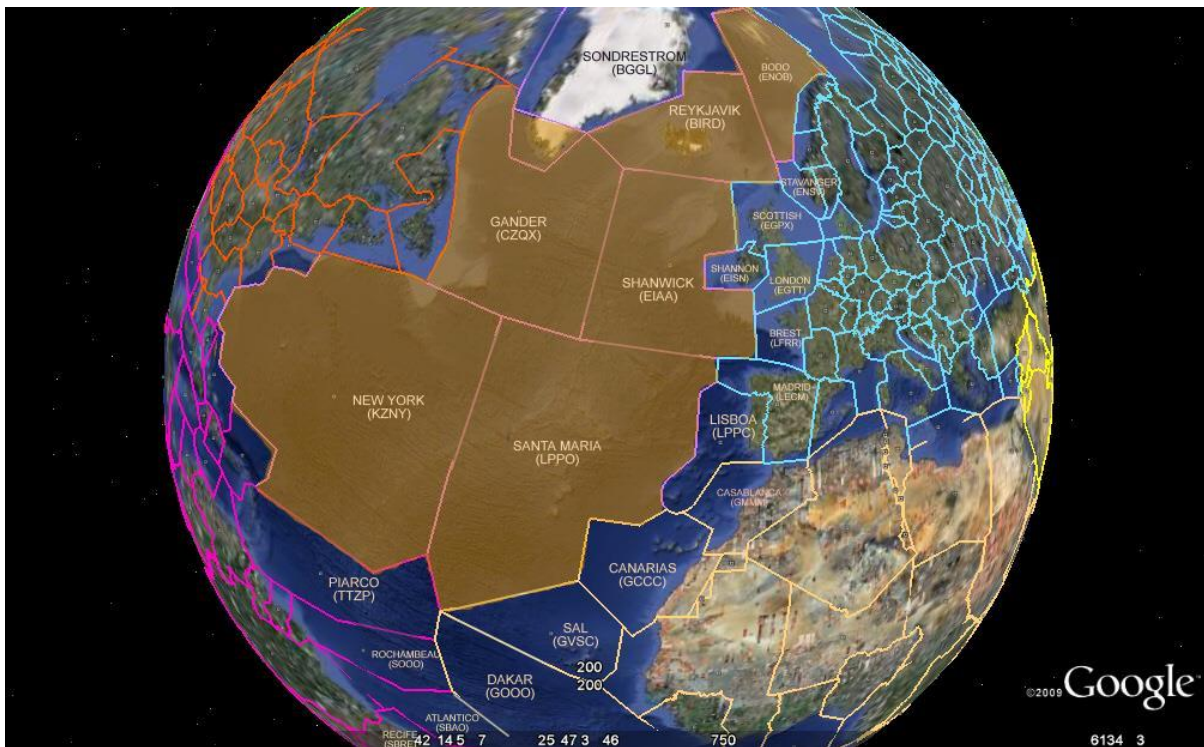


*(Appendix K to the NAT IMG/50 Summary of Discussions – NAT IMG Decision 50/7 refers)*

# NAT REGION

*Aeronautical Radio Stations Network*



2016

*Data consolidation report*

*(Presented by Portugal)*

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## Contents

1	INTRODUCTION .....	7
2	NAT REGION VOICE TRAFFIC OVERVIEW (BY RADIO STATION AND OVERALL SUM).....	8
2.1	Total of messages and relative variation .....	8
2.2	Five year period traffic variation.....	11
2.3	Band/Frequency utilization.....	14
2.3.1	Aeronautical stations individual analysis .....	15
2.3.2	NAT overall analysis .....	17
3	VOICE COMMUNICATION SYSTEM PERFORMANCE ASSESSMENT .....	18
3.1	ATC intervention messages (Clearances, Requests and Advisories).....	18
3.2	Surveillance messages (Position reports) .....	19
3.3	FAA voice communications performance assessment .....	20
4	APPENDIXES .....	23
4.1	Appendix 1 – NAT Region.....	25
4.2	Appendix 2 – Bodo .....	33
4.3	Appendix 3 - Gander .....	37
4.4	Appendix 4 - New York.....	41
4.5	Appendix 5 - Santa Maria.....	45
4.6	Appendix 6 – Shanwick and Iceland.....	49

## TABLES

Table 1 – Total of voice messages and relative variation in comparison with previous year .....	8
Table 2 – Relative variation of voice messages between 2011 and 2015 .....	12
Table 3 – Most used HF bands and frequencies .....	14
Table 4 – Santa Maria voice ATC intervention messages summary .....	18
Table 5 – Santa Maria voice surveillance messages summary .....	19

## FIGURES

Figure 1 - RELATIVE VARIATION 2016-2015 (NAT REGION AND BY RADIO STATION) .....	9
Figure 2 – Aeronautical stations traffic comparison.....	10
Figure 3 – Traffic comparison among aeronautical stations in the last five years .....	11
Figure 4 - 5 year relative variation of voice messages (NAT Region and by radio station) .....	12
Figure 5 – 2011-2015 voice messages variation (absolute and relative).....	12
Figure 6 – Monthly variation of RT contacts.....	16
Figure 7 – Frequency usage .....	16
Figure 8 – Aggregate RT contacts by NAT/RDARA family and on VHF/SATVOICE .....	17
Figure 9 – Santa Maria voice ATC intervention messages performance .....	18
Figure 10 – Santa Maria voice surveillance messages performance .....	19
Figure 11 – FAA voice communication performance assessment criteria.....	20
Figure 12 – FAA voice communication performance.....	20
Figure 13 – FAA voice surveillance performance assessment criteria.....	21
Figure 14 – FAA voice surveillance performance.....	21

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## 1 INTRODUCTION

This data consolidation is presented in accordance with NATSPG Conclusion 29/13 - HF DATA COLLECTION alineas a), b) and c) and reflects the NAT Aeronautical Stations contacts in 2016.

The report is organized to provide both a global overview and individual Stations analysis. It allows an annual comparison of total RT contacts, frequency utilization and NAT Family utilization in both graphic and tabular forms.

Additionally, for the aeronautical stations able to provide that information, the report contains an assessment of the Voice Communications System Performance and information on the use of SATVOICE, in accordance with CNSG9 Summary of Discussions, paragraphs 4.2 to 4.4 and ACSI14 Summary of Discussions, paragraph 3.8.

## 2 NAT REGION VOICE TRAFFIC OVERVIEW (BY RADIO STATION AND OVERALL SUM)

### 2.1 Total of messages and relative variation

	TOTAL OF MESSAGES	Variation. 2016-2015
BODO	63.744	+24%
GANDER	859.819	+2%
NEW YORK	381.038	+8%
SANTA MARIA	360.726	-13%
SHANWICK AND ICELAND	1.369.000	-15%
NAT REGION	3.034.327	-4,4%

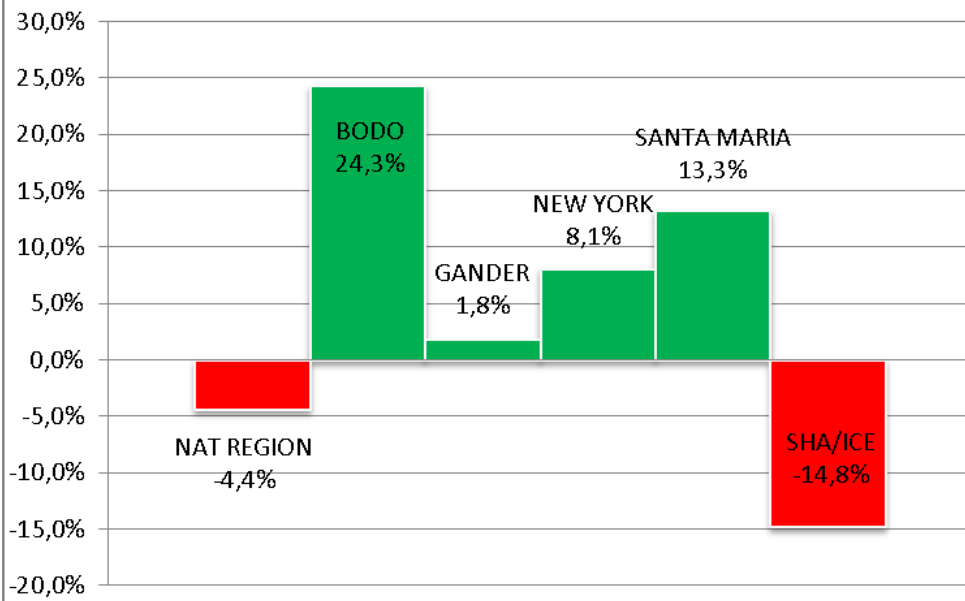
Table 1 –Total of voice messages and relative variation in comparison with previous year

In reference to the 2015 statistics:

- **Bodo, Gander, New York** and **Santa Maria** have **increased** the number of handled messages;
- **Shanwick/Iceland** has **decreased** the number of messages.
- Overall, in the **NAT Region**, there were 3.034.327 voice messages processed in 2016, a **decrease of 4,4%**.



## RELATIVE VARIATION 2016-2015 NAT REGION AND BY RADIO STATION



### 2016 MESSAGES IN THE NAT REGION BY RADIO STATION

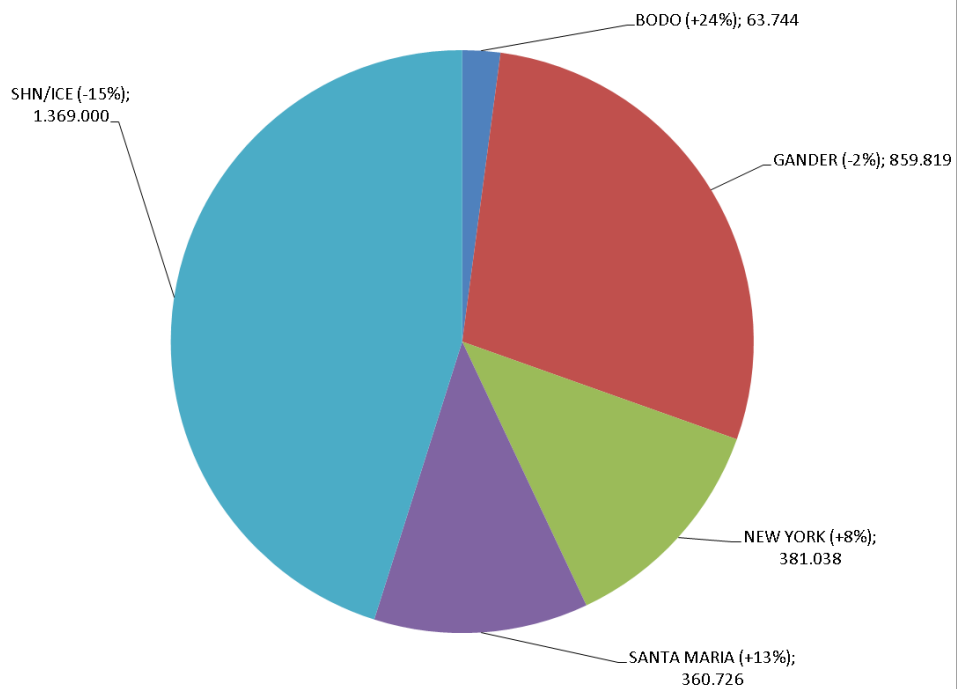
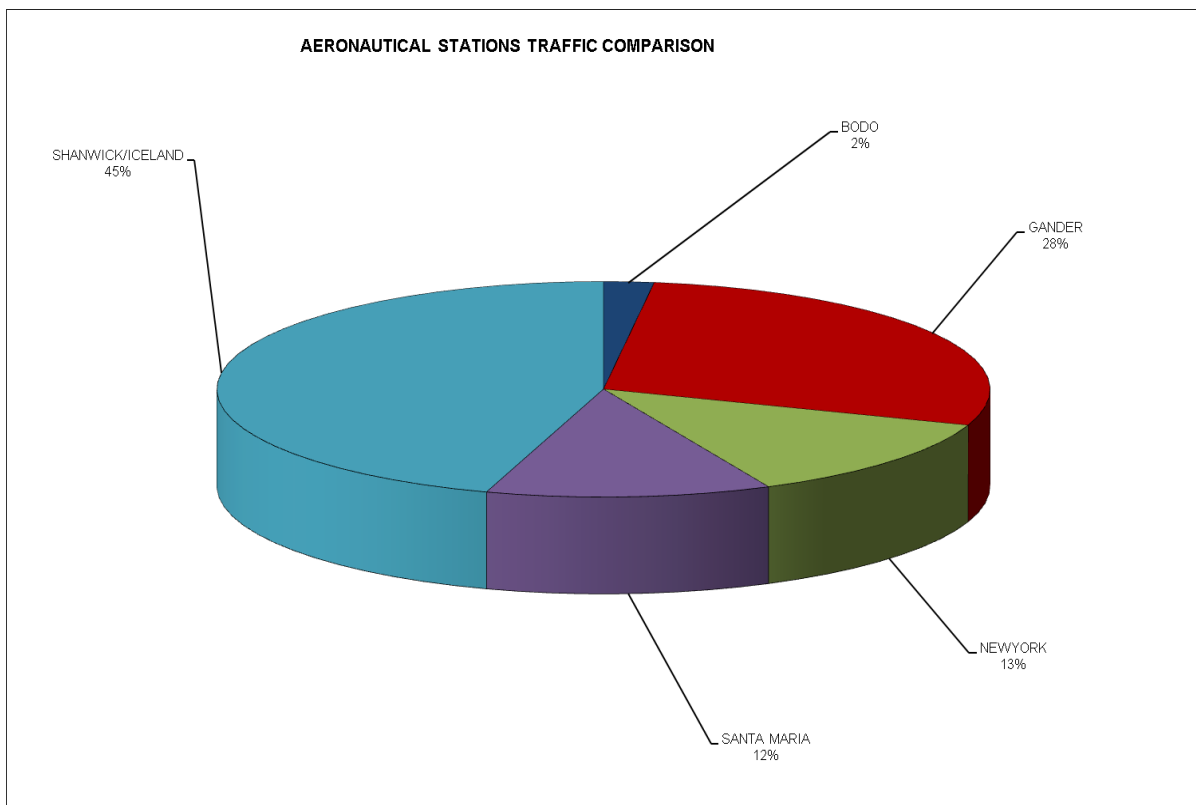


Figure 1 - RELATIVE VARIATION 2016-2015 (NAT REGION AND BY RADIO STATION)



**Figure 2 – Aeronautical stations traffic comparison**

In **2016**, from NAT voice messages total:

- **Shanwick/Iceland** processed **45%**;
- **Gander** processed **28%**;
- **New York** processed **13%**;
- **Santa Maria** processed **12%**; and
- **Bodo** processed **2%**.

## 2.2 Five year period traffic variation

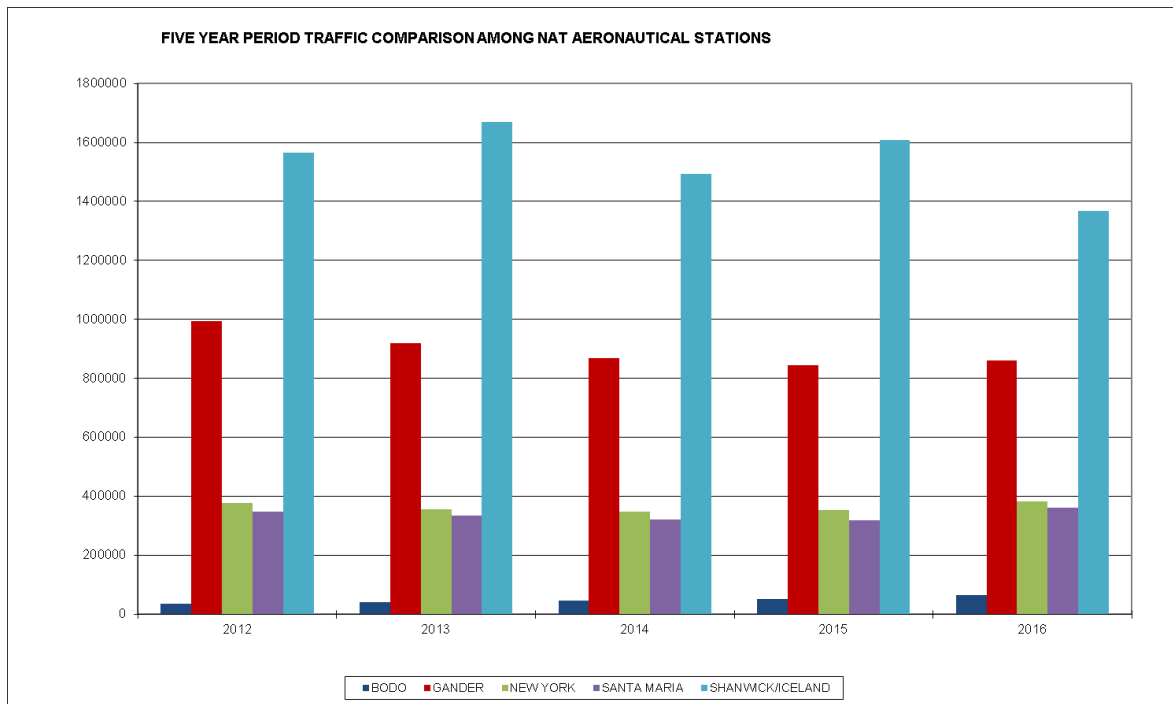


Figure 3 – Traffic comparison among aeronautical stations in the last five years

Along the **past five years**, the **traffic comparison** among NAT stations has **maintained a similar proportion**:

- The joint operations **Shanwick/Iceland** is the station **processing almost half** of the messages and **Gander about a quarter**;
- **New York and Santa Maria** handle approximately the same number of messages, **evenly sharing about a quarter** of the messages; and
- **Bodo** has a **low messages count**.

