

PBN IMPLEMENTATION PROJECT

EN-ROUTE OPERATIONS

SHORT TERM

SAM REGION

Introduction

The purpose of this document is to detail the activities of the Short-term Performance-Based Navigation Implementation Project for En-Route Operations in the South American Region in relation to RNAV-5 implementation. It also specifies the results that should be obtained from each of the activities of the action plan.

Project RLA 06/901 will carry out the activities of the PBN Project for En-Route Operations in the SAM Region, with the support of States and International Organizations. Project 99/901 will provide support in the areas concerning fleet navigation capacity and aircraft and operator approval documentation.

The Short Term Action Plan for En-Route Operations is shown in **Attachment 1**.

PBN Implementation – En-Route Operations - Short Term

1. Airspace Concept

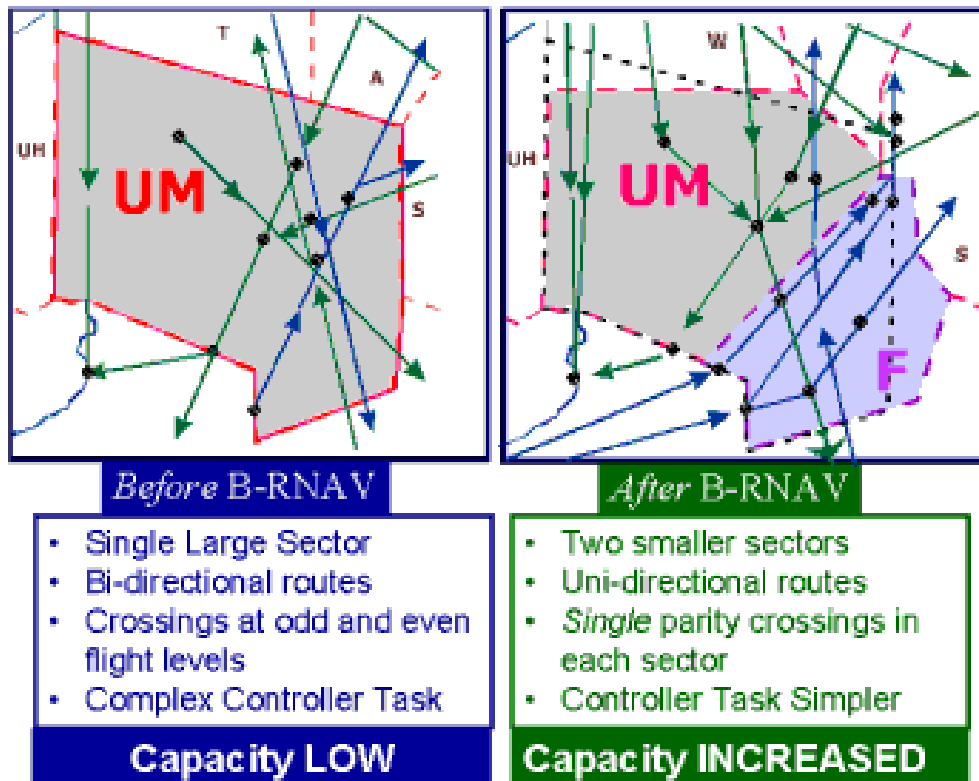
The Airspace Concept provides the scheme of operations within an airspace and is developed to meet explicit strategic objectives, such as safety enhancement, adjustment of service provision to air traffic growth, environmental impact mitigation capacity, etc. The Airspace Concept must include details about the practical organization of the airspace, based on user characteristics and on the CNS/ATM infrastructure in place or to be implemented. Further details about the Airspace concept can be found in the PBN Manual, Volume I, Chapter 2.

1.1. Establish and prioritize strategic objectives (safety, efficiency, the environment, etc.).

RNAV-5 implementation in the SAM Region will address mainly the following Strategic Objectives:

