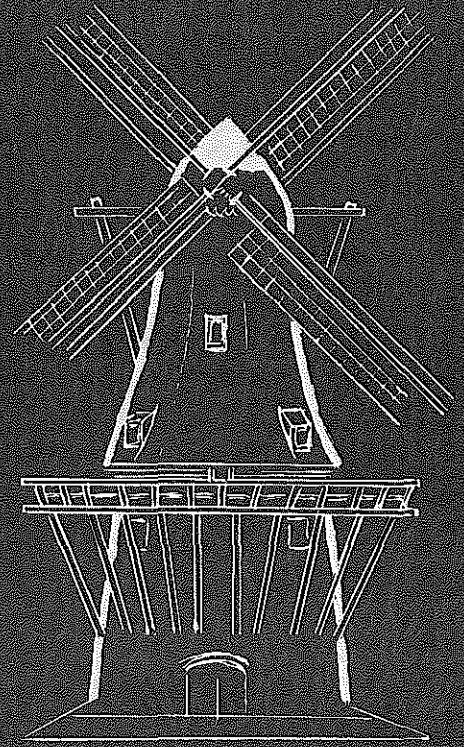


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# HOLLAND - ZEELAND

## AREA TRANSPORTATION STUDY



ORIGIN-DESTINATION STUDY  
ACCURACY CHECKS  
SCREEN LINE ADJUSTMENT

1967

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS

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DEPARTMENT OF STATE HIGHWAYS

STATE HIGHWAYS BUILDING - POST OFFICE DRAWER K - LANSING, MICHIGAN 48904

HENRIK E. STAFSETH, Director

June 25, 1970

Mr. Sam F. Cryderman  
Engineer of Transportation Planning  
Transportation Planning Division  
Michigan Department of State Highways  
Lansing, Michigan

Dear Mr. Cryderman:

We are presenting the "Accuracy Check and Screenline Adjustment" report for the 1967 Holland-Zeeland Area Transportation Study. This is a bench mark publication required by the Bureau of Public Roads.

The three-fold purpose of this report is to ascertain the reliability of expanded socio-economic survey data, expanded trip data and screenline adjustment factors.

This report was prepared by the Transportation Survey and Analysis Section. Transportation Analyst was Ruby Dell Brenner, her Supervisor is Leo Farman.

Respectfully Presented,

A handwritten signature in cursive script that reads "Keith E. Bushnell".

Keith E. Bushnell, Engineer  
Transportation Survey and Analysis



HOLLAND-ZEELAND AREA  
TRANSPORTATION STUDY

ACCURACY CHECKS AND  
SCREENLINE ADJUSTMENT

Prepared By:

MICHIGAN DEPARTMENT OF STATE HIGHWAYS  
TRANSPORTATION PLANNING DIVISION

Sam F. Cryderman, Chief Planning Engineer  
K. E. Bushnell, Engineer of Transportation Survey & Analysis  
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INTERVIEW ADDRESS SUMMARY

ACCURACY CHECKS

JULY, 1970

## INTRODUCTION

The 1967 Holland-Zeeland Area Transportation Study was made to obtain travel characteristics, land use and socio-economic data for the area. To obtain this information a sampling technique was used, as interviews at every address would have been prohibitive in both cost and time. The procedure recommended by the Bureau of Public Roads was followed to obtain the sample data.

This report contains a series of accuracy checks to verify the completeness of the expanded data and to justify the premise that the data is representative of the study area for an average weekday in July-August, 1967.

## HOME INTERVIEW SURVEY

An internal sample of twelve and one-half percent was taken. Home interviewing was started July 11 and completed August 18, 1967. Completed interviews were obtained from 1880 households of the 2280 samples selected. Some sample addresses were vacant, on vacation, refused or some unable to be contacted. Completed interviews were obtained from 82.5% of all samples selected.

## THE TRUCK-TAXI SURVEY

The main sample source was the Michigan Secretary of State Commercial Motor Vehicle License file. A sample selection of 25% resulted in 663 trucks being studied, of these 32 were refused or unable to be contacted. Of the remaining 631 trucks, there were 186 which made no trips. The remainder of 445 trucks averaged 5.5 trips per truck. This was a completion rate of 95.2%.

In the taxi survey a 100% sample was used. The Holland Cab Company owns 5 cabs. At the time the survey was made 4 cabs were being used. They averaged 80.3 trips each in the 24-hour survey period.