5 YEAR VARIATION					
	2012-2013	2013-2014	2014-2015	2015-2016	2012-2016
BODO	+18%	+15%	+13%	+24,3%	+89,7%
GANDER	-7%	-5%	-2,9%	+1,8%	-13,4%
NEW YORK	-6%	-2%	+1,3%	+8,1%	+1,0%
SANTA MARIA	-3%	-4%	-0,6%	+13,3%	+4,0%
SHANWICK/ICELAND	+7%	-10%	+7,6%	-14,8%	-12,6%
NAT REGION	+0,03%	-7%	+2,9%	-4,4%	-8,5%

Table 2 – Relative variation of voice messages between 2011 and 2015

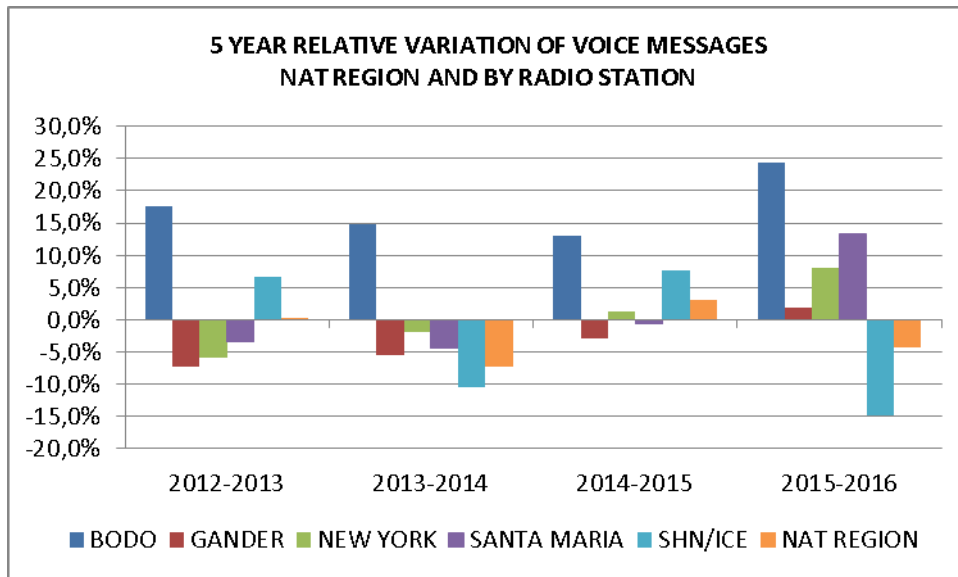


Figure 4 - 5 year relative variation of voice messages (NAT Region and by radio station)

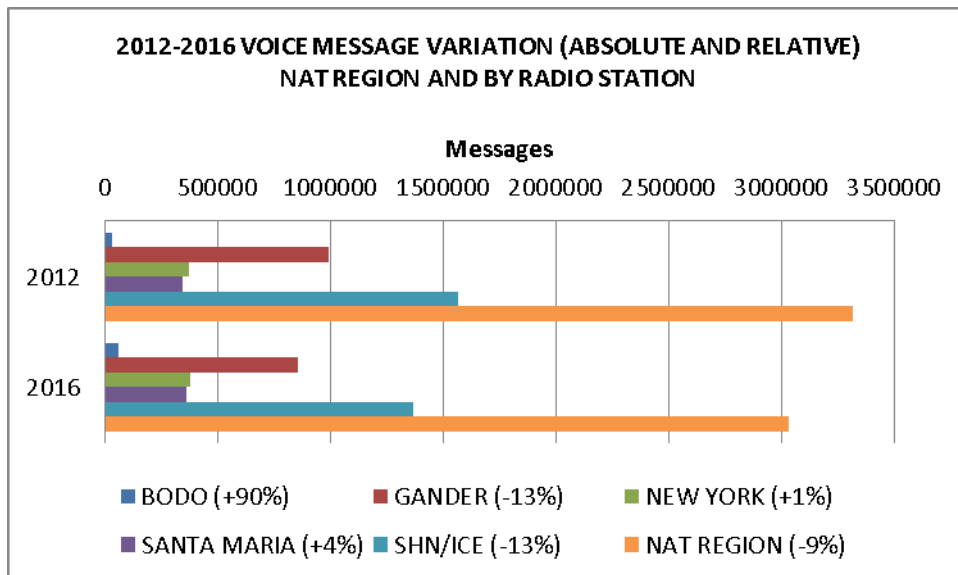


Figure 5 – 2011-2015 voice messages variation (absolute and relative)

Along the **five years** analyzed:

- **Bodo** has increased each year the number of messages, with a **90% increase** in 2016 in comparison with 2012.
- **Gander** has decreased the number of messages from 2012 till 2015 and increased slightly in 2016. In 2016 the number of handled messages was **13% less** than in 2012.
- **New York** has decreased the number of messages from 2012 till 2014 and increased slightly in 2015 and 2016. In 2016 the number of handled messages was **1% more** than in 2012.
- **Santa Maria** also has decreased the number of messages from 2012 till 2015 and increased slightly in 2016. In 2016 the number of handled messages was **4% more** than in 2012.
- The joint operations of **Shanwick and Iceland** had an increase in 2013 and 2015 while decreasing in 2014 and 2016. In 2016 the number of handled messages was **13% less** than in 2012
- Overall in the **NAT Region**, voice messages have increased in 2013 (very slightly) and 2015 and decreased in 2014 and 2016. There were about **9% less** of voice messages handled in the NAT Region in 2016 when comparing to 2012.

## 2.3 Band/Frequency utilization

		NAT REGION		BODO		GANDER		NEW YORK		SANTA MARIA		SHANWICK ICELAND	
2/4 KHz 280876 9%	QA	7094	0,2%			0	0%	2477	1%	4603	1%	14	0%
	QB	52426	1,7%			51567	6%					859	0%
	QC	57814	1,9%			3352	0%					54462	4%
	QD	19438	0,6%	1	0%	33	0%					19404	1%
	QE	932	0,0%					915	0%	17	0%		
	QF	46752	1,5%			25505	3%					21247	2%
	QH	31233	1,0%						0%	7762	2%	23471	2%
	QI	2	0,0%									2	0%
	QJ	42543	1,4%									42543	3%
	QK	22587	0,7%									22587	2%
QL	55	0,0%									55	0%	
5/6 KHz 967854 32%	TA	113212	3,7%			6	0%	38191	10%	74811	21%	204	0%
	TB	97967	3,2%			97119	11%					848	0%
	TC	162272	5,3%			4442	1%					157830	12%
	TD	121088	4,0%	55900	88%	1083	0%					64105	5%
	TE	87338	2,9%					25938	7%	61400	17%		
	TF	105703	3,5%			4476	1%					101227	7%
	TH	30027	1,0%							595	0%	29432	2%
	TI	46063	1,5%									46063	3%
	TJ	109556	3,6%									109556	8%
	TK	75499	2,5%									75499	6%
TL	19129	0,6%									19129	1%	
8 KHz 684802 23%	VA	134731	4,4%			3	0%	30961	8%	103681	29%	86	0%
	VB	160383	5,3%			119713	14%					40670	3%
	VC	51125	1,7%			19	0%					51106	4%
	VD	189553	6,2%	7596	12%	123660	14%					58297	4%
	VE	119724	3,9%					35256	9%	84468	23%		
	VF	29275	1,0%			28880	3%					395	0%
	VH	9	0,0%									9	0%
	VI	2	0,0%									2	0%
	VJ	0	0,0%									0	0%
	10/13 KHz 305179 10%	YA	64664	2,1%			15	0%	64509	17%	133	0%	7
YB		119	0,0%			112	0%					7	0%
YC		0	0,0%			0	0%						
XC		23008	0,8%			22962	3%					46	0%
YD		0	0,0%	0	0%								
XD		104569	3,4%	247	0%	102817	12%					1505	
YE		54917	1,8%					54907	14%	10	0%		
XE		39497	1,3%					34699	9%	4798	1%		
XH		18405	0,6%									18405	1%
XI		0	0,0%									0	0%
16/22 KHz 23148 1%	ZA	11569	0,4%					11566	3%	0	0%	3	0%
	ZE	11524	0,4%					11524	3%				
	PE/PT	55	0,0%					55	0%				
VHF 766690 25%	120,55	15045	0,5%			15045	2%						
	122,375	145403	4,8%			145403	17%						
	123,75	14992	0,5%			14992	2%						
	124,82	8568	0,3%			8568	1%						
	126,9	2844	0,1%			2844	0%						
	127,1	4351	0,1%			4351	1%						
	127,9	59376	2,0%			18212	2%			0	0%	41164	3%
	134,47	9873	0,3%			9873	1%						
	134,95	5954	0,2%			5954	1%						
	119,85	14739	0,5%			14739	2%						
	135,35	32590	1,1%			32590	4%						
	ATC	380	0,0%			380	0%						
	129,9	68721	2,3%					68721	18%				
	132,075	16833	0,6%							16833	5%		
	124,175	31610	1,0%									31610	2%
	126,55	60154	2,0%									60154	4%
	127,85	253354	8,3%									253354	19%
129,625	21903	0,7%									21903	2%	
SATVOICE 0,2%	SP	5778	0,2%			1104	0,1%	1319	0,3%	1615	0,4%	1740	0,1%
	Totals	3034327		63744		859819		381038		360726		1369000	
	Legend:	> 50.000		>25.000 <49.999		>10.000 <24.999		>5.000 <9.000					

Table 3 – Most used HF bands and frequencies

## 2.3.1 Aeronautical stations individual analysis

### 2.3.1.1 Bodo

- 88% of messages on the 5-6 KHz band, on frequency TD.
- 12% of messages on the 8 KHz band, on frequency VD.

### 2.3.1.2 Gander

- 68% on HF
  - About 31% on the 8 KHz band, mostly on frequencies VB, VD and VF.
  - About 15% on the 11/13 KHz band, mostly on frequencies XD and XC.
  - About 11% the 5/6 KHz band, mostly on frequency TB.
  - About 9% on the 2/4 KHz band, mostly on frequency QB and QF.
- 32% on VHF
  - The most used VHF frequency was 122,375 MHz
- SATVOICE residual

### 2.3.1.3 New York

- 82% on HF
  - About 42% on the 11/13 KHz band, mostly on frequencies YA, YE and XE.
  - About 17% on the 8 KHz band, mostly on frequencies VE and VA.
  - About 17% the 5-6 KHz band, mostly on frequencies TA and TE.
  - About 6% on the 16/22 KHz band, mostly on frequencies ZA and ZE.
- 18% on VHF
- SATVOICE residual

### 2.3.1.4 Santa Maria

- 95% on HF
  - About 52% on the 8 KHz band, mostly on frequencies VA and VE.
  - About 38% the 5-6 KHz band, mostly on frequencies TA and TE.
  - About 3% on the 2/4 KHz band, mostly on frequencies QH and QA.
  - About 1% on the 11/13 KHz band, mostly on frequency XE.
- 5% on VHF
- SATVOICE residual

### 2.3.1.5 Shanwick/Iceland

- 70% on HF
  - About 44% the 5-6 KHz band, mostly on frequencies TC, TJ, TF, TK, TD, TI, TH and TL.
  - About 14% on the 2/4 KHz band, mostly on frequencies QC, QJ, QH, QK, QF and QD.
  - About 11% on the 8 KHz band, mostly on frequencies VC, VD and VB.
  - About 1% on the 11/13 KHz band, mostly on frequency XH.
- 30% on VHF
  - The most used VHF frequency was 127,850 MHz
- SATVOICE residual

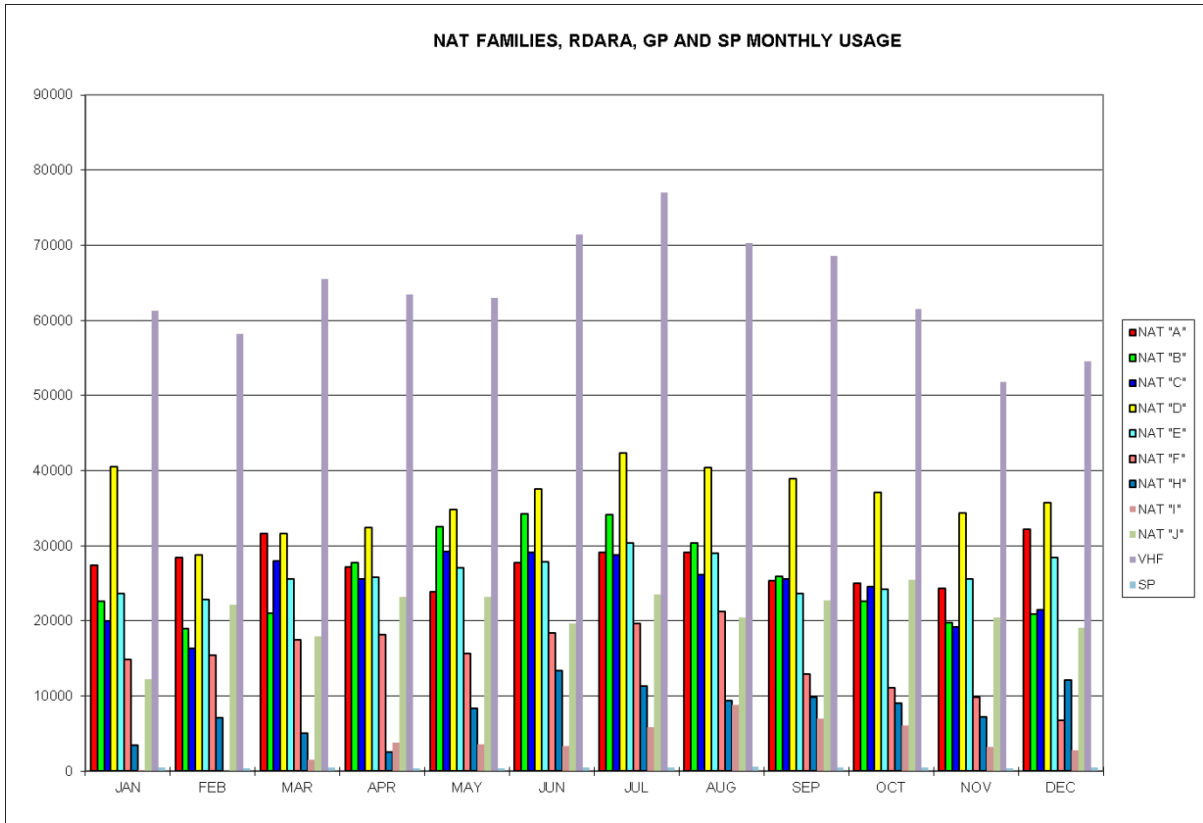


Figure 6 – Monthly variation of RT contacts

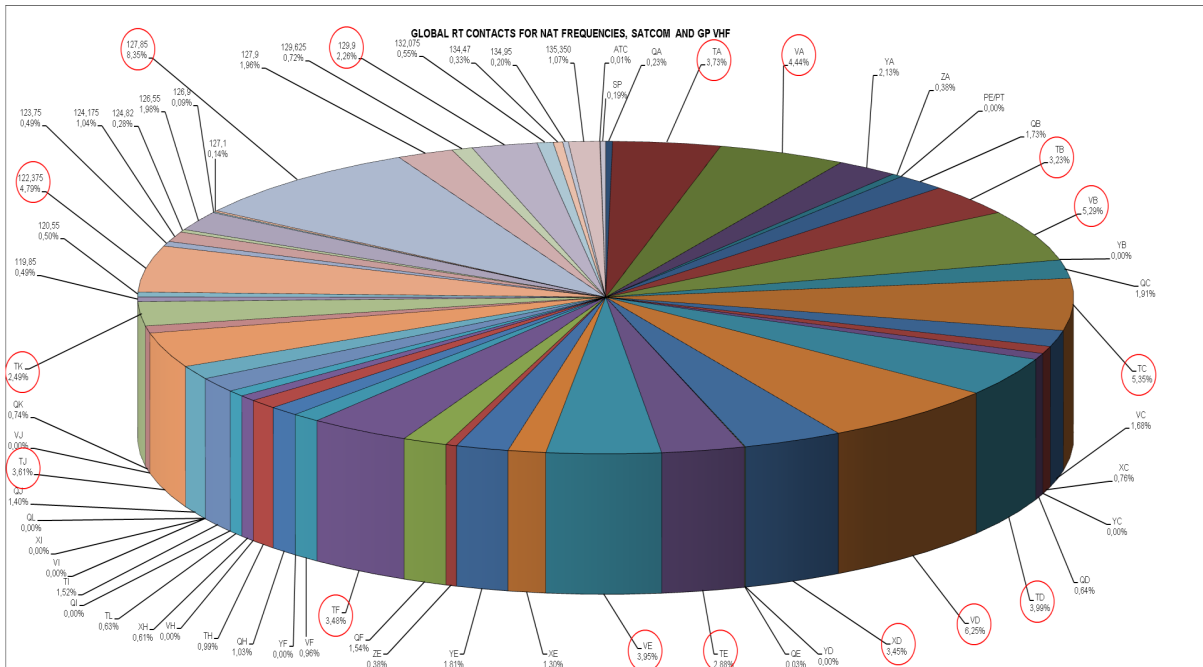


Figure 7 – Frequency usage



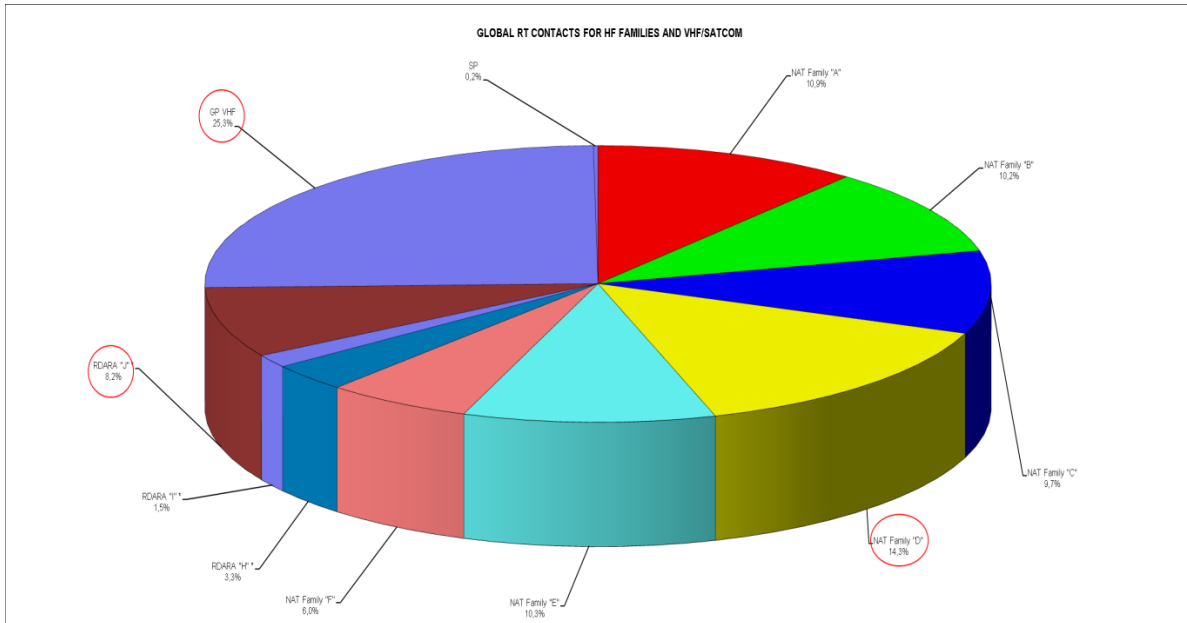


Figure 8 – Aggregate RT contacts by NAT/RDARA family and on VHF/SATVOICE

### 2.3.2 NAT overall analysis

Overall, in the NAT Region, the most used HF frequencies are of the 5-6 KHz band (32%) and the 8 KHz band (23%).

VHF frequencies are used in about 25% of contacts, alleviating HF congestion, particularly in Gander and Shanwick/Iceland.

SATVOICE still has a residual use, representing only 0,2% of total voice messages in the NAT Region. Santa Maria and New York were the stations with the higher relative usage of SATVOICE (respectively 0,4% and 0,3%).

The most used HF frequencies in the NAT Region were VD (189.553; 6,2%), VB (160.383; 5,3%) and TC (162.272; 5,3%) while on VHF it was 127.850 MHz (253.354; 8,3%) and 122,375 (145.403; 4,8%).

The most used NAT Family was “D” (14,3%) and the most used RDARA was “J” (8,2%). VHF has assured about a quarter of NAT voice communications (25%).

### 3 VOICE COMMUNICATION SYSTEM PERFORMANCE ASSESSMENT

Only Santa Maria Radio Station has provided the data to assess the voice communications system performance according the common agreed template.

The analysis was made between January 1, 2016 to December 31, 2016 (12 months).

The FAA has made an assessment within the PARC CWG, comparing the SATVOICE and HF voice performance, both against RCP/RSP 400, between January 1, 2015 to December 31, 2016 (24 months).. Although these statistics have been produced within a different context, because they are valuable, a summary is presented also in this report.

#### 3.1 ATC intervention messages (Clearances, Requests and Advisories)

The voice ATC intervention performance analysis focused on Clearances (excluding OCL), Requests and Advisories (excluding SQK) and measures the time interval between the time the message is received at the station and the time the *readback* message is sent to ATC. The time unit used is minutes.

	Msg Total	Msg Daily Average Count	Msg Average Delay (minutes)
CLE	16165	44	2,1
ADZ	2961	8	2,1
RQU	4394	12	3,1
Aggregate	23520	130	2,4

Table 4 – Santa Maria voice ATC intervention messages summary

Santa Maria Radio processed 23.520 messages and delivered 95% of them within 5 minutes and 98% within 10 minutes. The aggregate average message delay was 2,4 minutes.

About 70% of the messages are clearances. The message performance and average message delay is slightly better than the aggregate values.