- a) Safety – At present, there is no formal airworthiness certification and operational approval process for flights in RNAV routes in the SAM Region. Implementation of RNAV-5, which is the least demanding navigation specification in terms of airborne equipment, will make it possible to formalize and harmonize the use of RNAV in new and existing RNAV routes, and will provide the necessary conditions for a complete restructuring of the route network. This will permit the development of an optimized route network, thus reducing conflict points and, as a result, increasing safety.
- b) Capacity – The reduction in airspace complexity and the resulting decrease in controller workload will enhance sector ATC capacity, thus permitting a larger number of flights.
- c) Cost-effectiveness –PBN implementation will enable a larger number of aircraft to fly their optimum flight profiles, offering users a better cost-effectiveness ratio.
- d) Efficiency - RNAV-5 application will improve operational efficiency through:
 - ✓ Improvements in airspace management via the repositioning of intersections
 - ✓ Better use of available airspace by means of a route structure that will allow for the establishment of:
 - More direct routes (double and parallel, if necessary) to accommodate a larger air traffic flow
 - A “bypass” route for aircraft overflying TMAs with high air traffic density
 - Alternate or contingency routes
 - Optimum in-flight holding positions
 - Optimized feeder routes

- ✓ Reduction of distances flown, resulting in a fuel saving
 - ✓ Reduction in the number of radio navigation aids
- e) Environmental Protection – Increased efficiency and fuel savings will reduce noxious gas emissions into the atmosphere. Furthermore, the application of specific procedures may help reduce aircraft noise (e.g., continuous descent approach – CDA).
- f) Access and Equity – PBN implementation shall not prevent the flight of unapproved aircraft in a given airspace unless absolutely necessary due to air traffic density. Access and equity are expected to be addressed in this way.
- g) Global Interoperability – RNAV application, as provided for in the PBN Manual, will guarantee global interoperability through the application of standard navigation specifications, thereby avoiding the need to obtain various aircraft and operator approvals in order to fly in airspaces that use the same navigation application.
- h) ATM Community Participation– The success of PBN implementation will depend upon the effective participation of the ATM community, with a view towards guaranteeing that the operational requirements of both the different airspace users and the service providers are met.



1.2. Collect air traffic data in order to understand air traffic flows within a particular airspace.

Domestic and international RNAV routes already handle the main traffic flows. Even so, aircraft operators continue to request new RNAV routes, which must be assessed from the viewpoint of their application, in order to be able to favour the main air traffic flows. It is important to note that the composition and mix of RNAV and non-RNAV routes add complexity to the airspace and prevent a better air traffic management in the SAM Region. The elimination of unused and “conventional” routes should be the first step toward optimizing the route network, depending upon the analysis of the fleet navigation capacity, which will be considered in paragraph 1.3 below. Furthermore, the complete restructuring of the route network in the SAM Region should be undertaken simultaneously with the route implementation, elimination and realignment strategy. This activity will require the creation of an aircraft movement database, in order to precisely identify air traffic flows in the region.

Attachment 2 contains graphic information about the use of the main ATS routes in the Region, by FIR. **Attachment 3** presents graphs showing the city pairs with the largest number of flights, by FIR. The same air traffic sample for which CARSAMMA data were collected over the period of 13 to 28 January 2008 for the RVSM safety assessment was used to prepare the graphs. As a result, only flights between FL 290 and FL 410 were considered. Full information may be obtained at the SAM Office website.

1.3. Analyze fleet navigation capacity

ICAO is developing a global system to register operator certificates and the corresponding operating specifications. This registry will offer access to information about the authorized operating specifications of any commercial aircraft and is expected to be ready within 5 years.

Given the specific requirements of the SAM Region, it will be necessary to create a PBR regional database before the deadline set by ICAO, in order to make it possible to verify aircraft PBN capacity from the registration data for each aircraft operating in the region.

A survey must first be conducted, so that Civil Aviation Authorities (CAA) can collect the necessary information for the creation of that database.

CAAs shall complete the survey by phases given the complexity of obtaining PBN information for all aircraft operating in the SAM Region. This survey shall include a specific table for each Navigation Specification, making easy and direct consultation by aircraft operators possible, in order to determine whether a specific aircraft is eligible for a given Navigation Specification based only on the list of its installed avionics. An example of the list used by the FAA, which is applicable to RNAV-1 and RNAV-2 navigation specifications, can be found at http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs470/media/AC90-100compliance.xls.

Once the database of PBN-Approved Aircraft and Operators has been created, it will be necessary to compare it with the air traffic movement in the Region, in order to determine the number/percentage of operations that would be carried out by the aircraft approved for each of the

navigation specifications that are expected to be applied in the short term (RNAV-5, RNAV-1, RNP-APCH). In this way, the feasibility of implementation can be determined. The graphs showing the distribution of air traffic movement, of the main operators and types of aircraft, by FIR, are included in **Attachment 5**. In this case, CARSAMMA data for the period 13 - 28 January 2008 was also considered. Complete information can be found at the SAM Office website.

