.5%		3
0.0%	minimum	3

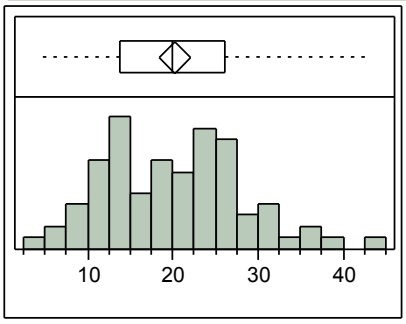
Moments

Mean	17.496181
Std Dev	8.7948195
Std Err Mean	0.8976175
Upper 95% Mean	19.278177
Lower 95% Mean	15.714184
N	96

Distribution with 2 outliers removed.

The passage times in the Saturday survey had a very similar distribution of non outlying passage times in both directions, as shown below. Here too, the distribution with outliers removed was left-skewed for the Jerusalem to Bethlehem passage, and normal (mean of 20 minutes and standard deviation of 8 minutes) for the Bethlehem to Jerusalem passage.

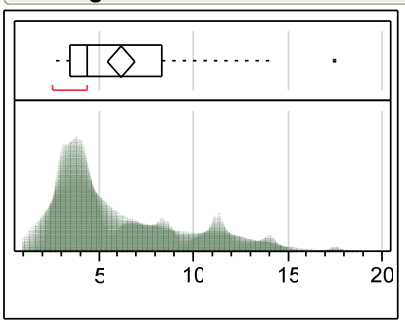
Bethlehem to Jerusalem time (with 4 outliers removed)



Quantiles		
100.0%	maximum	43.1167
99.5%		43.1167
97.5%		38.2392
90.0%		30.4933
75.0%	quartile	26.1125
50.0%	median	19.8917
25.0%	quartile	13.725
10.0%		10.2967
2.5%		6.13542
0.5%		4.41667
0.0%	minimum	4.41667

Moments	
Mean	20.211042
Std Dev	8.1303645
Std Err Mean	0.9090024
Upper 95% Mean	22.020366
Lower 95% Mean	18.401718
N	80

Passage time Jerusalem to Bethelem (5 outliers removed) Saturday Feb. 27, 2010



Quantiles		
100.0%	maximum	17.45
99.5%		17.45
97.5%		14.1
90.0%		11.43
75.0%	quartile	8.3
50.0%	median	4.43333
25.0%	quartile	3.51667
10.0%		2.87667
2.5%		2.63
0.5%		2.51667
0.0%	minimum	2.51667

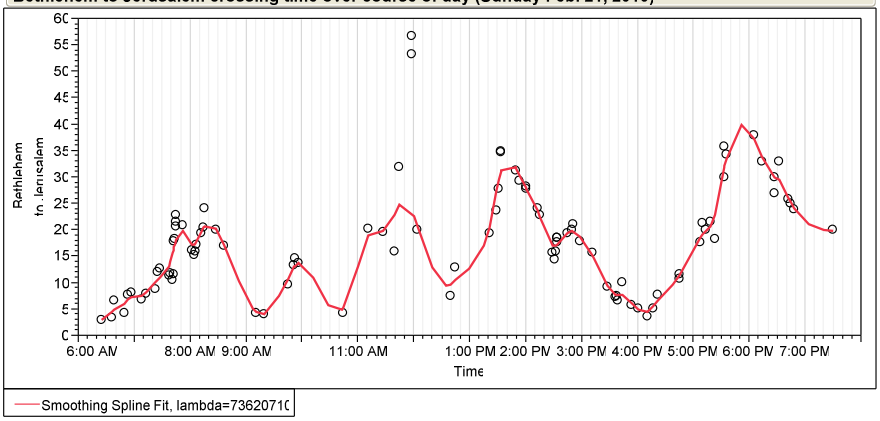
Moments	
Mean	6.1727969
Std Dev	3.5026514
Std Err Mean	0.3755236
Upper 95% Mean	6.9193132
Lower 95% Mean	5.4262806
N	87

A closer analysis of outlying long passage times

While the experience of the overwhelming majority of buses is important, the presence of outliers with exceptionally long passage times is obviously a concern. These outliers are examined in this section, and, in addition, to facilitate further qualitative analysis, an appendix to this report (not available for public release) contains the names and contact information for the companies whose buses seem to have experienced exceptionally long transit times.