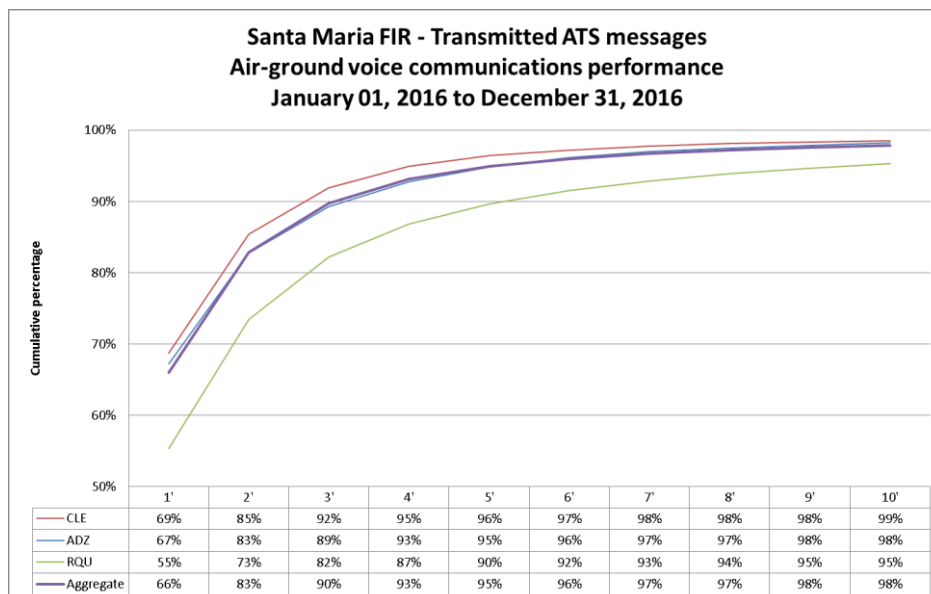


Figure 9 – Santa Maria voice ATC intervention messages performance

### 3.2 Surveillance messages (Position reports)

The Voice surveillance performance analysis focused on POS messages (excluding data link equipped aircraft) and measures the time interval between the time over position and time message is sent from the radio station to the ATC unit. The time unit used is minutes.

	Msg Total	Msg Daily Average Count	Msg Average Delay (minutes)
POS	48979	134	3,6

Table 5 – Santa Maria voice surveillance messages summary

Santa Maria Radio processed 48.979 messages and delivered 89% of them within 5 minutes and 95% within 10 minutes. The average message delay was 3,6 minutes

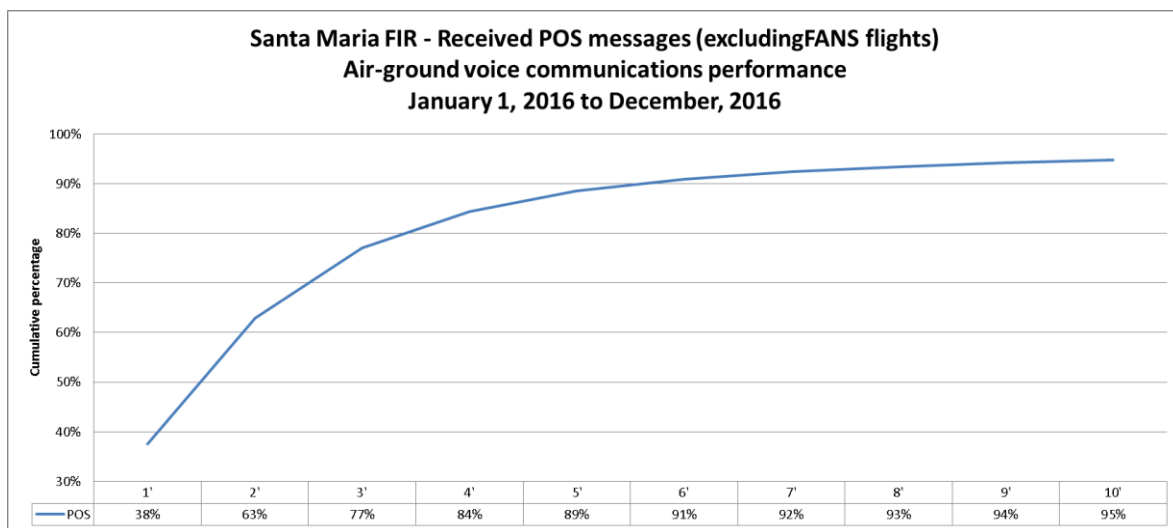


Figure 10 – Santa Maria voice surveillance messages performance

### 3.3 FAA voice communications performance assessment

About 99% of intervention messages were delivered and confirmation sent to the controller within 5 minutes.

## Voice ACP Analysis

- Data source: Ocean21 DR&A - ACARS data
- Analysis Procedure:
  - Identify all voice uplink (UL) clearance messages (key on "ATCC")
  - Match downlink (DL) readback message (key on "RB" and matching timestamp within message)
  - Distinguish SAT (key on "DT SFO SV" for KZAK, "DT NYC SP" for KZNY)
  - Calculate time difference between Ocean21 receipt time of downlink readback and generation time of uplink clearance message

**OC21 Receipt Time<sub>DL readback</sub> - Send Time<sub>UL clearance</sub> = ACP<sub>Voice</sub>**

- Analysis period:
  - 2 years: January 2015 – December 2016
- Analysis Criteria: RCP400
  - 95% within 320 sec
  - 99.9% within 370 sec






Figure 11 – FAA voice communication performance assessment criteria

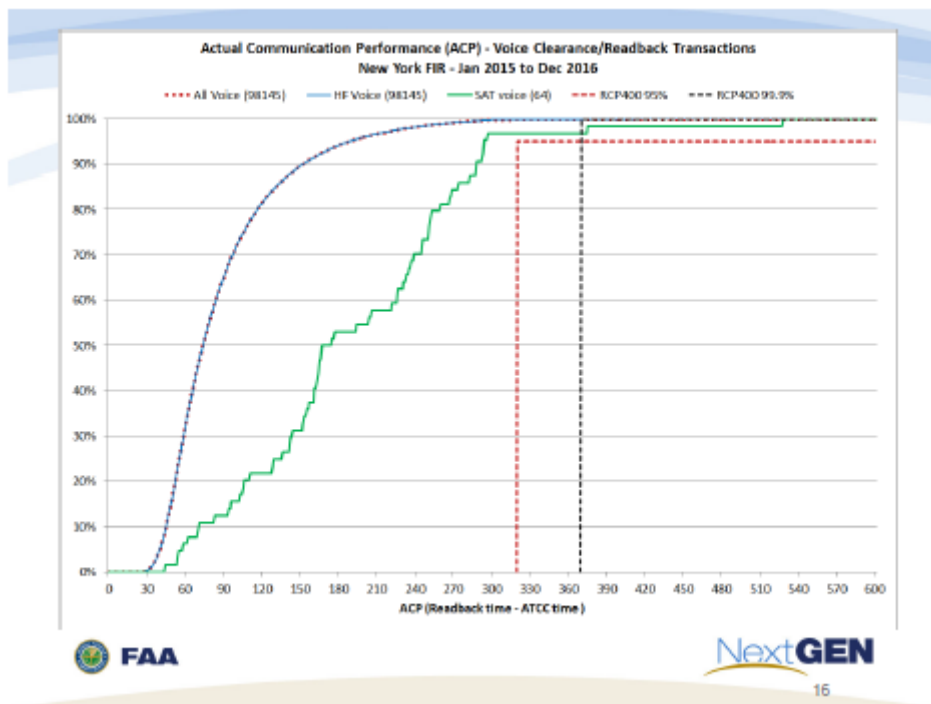


Figure 12 – FAA voice communication performance

About 90% of POS messages were delivered within 5 minutes and about 95% within 10 minutes.

## Voice ASP Analysis

- Data source: Ocean21 DR&A - ACARS data
- Analysis Procedure:
  - Identify all voice position report (DL) clearance messages (key on "AEP", "POS")
  - Distinguish SAT (key on "DT SFO SV" for KZAK, "DT NYC SP" for KZNY)
  - Calculate time difference between Ocean21 receipt time of position report and time over "OV" reported

**OC21 Receipt Time<sub>DL pos rpt</sub> - Reported Time Over Position = ASP<sub>Voice</sub>**

- Analysis period:
  - 2 years: January 2015 – December 2016
- Analysis Criteria: RSP400
  - 95% within 290 sec
  - 99.9% within 385 sec






Figure 13 – FAA voice surveillance performance assessment criteria

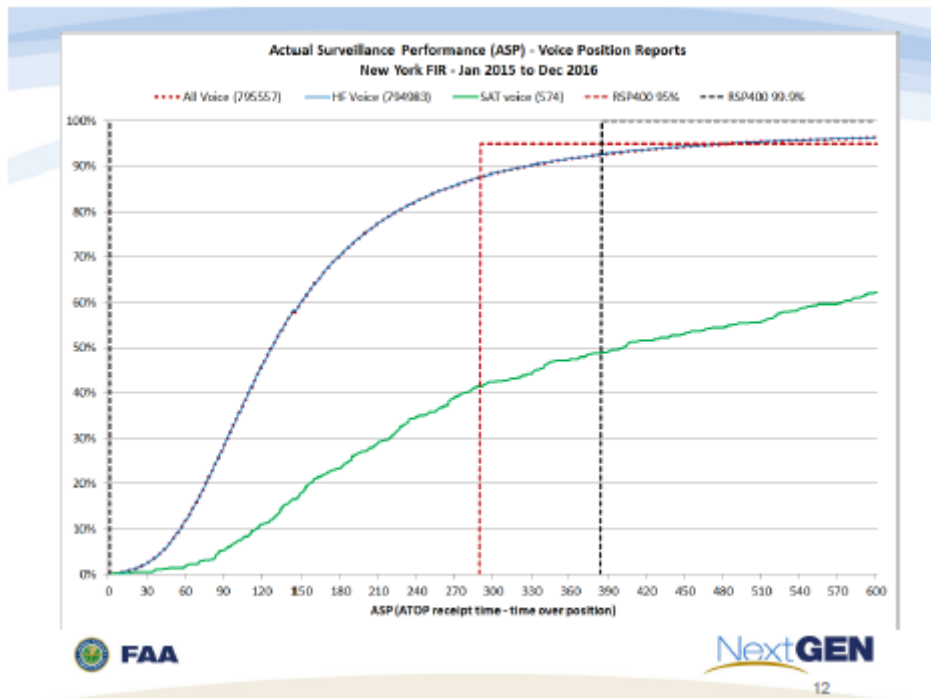


Figure 14 – FAA voice surveillance performance

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## **4 APPENDIXES**

In the appendixes, a detailed analysis of traffic is provided for each station.

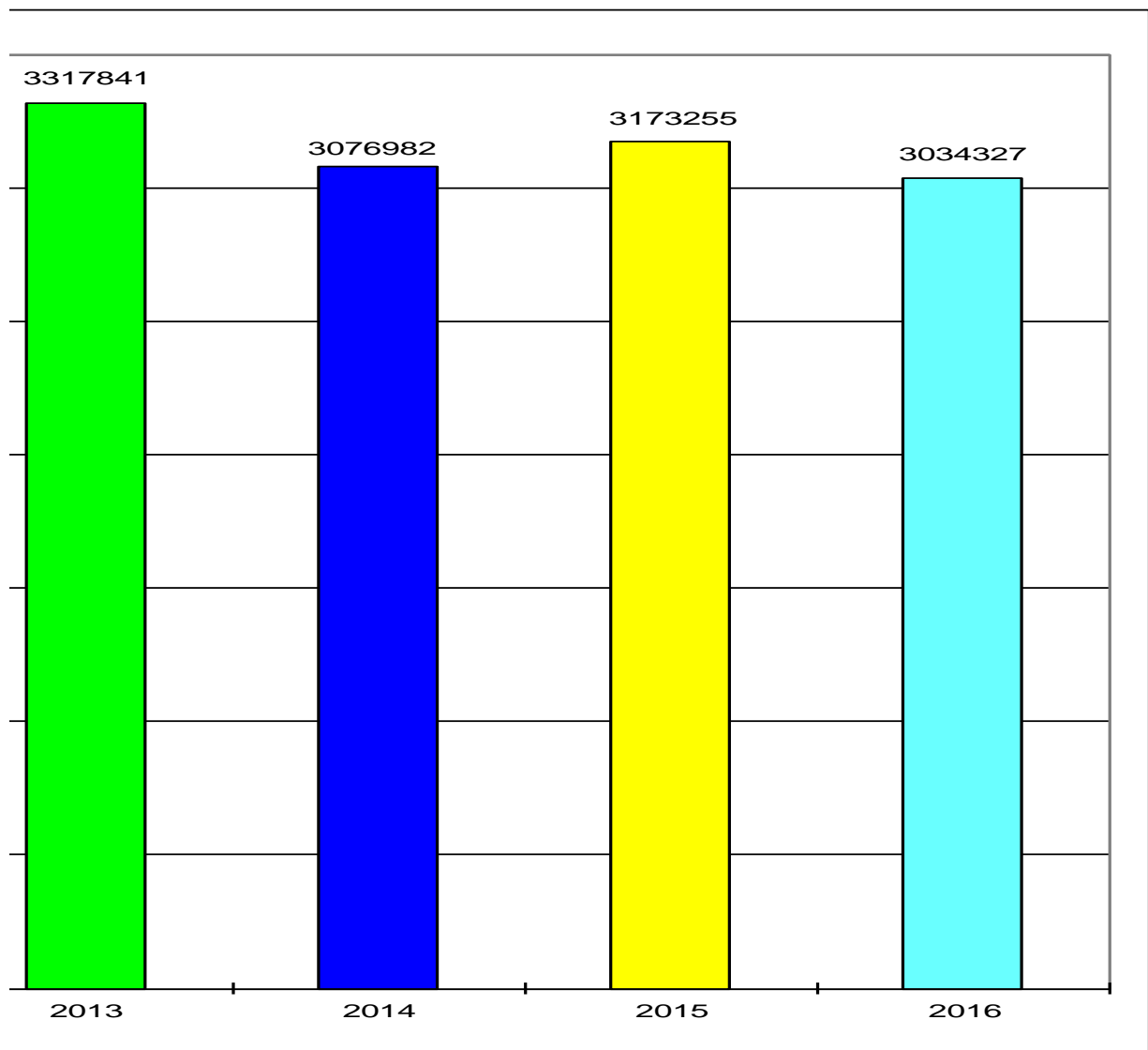
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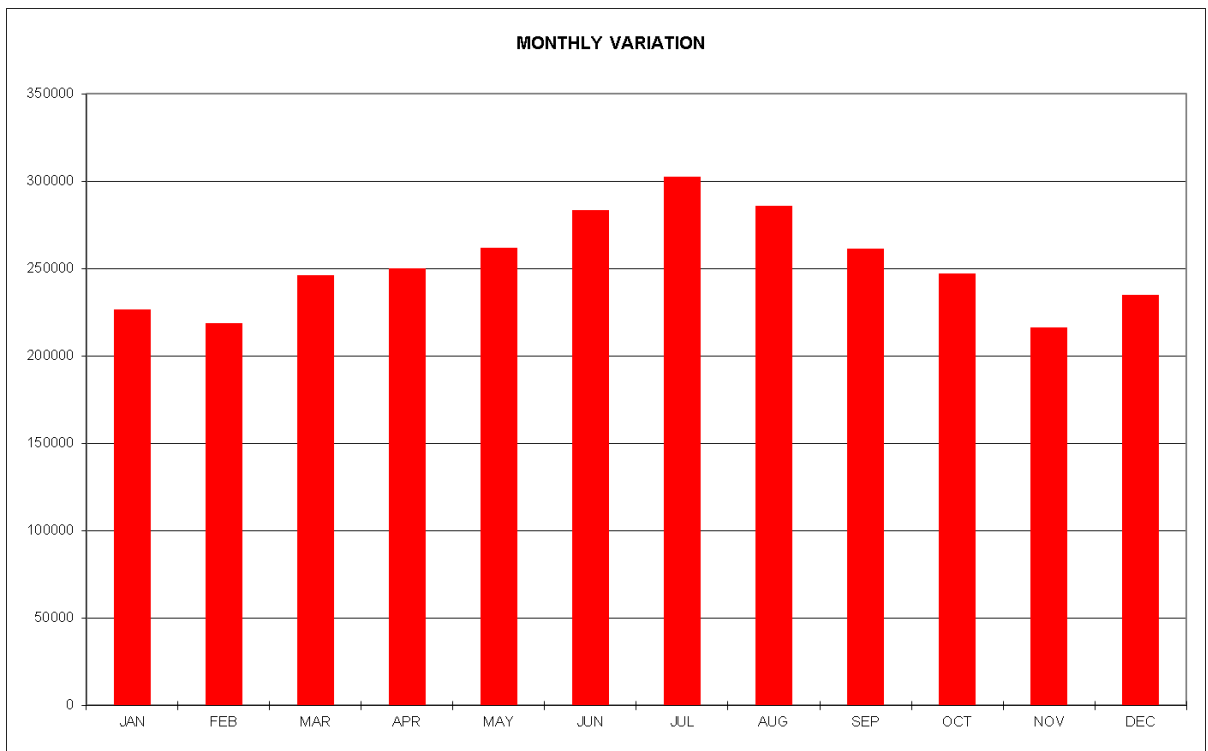
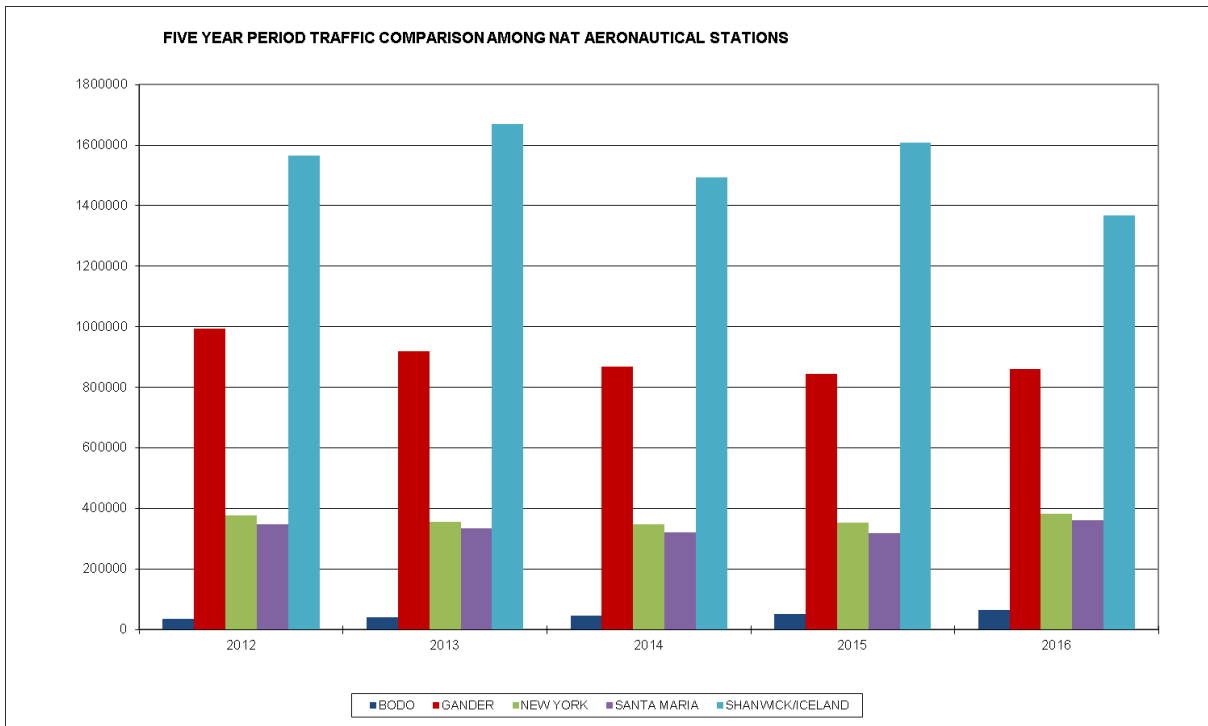