## EXTERNAL SURVEY

Interviewing for the External Survey was started on July 11 and completed on September 6, 1967. This survey supplements the internal surveys taken in the home. The purpose of this survey is to obtain information on trips made by all types of vehicles entering, leaving or passing through the survey area. Roadside interviews were taken at twenty-five external stations. Motorists were questioned as to the origin and destination of the trip in progress. On heavily traveled routes it is impossible to interview all drivers. However, all vehicles are counted and classified. A total of 43,382 vehicles were classified and 74.9% of this number were interviewed.

## ACCURACY CHECKS

There are many possibilities of error entering into an O-D Study. For this reason accuracy checks are made on socio-economic data and also on trip data.

In the home interview some trips may be forgotten and, as all members of the household are not interviewed, some may be omitted unknowingly. Some people do not realize the importance of the information, so are not as accurate in reporting trips as they should be. Errors may be made by the interviewer in recording the data.

Because of the possibility of errors and the importance of accurate information it is necessary to compare survey records with the other sources of data.

## POPULATION ACCURACY CHECK

In checking the population accuracy Preliminary Population Projections in Small Areas in Michigan, Working Paper No. 9, prepared by the State Resource Planning Program, Michigan Department of Commerce, Nov. 1966, was used.

As a sample of 12 1/2% was taken for the O-D data, the sample interviews were expanded by 8 to bring them up to a universe for dwelling units. The occupants averaged 3.45 per dwelling unit sample. In each tract some sample addresses were occupied but could not be contacted. These were tabulated with the average occupancy rate.

Different boundary lines were used in the two comparisons. However, the overall comparison of 99.5% is very good.

POPULATION ACCURACY CHECK

	<u>Paper No. 9</u>	<u>O-D Data</u>	
Holland	23,910	23,107	
Fillmore Twp.	4,880	2,386	
Laketown Twp.	1,840	2,696	
Park Twp.	5,340	7,962	
Holland Twp.	<u>10,880</u>	<u>10,138</u>	
	46,850	46,289	= 98.8%
Zeeland	3,910	4,923	
Zeeland Twp.	<u>2,900</u>	<u>2,371</u>	
	6,810	7,294	= 107.2%
Overisel Twp.	1,620	1,424	
Port Sheldon Twp.	260	419	
Olive	600	652	
Blendon	<u>730</u>	<u>507</u>	
	3,210	3,002	= 93.5%
TOTALS	56,870	56,585	99.5%

## TOTAL DWELLING UNIT ACCURACY CHECK

The total dwelling unit accuracy check includes all sample dwelling units expanded by 8 as 12 1/2% were sampled.

The check data was obtained from an update of the 1960 census data and a comparison from the Polk City Directory. In updating the 1960 census data the number of residential building permits issued (1960-67) in each political unit were added to the census dwelling unit counts for 1960.

The check data source felt that demolitions for this area, during this period of time (1960-67), were very few, so were not deducted.

The total accuracy check of 103.7% is within an acceptable range.

TOTAL DWELLING UNIT ACCURACY CHECK

	<u>Check</u>	<u>O-D Data</u>
Holland	8,234	8,464
Fillmore Twp.	524	504
Laketown Twp.	647	1,008
Park Twp.	2,228	2,352
Holland Twp.	<u>2,830</u>	<u>2,992</u>
	14,463	15,320 = 105.9%
Zeeland	1,539	1,504
Zeeland Twp.	<u>716</u>	<u>536</u>
	2,255	2,040 = 90.5%
Overisel Twp.	465	432
Port Sheldon Twp.	128	144
Olive Twp.	149	168
Blendon Twp.	<u>127</u>	<u>128</u>
	869	872 = 100.3%
TOTAL	17,587	18,232 = 103.7%

## OCCUPIED DWELLING UNIT ACCURACY CHECK

One of the best checks of the accuracy of the home interview sample is in a check of occupied dwelling units recorded by the survey and the independent estimate of occupied dwelling units.

As Park, Laketon and Port Sheldon townships have a large number of cottages, which would be occupied during the time of the survey but at the time of the census would be unoccupied, the accuracy ratio is very high there.

The vacancy rate of the 1960 census averaged 4.36 percent for the area. This varied from 2.89 percent to 4.85 percent for the various political units. These rates were used for the 1967 census update used for comparison.