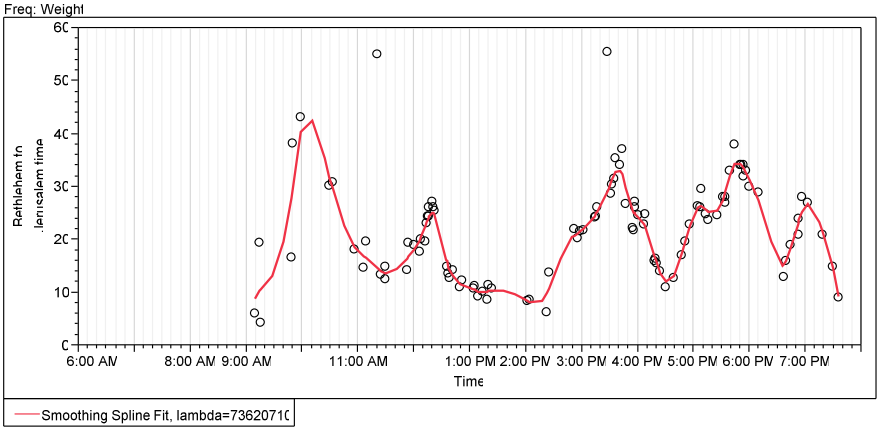
As shown on the following page, in the graph of the Jerusalem to Bethlehem crossing times, which typically take a matter of minutes, the few much longer crossing times "hover" above the non-exceptional crossings, which exhibit no discernable pattern. These outliers occur within defined bands: roughly from 11 AM to 4 PM on the Sunday and 10 AM to 2 PM on the Saturday. For the Bethlehem to Jerusalem crossings, there are, perhaps, two kinds of outliers: more frequent ones in the 30-40 minute range and rarer ones in the 60 minute range. And, as opposed to the Jerusalem to Bethlehem crossings, in the reverse (Bethlehem to Jerusalem) direction there is a distinctive temporal pattern to the non-exceptional passage times, which rise and fall over the course of the day (indicated by the red spline fit based on all except the two one hour outliers in each case). The Feb. 21 graph appears on the cover of this report, with bands denoting the central 50% and 80% of data marked).

Bethlehem to Jerusalem crossing time over course of day (Sunday Feb. 21, 2010)

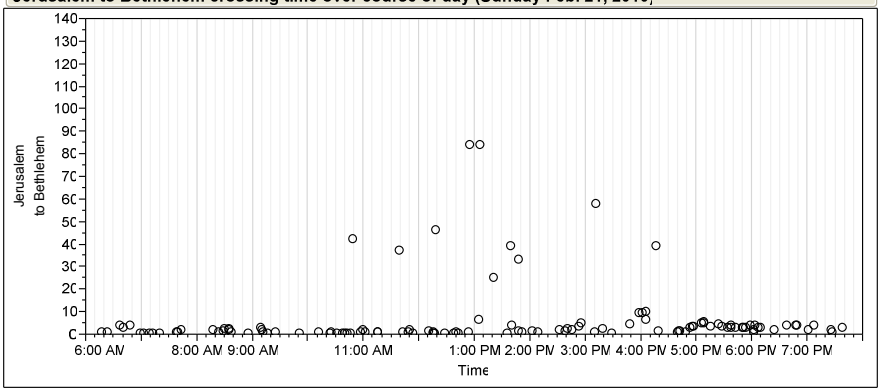


Bethlehem to Jerusalem crossing time over course of day (Saturday Feb. 27, 2010)