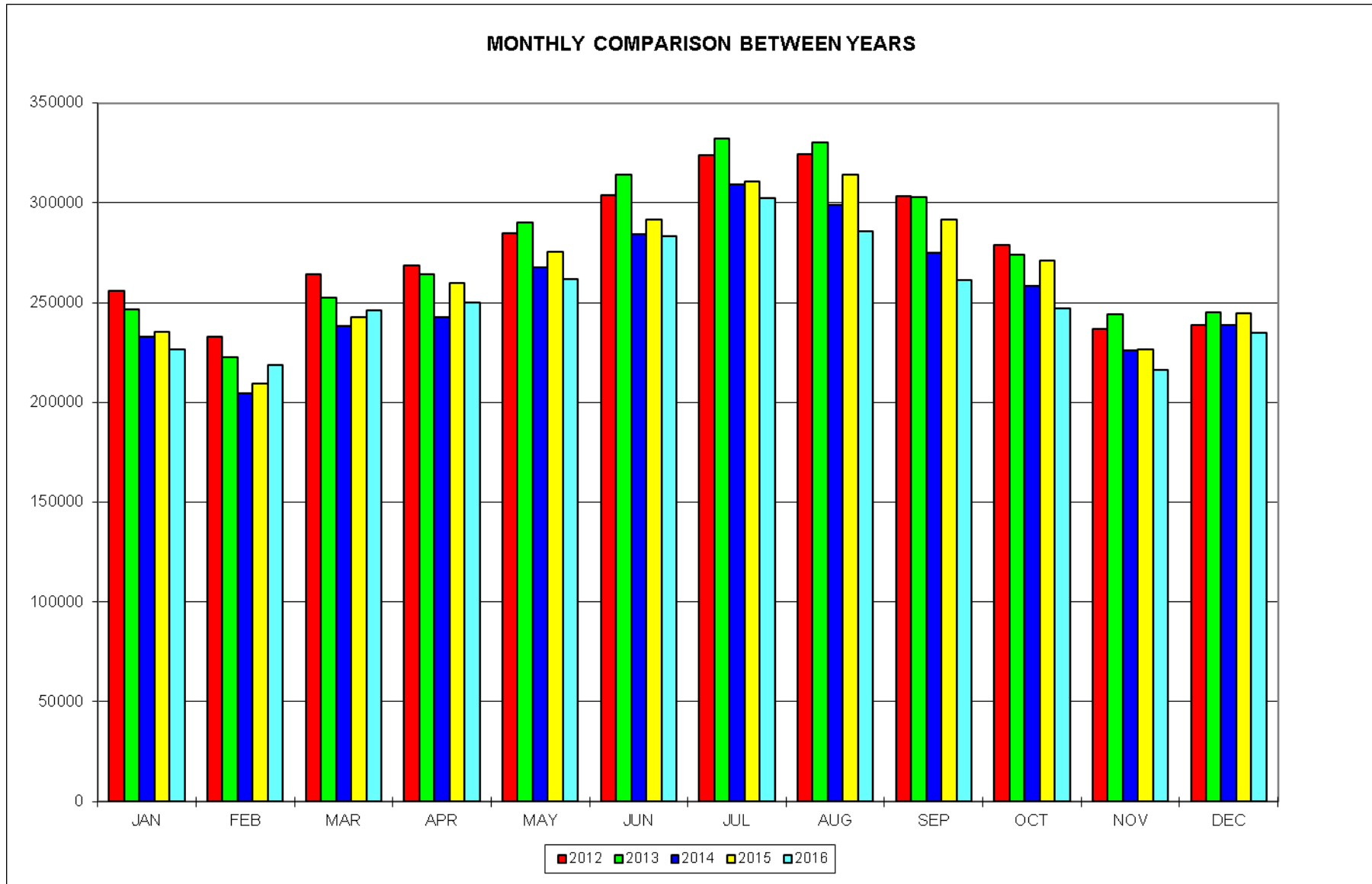
## 4.1 Appendix 1 - NAT Region

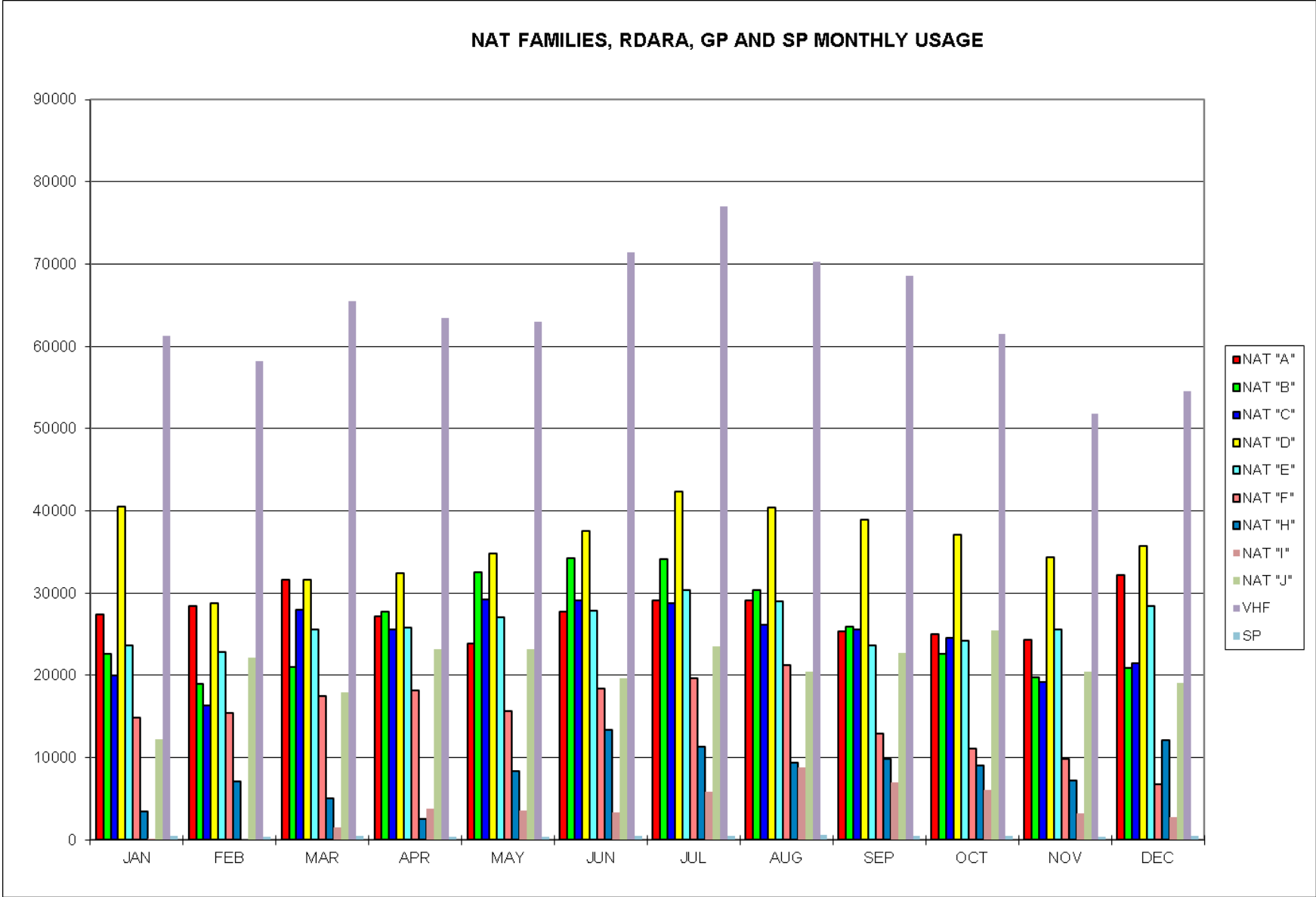
### RT TRAFFIC COMPARISON

2012	2013	2014	2015	2016
256018	246591	233139	235496	226474
232855	222460	204382	209264	218746
264339	252445	238396	242902	245923
268652	264040	242913	259830	250230
284802	290132	267392	275328	261930
303989	314295	284017	291583	283266
323883	332001	309382	310859	302521
324488	330143	298999	314116	285953
303404	302951	275011	291624	261121
278627	273987	258336	271162	247194
236864	243909	226151	226626	216339
238934	244887	238864	244465	234630
3316855	3317841	3076982	3173255	3034327

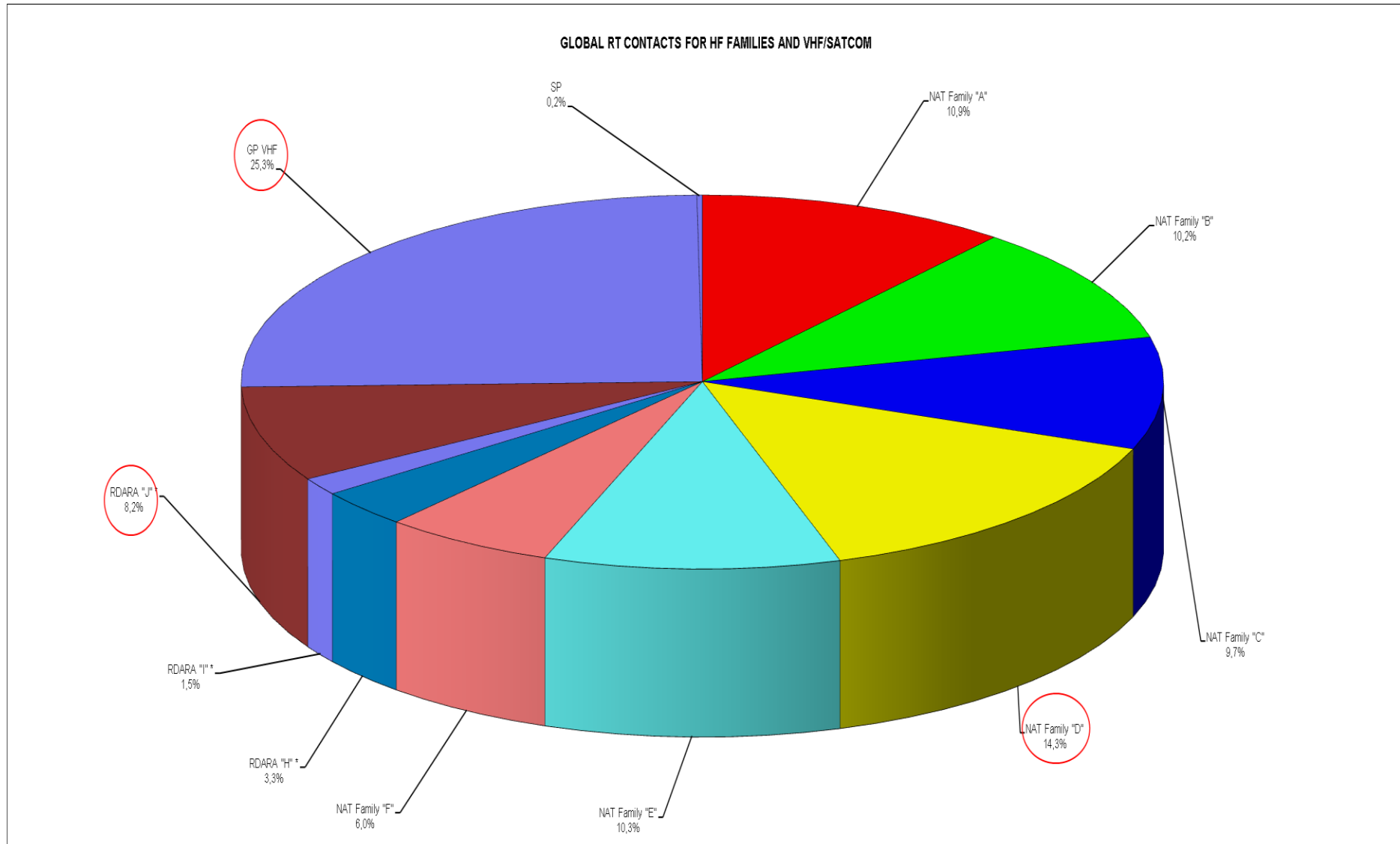


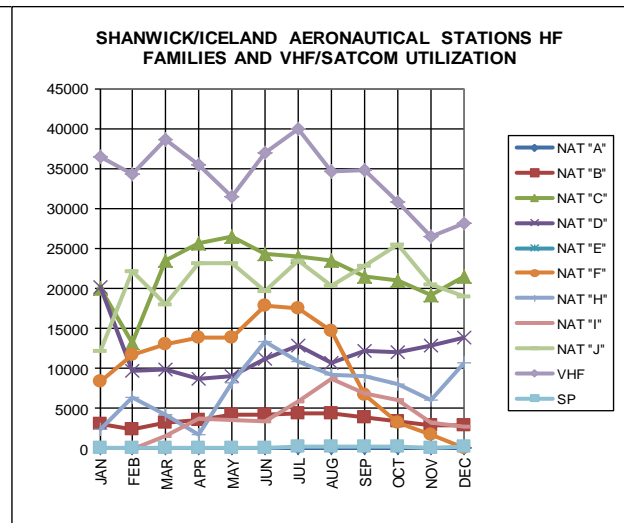
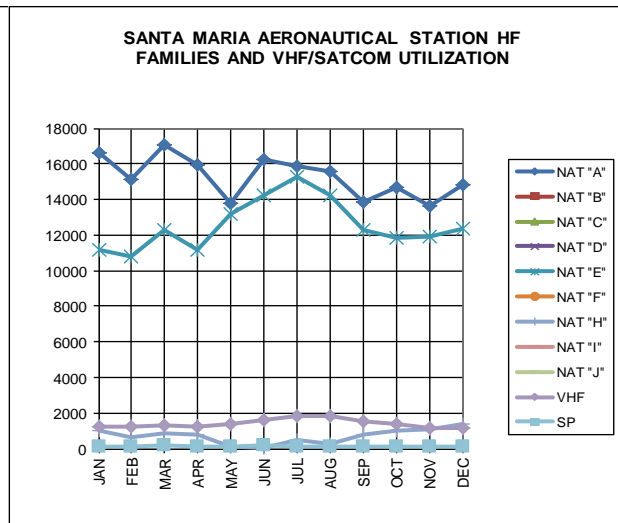
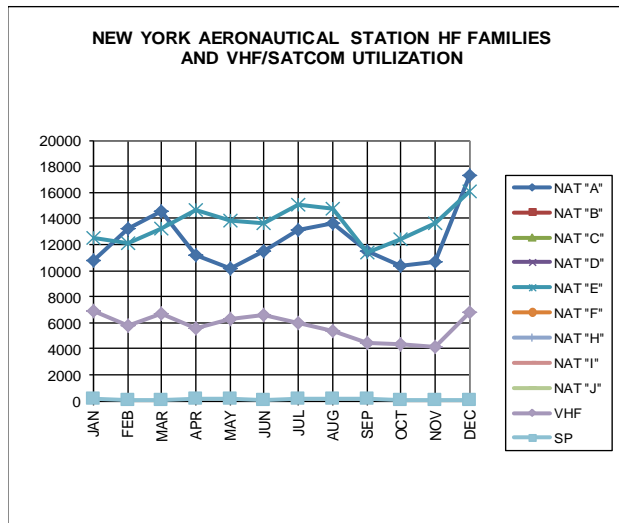
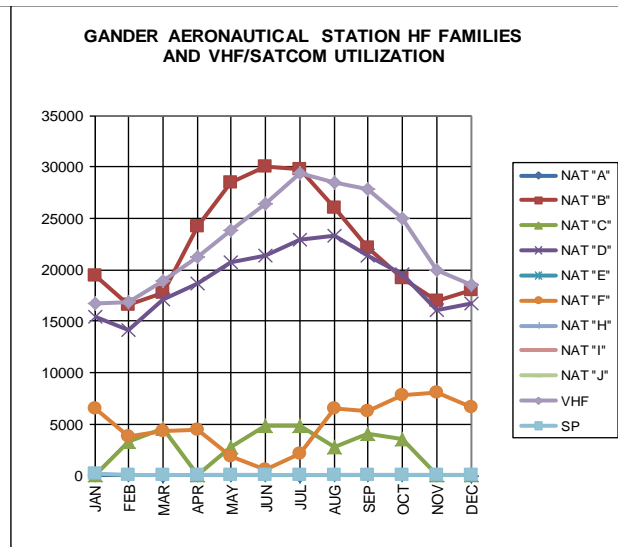
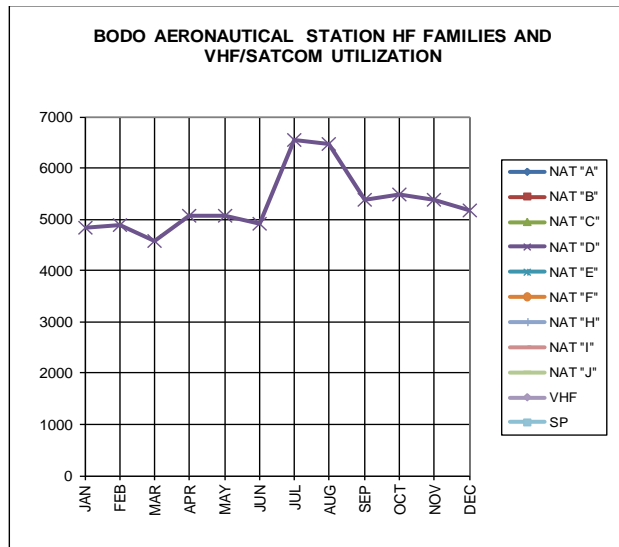












