

McDonough & Rea Associates, Inc.

Traffic and Transportation Consulting

Kevin P. McDonough (1953-1994)
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Jay S. Troutman, Jr., P.E.
Scott T. Kennel

December 5, 2019

West Long Branch Zoning Board of Adjustment
965 Broadway
West Long Branch, NJ 07764

Re: Monmouth University Proposed Main Campus Use Changes & Improvements
Lots, 1-5, 7, 12.01 & 12.02 in Block 39
Borough of West Long Branch, Monmouth County
MRA File No. 19-162

Dear Board Members:

McDonough and Rea Associates (MRA) has been asked to provide the Zoning Board of Adjustment with a *Traffic Impact Study* for plans to make improvements to facilities located within the campus of *Monmouth University*, specifically at the southeast quadrant of the intersection of Cedar Avenue (New Jersey State Route 71) and Larchwood Avenue in the Borough of West Long Branch. Plans prepared by Bill Fitzgerald, PE show the following:

- A new campus ingress/egress driveway from Larchwood Avenue approximately 280 feet south of the signalized Cedar Avenue/Larchwood Avenue intersection.
- Construction of new *University* police headquarters on Lots 4, 5 and 12.01.
- Relocation of the existing *University Alumni Center* to Lot 2.
- Use of the existing *Alumni Center* building as temporary police headquarters until the new headquarters are completed and occupied.
- Conversion of an existing 1-story single family residence to *University* general office use on Lot 12.02.
- Relocation/Consolidation of Lot 12.02 *Facilities Management* operations.

Please reply to:

- ☐ 1431 Lakewood Road, Suite C, Manasquan, NJ 08736 • (732) 528-7076 • Fax (732) 528-6673
- ☐ 105 Elm Street, Lower Level, Westfield, NJ 07090 • (908) 789-7180 • Fax (908) 789-7181



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- An indoor golf practice facility on Lot 12.02.
- Construction of additional parking (Lots 4, 5, 12.01 and 12.02) totaling 246 additional vehicle parking stalls.
- A new monument style *University* identification sign on Lot 1.

As previously indicated, the improvements to the *Monmouth University* campus will generally take place in the area of the southeast quadrant of Cedar Avenue/Larchwood Avenue. The changes are being proposed to upgrade campus facilities and are not in anticipation of increases in undergraduate or graduate student enrollment. From a traffic impact perspective, the main change will be the construction of additional parking stalls which will have direct access to Larchwood Avenue and, therefore, direct access through the Cedar Avenue/Larchwood Avenue signalized intersection.

Peak hour traffic counts were conducted by MRA at the following locations in October of 2019 when *Monmouth University* was in session.

- Cedar Avenue at Larchwood Avenue (signalized intersection)
- Access to Cedar Avenue from *Monmouth University* parking areas east of Larchwood Avenue (unsignalized “T” intersection)

Figure 1, appended to this letter shows existing peak hour traffic volumes utilizing the 2 intersections. Peak hours at these 2 intersections generally coincide with activity at *Monmouth University* (7:30 AM-8:30 AM and 2:15-3:15 PM).

ANALYSIS OF PROPOSED CHANGES

MRA finds that the proposed changes will have a beneficial impact on traffic conditions entering and exiting the *Monmouth University* parking facilities in this general area. Currently, parking lots in this area of the campus typically use the unsignalized access to Cedar Avenue that is east of the signalized Cedar Avenue/Larchwood Avenue intersection. Long queues are typically experienced during peak hours at this location. Traffic from these parking areas, including the new 246 space parking lot facility, can now access Larchwood Avenue and utilize the traffic signal at Cedar Avenue/Larchwood Avenue. It is our opinion that this will result in a safer and more efficient means of exiting the campus.



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December 5, 2019

MRA also calculated existing levels of service at the Cedar Avenue/Larchwood Avenue intersection in accordance with procedures set forth by the Federal Highway Administration in accordance with the *Highway Capacity Manual (HCM)*. Definitions of signalized levels of service are indicated below.

Traffic engineers calculate levels of service of signalized intersections which relate to the quality of traffic flow. Level of service is a measure of average control delay. Average control delay is the time lost due to deceleration and the amount of time from when a vehicle is stopped for a traffic control device (or at the end of the queue) to when the vehicle departs the intersection. Delay is a relative quantity of driver discomfort, frustration, fuel consumption, and loss in travel time.

Levels of service range from “A” to “F,” with “A” being the highest or best attainable level of service. Level of service “E” with average control delays of not more than 80 seconds per vehicle at a signalized intersection indicates near to or at capacity conditions and is generally considered the limit of acceptable level of service and delay.