Freq: Weight

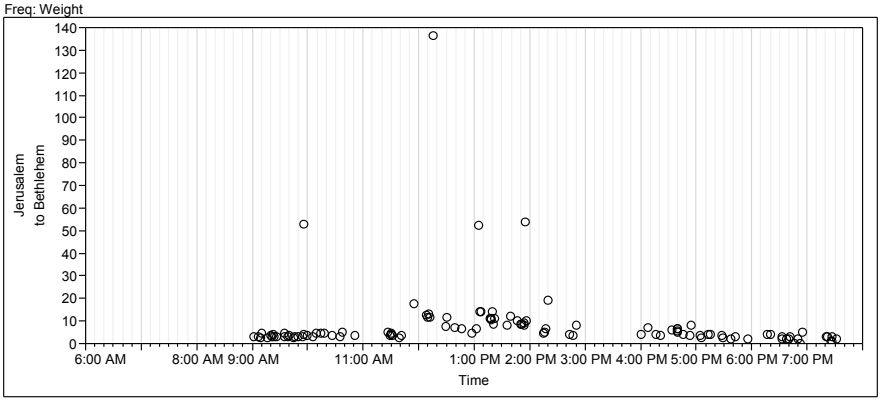


Jerusalem to Bethlehem crossing time over course of day (Sunday Feb. 21, 2010)



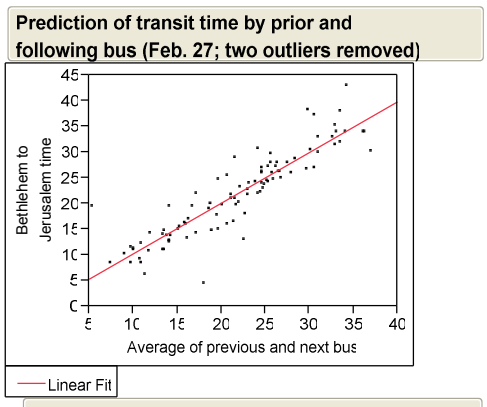
Jerusalem to Bethlehem crossing time over course of day (Saturday Feb. 27, 2010)

Freq: Weight



As can be seen from comparison with the previous sections portraying the overall timing of approaches and crossings, the outliers do not seem to systematically coincide with larger bus load on the checkpoint (neither overall load nor load in any particular direction). Overall traffic (including private cars and pedestrians) might be different, however, and related to the delays.

For the Bethlehem to Jerusalem trips, there are two outliers at approximately the 60 minute level on each of the days, with the second set of "outlying" crossings at the 30-40 minute level, in fact, constituting the "peaks" of the cycles fitted by the red spline curves. These curves mean, essentially, that we can predict the transit time of a given bus remarkably well if we know the transit time of its neighboring bus. This is modeled below, where a linear regression is performed between the transit time of a bus and the averaged transit times of the neighboring buses (the ones that departed Bethlehem just before and just after it). Over 80% of the variance in a bus' crossing time can be explained by its location with respect to neighboring buses (thus, little of the variance is explained by any intrinsic characteristic of the bus itself).



Linear Fit

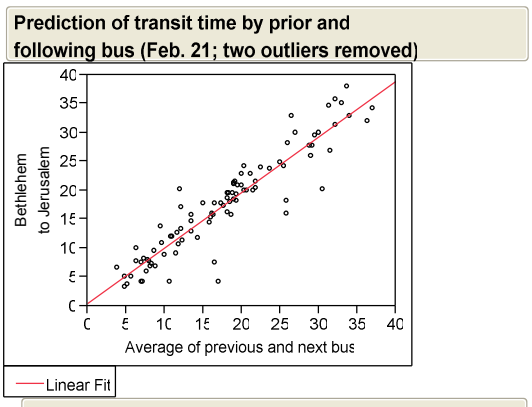
Bethlehem to Jerusalem time = 0.3675969 + 0.9874729*Last and next

Summary of Fit

RSquare	0.80843
RSquare Adj	0.806484
Root Mean Square Error	3.609869
Mean of Response	21.7045
Observations (or Sum Wgts)	100

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.3675969	1.10954	0.33	0.7411
Last and next	0.9874729	0.04855	20.34	<.0001*