1.4. Analyze the ground communication, navigation (VOR, DME) and surveillance infrastructure for navigation specifications, in order to comply with the Navigation Specification and the navigation reversal mode.

The ground communication, navigation (VOR, DME) and surveillance infrastructure is of fundamental importance for RNAV-5, both to permit the application of that navigation specification and to guarantee the navigation reversal mode in case of loss of the GNSS signal, considering that:

- a) The application of a single RNAV system consisting of one or more sensors, an RNAV computer, a control display unit and a navigation display (HSI, CDI, etc.) can assure the required minimum level of availability and integrity. This is acceptable if the system is monitored by the crew and if the aircraft is capable of navigating using a ground-based navigation system (VOR, DME) in case of a system failure. Therefore, aircraft must fly within the service area of one of the ground-based navigation systems, in order to permit a navigation reversal to a “conventional” system, if needed for safety purposes.
- b) Inasmuch as this is an RNAV specification that does not require on board performance monitoring and alerting systems, ATS surveillance can mitigate the requirement for greater route spacing in order to remedy possible navigation systems failures undetected by the flight crew.
- c) Another basic requirement for RNAV-5 implementation is direct controller-pilot communication, considering that, for the reasons explained in “a” and “b” above, reversion to another navigation system and/or the observation by the controller of the aircraft possible “exit” from its planned flight path, will make an immediate controller-pilot contact necessary.

A full evaluation of the VOR/DME and DME/DME infrastructure will be necessary in order to verify the possibility of implementing the RNAV-5 navigation specification with the use of VOR/DME and/or DME/DME. The information available at this time does not permit this analysis. It is important to stress that in airspaces where this coverage is not available, RNAV-5 can be applied with the use of GNSS and of INS, the latter being limited to 2 hours of flight without a system update.

1.5. Optimize airspace structure by reorganizing the route network or implementing new routes based on the strategic objectives of the Airspace Concept, considering Airspace Modelling, ATC Simulations (in fast time and/or real time), and live trials, etc.

The optimization of airspace structure through a complete reorganization of the route network is the strategy that will guarantee the efficiency of en-route operations in the SAM Region. Because of the complexity and extension of the route network, however, this strategy cannot be carried out in the short term. A short-term strategy should be to optimize the existing network by implementing new routes and, particularly, eliminating unused RNAV or “conventional” routes. The SAM/IG could, after assessing the aircraft fleet navigation capacity and CNS infrastructure, recommend the exclusionary implementation of RNAV-5 within a given airspace volume, between FL 290 and FL 410, for example. If that application is possible, it will, consequently, also be possible to eliminate existing “conventional” routes and to implement a larger number of new RNAV routes to replace routes that have been eliminated, as well as to completely review all existing RNAV routes. In order to be successful with this new route structure, it will be necessary to establish well-defined departure and arrival points in the main TMAs of the Region, in order to favour the main traffic flows.

In the case of a complete restructuring of the route network, Project RLA 06/901 shall consider using the following tools:

- a) airspace modelling;
- b) Fast Time Simulation (FTS);
- c) Real Time Simulation (RTS);
- d) live ATC trials

Use of these tools is not necessary for simple airspace modifications like the implementation of a new RNAV route. But for more complex airspace changes, these tools can provide essential information for guaranteeing efficiency and safety. More information about these tools can be found in the PBN Manual, Volume I, part B, item 4.3.2.

Use of a specific methodology established in the Guide for the Implementation of RNAV Routes in the CAR/SAM Regions, approved in Conclusion 12/7 of GREPECAS/12, should be considered for reorganizing the route structure and/or RNAV route implementation, realignment or elimination.

Route implementation requires the establishment of route spacing and aircraft separation. To accomplish this, it will be necessary to hire experts to make the necessary assessment or to perform a comparative analysis, with other airspaces, for example. The studies made in Europe led to the following route spacing values:

- a) Without additional workload for the air traffic controller:
 - ✓ 18 NM for bi-directional routes;
 - ✓ 16.5 NM for one-way routes; and
 - ✓ 15 NM if aircraft in adjacent routes (opposite directions) do not use the same cruising levels and the percentage of climbs and descents is 40% or less.

- b) When monitoring through ATS surveillance is feasible and ATC intervention capacity is available, a reduction in route spacing to 10-15 NM is possible.
- c) In cases where the application of reduced spacing had been considered, data had to be obtained in order to establish RNAV performance on RNAV-5 routes in Europe.