Full definitions of levels of service for signalized intersections as well as level of service summaries are included in the *Appendix*. The intersections studied by this report were analyzed according to the procedures set forth in the *HCM 2010*, using the *McTrans Highway Capacity Software (HCS)*, release 7.5.

Findings were that the signalized intersection of Cedar Avenue/Larchwood Avenue is currently operating at level of service “B” during both the AM peak street hour and PM peak street hour. This is indicative of additional capacity being available for traffic to exit the existing and new parking facilities in this area of the *Monmouth University* campus to be able to utilize this intersection without creating over capacity conditions.

CONCLUSIONS

It is concluded, based on MRA’s analysis of the plans prepared by Bill Fitzgerald, PE, that they will result in safer and more efficient ingress and egress movements to and from the facilities of *Monmouth University* that are located in the southeast quadrant of Cedar Avenue/Larchwood Avenue. The signalized intersection of Cedar Avenue/Larchwood Avenue will now be able to be utilized by existing and new parking facilities in this area and will allow motorists to utilize the safety and efficiency of a signalized intersection. This intersection is currently operating at level of service “B” during both the AM and PM peak hours and is therefore capable of receiving additional traffic flow without creating over capacity conditions.



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December 5, 2019

A representative of MRA will be in attendance at an upcoming Borough of West Long Branch Zoning Board of Adjustment meeting to provide expert testimony and answer any questions board members, board experts or the public may have.