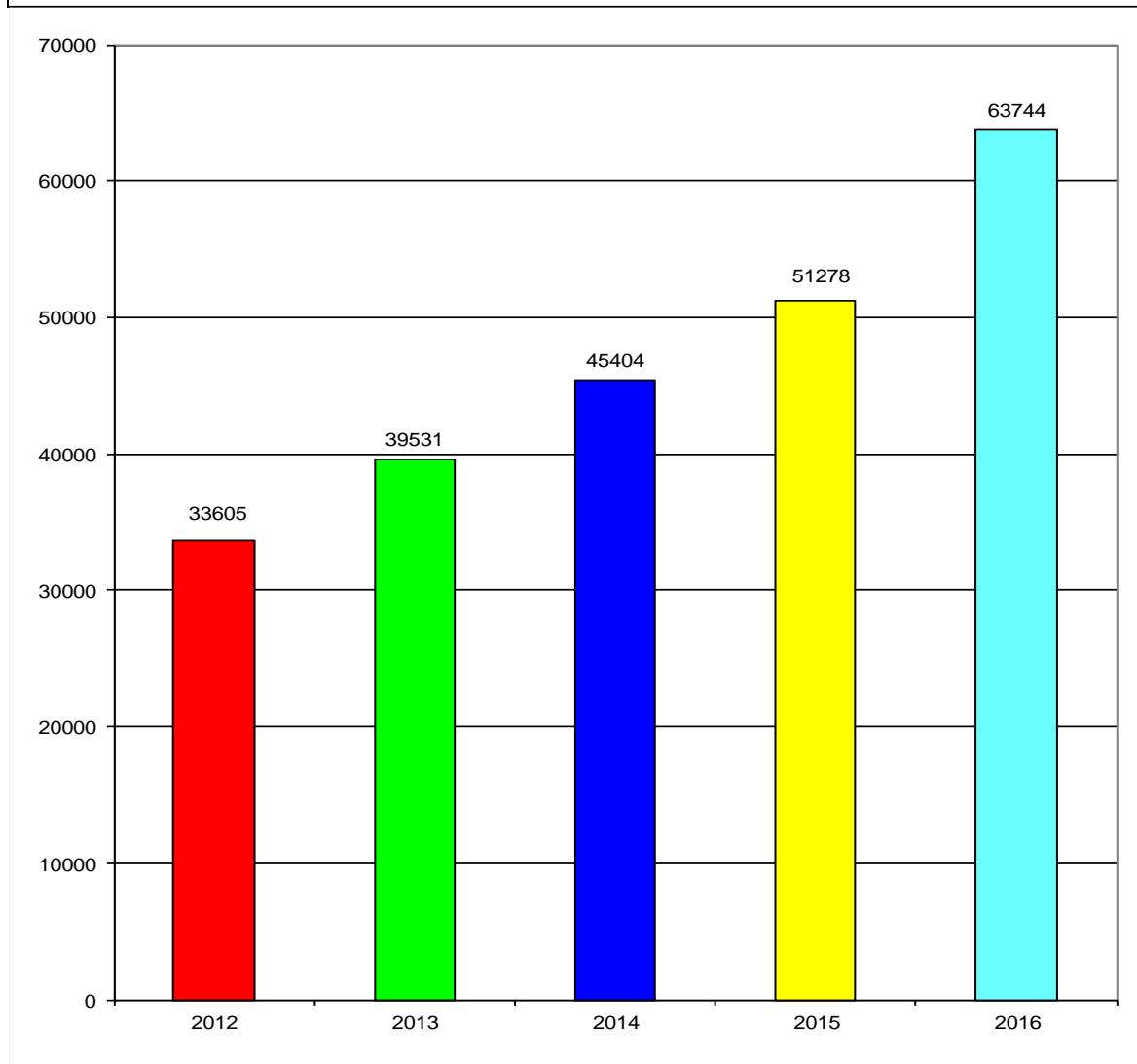
NAT Family "A"			NAT Family "B"			NAT Family "C"			NAT Family "D"			NAT Family "E"			NAT Family "F"			RDARA "H" *		RDARA "I" *		RDARA "J" *		GP VHF			SP					
QA	7094	0,23%	QB	52426	1,73%	QC	57814	1,91%	QD	19438	0,64%	QE	932	0,03%	QF	46752	1,54%	QH	31233	1,03%	QI	2	0,00%	QJ	42543	1,40%	119,850	14739	0,49%	5778	0,19%	
TA	113212	3,73%	TB	97967	3,23%	TC	162272	5,35%	TD	121088	3,99%	TE	87338	2,88%	TF	105703	3,48%	TH	30027	0,99%	TI	46063	1,52%	TJ	109556	3,61%	120,550	15045	0,50%			
VA	134731	4,44%	VB	160383	5,29%	VC	51125	1,68%	VD	189553	6,25%	VE	119724	3,95%	VF	29275	0,96%	VH	9	0,00%	VI	2	0,00%	VJ	0	0,00%	122,375	145403	4,79%			
YA	64664	2,13%	YB	119	0,00%	XC	23008	0,76%	XD	104569	3,45%	XE	39497	1,30%	YF	0	0,00%	XH	18405	0,61%	XI	0	0,00%	QK	22587	0,74%	123,750	14992	0,49%			
ZA	11569	0,38%				YC	0	0,00%	YD	0	0,00%	YE	54917	1,81%				TL	19129	0,63%	QL	55	0,00%	TK	75499	2,49%	124,175	31610	1,04%			
PE/PT	55	0,00%										ZE *	11524	0,38%										124,820	8568	0,28%						
																								126,550	60154	1,98%						
																								126,900	2844	0,09%						
																								127,100	4351	0,14%						
																								127,850	253354	8,35%						
																								127,900	59376	1,96%						
																								129,625	21903	0,72%						
																								129,900	68721	2,26%						
																								132,075	16833	0,55%						
																								134,470	9873	0,33%						
																								134,950	5954	0,20%						
																								135,350	32590	1,07%						
																								ATC	380	0,01%						
<b>TOTAL</b>	<b>331325</b>	<b>10,9%</b>	<b>TOTAL</b>	<b>310895</b>	<b>10,2%</b>	<b>TOTAL</b>	<b>294219</b>	<b>9,7%</b>	<b>TOTAL</b>	<b>434648</b>	<b>14,3%</b>	<b>TOTAL</b>	<b>313932</b>	<b>10,3%</b>	<b>TOTAL</b>	<b>181730</b>	<b>6,0%</b>	<b>TOTAL</b>	<b>98803</b>	<b>3,3%</b>	<b>TOTAL</b>	<b>46122</b>	<b>1,5%</b>	<b>TOTAL</b>	<b>250185</b>	<b>8,2%</b>	<b>TOTAL</b>	<b>766690</b>	<b>25,3%</b>	<b>5778</b>	<b>0,2%</b>	<b>3034327</b>

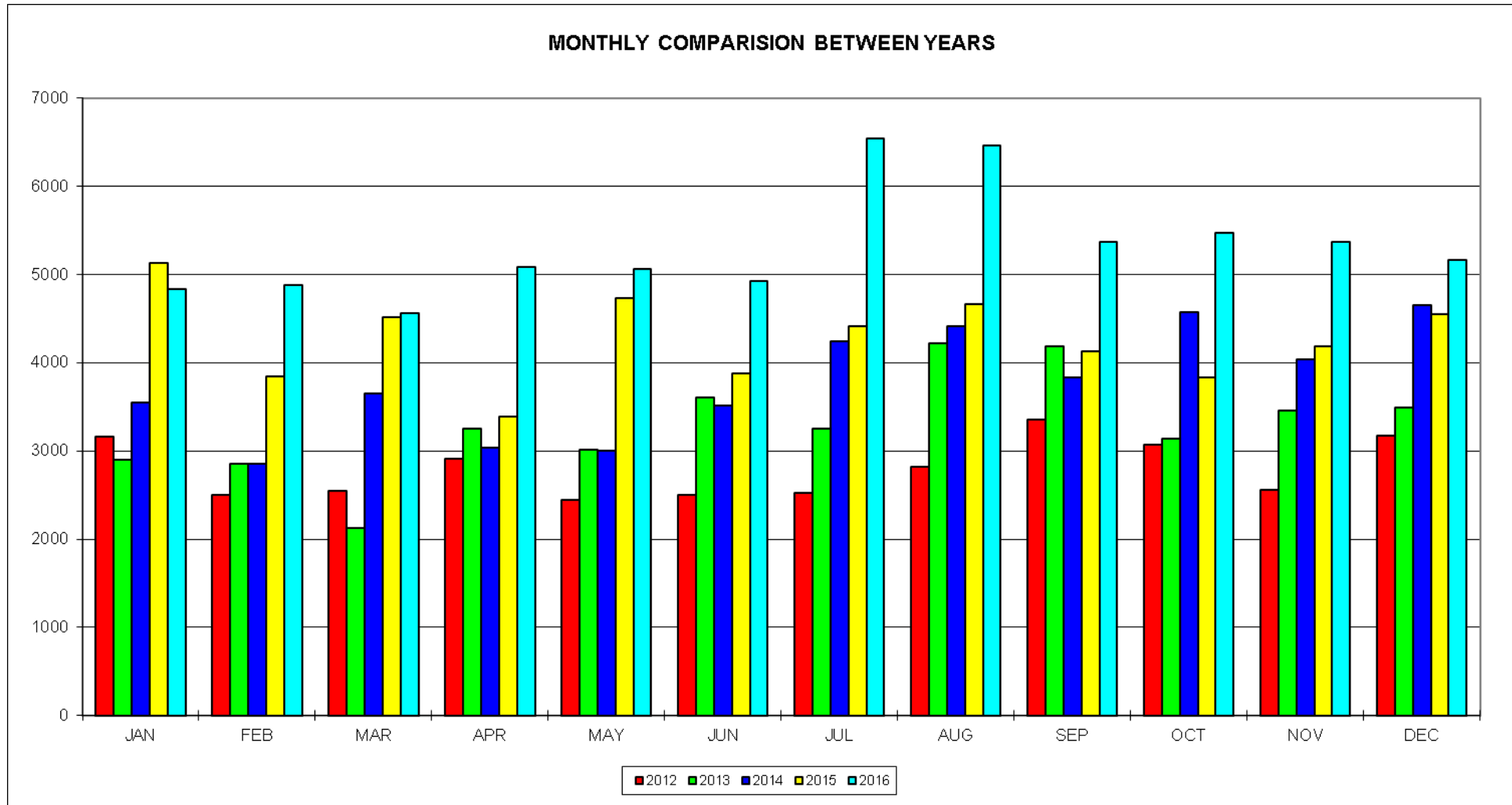


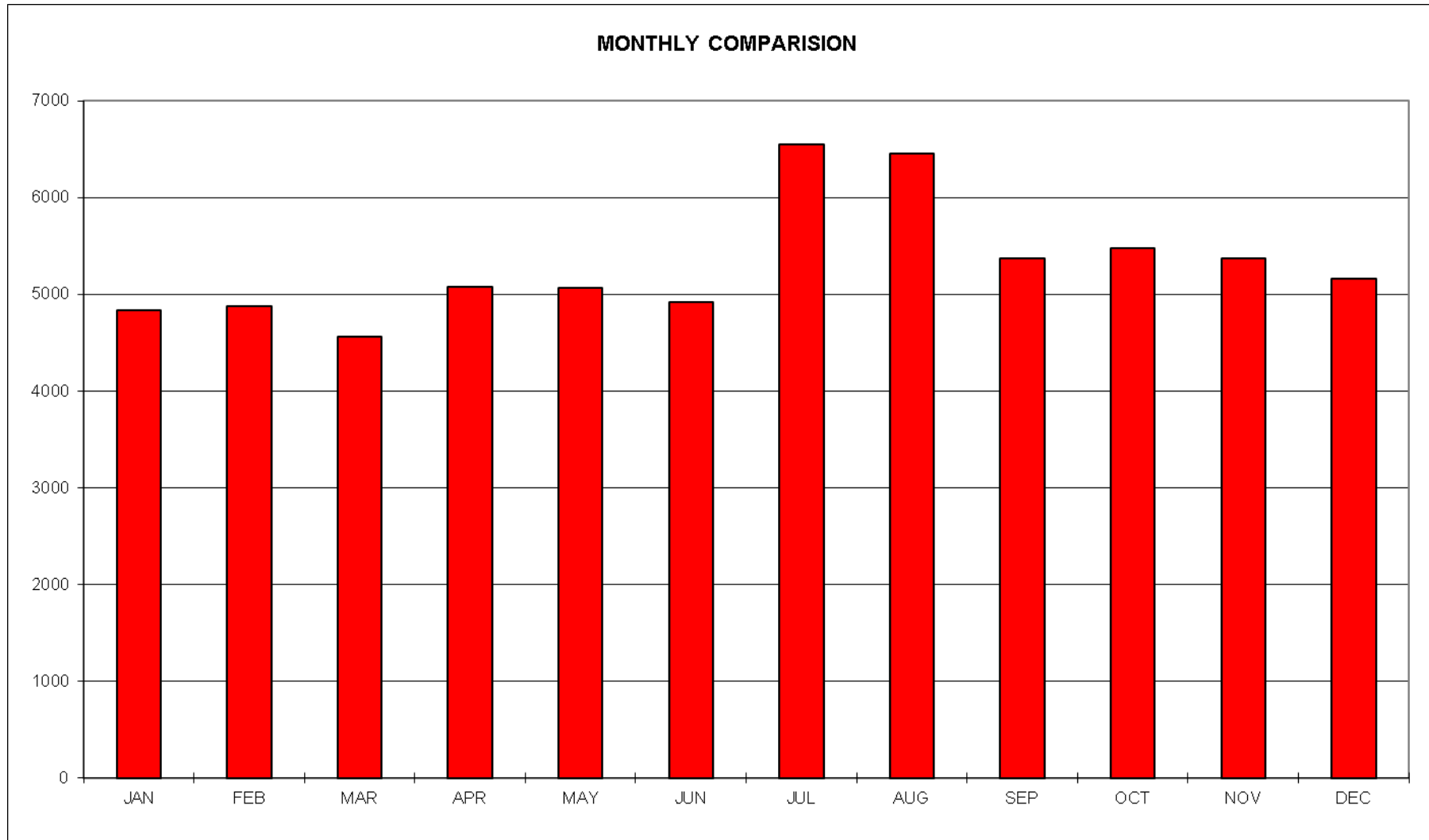
## 4.2 Appendix 2 - Bodo

### RT TRAFFIC COMPARISON

MONTH \ YEAR	2012	2013	2014	2015	2016
JANUARY	3168	2902	3550	5134	4833
FEBRUARY	2501	2860	2863	3843	4875
MARCH	2550	2131	3658	4515	4565
APRIL	2920	3259	3039	3393	5081
MAY	2444	3013	3011	4738	5068
JUNE	2500	3607	3516	3884	4923
JULY	2524	3253	4250	4418	6547
AUGUST	2827	4218	4412	4667	6461
SEPTEMBER	3356	4187	3836	4127	5374
OCTOBER	3075	3144	4574	3828	5475
NOVEMBER	2566	3460	4037	4184	5375
DECEMBER	3174	3497	4658	4547	5167
<b>TOTAL</b>	<b>33605</b>	<b>39531</b>	<b>45404</b>	<b>51278</b>	<b>63744</b>







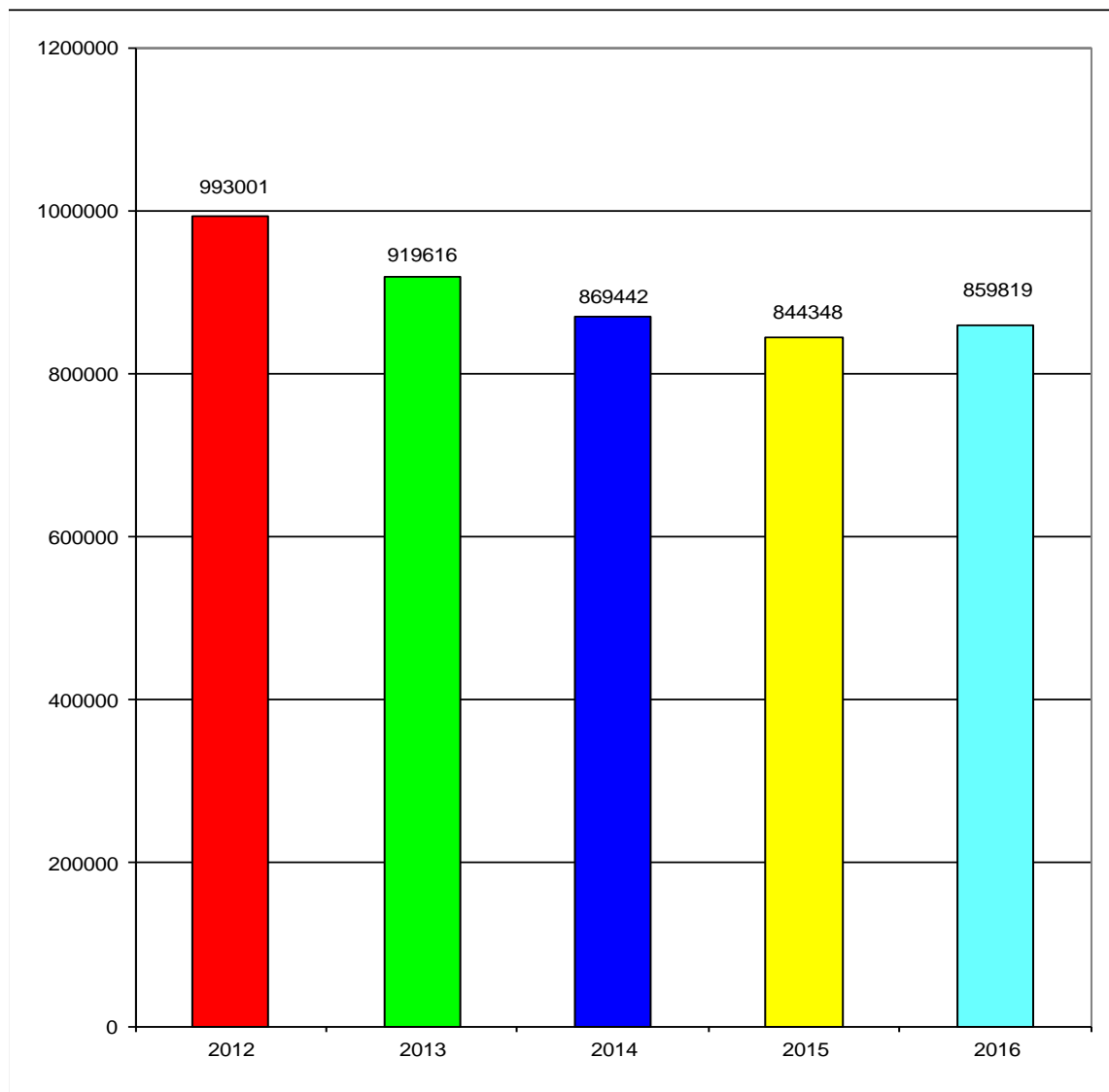
FAMILY	NAT Family D										TOTALS
	FREQ	QD	TD	VD	XD	YD					
MONTH	2971	4675	8891	11279	13291						
JANUARY		4444	388	1	0						4833
FEBRUARY		4157	718	0	0						4875
MARCH		3997	559	9	0						4565
APRIL		4553	518	10	0						5081
MAY		4024	1018	26	0						5068
JUNE		4142	749	32	0						4923
JULY		5628	901	18	0						6547
AUGUST		5751	646	64	0						6461
SEPTEMBER	1	4718	626	29	0						5374
OCTOBER		5077	388	10	0						5475
NOVEMBER		4956	416	3	0						5375
DECEMBER		4453	669	45	0						5167
<b>SUB-TOTALS</b>	1	55900	7596	247	0						63744
<b>PERCENT %</b>	0,00%	87,69%	11,92%	0,39%	0,00%						100,00%

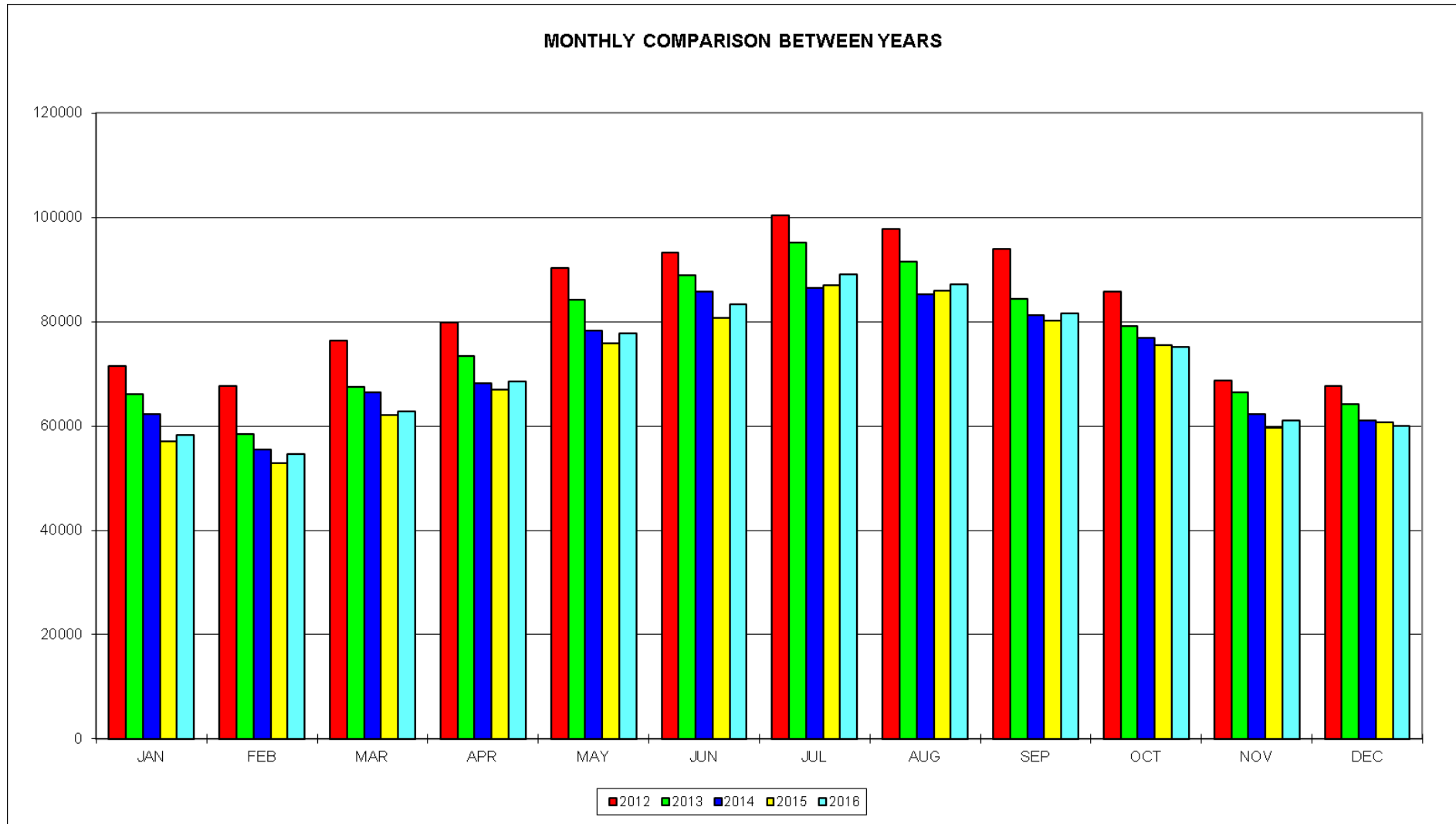
NAT Family "D"		
QD	1	0,00%
TD	55900	87,69%
VD	7596	11,92%
XD	247	0,39%
YD	0	0,00%
<b>TOTAL</b>	63744	100,00%