RNAV-5 approval requirements will enable most aircraft equipped with RNAV systems to meet such requirements. RNAV-5 use does not require a navigation database and does not specify the fulfilment of ARINC 424 leg types. The RNAV-5 Navigation Specification does not meet the requirements for RNAV operations in complex TMAs. RNAV-5 may be used above the MSA, depending on path spacing requirements in the TMAs involved. The purpose of RNAV-5 requirements is to establish RNAV capacity as soon as possible, without any need for significant changes in the airborne equipment of most aircraft.

2. Develop a performance measurement plan, including gas emissions, safety, efficiency, etc.

Performance-Based Air Traffic Management is organized based on the principle that ATM community expectations can best be met by quantifying those needs. Therefore, a series of performance objectives, goals and indicators should be established that would make it possible to objectively justify projects that seek to implement performance improvements in the air traffic management system.

The estimated future performance of the ATM system will be of fundamental importance in guiding the planning of the improvements to be implemented. Research and development initiatives should be organized to foster risk analysis in the following situations:

- a) the consequences of keeping the current ATM system status unchanged. In this case, the ATM system would be subject to changes outside the scope of operation of the service provider, such as: air traffic growth, changes in the fleet mix, etc.; and
- b) the consequences of making changes that do not generate the expected improvement in system performance, therefore ceasing to meet established performance goals.

In the case of simple implementations, such as an RNAV route the Key Performance Areas (KPA) involved are safety, efficiency and environmental protection. Safety can be measured qualitatively through a safety case. This possibility will be better described in the specific point on Safety Assessment. Efficiency and environmental protection are intrinsically related, inasmuch as an increase in efficiency normally results in a reduction in fuel consumption, thereby decreasing the amount of gas emissions released into the atmosphere. RNAV route implementation must at least measure the expected savings in flying time and fuel. It is important to stress that the implementation of an RNAV route will not always result in a reduction in flying time, inasmuch as the purpose for its implementation could be, for example, to simplify TMA entry and exit flows, thus reducing the workload of air traffic controllers and, consequently, increasing ATC capacity. In this case, a longer route could possibly create the necessary conditions for the use of continuous descent approach (CDA) procedures.

In more complex implementations, such as a complete restructuring of the route network, the performance assessment will normally depend upon the use of specific tools like Fast Time Simulation, because a full and integrated assessment of the system will be needed that would be difficult to perform manually. Therefore, if the SAM/IG decides on the complete restructuring of the route network, it will be necessary to study alternatives for using the necessary assessment tools.

PBN implementation should consider at least the savings in flying time and fuel consumption, as well as the reduction of noxious gas emissions into the atmosphere. IATA has developed a fuel saving calculation template that can be used to measure system performance. This template can be obtained at the SAM Office website.

3. Safety Assessment

3.1. Determine the methodology to be used for assessing airspace safety and route spacing, depending upon the navigation specification, considering the airspace model, ATC (fast time and/or real time) simulations, and live ATC trials, etc.

Airspace safety assessment methodology may be either quantitative or qualitative. An example of a quantitative method is the safety assessment applied to RSVM implementation and post-implementation. These quantitative methods are based on the Collision Risk Model (CRM) and require the use of experts in specific areas, such as Statistics and Mathematics. CARSAMMA will be responsible for the safety assessment for en-route PBN application. However, this safety assessment would be justified only in the case of major airspace changes such as the complete restructuring of the route network in a significant volume of airspace. Examples of Collision Risk Models used in safety assessments can be found in DOC 9689 – Manual on the Airspace Planning Methodology for Determining Separation Minima.

A qualitative assessment based on the operational judgment would be more advisable in the case of lone route implementation. This type of assessment should be documented through an SMS methodology-based safety case. Doc. 9859, the ICAO Safety Management Manual, and United Kingdom Doc. CAP 760 (Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases) offer examples of systematic use of this methodology. The latter document can be found at the following website: <http://www.caa.co.uk/docs/33/CAP760.PDF>

Another matter to be considered is the need to calculate route spacing on the basis of the specific characteristics of a given airspace, such as passing frequency, air traffic volume, lateral deviations, etc. This method is based on quantitative methods using CRM.

- 3.2. Prepare a data collection programme for the airspace safety assessment.