Very truly yours,

John H. Rea, PE
Principal

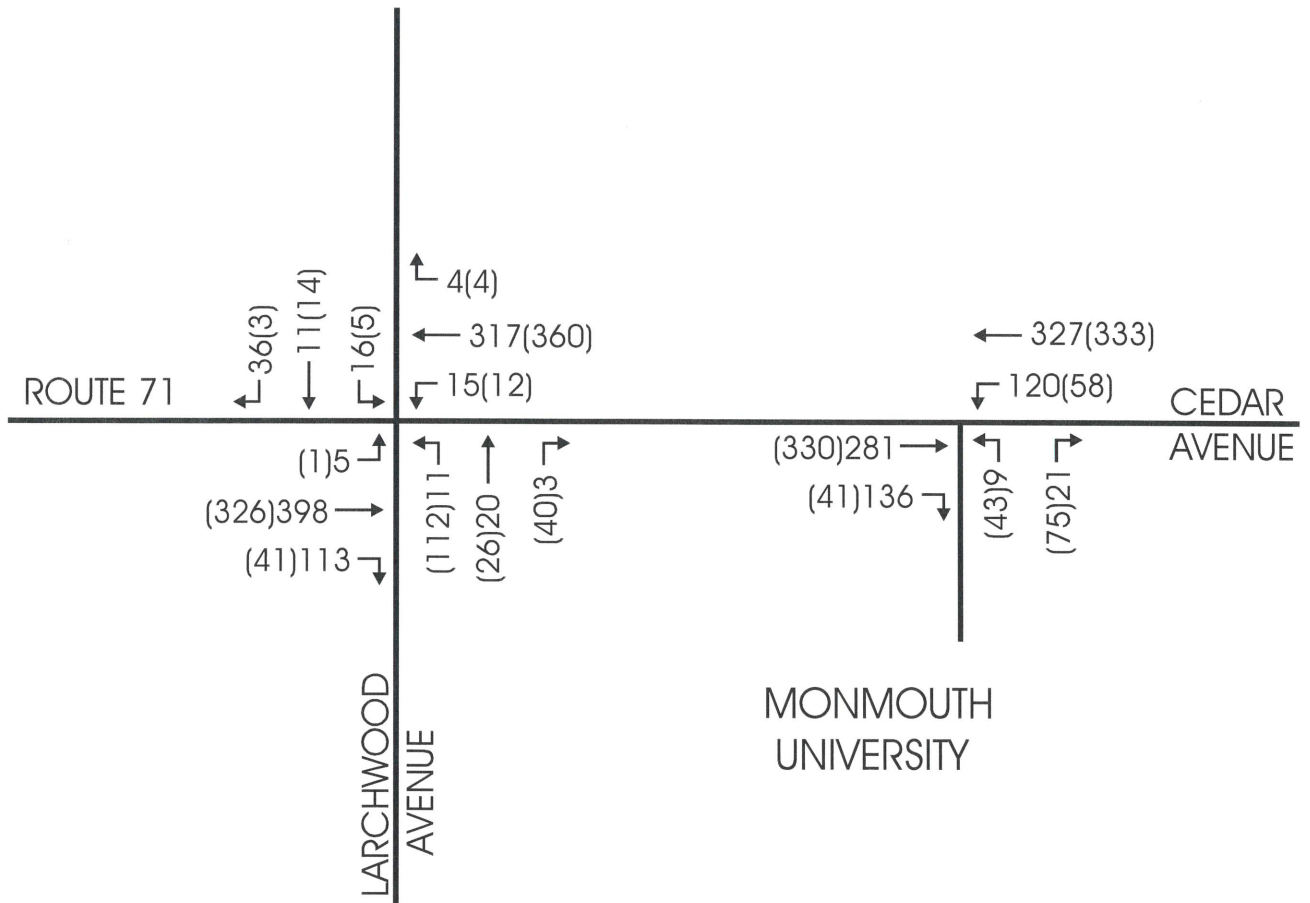
Scott T. Kennel
Sr. Associate

cc: Gary S. Forshner, Esq.
Bill Fitzgerald, PE
Robert Cornero, AVP, Campus Planning & Construction

APPENDIX



SUBJECT: MONMOUTH UNIVERSITY
OCTOBER 2019 EXISTING AM PSH 7:30-8:30 (PM PSH 2:15-3:15) TRAFFIC VOLUMES



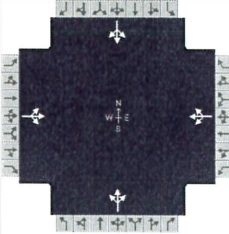
LEGEND: ← AM PSH(PM PSH)

**LEVEL OF SERVICE
FOR
SIGNALIZED INTERSECTIONS¹**

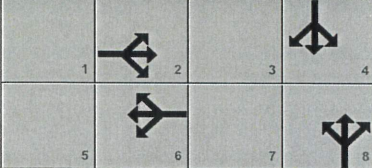
<u>Level of Service</u>	<u>Description</u>	<u>Control (Signal) Delay Per Vehicle (Seconds)</u>
A	Very short delay, good progression; most vehicles do not stop at intersection.	≤ 10.0
B	Generally good progression and/or short cycle length; more vehicles stop at intersection than at Level of Service "A."	> 10.0 and ≤ 20.0
C	Fair progression and/or longer cycle length; significant number of vehicles stop at intersection, though many still pass through without stopping.	> 20.0 and ≤ 35.0
D	Congestion becomes noticeable; longer delays from unfavorable progression, long cycle lengths, or high volume/capacity ratios; many vehicles stop at intersection.	> 35.0 and ≤ 55.0
E	Considered to be the <u>limit of acceptable delay</u> ; indicative of poor progression, long cycle lengths, or high volume/capacity ratios; frequent individual cycles failures.	> 55.0 and ≤ 80.0
F	Often an indication of over-saturation (i.e., arrival flow exceeds capacity); also caused by poor progression and long cycles lengths; capacity is not necessarily exceeded under this level of service.	> 80.0

¹ Transportation Research Board, Highway Capacity Manual 2010, National Research Council, Washington, DC, 2010.

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information					
Agency	MRA	Duration, h	0.25						
Analyst	STK	Analysis Date						Area Type	Other
Jurisdiction		Time Period	AM					PHF	0.90
Urban Street	CEDAR AV	Analysis Year	2019 EXIST					Analysis Period	1> 7:00
Intersection	LARCHWOOD AV	File Name	19-162AFB-1.xus						
Project Description	19-162AE-1								

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	5	398	113	15	317	4	11	20	3	16	11	36

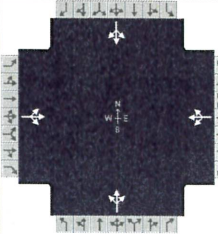
Signal Information												
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
		Green	38.0	20.0	0.0	0.0	0.0	0.0				
		Yellow	4.0	4.0	0.0	0.0	0.0	0.0				
		Red	2.0	2.0	0.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		44.0		44.0		26.0		26.0
Change Period, (Y+R _c), s		6.0		6.0		6.0		6.0
Max Allow Headway (MAH), s		0.0		0.0		3.2		3.2
Queue Clearance Time (g _s), s						3.0		4.2
Green Extension Time (g _e), s		0.0		0.0		0.2		0.1
Phase Call Probability						1.00		1.00
Max Out Probability						0.00		0.00