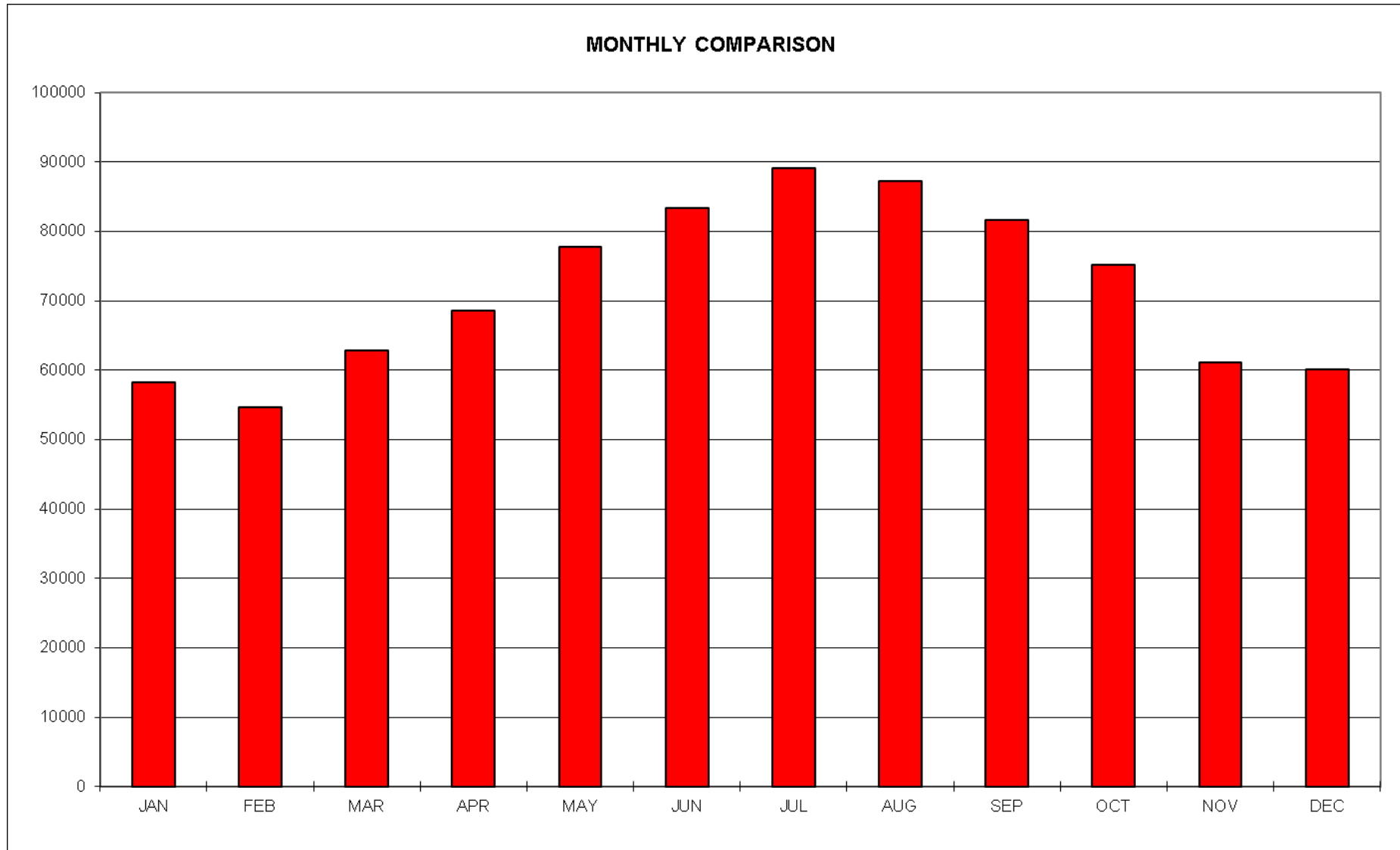
### 4.3 Appendix 3 - Gander

#### RT TRAFFIC COMPARISON

MONTH \ YEAR	2012	2013	2014	2015	2016
JANUARY	71467	66153	62217	56984	58221
FEBRUARY	67738	58515	55551	52935	54668
MARCH	76385	67508	66394	62040	62856
APRIL	79855	73387	68167	66942	68583
MAY	90220	84240	78303	75799	77781
JUNE	93317	88971	85728	80711	83342
JULY	100321	95184	86497	86952	89141
AUGUST	97752	91444	85186	85936	87212
SEPTEMBER	93916	84328	81313	80133	81657
OCTOBER	85745	79101	76812	75587	75180
NOVEMBER	68660	66509	62232	59607	61122
DECEMBER	67625	64276	61042	60722	60056
<b>TOTAL</b>	<b>993001</b>	<b>919616</b>	<b>869442</b>	<b>844348</b>	<b>859819</b>







FAMILY	NAT Family A				NAT Family B				NAT Family C				NAT FAMILY "D"				NAT Family F				GP VHF										SP	TOTALS			
	FREQ	QA	TA	VA	YA	QB	TB	VB	YB	QC	TC	VC	XC	YC	QD	TD	VD	XD	QF	TF	VF	YF	20,55MHz	22,375MHz	23,75MHz	24,82MHz	26,9MHz	27,1MHz	27,9MHz	34,47MHz			34,95MHz	19,85MHz	35,35MHz
MONTH	3016	5598	8906	13306	2899	5616	8864	13291	2872	5649	8879	11336	13306	2971	4675	8891	11279	3476	6622	8831	13291	120,55	122,375	123,75	124,82	126,9	127,1	127,9	134,47	134,95	119,85	135,35	ATC		
JANUARY	0	1	3	3	5426	6053	7949	0	40	6	2	2	0	3	89	9022	6309	1575	3	4915	0	732	9690	602	422	313	0	971	494	309	252	2883	8	144	58221
FEBRUARY	0	2	0	2	5226	4629	6727	2	2366	744	2	122	0	1	120	8425	5588	3	4	3745	0	1026	9458	721	453	334	2	933	467	344	1538	1592	6	86	54668
MARCH	0	0	0	0	4624	3832	9203	79	889	3669	2	3	0	3	62	9174	7931	523	164	3675	0	1078	10559	913	592	542	411	1143	496	320	443	2301	104	121	62856
APRIL	0	0	0	3	5888	8012	10306	1	15	1	0	2	0	1	5	9576	9105	298	38	4075	0	1709	11433	1346	707	177	324	1301	538	388	974	2274	19	67	68583
MAY	0	0	0	2	5908	10318	12176	14	7	3	2	2780	0	0	6	10259	10487	1	8	1858	0	1285	12241	1531	825	195	221	1576	810	543	1470	3176	11	68	77781
JUNE	0	0	0	2	5287	11907	12839	0	11	3	1	4851	0	2	2	10774	10606	599	4	11	0	1447	13394	1486	1026	676	154	1875	1017	632	1287	3375	16	58	83342
JULY	0	0	0	0	4322	12657	12786	1	6	3	1	4864	0	0	197	12450	10314	802	1295	7	0	1040	15783	1452	964	2	1	2199	1043	670	2341	3829	21	91	89141
AUGUST	0	2	0	1	1305	12395	12375	0	1	4	2	2714	0	0	1	11943	11397	4134	330	2057	0	1086	15439	1519	610	2	1385	2095	1053	539	1125	3618	14	66	87212
SEPTEMBER	0	0	0	1	1738	9478	10864	14	5	2	3	4040	0	0	7	11534	9867	5638	181	383	0	1208	14346	1441	749	413	413	2284	1306	668	1251	3712	16	95	81657
OCTOBER	0	1	0	0	3887	6070	9233	0	11	1	0	3569	0	1	266	10685	8626	3951	2170	1683	0	1424	12619	1841	968	1	626	1303	1053	701	1721	2671	4	94	75180
NOVEMBER	0	0	0	1	2979	6263	7732	0	1	3	1	11	0	11	120	9288	6629	4705	122	3244	0	2065	10018	1276	807	188	264	1150	762	449	2085	840	10	98	61122
DECEMBER	0	0	0	0	4977	5505	7523	1	0	3	3	4	0	11	208	10530	5958	3276	157	3227	0	945	10423	864	445	1	550	1382	834	391	252	2319	151	116	60056
<b>SUB-TOTALS</b>	0	6	3	15	51567	97119	119713	112	3352	4442	19	22962	0	33	1083	123660	102817	25505	4476	28880	0	15045	145403	14992	8568	2844	4351	18212	9873	5954	14739	32590	380	1104	859819
<b>PERCENT %</b>	0,00%	0,00%	0,00%	0,00%	6,00%	11,30%	13,92%	0,01%	0,39%	0,52%	0,00%	2,67%	0,00%	0,00%	0,13%	14,38%	11,96%	2,97%	0,52%	3,36%	0,00%	1,75%	16,91%	1,74%	1,00%	0,33%	0,51%	2,12%	1,15%	0,69%	1,71%	3,79%	0,04%	0,13%	100,00%

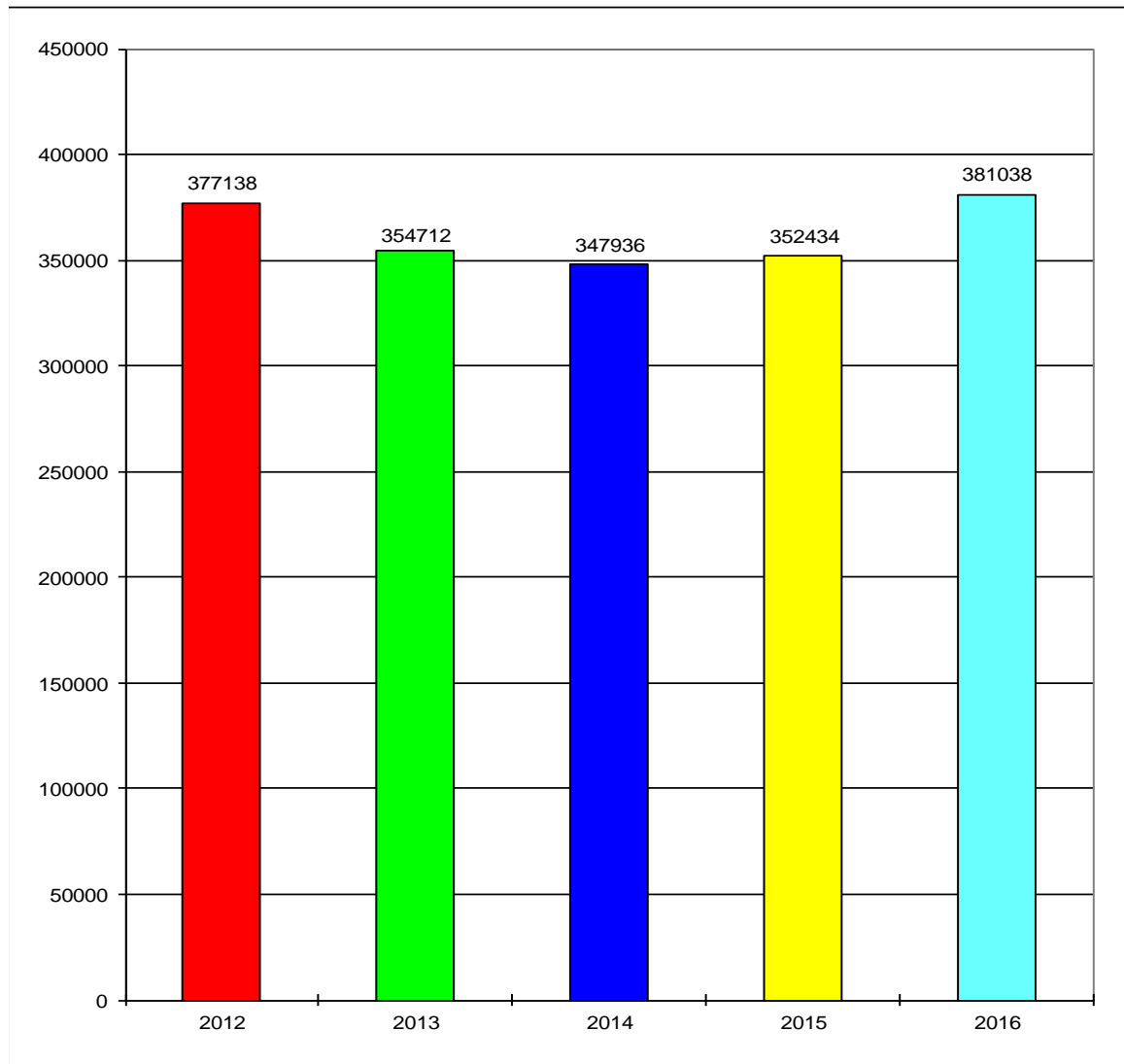
	NAT Family "A"		NAT Family "B"		NAT Family "C"		NAT Family "D"		NAT Family "F"		GP VHF			SP					
QA	0	0,00%	QB	51567	6,00%	QC	3352	0,39%	QD	33	0,00%	QF	25505	2,97%	120,55	15045	1,75%	1104	0,13%
TA	6	0,00%	TB	97119	11,30%	TC	4442	0,52%	TD	1083	0,13%	TF	4476	0,52%	122,375	145403	16,91%		
VA	3	0,00%	VB	119713	13,92%	VC	19	0,00%	VD	123660	14,38%	VF	28880	3,36%	123,75	14992	1,74%		
YA	15	0,00%	YB	112	0,01%	XC	22962	2,67%	XD	102817	11,96%	YF	0	0,00%	124,82	8568	1,00%		
						YC	0	0,00%							126,9	2844	0,33%		
															127,1	4351	0,51%		
															127,9	18212	2,12%		
															134,47	9873	1,15%		
															134,95	5954	0,69%		
															ATC	14739	1,71%		
															ATC	32590	3,79%		
															ATC	380	0,04%		
<b>TOTAL</b>	24	0,00%	<b>TOTAL</b>	268511	31,23%	<b>TOTAL</b>	30775	3,58%	<b>TOTAL</b>	227593	26,47%	<b>TOTAL</b>	58861	6,85%	<b>TOTAL</b>	272951	31,75%	1104	0,13%