The total accuracy rate of 104.0% is well within an acceptable range.

OCCUPIED DWELLING UNIT ACCURACY CHECK

	<u>Check</u>	<u>O-D Data</u>	
Holland	7,843	7,544	
Fillmore Twp.	499	496	
Laketown Twp.	474	688	
Park Twp.	1,513	2,184	
Holland Twp.	<u>2,708</u>	<u>2,920</u>	
	13,037	13,832	= 106.1%
Zeeland	1,469	1,432	
Zeeland Twp.	<u>684</u>	<u>512</u>	
	2,153	1,944	= 90.3%
Overisel Twp.	442	416	
Port Sheldon Twp.	81	144	
Olive Twp.	143	168	
Blendon Twp.	<u>123</u>	<u>120</u>	
	789	848	= 107.5%
TOTAL	15,979	16,624	= 104.0%



## AUTOMOBILES AVAILABLE

In the census auto update Ottawa County averaged a 13.22 percent increase and Allegan County a 7.87 percent.

The accuracy ratio shows that the auto ownership increased at considerably higher than average rate in the suburban area of Allegan County. Thus the overall accuracy rate of 109.5% is high, but felt to be acceptable.

TOTAL AUTO ACCURACY CHECK

	<u>Check</u>	<u>O-D</u>	<u>Percent</u>
Ottawa Co. (Portion)	19,249	20,534	106.7
Allegheny Co. (Portion)	3,311	4,164	125.8
TOTAL	22,560	24,698	109.5

## AREA RATE COMPARISONS

Some of the general rates developed in the Holland-Zeeland O-D study are compared below with other western Michigan area O-D studies.

These rates seem to be consistent with the other study results.

	<u>Battle Creek</u>	<u>Muskegon</u>	<u>Kalamazoo</u>	<u>Grand Rapids</u>	<u>Holland Zeeland</u>
Year	<u>1961</u>	<u>1964</u>	<u>1966</u>	<u>1965</u>	<u>1967</u>
Population	79,391	115,311	163,391	363,088	57,289
Persons Per D.U.	3.06	3.24	3.14	3.49	3.45
Cars Per D.U.	1.11	1.18	1.28	1.24	1.48
Cars Per Person	.363	.363	.408	.356	.428

## RECOMMENDATIONS

The accuracy checks made on Internal Interview Address Summary data indicate that the basic data is reliable and acceptable.

The results of the study area checks are summarized below:

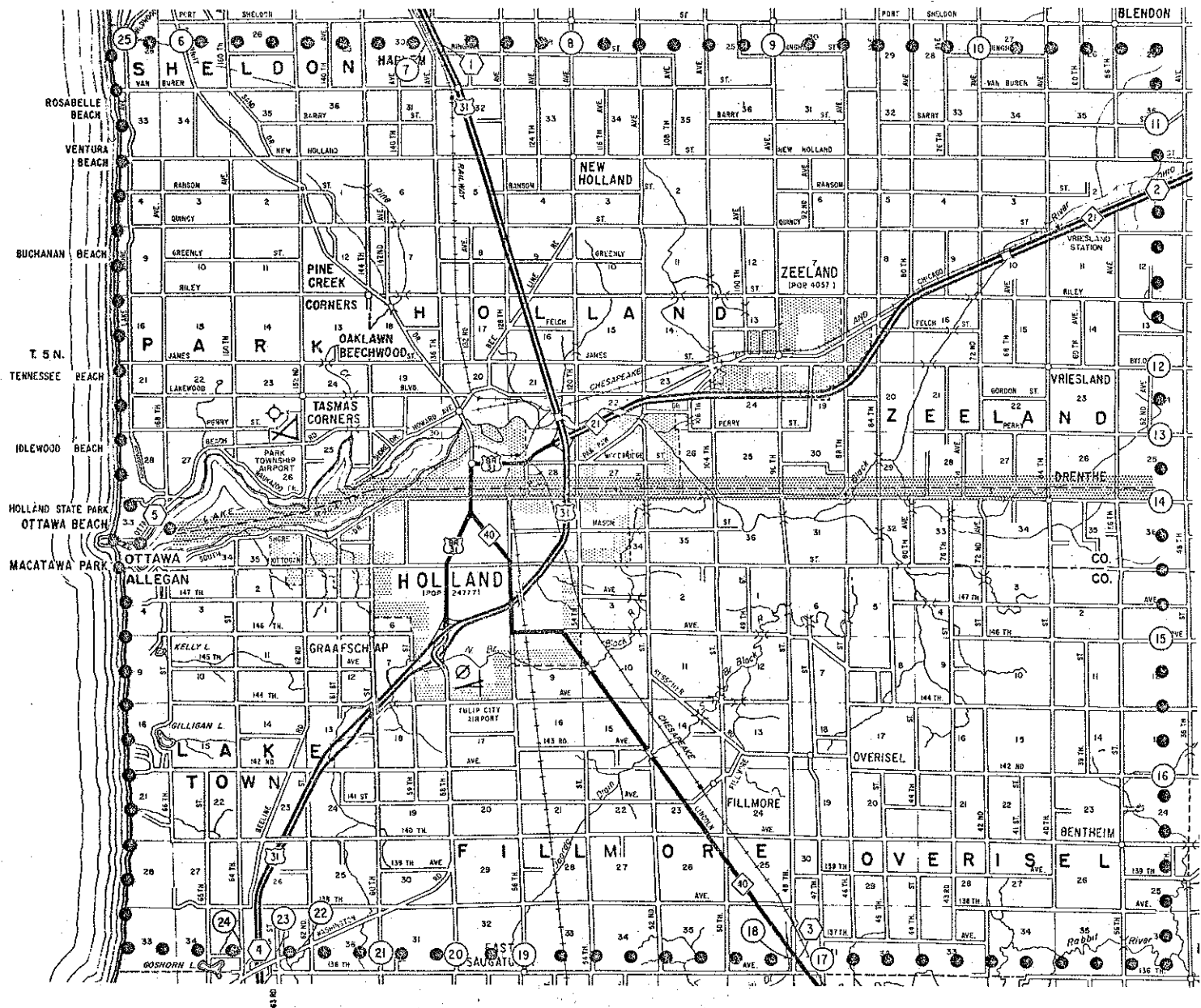
<u>Accuracy Check</u>	<u>Accuracy Ratio</u>
Population	99.5%
Total Dwelling Units	103.7%
Occupied Dwelling Units	104.0%
Automobiles	109.5%

The above results indicate that the sample data was acceptably complete and correctly expanded.

TRAVEL PATTERNS  
ACCURACY CHECKS

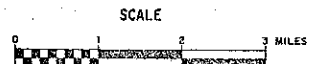
JULY, 1970

# HOLLAND - ZEELAND AREA TRANSPORTATION STUDY



## LEGEND

- ● CORDON LINE
- ▨ SCREEN LINE
- ⑤ 24 HOUR STATIONS
- ②⑤ 16 HOUR STATIONS



MICHIGAN DEPARTMENT OF STATE HIGHWAYS

## SCREENLINE ACCURACY CHECKS

These checks help to determine the accuracy of the data received from the Internal, Truck and Taxi, and External Surveys. The summary of expanded trips can be compared with the Screenline Classification counts.

There were 24 screenline stations where vehicles were counted and classified for 24 hours. Of the reported trips 34.7% crossed the screenline. At 8 of the stations machine counts were taken 120 hr. (Monday through Friday)

	EXTERNAL			
	<u>Crossing</u>	<u>Not Crossing</u>	<u>Total Vehicles</u>	<u>Percent of Total</u>
Passenger Cars	12,717	17,676	30,393	82.6
Single Unit Trucks	1,691	2,867	4,558	12.4
Combination Trucks	1,236	624	1,860	5.0
<b>TOTAL</b>	<b>15,644</b>	<b>21,167</b>	<b>36,811</b>	<b>100.0</b>

INTERNAL TRUCK AND TAXI RECORDS

	<u>Crossing</u>	<u>Not Crossing</u>	<u>Total Vehicles</u>	<u>Percent of Total</u>
Taxi	12	20	32	3.7
Single Unit Trucks	226	573	799	92.7
Combination Trucks	6	25	31	3.6
TOTAL	244	618	862	100.0

SCREENLINE CHECK

	<u>Ground Count</u>	<u>Reported Trips</u>	<u>Percent Comparison</u>
Passenger Cars and Taxis	56,856	45,526	80.07
Busses and Single Units	7,136	1,918	26.87
Combination Trucks	1,564	1,242	79.41
Total Trucks	8,700	3,160	36.32
TOTAL ALL VEHICLES	65,556	48,686	74.27

The passenger car occupancy indicates a comparison of 80%. The truck comparison is not as good, especially in the single unit category. Many single unit trucks crossed the screenline but were garaged outside the area, thus their internal trips were not recorded. Many pick-up trucks were used as passenger cars and not reported in the truck survey and some truck trips were not reported.