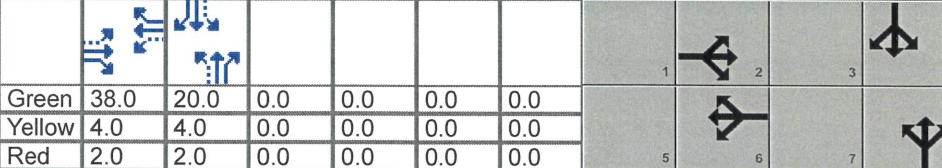
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	573			373			38			70		
Adjusted Saturation Flow Rate (s), veh/h/ln	1796			1828			1682			1605		
Queue Service Time (g _s), s	0.0			0.0			0.0			0.0		
Cycle Queue Clearance Time (g _c), s	15.0			8.0			1.0			2.2		
Green Ratio (g/C)	0.54			0.54			0.29			0.29		
Capacity (c), veh/h	1027			1046			549			523		
Volume-to-Capacity Ratio (X)	0.558			0.357			0.069			0.134		
Back of Queue (Q), ft/ln (50 th percentile)	144.1			78.1			11.7			22.4		
Back of Queue (Q), veh/ln (50 th percentile)	5.7			3.1			0.5			0.9		
Queue Storage Ratio (RQ) (50 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d ₁), s/veh	10.7			9.1			18.2			18.6		
Incremental Delay (d ₂), s/veh	2.2			1.0			0.2			0.5		
Initial Queue Delay (d ₃), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	12.9			10.1			18.5			19.2		
Level of Service (LOS)	B			B			B			B		
Approach Delay, s/veh / LOS	12.9	B		10.1	B		18.5	B		19.2	B	
Intersection Delay, s/veh / LOS	12.5						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information					
Agency	MRA	Duration, h	0.25						
Analyst	STK	Analysis Date						Area Type	Other
Jurisdiction		Time Period	PM					PHF	0.90
Urban Street	CEDAR AV	Analysis Year	2019 EXIST					Analysis Period	1> 7:00
Intersection	LARCHWOOD AV	File Name	19-162PE-1.xus						
Project Description	19-162PE-1								

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	1	326	41	12	360	4	112	26	40	5	14	3

Signal Information												
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
		Green	38.0	20.0	0.0	0.0	0.0	0.0				
		Yellow	4.0	4.0	0.0	0.0	0.0	0.0				
		Red	2.0	2.0	0.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		44.0		44.0		26.0		26.0
Change Period, (Y+R _c), s		6.0		6.0		6.0		6.0
Max Allow Headway (MAH), s		0.0		0.0		3.2		3.2
Queue Clearance Time (g _s), s						9.4		2.7
Green Extension Time (g _e), s		0.0		0.0		0.3		0.4
Phase Call Probability						1.00		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	409			418			198			24		
Adjusted Saturation Flow Rate (s), veh/h/ln	1833			1848			1508			1723		
Queue Service Time (g _s), s	0.0			0.0			6.2			0.0		
Cycle Queue Clearance Time (g _c), s	9.2			9.2			7.4			0.7		
Green Ratio (g/C)	0.54			0.54			0.29			0.29		
Capacity (c), veh/h	1047			1056			515			555		
Volume-to-Capacity Ratio (X)	0.391			0.396			0.384			0.044		
Back of Queue (Q), ft/ln (50 th percentile)	88			90.2			71.1			7.5		
Back of Queue (Q), veh/ln (50 th percentile)	3.5			3.6			2.8			0.3		
Queue Storage Ratio (RQ) (50 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d ₁), s/veh	9.4			9.4			20.4			18.1		
Incremental Delay (d ₂), s/veh	1.1			1.1			2.2			0.1		
Initial Queue Delay (d ₃), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	10.5			10.5			22.6			18.2		
Level of Service (LOS)	B			B			C			B		
Approach Delay, s/veh / LOS	10.5	B		10.5	B		22.6	C		18.2	B	
Intersection Delay, s/veh / LOS	13.0						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

MONMOUTH UNIVERSITY
 CEDAR AVENUE & CEDAR AVENUE ACCESS
 WEST LONG BRANCH BORO, MONMOUTH COUNTY
 MRA JOB 19-162 WEDNESDAY AM COUNT

McDonough & Rea Associates
 1431 Lakewood Road Suite C
 Manasquan NJ 08736
 (732) 528-7076

File Name : 19162 cedar & main gate am 1
 Site Code : 00191622
 Start Date : 10/9/2019
 Page No : 1