In order to prepare the data collection programme, the SAM/IG shall decide upon the safety assessment strategy, considering whether the assessment should be quantitative or qualitative. In the case of complete route network restructuring, CARSAMMA should indicate which data are needed for the safety assessment and/or determining the route spacing to be applied in the SAM Region.

- 3.3. Prepare the preliminary airspace safety assessment.

The preliminary airspace safety assessment should be completed before the implementation date, in order to guarantee the necessary conditions for the start of the pre-operational phase, which normally takes one year.

- 3.4. Prepare the final airspace safety assessment.

The final airspace safety assessment is usually performed one year after the implementation date, which will guarantee the start of the operational phase of a route or of a route network.

4. Establish a collaborative decision-making process (CDM)

The objective of the collaborative decision-making process is to guarantee that all actors involved in the implementation participate in the different phases of the project, thereby guaranteeing its transparency and adjustment to the interests of all users and service providers.

- 4.1. Coordinate planning and implementation needs with air navigation service providers, airports, regulators, users, aircraft operators and military authorities.

The SAM/IG meetings coordinate most of the planning and implementation needs, bearing in mind the involvement of most of the actors that should participate in the process. Nonetheless, the participating States should ensure that the interests of actors not represented at SAM/IG meetings are also taken into account in the planning and implementation, such being, for example, general aviation, military flights, air navigation service providers (when the representatives in the SAM/IG involve only regulators), etc.

- 4.2. Establish the implementation date.

The implementation date is one of the main project aspects to be taken into account, bearing in mind that it may possibly be adjusted to the interests of the various actors involved.

- 4.3. Establish the documentation format at the CAR/SAM RNAV/RNP website.

The Internet is an important mechanism for disseminating PBN documentation to all actors involved in its implementation. The SAM/IG Meeting should decide the form to be given to the website, so that PBN supporting documents can be posted there. The South American Regional Office already has a website for the PBN: <http://www.lima.icao.int/submenu1.asp?Url=/ICAOSAMNET/AirNav-eDocumentsMenu.asp>. This website appears to be “hidden,” however, and does not facilitate access by those involved in PBN implementation in the Region.

4.4. Report advances in planning and implementation to the relevant Regional office.

Planning and implementation advances will be made known to the South American Regional Office through the reports of SAM/IG meetings. It will also be necessary to set up a mechanism to ensure the harmonization of CAR and SAM implementation. Several members from the CAR Region expressed their interest, at the Sixth Meeting of the GREPECAS ATM Committee, in participating in SAM/IG meetings with a view towards achieving joint CAR/SAM implementation by following the same RVSM implementation model. In this connection, the SAM/IG/2 Meeting should study the advisability of adopting a mechanism similar to that used for RVSM implementation for PBN en-route implementation.

5. Automated ATC Systems

5.1. Assess PBN implementation in automated ATC systems, considering amendment 1 to the PANS/ATM (FPLSG).

Making changes in the automated ATC system as a result of PBN implementation is closely related to the need of the air traffic controller to differentiate between aircraft that are equipped for operations based on RNAV and RNP navigation specifications, and those that are not. That differentiation is particularly important in operating environments where aircraft separation depends upon aircraft PBN approval. Changes in automated systems may vary in complexity, from the insertion of letters or codes in the flight progress cards and/or in the radar screen targets, to a complete change involving differentiated colours or a prior analysis before a flight plan is entered into the flight plan processing system, in order to guarantee that only approved aircraft may fly an RNAV route or perform an RNP procedure at the FPL.

Changes in automated ATC systems must consider amendment 1 to the PANS/ATM. This amendment, resulting from the work of the ICAO Air Navigation Commission Study Group on Flight Plans, was approved at the 177th Session of that Commission and will enter into effect on 15 November 2012. States were informed of the approval of amendment 1 to the PANS/ATM through ICAO State Letter AN 13/2.1-08/50, of 25 June 2008.