Appropriate adjustments will be made to bring the trips within an acceptable percentage of the ground counts.



TABULATION OF UNADJUSTED  
PASSENGER CAR TRIPS

INTERNAL

	Crossing		Not Crossing		Total Trips	Percent of Total
	Home Based	Non Home Based	Home Based	Non Home Based		
Work	10,414	973	14,078	2,630	28,095	29.8
Business	1,419	711	2,881	1,601	6,612	7.0
Shopping	4,703	1,901	10,718	4,619	21,941	23.2
School	118	-----	170	10	298	0.3
Social-Recreation	4,825	1,540	9,854	2,950	19,169	20.3
Change Mode	80	10	93	27	210	0.2
Eat Meal	915	325	1,632	885	3,757	4.0
Medical	363	77	663	202	1,305	1.4
Serve Passenger	3,289	1,114	6,537	2,058	12,998	13.8
TOTAL	26,126	6,651	46,626	14,982	94,385	100.0

It was decided to group business, school, change mode, eat meal, medical and serve passenger under other in trip purpose, as they were lower in percentage of total trip purposes.

SCREENLINE COMPARISON OF PASSENGER CAR TRIPS  
UNADJUSTED SURVEY-BY HOUR

<u>Hour Ending</u>	<u>Internal Survey</u>		<u>External Survey</u>	<u>Total Survey</u>	<u>Ground Count</u> (3% reduction)		<u>Percent of Ground Count</u>
	<u>Work</u>	<u>Non Work</u>			<u>Count</u>	<u>Ground Count</u>	
1:00A.M.	144	144	150	438	543	80.7	
2:00A.M.	35	44	66	145	223	65.0	
3:00A.M.	34	8	63	105	118	89.0	
4:00A.M.	28	0	34	62	84	73.8	
5:00A.M.	28	0	32	60	68	88.2	
6:00A.M.	26	54	67	147	260	56.5	
7:00A.M.	980	197	459	1,636	2,174	75.3	
8:00A.M.	1,560	335	594	2,489	2,279	109.2	
9:00A.M.	1,135	524	540	2,199	2,167	101.5	
10:00A.M.	425	750	651	1,826	2,483	73.5	
11:00A.M.	161	1,387	733	2,281	2,744	83.1	
12:00Noon	259	1,305	779	2,343	3,171	73.8	
1:00P.M.	721	1,831	763	3,315	3,866	85.7	
2:00P.M.	814	1,181	843	2,838	3,180	89.2	
3:00P.M.	236	1,165	817	2,218	3,226	68.8	
4:00P.M.	910	1,590	1,047	3,547	4,209	84.3	
5:00P.M.	786	1,552	804	3,142	4,574	68.7	
6:00P.M.	1,561	1,628	1,139	4,328	4,436	97.6	
7:00P.M.	473	1,283	663	2,419	3,069	78.8	
8:00P.M.	196	1,665	685	2,546	3,307	77.0	
9:00P.M.	186	1,651	606	2,443	2,925	83.5	
10:00P.M.	186	1,431	514	2,131	2,625	81.2	
11:00P.M.	259	1,098	366	1,723	2,004	86.0	
12:00P.M.	244	567	302	1,113	1,323	84.1	
TOTAL	11,387	21,390	12,717	45,494	55,058	82.6	