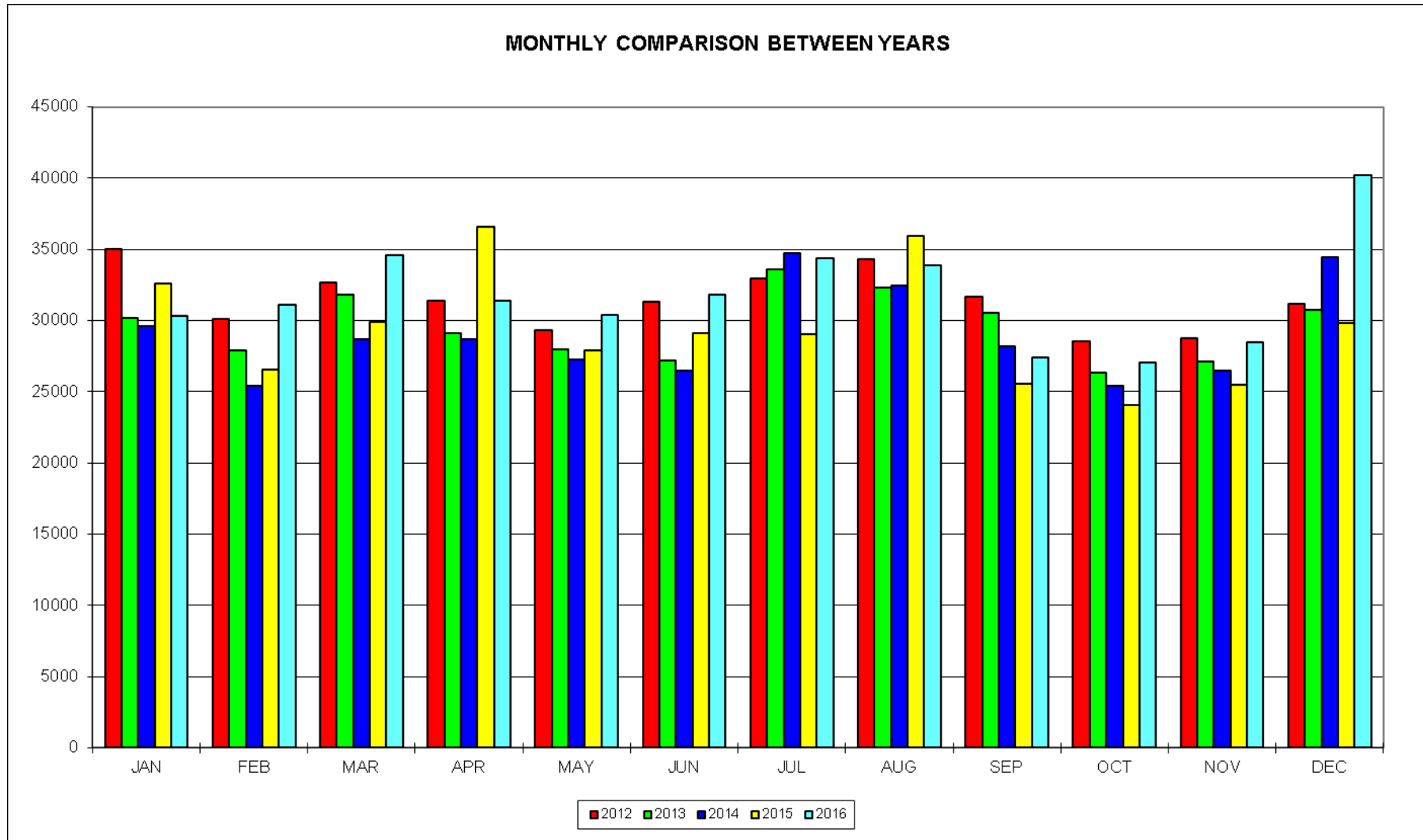


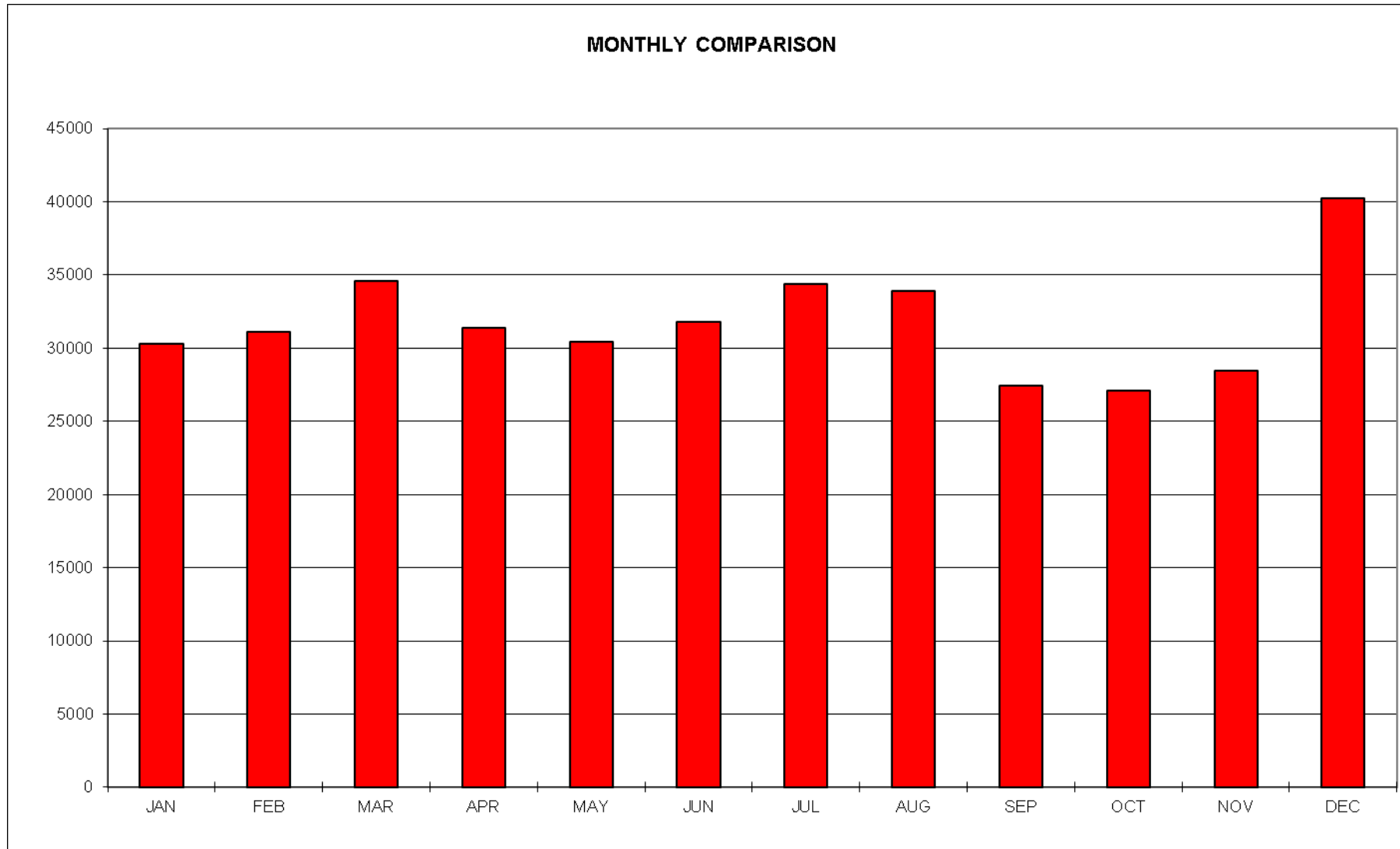
#### 4.4 Appendix 4 - New York

##### RT TRAFFIC COMPARISON

MONTH \ YEAR	2012	2013	2014	2015	2016
JANUARY	34978	30148	29636	32567	30303
FEBRUARY	30110	27882	25399	26551	31135
MARCH	32645	31788	28705	29869	34578
APRIL	31376	29076	28696	36561	31398
MAY	29291	27996	27294	27889	30410
JUNE	31342	27218	26460	29137	31788
JULY	32956	33598	34727	29052	34351
AUGUST	34277	32327	32485	35914	33875
SEPTEMBER	31667	30540	28198	25531	27434
OCTOBER	28546	26307	25405	24084	27068
NOVEMBER	28780	27094	26500	25458	28482
DECEMBER	31170	30738	34431	29821	40216
<b>TOTAL</b>	<b>377138</b>	<b>354712</b>	<b>347936</b>	<b>352434</b>	<b>381038</b>







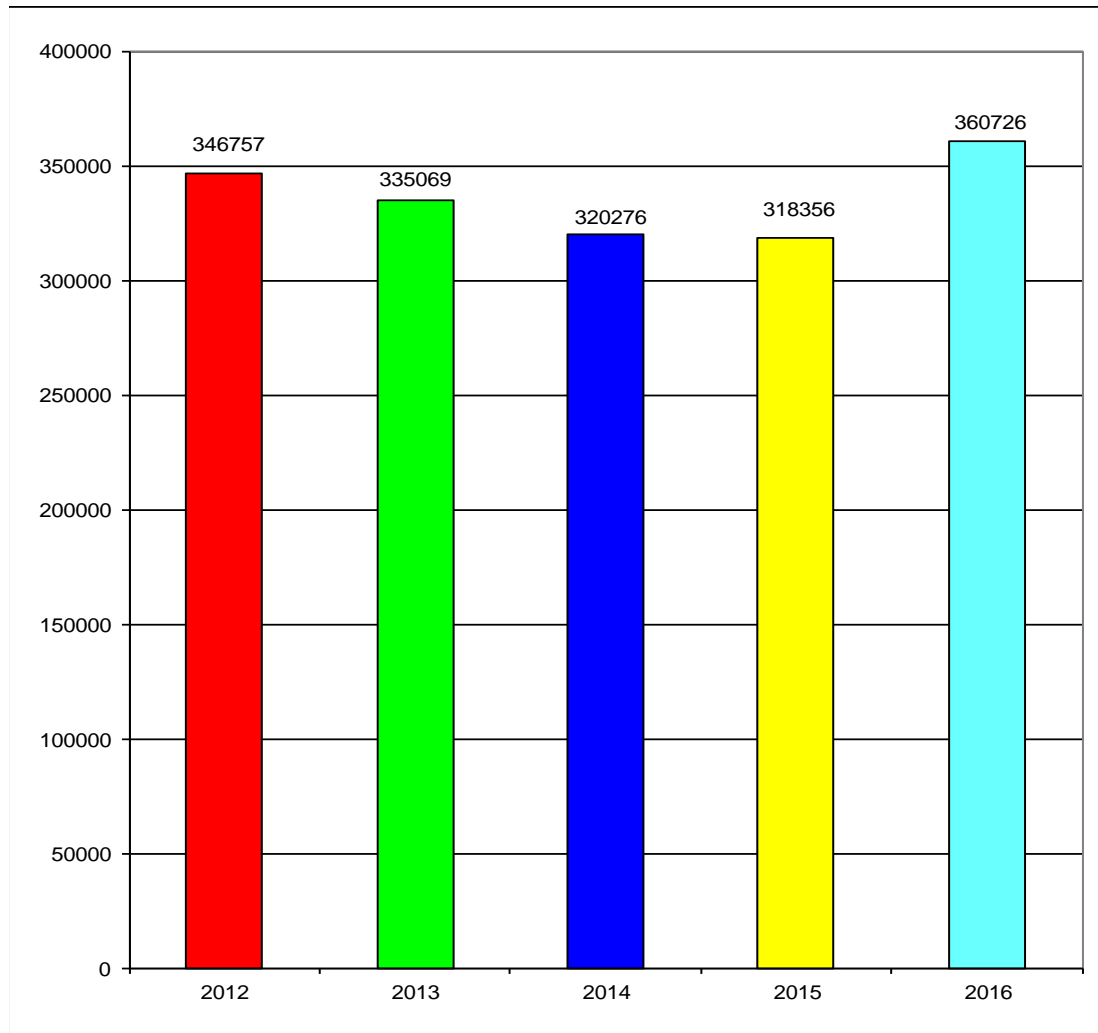
FAMILY	NAT Family A						NAT Family E						GP	SP	TOTALS
	FREQ	QA	TA	VA	YA	ZA	PE/PT	QE	TE	VE	XE	YE	ZE		
MONTH	3016	5598	8906	13306	17946	21964	2962	6628	8825	11309	13354	17952	129,9		
JANUARY	419	4629	1570	4149	19	3	265	3921	2634	163	4253	1252	6901	125	30303
FEBRUARY	53	3137	2516	7474	33	3	87	2816	2646	401	2756	3373	5764	76	31135
MARCH	177	2702	3268	8363	51	3	116	2709	3200	486	5166	1571	6676	90	34578
APRIL	27	2358	2857	5796	89	2	76	2397	2460	1318	8032	333	5532	121	31398
MAY	33	2474	2737	4548	317	0	48	1213	3274	1949	6885	506	6293	133	30410
JUNE	4	923	4779	4155	1587	8	3	596	3662	2066	5643	1691	6576	95	31788
JULY	19	1604	3474	3813	4239	5	3	510	4323	1202	7460	1602	5969	128	34351
AUGUST	34	1834	3770	4474	3457	19	27	802	3498	3209	6420	800	5377	154	33875
SEPTEMBER	331	2715	2137	4879	1428	8	60	1620	2292	5027	2150	183	4486	118	27434
OCTOBER	269	2952	1231	5697	160	0	70	2163	2403	4946	2625	159	4295	98	27068
NOVEMBER	134	3679	1134	5589	132	3	52	3027	2191	6135	2166	42	4117	81	28482
DECEMBER	977	9184	1488	5572	54	1	108	4164	2673	7797	1351	12	6735	100	40216
<b>SUB-TOTALS</b>	2477	38191	30961	64509	11566	55	915	25938	35256	34699	54907	11524	68721	1319	381038
<b>PERCENT %</b>	0,65%	10,02%	8,13%	16,93%	3,04%	0,01%	0,24%	6,81%	9,25%	9,11%	14,41%	3,02%	18,04%	0,35%	100,00%

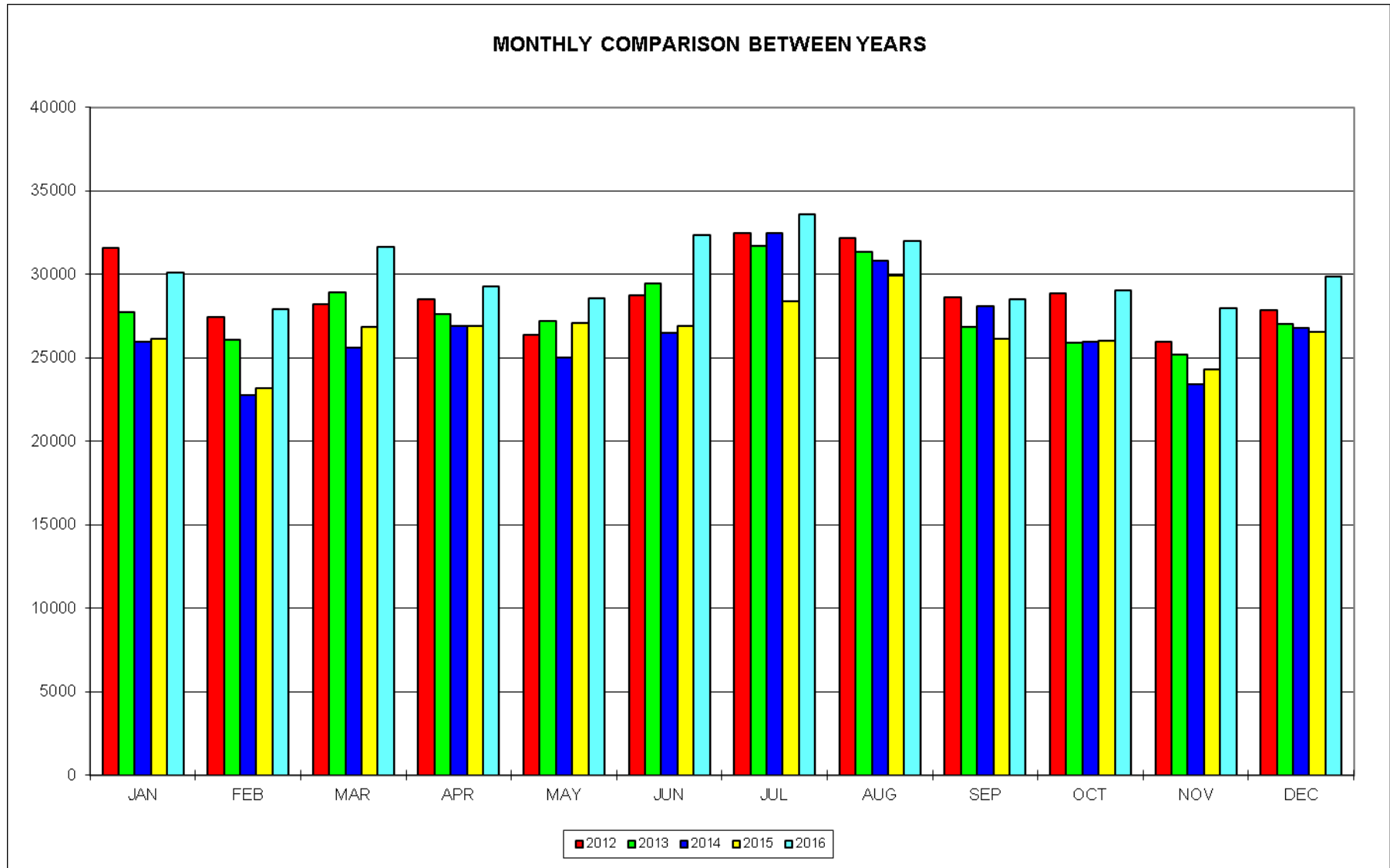
	NAT Family "A"		NAT Family "E"		GP VHF/SP		SP			
QA	2477	0,65%	QE	915	0,24%	129,9	68721	18,04%	1319	0,35%
TA	38191	10,02%	TE	25938	6,81%					
VA	30961	8,13%	VE	35256	9,25%					
YA	64509	16,93%	XE	34699	9,11%					
ZA	11566	3,04%	YE	54907	14,41%					
PE/PT	55	0,01%	ZE	11524	3,02%					
<b>TOTAL</b>	147759	38,78%	<b>TOTAL</b>	163239	42,84%	<b>TOTAL</b>	68721	18,04%	1319	0,35%

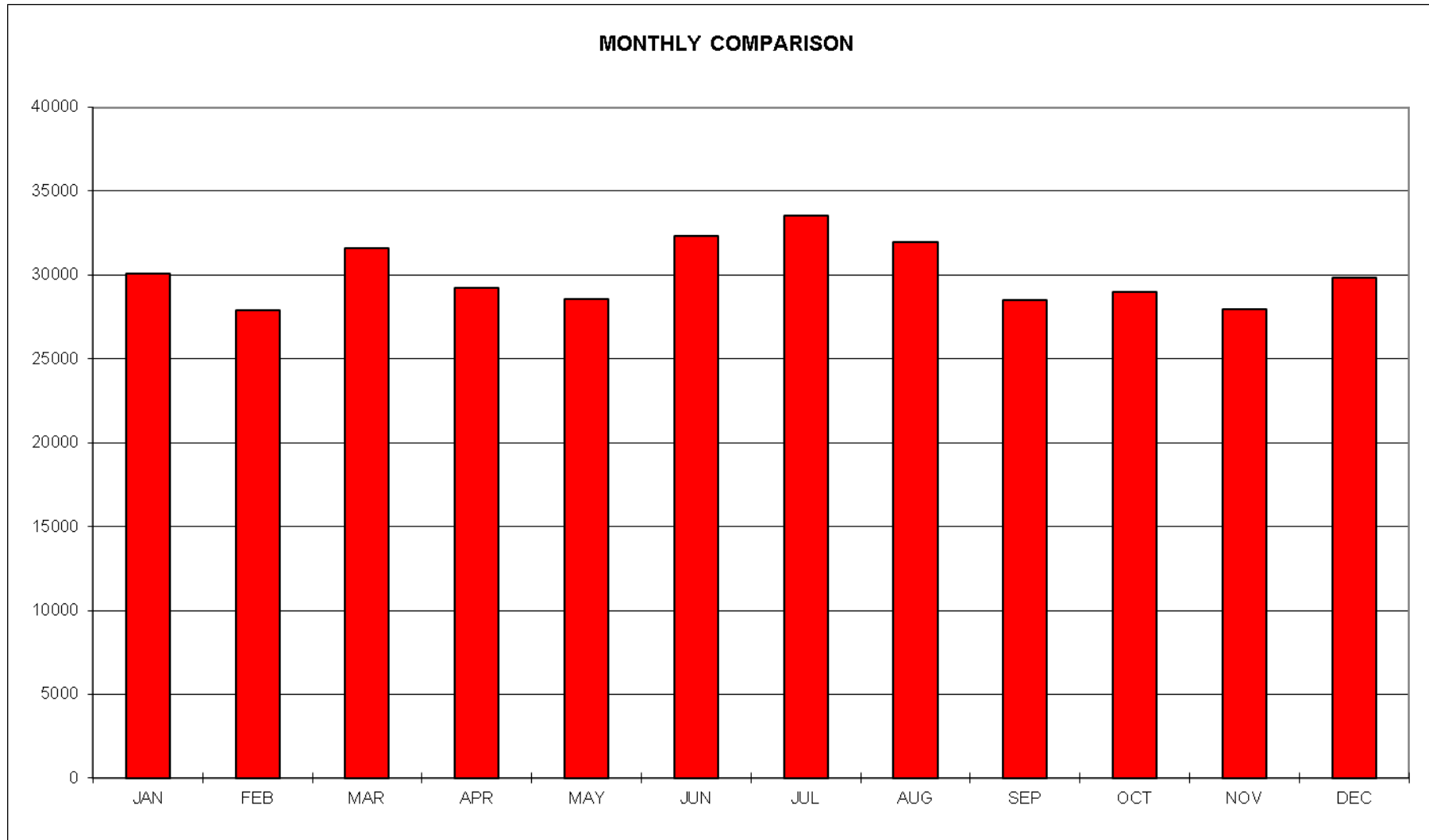
## 4.5 Appendix 5 - Santa Maria

### RT TRAFFIC COMPARISON

MONTH \ YEAR	2012	2013	2014	2015	2016
JANUARY	31553	27742	25988	26133	30111
FEBRUARY	27467	26099	22758	23164	27897
MARCH	28210	28936	25581	26865	31626
APRIL	28505	27601	26928	26904	29264
MAY	26401	27215	24996	27073	28568
JUNE	28715	29425	26515	26893	32343
JULY	32463	31700	32468	28386	33563
AUGUST	32180	31356	30806	29915	31996
SEPTEMBER	28631	26820	28089	26137	28508
OCTOBER	28842	25919	25945	26042	29023
NOVEMBER	25933	25213	23432	24295	27968
DECEMBER	27857	27043	26770	26549	29859
<b>TOTAL</b>	<b>346757</b>	<b>335069</b>	<b>320276</b>	<b>318356</b>	<b>360726</b>







FAMILY	NAT Family A					NAT Family E					RDARA NAT H		GP		SP	TOTALS
	FREQ	QA	TA	VA	YA	ZA	QE	TE	VE	XE	YE	QH	TH	JK		
MONTH	3016	5598	8906	13306	17946	2962	6628	8825	11309	13354	3491	6667	127,9	132,075		
JANUARY	1001	7987	7606	4	0	1	5007	5922	235	0	1005	2	88	1134	119	30111
FEBRUARY	479	6284	8357	1	0	4	3910	6155	737	1	608	6	97	1132	126	27897
MARCH	624	6612	9811	7	0	3	4960	7018	312	0	776	53	171	1127	152	31626
APRIL	345	6407	9216	15	0	3	4481	6217	439	5	779	2	156	1056	143	29264
MAY	36	6060	7673	14	0	1	6055	6955	151	0	109	0	187	1186	141	28568
JUNE	7	7184	9058	16	0	0	6247	7671	312	0	11	21	333	1292	191	32343
JULY	53	5638	10199	10	0	0	6070	8542	625	3	60	427	213	1593	130	33563
AUGUST	74	6205	9251	35	0	0	5976	8008	265	1	242	3	289	1519	128	31996
SEPTEMBER	262	5306	8247	9	0	0	4291	7594	377	0	783	3	350	1151	135	28508
OCTOBER	483	5805	8373	2	0	1	4895	6761	196	0	986	0	271	1106	144	29023
NOVEMBER	554	5114	7941	13	0	1	4185	7063	689	0	1104	3	249	945	107	27968
DECEMBER	685	6209	7949	7	0	3	5323	6562	460	0	1299	75	244	944	99	29859
<b>SUB-TOTALS</b>	4603	74811	103681	133	0	17	61400	84468	4798	10	7762	595	2648	14185	1615	360726
<b>PERCENT %</b>	1,28%	20,74%	28,74%	0,04%	0,00%	0,00%	17,02%	23,42%	1,33%	0,00%	2,15%	0,16%	0,73%	3,93%	0,45%	100,00%