Groups Printed- CARS - TRUCKS - SCHOOL BUS

Start Time	Cedar Avenue (Route 71) Southbound			Cedar Avenue (Route 71) Northbound			Monmouth University Access Eastbound			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
07:00 AM	59	4	63	4	45	49	0	2	2	114
07:15 AM	91	8	99	7	70	77	2	2	4	180
07:30 AM	75	20	95	11	75	86	0	4	4	185
07:45 AM	69	13	82	10	76	86	1	4	5	173
Total	294	45	339	32	266	298	3	12	15	652
08:00 AM	79	48	127	39	64	103	1	7	8	238
08:15 AM	70	41	111	51	66	117	3	6	9	237
08:30 AM	60	34	94	20	84	104	4	4	8	206
08:45 AM	74	20	94	19	51	70	2	5	7	171
Total	283	143	426	129	265	394	10	22	32	852
09:00 AM	66	18	84	13	55	68	1	3	4	156
09:15 AM	62	15	77	13	39	52	2	7	9	138
09:30 AM	54	18	72	26	72	98	4	5	9	179
09:45 AM	81	28	109	33	61	94	14	30	44	247
Total	263	79	342	85	227	312	21	45	66	720
Grand Total	840	267	1107	246	758	1004	34	79	113	2224
Approch %	75.9	24.1		24.5	75.5		30.1	69.9		
Total %	37.8	12.0	49.8	11.1	34.1	45.1	1.5	3.6	5.1	

Start Time	Cedar Avenue (Route 71) Southbound			Cedar Avenue (Route 71) Northbound			Monmouth University Access Eastbound			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
08:00 AM	136	48	184	51	66	117	3	6	9	854
08:15 AM	32.9	48	81.7	29.3	70.7	103	30.0	70.0	30	238
08:30 AM	48		48	39	64	103	1	7	8	0.897
08:45 AM	48		48	51	66	117	3	6	9	0.833
Total	136	48	184	51	66	117	3	6	9	854
Approch %	32.9	48	81.7	29.3	70.7	103	30.0	70.0	30	238
Total %	48		48	39	64	103	1	7	8	0.897

MONMOUTH UNIVERSITY
 CEDAR AVENUE & CEDAR AVENUE ACCESS
 WEST LONG BRANCH BORO, MONMOUTH COUNTY
 MRA JOB 19-162 TUESDAY PM COUNT

McDonough & Rea Associates
 1431 Lakewood Road Suite C
 Manasquan NJ 08736
 (732) 528-7076

File Name : 19162 cedar & main gate pm1
 Site Code : 00191622
 Start Date : 10/1/2019
 Page No : 1

Groups Printed- CARS - TRUCKS - SCHOOL BUS

Start Time	Cedar Avenue (Route 71) Southbound			Cedar Avenue (Route 71) Northbound			Monmouth University Access Eastbound			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
02:00 PM	74	6	80	9	76	85	6	10	16	181
02:15 PM	103	9	112	18	89	107	5	14	19	238
02:30 PM	88	15	103	27	91	118	22	30	52	273
02:45 PM	102	13	115	5	83	88	9	21	30	233
Total	367	43	410	59	339	398	42	75	117	925
03:00 PM	86	4	90	8	96	104	7	10	17	211
03:15 PM	89	5	94	8	100	108	12	13	25	227
03:30 PM	94	9	103	5	89	94	4	7	11	208
03:45 PM	62	7	69	10	81	91	6	11	17	177
Total	331	25	356	31	366	397	29	41	70	823
04:00 PM	95	16	111	21	75	96	7	22	29	236
04:15 PM	100	26	126	29	97	126	20	31	51	303
04:30 PM	80	6	86	13	96	109	9	14	23	218
04:45 PM	75	4	79	12	79	91	8	14	22	192
Total	350	52	402	75	347	422	44	81	125	949
Grand Total	1048	120	1168	165	1052	1217	115	197	312	2697
Approch %	89.7	10.3		13.6	86.4		36.9	63.1		
Total %	38.9	4.4	43.3	6.1	39.0	45.1	4.3	7.3	11.6	

Start Time	Cedar Avenue (Route 71) Southbound			Cedar Avenue (Route 71) Northbound			Monmouth University Access Eastbound			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
02:00 PM to 04:45 PM - Peak 1 of 1										
Intersection	379	41	420	58	359	417	43	75	118	955
Volume	90.2	9.8	103	13.9	86.1	118	36.4	63.6	52	273
Percent	88	15	103	27	91	118	22	30	52	0.875
Peak Factor										
High Int. Volume	102	13	115	27	91	118	22	30	52	
Peak Factor			0.913			0.883			0.567	