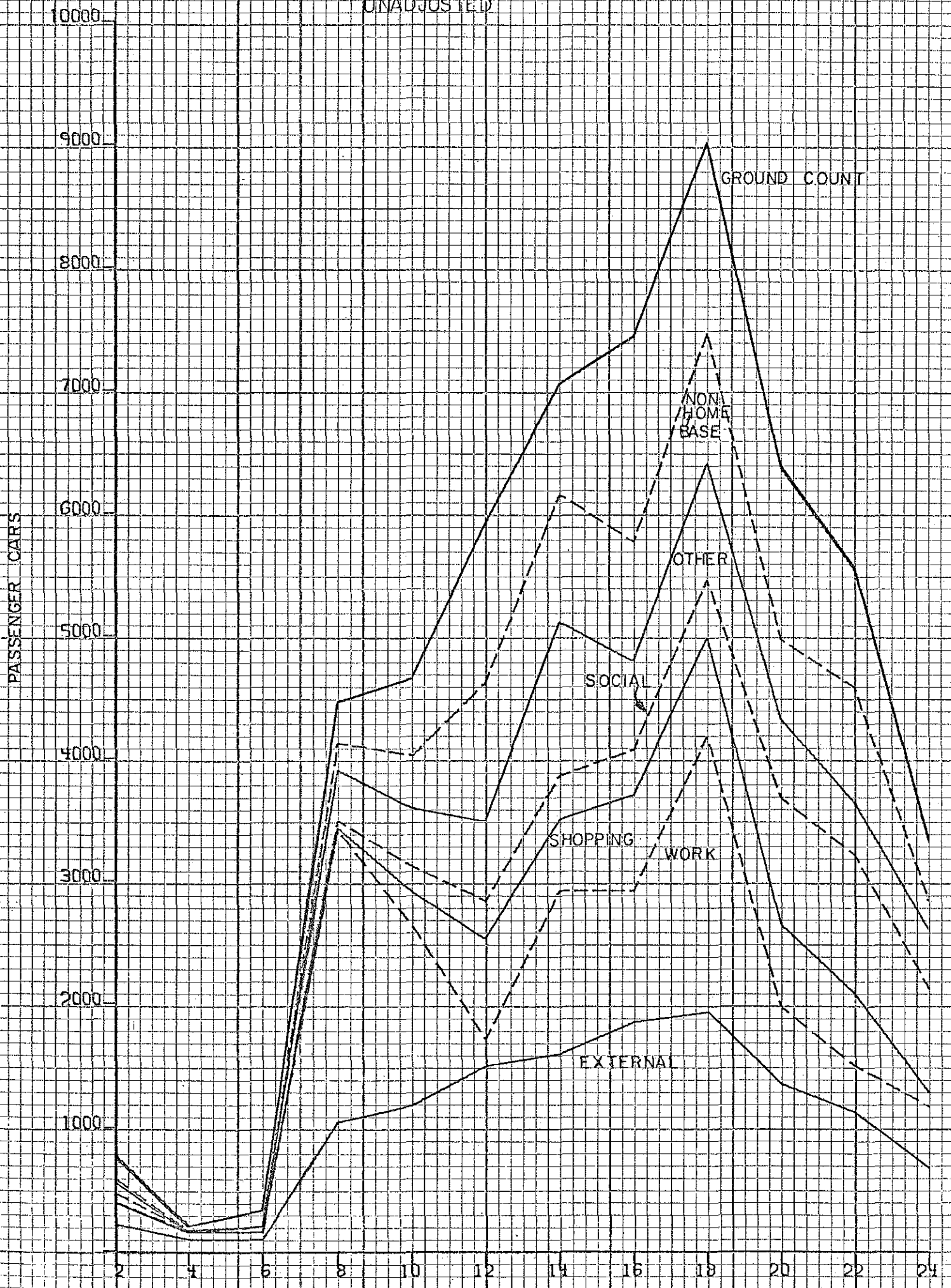
SCREENLINE COMPARISONS OF  
PASSENGER CARS  
BY 2-HOUR PERIODS

<u>Hour Ending</u>	<u>Ground Count</u> (3% reduction)	<u>Reported Count</u>	<u>Percent Reported</u>
2:00A.M.	766	583	76.1
4:00A.M.	202	167	82.7
6:00A.M.	328	207	63.1
8:00A.M.	4,453	4,125	92.6
10:00A.M.	4,650	4,025	86.6
12:00Noon	5,915	4,624	78.2
2:00P.M.	7,046	6,153	87.3
4:00P.M.	7,435	5,765	77.5
6:00P.M.	9,010	7,470	82.9
8:00P.M.	6,376	4,965	77.9
10:00P.M.	5,550	4,574	82.4
12:00P.M.	3,327	2,836	85.2
TOTAL	55,058	45,494	82.6

An unadjusted network assignment showed the double crossings at the screenline to be very low, however, 3% was deducted from the original screenline counts to allow for double crossings and circulating traffic.