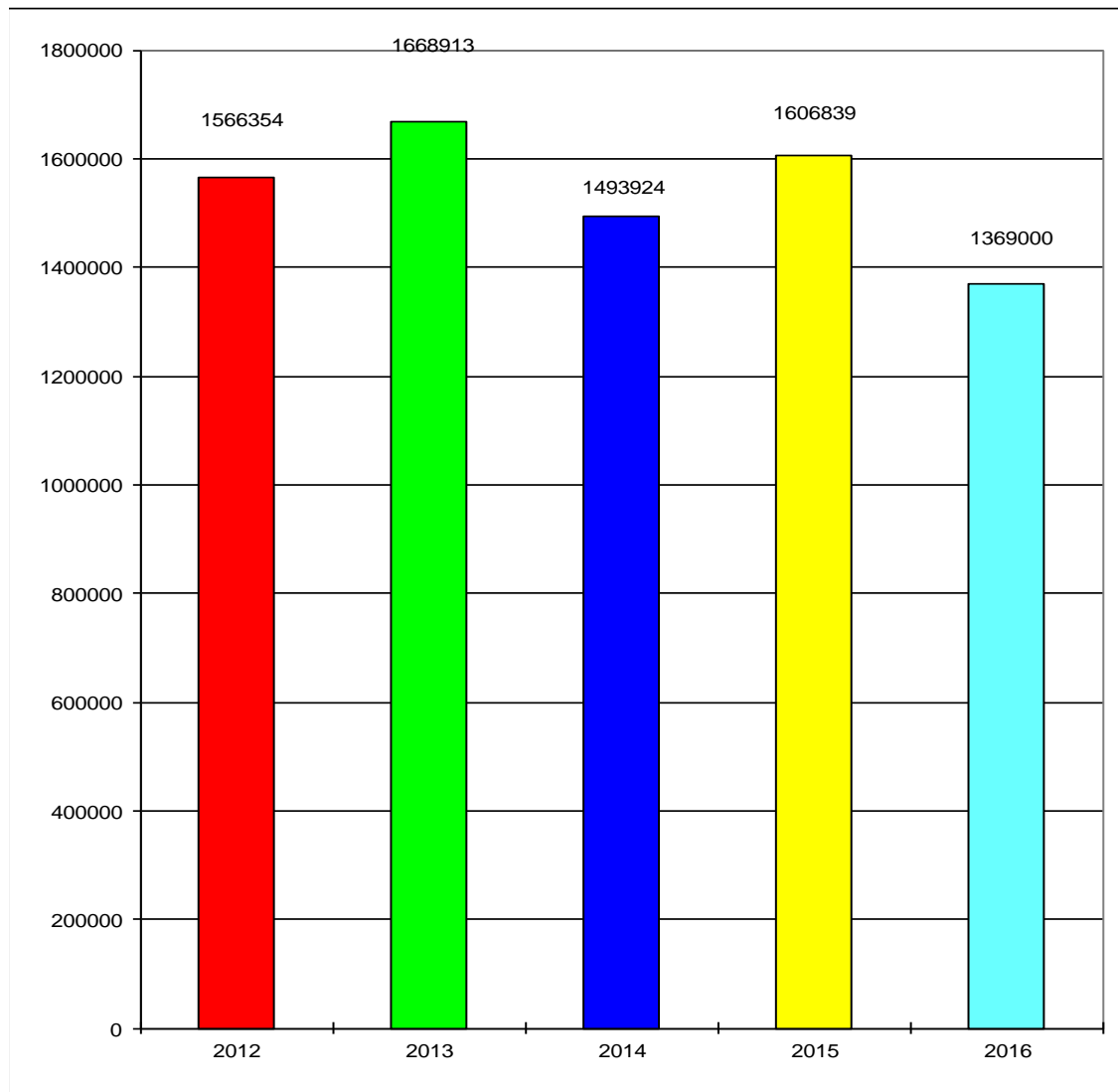
	NAT Family A		NAT Family E		RDARA NAT H		GP VHF		SP							
	QA	TA	VA	YA	ZA	QE	TE	VE	XE	YE	QH	TH	JK	JL	SP	TOTALS
	4603	74811	103681	133	0	17	61400	84468	4798	10	7762	595	2648	14185	1615	360726
	1,28%	20,74%	28,74%	0,04%	0,00%	0,00%	17,02%	23,42%	1,33%	0,00%	2,15%	0,16%	0,73%	3,93%	0,45%	100,00%
<b>TOTAL</b>	183228	50,79%	150693	41,77%	8357	2,32%	16833	4,67%	1615	0,45%						

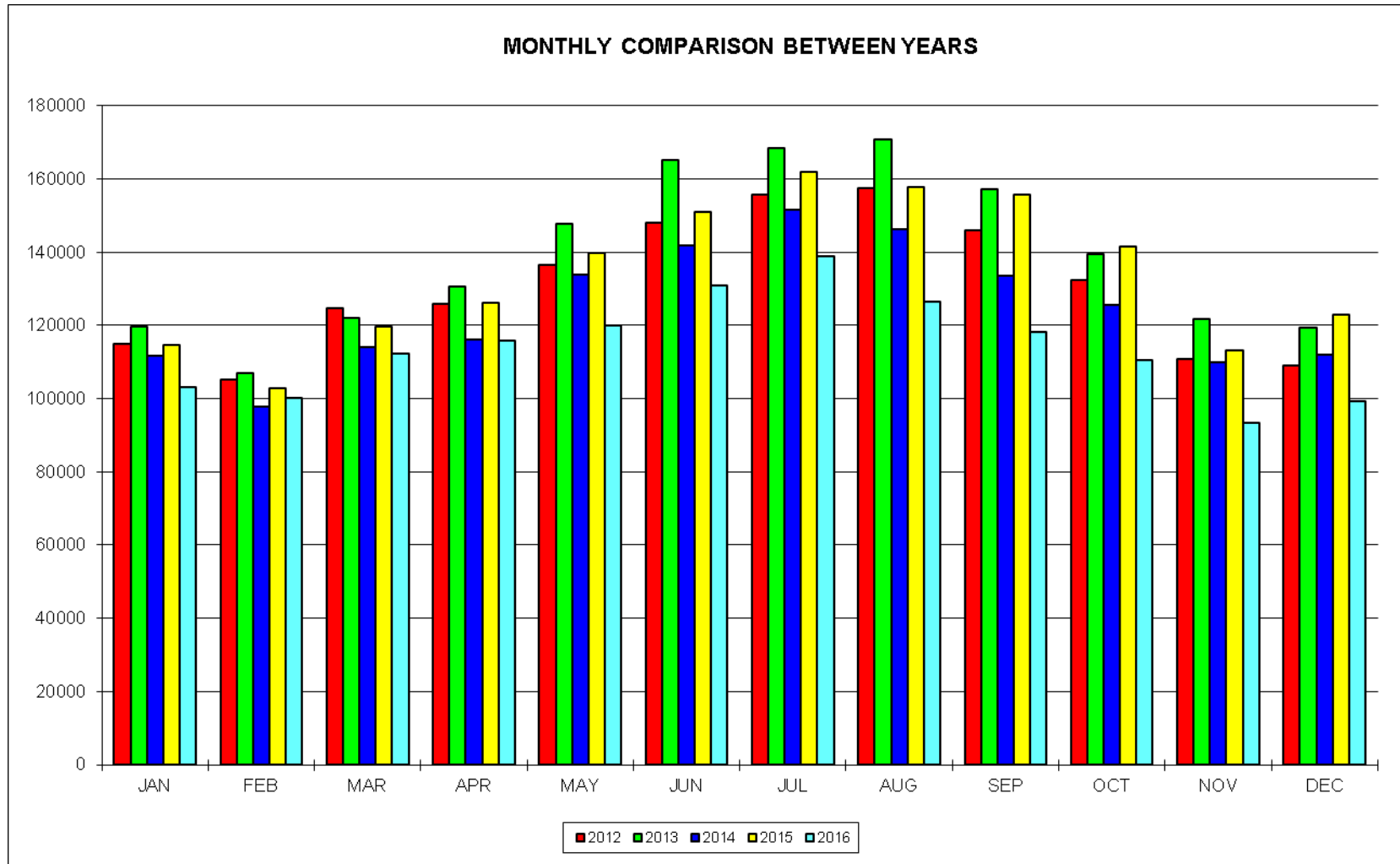


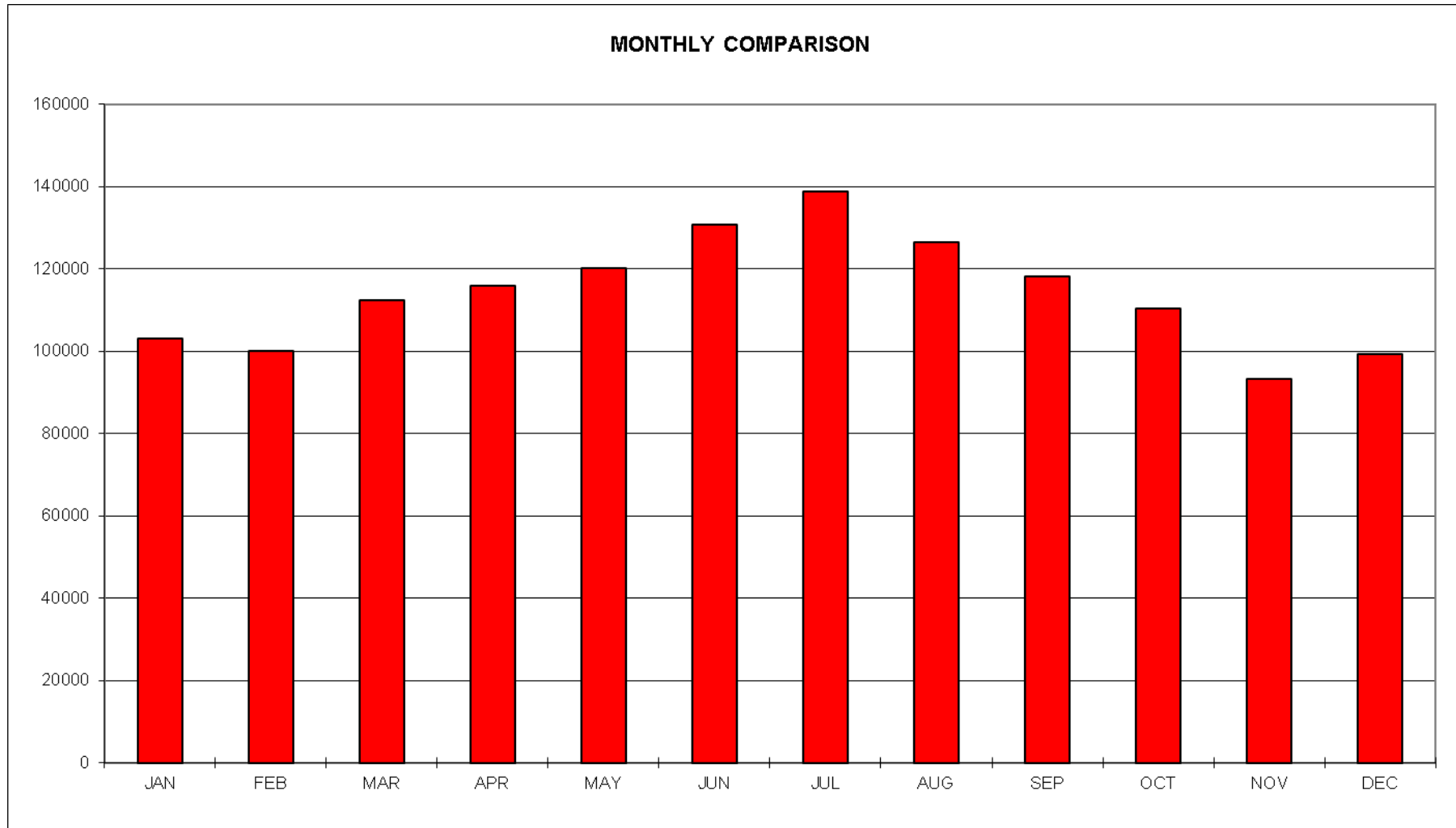
## 4.6 Appendix 6 – Shanwick and Iceland

### RT TRAFFIC COMPARISON

MONTH \ YEAR	2012	2013	2014	2015	2016
JANUARY	114852	119646	111748	114678	103006
FEBRUARY	105039	107104	97811	102771	100171
MARCH	124549	122082	114058	119613	112298
APRIL	125996	130717	116083	126030	115904
MAY	136446	147668	133788	139829	120103
JUNE	148115	165074	141798	150958	130870
JULY	155619	168266	151440	162051	138919
AUGUST	157452	170798	146110	157684	126409
SEPTEMBER	145834	157076	133575	155696	118148
OCTOBER	132419	139516	125600	141621	110448
NOVEMBER	110925	121633	109950	113082	93392
DECEMBER	109108	119333	111963	122826	99332
<b>TOTAL</b>	<b>1566354</b>	<b>1668913</b>	<b>1493924</b>	<b>1606839</b>	<b>1369000</b>







FAMILY	NAT Family A				NAT Family B				NAT Family C				NAT Family D				NAT Family F				RDARA NAT FAMILY "H"				RDARA NAT FAMILY "I"				RDARA NAT FAMILY "J"				GP VHF					SP	TOTALS				
	FREQ	QA	TA	VA	YA	QB	TB	VB	YB/YD	QC	TC	VC	XC	QD	TD	VD	XD	ZA	QF	TF	VF	YF	QH	TH	VH	XH	TL	QI	TI	VI	XI	QL	QJ	TJ	VJ	QK	TK	124,175		126,550	127,850	127,900	129,625
MONTH	3016	5598	8906	13306	2899	5616	8864	13291	2872	5649	8879	11336	2971	4675	8891	11279	17946	3476	6622	8831	13291	3491	6667	8864	10021	5583	2890	6595	10066	2860	3446	6547	8954	2944	4651	124,175	126,550	127,850	127,900	129,625			
JANUARY	0	6	11	0	119	32	3000	0	8164	7990	3780	3	5286	10357	4500	100	0	2124	6276	4	0	2416	7	0	0	2	0	1	0	0	63	5802	0	2088	4294	9293	3876	17281	4327	1690	124	103006	
FEBRUARY	0	109	4	1	38	11	2331	0	29	9127	3975	0	14	5008	4713	49	0	4375	7288	3	0	6430	6	0	0	2	0	0	0	132	7000	0	7564	7514	2951	3804	17513	8510	1528	142	100171		
MARCH	7	4	5	0	17	75	3142	4	6058	12819	4579	8	285	5462	4039	91	0	4006	9081	3	0	3896	2	0	375	4	0	1556	1	0	2	153	8786	0	2748	6306	7149	3802	19736	6311	1676	110	112298
APRIL	1	5	12	0	21	27	3488	0	6205	14929	4465	5	5	3818	4737	115	0	3698	10102	10	0	456	860	1	412	2	0	3775	0	0	1	2226	9412	0	3491	8025	7423	3592	17648	5521	1345	71	115904
MAY	1	10	5	3	11	88	4073	0	5001	16451	4972	6	0	4045	4734	197	0	3063	10583	197	0	354	4725	0	2348	862	0	3614	0	0	0	2468	10828	0	523	9369	499	4947	22487	1869	1695	75	120103
JUNE	1	6	4	0	4	43	4223	0	2273	17204	4807	6	2	5615	5386	200	0	1915	15886	5	0	114	5039	2	3298	4891	0	3367	1	0	1	2020	12151	0	2	5443	312	6030	25693	2252	2582	92	130870
JULY	0	5	12	0	2	26	4295	0	494	18467	4945	10	0	6042	6471	300	0	1655	15909	1	0	0	5098	3	3707	1986	0	5906	0	0	0	3609	12529	0	0	7407	245	7316	27546	2334	2426	173	138919
AUGUST	2	2	9	3	3	41	4276	3	110	18967	4371	3	0	4904	5603	130	1	171	14565	1	0	2109	3306	0	3070	679	0	8783	0	0	0	3922	9912	0	0	6581	304	6327	24559	1949	1707	236	126409
SEPTEMBER	0	2	6	0	305	40	3506	0	2716	14849	3955	2	1829	5483	4767	86	1	8	6609	155	0	1626	3181	2	2591	1664	1	6915	0	0	48	4397	9704	0	649	8034	725	6568	23226	2171	2128	199	118148
OCTOBER	0	36	6	0	167	372	2855	0	5083	11935	3971	1	2786	4755	4478	88	1	172	3118	8	0	1207	3558	1	2598	683	1	6071	0	0	0	5686	8173	0	1964	9853	868	5284	20726	2237	1739	167	110448
NOVEMBER	0	6	5	0	154	60	2613	0	8242	7678	3306	0	4292	4014	4543	85	0	18	1801	3	0	945	1959	0	1	3215	0	3277	0	0	0	8970	7444	0	1619	2464	733	4402	18442	1682	1278	141	93392
DECEMBER	2	13	7	0	18	33	2868	0	10087	7424	3980	2	4905	4602	4326	64	0	42	9	5	0	3918	1691	0	5	5139	0	2798	0	0	3	8897	7815	0	1939	409	1108	4206	18697	2001	2109	210	99332
SUB-TOTALS	14	204	86	7	859	848	40670	7	54462	157830	51106	46	19404	64105	58297	1505	3	21247	101227	395	0	23471	29432	9	18405	19129	2	46063	2	0	55	42543	109556	0	22587	75499	31610	60154	253354	41164	21903	1740	1369000
PERCENT %	0.00%	0.01%	0.01%	0.00%	0.06%	0.06%	2.97%	0.00%	3.98%	11.53%	3.73%	0.00%	1.42%	4.68%	4.26%	0.11%	0.00%	1.55%	7.39%	0.03%	0.00%	1.71%	2.15%	0.00%	1.34%	1.40%	0.00%	3.36%	0.00%	0.00%	0.00%	3.11%	8.00%	0.00%	1.65%	5.51%	2.31%	4.39%	18.51%	3.01%	1.60%	0.13%	

	NAT Family A		NAT Family B		NAT Family C		NAT Family D		NAT Family F		RDARA NAT FAMILY "H"		RDARA NAT FAMILY "I"		RDARA NAT FAMILY "J"		GP VHF			SP																								
QA	14	0.00%	QB	859	0.06%	QC	54462	3.98%	QD	19404	1.42%	QF	21247	1.55%	QH	23471	1.71%	QI	2	0.00%	QJ	42543	3.11%	124,175	31610	2.31%	1740	0.13%																
TA	204	0.01%	TB	848	0.06%	TC	157830	11.53%	TD	64105	4.68%	TF	101227	7.39%	TH	29432	2.15%	TI	46063	3.36%	TJ	109556	8.00%	126,550	60154	4.39%																		
VA	86	0.01%	VB	40670	2.97%	VC	51106	3.73%	VD	58297	4.26%	VF	395	0.03%	VH	9	0.00%	VI	2	0.00%	VJ	0	0.00%	127,850	253354	18.51%																		
YA	7	0.00%	YB/YD	7	0.00%	XC	46	0.00%	XD	1505	0.11%	YF	0	0.00%	XH	18405	1.34%	XI	0	0.00%	QK	22587	1.65%	127,900	41164	3.01%																		
									ZA	3					TL	19129	1.40%	QL	55	0.00%	TK	75499	5.51%	129,625	21903	1.60%																		
TOTAL	311	0.02%	TOTAL	42384	3.10%	TOTAL	263444	19.24%	TOTAL	143314	10.47%	TOTAL	122869	8.98%	TOTAL	90446	6.61%	TOTAL	46122	3.37%	TOTAL	250185	18.28%	TOTAL	408185	29.82%	1740	0.13%																

= End =