Linear Fit

Bethlehem to Jerusalem = 0.3879793 + 0.9620931*Average of last and next

Summary of Fit

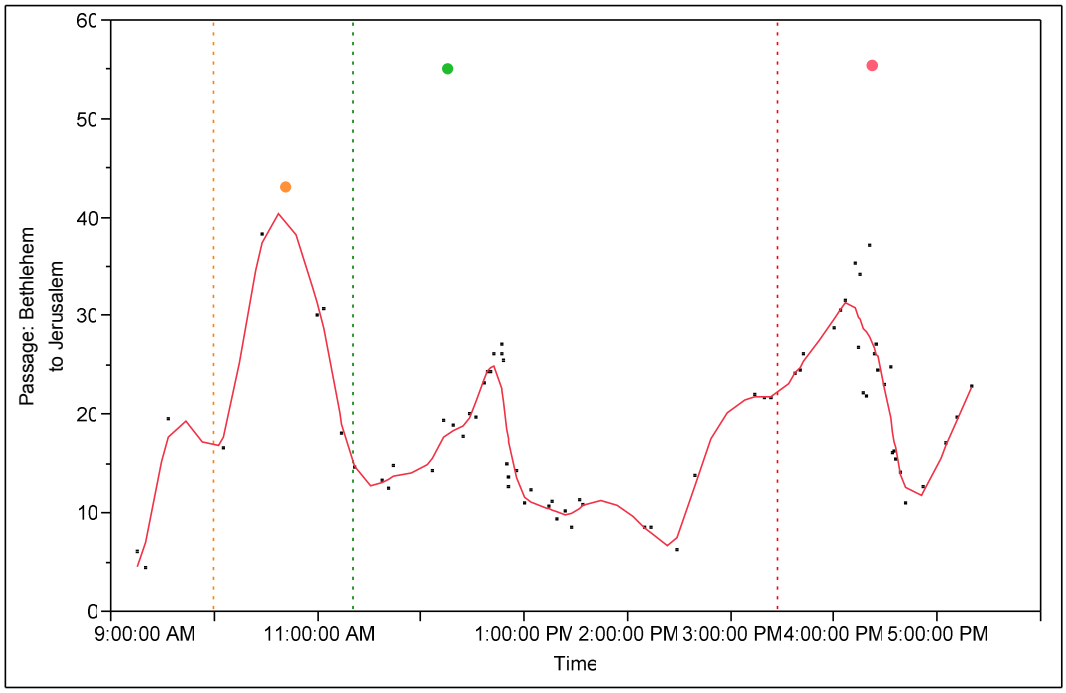
RSquare	0.86144
RSquare Adj	0.85991
Root Mean Square Error	3.28221
Mean of Response	17.54444
Observations (or Sum Wgts)	93

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.3879793	0.79756	0.49	0.6278
Average of last and next	0.9620931	0.04044	23.79	<.0001*

An obvious question raised by these cycles is whether the cycles in passage times are driven by outliers; this might occur, for example, if all the buses behind an outlier were held up by its treatment (as might occur if there was only a single lane through the checkpoint, or if the checking of an outlier hampered the checking of other buses). Clearly this question must be answered by interviews with those operating and using the crossing in the Bethlehem to Jerusalem direction. The graph below, however, suggests a rise in transit times after an outlier enters the queue and a sharp drop in transit times when it leaves the queue. The graph includes all the 74 photographed passages made from Bethlehem to Jerusalem that day, the three outlying (extreme)