A better adjustment was made using two-hour periods rather than one-hour periods as it is hard to pin point trip accuracy reports down to hour periods. Checks were run for both one and two-hour periods. Individuals report more accurately on work trips than most others, although during the summer, in this area, social-recreation trips would be well reported. Shopping, other, and non-home based trips would be forgotten more and thus under reported, necessitating high adjustment factors.

HOLLAND-ZEELAND SCREENLINE O-D SURVEY - 1967  
UNADJUSTED



## SCREENLINE ADJUSTMENT

The hourly distribution of crossings and ground counts were graphically compared and used as a rationale for determining the upper limits to be used in screenline adjustment and plotting. The screenline adjustment was made in accordance with the Bureau of Public Roads' prescribed methods and the screenline program on Burroughs 5500.

The screenline graph for this study area differs from most study areas as there is no pronounced A.M. or P.M. peak hours. This is due to the fact that it is a recreational area, with Holland State Park just outside of Station 5, accounting for high volumes during the other hours of the day. This helps to smooth out the travel pattern.

After running the screenline adjustment program several times, using various upper limit values, the following factors were selected as fitting the best in the adjustment.

External	1.000	Single Unit Trucks	3.72
Work	1.000	Taxi	3.72
Shopping	1.500	Combination Trucks	1.25
Social	1.084		
Other	1.552		
Non Home Based	1.438		

TABLE 1

ADJUSTED INTERNAL AUTO DRIVER TRIPS  
CROSSING SCREENLINE

<u>Purpose</u>	<u>Unadjusted Trips</u>			<u>Adjusted Trips</u>		
	<u>Home Based</u>	<u>Non Home Based</u>	<u>Percent</u>	<u>Home Based</u>	<u>Non Home Based</u>	<u>Percent</u>
Work	10,414	973	34.8	10,414	1,401	28.2
Shopping	4,703	1,901	20.1	7,056	2,737	23.4
Social	4,825	1,540	19.4	5,211	2,217	17.8
Other	6,184	2,237	25.7	9,586	3,222	30.6
TOTAL	26,126	6,651	100.0	32,267	9,577	100.0
		32,777			41,844	

TABLE 2

## ADJUSTED SCREENLINE CHECK

Internal Auto-Driver		External Auto-Driver	
	+		
41,844		12,717	= 96.1%
	56,762		
	Ground Count		
Internal Auto-Driver		External Auto-Driver	
	+		
41,844		12,717	= 99.10%
	55,058		
	Ground Count (Reduced 3%)		

TABLE 3

## TOTAL ADJUSTED INTERNAL AUTO DRIVER TRIPS

	<u>Unadjusted Trips</u>				<u>Adjusted Trips</u>			
	<u>Home Based</u>	<u>Non Home Based</u>	<u>Percent</u>	<u>Home Based Factor</u>	<u>Home Based</u>	<u>Non Home Based</u>	<u>Percent</u>	
Work	24,492	3,603	29.8	1.00	24,492	5,188	24.2	
Shopping	15,421	6,520	23.2	1.50	23,135	9,389	26.5	
Social	14,679	4,490	20.3	1.08	15,854	6,465	18.2	
Other	18,160	7,019	26.7	1.55	28,148	10,110	31.1	
TOTAL	72,752	21,632	100.0		91,629	31,152	100.0	
		94,384				122,781		

TABLE 4

## TOTAL AREA TRIPS

	<u>Unadjusted</u>	<u>Adjusted</u>
Auto Driver	94,384	122,781
Truck and Taxi	862	3,046
External	36,811	36,811
TOTAL	132,057	162,638

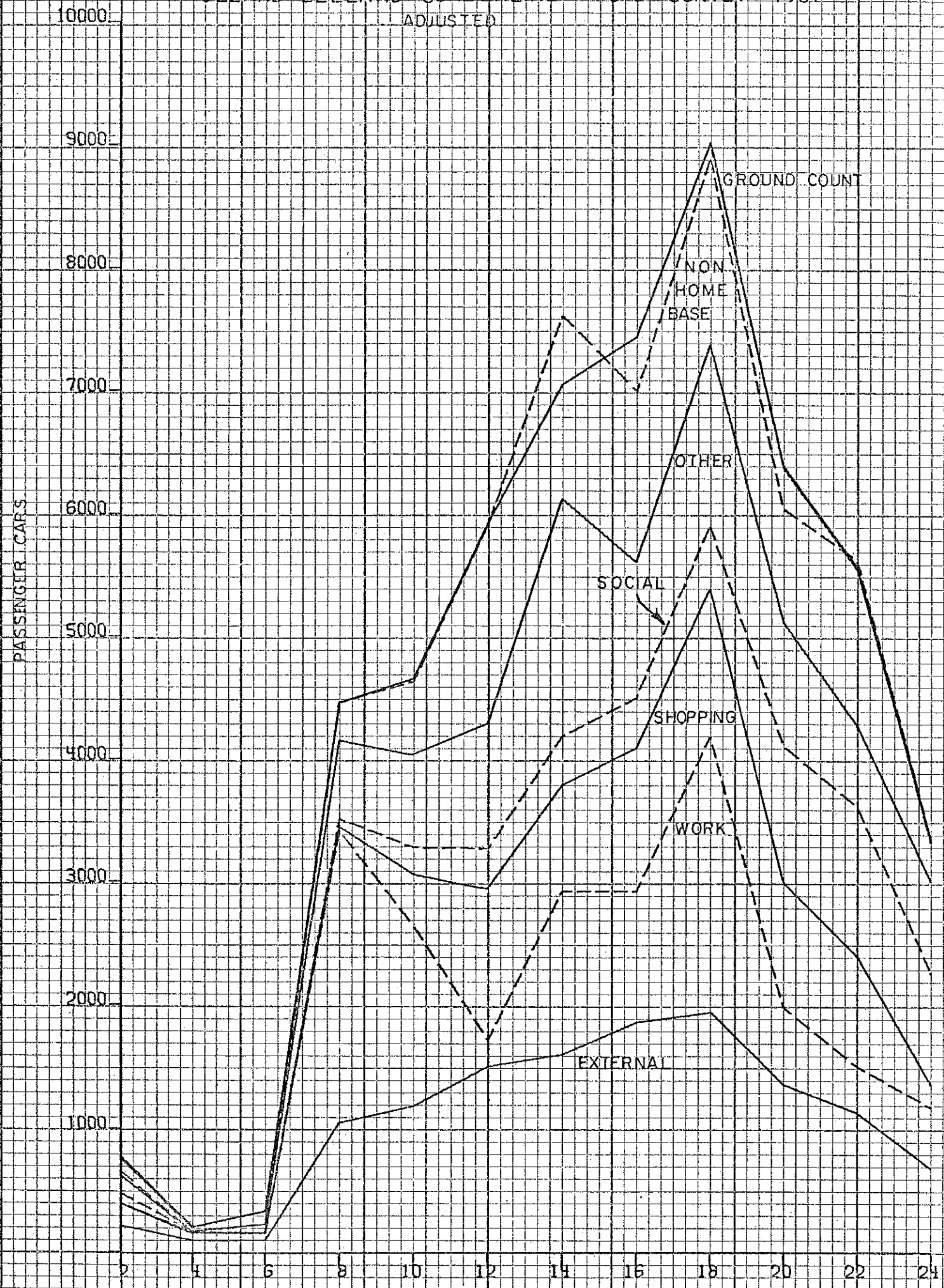


TABLE 5

TABULATION OF TOTAL ADJUSTED  
PASSENGER CAR TRIPSINTERNAL

	<u>Crossing</u>		<u>Not Crossing</u>		<u>Total Trips</u>	<u>Percent of Total</u>
	<u>Home Based</u>	<u>Non Home Based</u>	<u>Home Based</u>	<u>Non Home Based</u>		
Work	10,414	1,401	14,078	3,787	29,680	24.17
Business	2,200	1,024	4,465	2,305	9,994	8.14
Shopping	7,056	2,737	16,079	6,652	32,524	26.49
School	183		264	14	461	.38
Social- Recreation	5,211	2,217	10,643	4,248	22,319	18.18
Change Mode	123	14	144	39	320	.26
Eat Meal	1,418	469	2,530	1,274	5,691	4.64
Medical	563	111	1,027	292	1,993	1.62
Serve Passenger	5,099	1,604	10,132	2,964	19,799	16.12
TOTAL	32,267	9,577	59,362	21,575	122,781	100.00

ADJUSTED



## SUMMARY AND CONCLUSIONS

By using the major trip purposes and grouping all the remaining purposes under "other", factors were arrived at, that when applied, compared well with the ground counts. All non-home based trips were grouped together using one factor.

When these factors were applied to the base data it reflected a good base year screenline agreement.