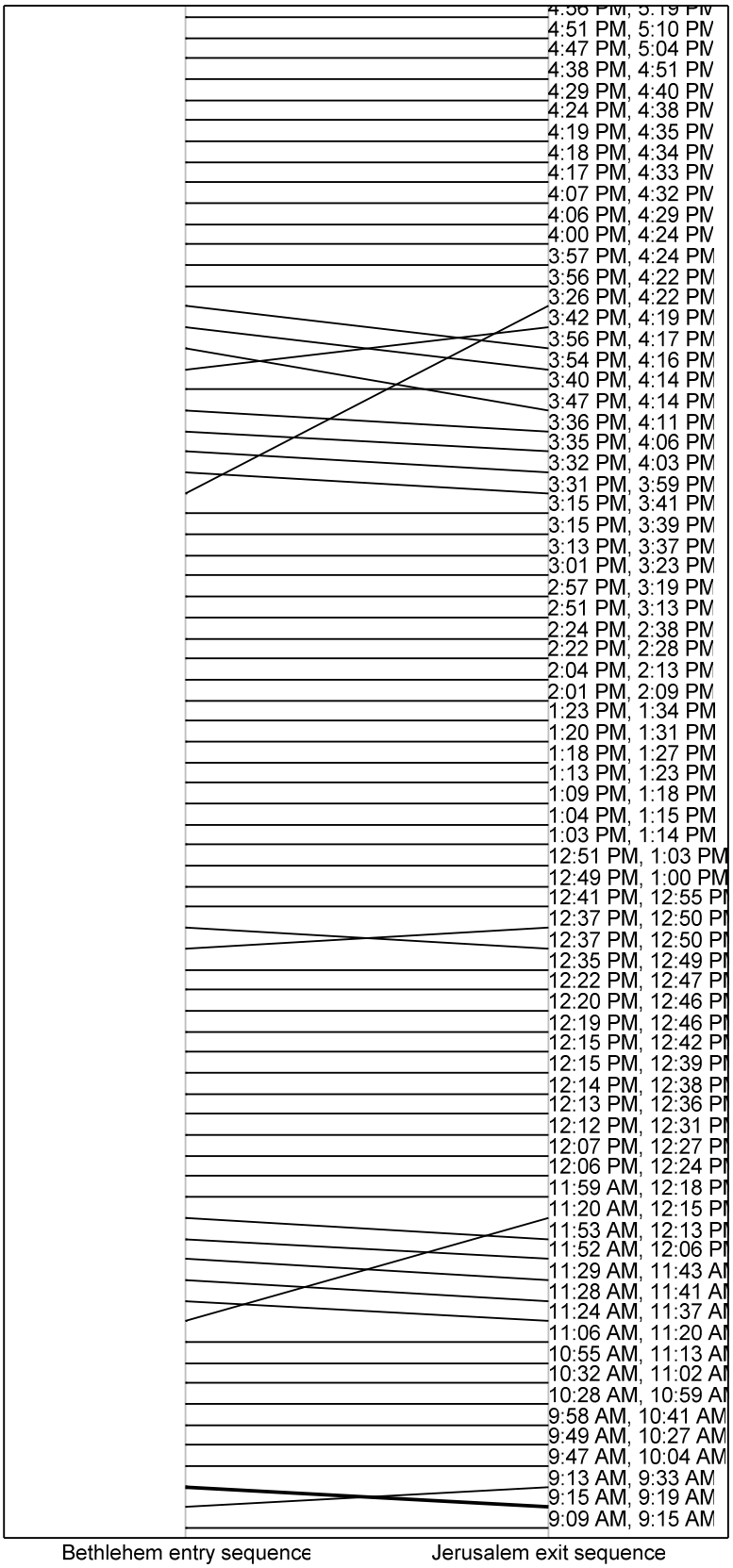
wait time buses are marked in orange, green, and red, with a dashed line indicating when the marked bus departed Bethelehem. In each case, there may be an indication that the "offending" bus seems to be holding up the buses that follow—there is a rise in wait time once they are in the queue, and a sharp drop once the outlying bus is out.



This kind of pattern might be expected if the held up bus was blocking the ones behind it, but this seems to not be the case. The following graph shows sequence of buses as they enter and exit the checkpoint in the Bethlehem to Jerusalem direction. (The numbers to the right are the entry and exit times of each bus). While most buses preserve the sequence absolutely, some cross-overs are apparent.

The larger message from the analysis of crossing times in the Bethlehem to Jerusalem direction is that with the exception of rare outliers, the passage time for a given bus fluctuates over the course of the day in a way that is controlled by factors having to do with the operation of the crossing (specifically, the passage time of neighboring buses) rather than with the characteristics of the bus (for example, security factors related to the bus itself). When the checkpoint is operating smoothly, long series of buses pass in under 15 minutes.

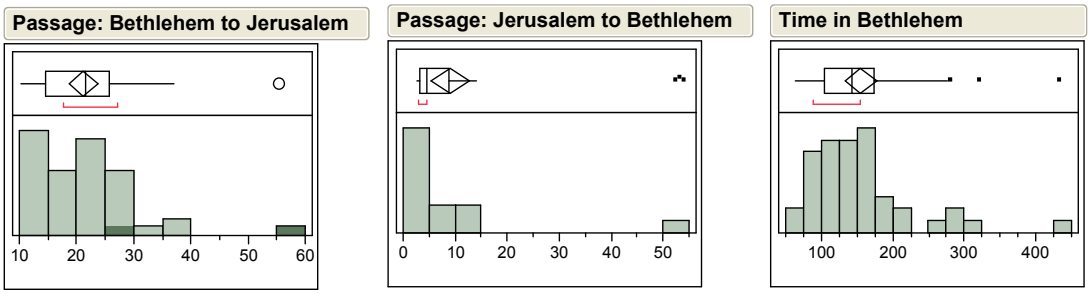
Bus entry and exit sequence



Passage and dwell times of the typical Jerusalem→Bethlehem→Jerusalem trips

The focus up to this point has been on the volumes of approaches and crossings, but one can track the behavior of buses over the course of the day. An example is given, here, of the photographed buses of the Saturday 27 survey. Of the 469 bus sightings on either side of the crossing, 260 (55%) were of sequences of 4 or 5 sightings, and 209 were 3 or less sightings. The longer sequences were predominantly (180 or 70% of the sightings) the following sequence: Depart Jerusalem→Enter Bethlehem→Depart Bethlehem→Enter Jerusalem. Another 21 (or 8%) were the reverse trip: Depart Bethlehem→Enter Jerusalem→ Depart Jerusalem→Enter Bethlehem. The remainder (58 sightings, 22%) were buses seen several times on the same side of the border, for example as they moved into and from the Jerusalem side of the Checkpoint facility for a quick pick up or drop off.

As shown in the summary statistics below, the Jerusalem→Bethlehem→Jerusalem (45 separate buses) averaged 9 minutes in transition to Bethlehem (80% are between 3 and 14 minutes), 155 minutes (two and a half hours) in Bethlehem, and 21 minutes in passage back (80% are between 11 and 31 minutes).



Breakdown of predominant travel pattern (times in minutes) (Jerusalem→Bethlehem→Jerusalem). 45 buses with photographic record			
Quantile	Bethlehem→Jerusalem	Jerusalem→Bethlehem	Time in Bethlehem
100% (Max)	55	54	432
90%	31	14	264
75%	26	9	174
50% (Median)	**22**	**4**	**143**
25%	15	3	105
10%	11	3	85
0% (Min)	10	3	63

Thus, a bus can assume that if they allocate three hours, they will spend 30 minutes in passage and the remainder in Bethlehem. The Bethlehem→Jerusalem→Bethlehem trips had similar timings, but since only five buses performed this route, aggregate statistics are less meaningful.

Conclusions

A fleet on the order of 2500 buses uses the Bethlehem-Gilo checkpoint, with about 170 buses on a given day approaching the checkpoint, with about 80% of these crossing through the checkpoint. A typical trip is from Jerusalem to Bethlehem and back, with half an hour spent in transit in both directions and two and a half hours in Bethlehem. The passage for 90% of the buses is fairly brisk with almost no delay going to Bethlehem and under 20 minutes coming from Bethlehem. However, some delays of an hour or more were apparent in a small number of crossings. In addition, the passage time from Bethlehem to Jerusalem seemed to cycle back and forth over the course of the day from a low level of consistently under ten minutes to a high level of close to 30 minutes. This means that a considerable part of the delay was not due to the characteristics of buses but to the passage times of adjacent buses (most likely the preceding ones). This pattern merits further qualitative investigation (interviews) as it may indicate queuing bottlenecks that could be solved by more efficient checkpoint layout and logistics.

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