The amendment involves making significant changes in the insertion of alphanumeric codes relating to RNAV and RNP approval that are of key importance for PBN implementation. Considering the present flight plan limitations, most of these codes will be inserted in field 18. To sum up, the changes concerning PBN are as follows:

- a) The name of FPL field 10 is changed to “Equipment and Capabilities”;
- b) The letter “R” in field 10 is changed to mean “PBN Approval”. Navigation specifications for which the aircraft and operator are approved should be inserted in FPL field 18, using the following codes:

- RNAV SPECIFICATIONS

- ✓ A1 - RNAV 10 (RNP 10)
- ✓ B1 - RNAV 5 all permitted sensors

- ✓
- ✓ B2 - RNAV 5 GNSS
- ✓ B3 - RNAV 5 DME/DME
- ✓ B4 - RNAV 5 VOR/DME
- ✓ B5 - RNAV 5 INS or IRS
- ✓ B6 - RNAV 5 LORANC
- ✓ C1 - RNAV 2 all permitted sensors
- ✓ C2 - RNAV 2 GNSS
- ✓ C3 - RNAV 2 DME/DME
- ✓ C4 - RNAV 2 DME/DME/IRU
- ✓ D1 - RNAV 1 all permitted sensors
- ✓ D2 - RNAV 1 GNSS
- ✓ D3 - RNAV 1 DME/DME
- ✓ D4 - RNAV 1 DME/DME/IRU
- RNP SPECIFICATIONS**
- ✓ L1 - RNP 4
- ✓ O1 - Basic RNP 1 all permitted sensors
- ✓ O2 - Basic RNP 1 GNSS
- ✓ O3 - Basic RNP 1 DME/DME
- ✓ O4 - Basic RNP 1 DME/DME/IRU
- ✓ S1 - RNP APCH
- ✓ S2 - RNP APCH with BARO-VNAV
- ✓ T1 - RNP AR APCH with RF (special authorization required)
- ✓ T2 - RNP AR APCH without RF (special authorization required)

- c) The letter “G” continues to be used in field 10 to mean “Equipped with GNSS.” The corresponding augmentations should be entered in field 18, using the NAV code.

5.2. Make the necessary changes in the automated ATC systems.

Making changes in automated ATC systems is usually a complicated, expensive and slow process for most States. As a result, only changes that are deemed essential for safety and efficiency purposes shall be made. Two main scenarios are possible in the case of PBN en-route implementation:

- a) RNAV and non-RNAV routes combined – in this scenario, use of the automated ATC system would be limited to “investigating” whether the aircraft is effectively approved for flight on the RNAV route. This investigation could be made offline, through the comparison of air traffic samples with a database of approved aircraft, in the same way that CARSAMMA and the States do in the case of RVSM operations. In this scenario, aircraft separation is not considered to be dependent upon RNAV approval. In the case of RNAV routes in which the separation depends upon RNAV approval, a greater degree of ATC automation will be needed to indicate to the air traffic controller which aircraft have RNAV approval and which do not.
- b) The existence in this scenario of exclusionary RNAV airspaces (with or without special exceptions--State aircraft, humanitarian flights, first delivery, etc.) means that route spacing will depend upon aircraft RNAV approval and ATC automation will be essential to indicate the approval status of aircraft to the air traffic controller.

6. Aircraft and operator approval

6.1. Analyze the requirements for aircraft and operator approval (pilots, dispatchers and maintenance personnel), as established in the PBN Manual, and prepare the necessary documentation.

The PBN Manual, Volume II, Part B, Chapter 2 stipulates the general requirements for aircraft and operator approval for RNAV-5. EUROCONTROL and the FAA have the following documents:

- a) EUROCONTROL - AMC 20-4 - Airworthiness Approval and Operational Criteria for the Use of Navigation Systems in European Airspace Designated for Basic RNAV Operations.
- b) FAA – AC 90-96A - Approval of U.S. Operators and Aircraft to Operate under Instrument Flight Rules (IFR) in European Airspace Designated for Basic Area Navigation (B-RNAV) and Precision Area Navigation (P-RNAV).

6.2. Publish national regulations for implementing the RNAV-5 navigation specification.

The navigation specifications in the PBN Manual identify the operational and airworthiness approval requirements for the use of RNAV or RNP applications. Provision must be made in national operational regulations for checking compliance with these requirements, which may require specific operational approval.

The RLA/99/901 Project is preparing the Latin American (LAR) Regulations, whose purpose is to harmonize the operational and airworthiness approval process in Latin America. Regional documentation provided through the LARs is expected to be available shortly. Coordination between this project and Project RLA 06/901 is fundamental for avoiding a duplication of efforts and facilitating the work of the States involved. Project RLA 99/901 could at least offer guidance material for adoption and publication by the States.

One option already in use by CAR/SAM States has been to adopt documents of other States and International Organizations, as in the case of Interim Guidance 91 (RVSM) and Order 8400-12 (RNP-10).

6.3. Start the aircraft and operator approval process.

In order to meet the established implementation deadline, States should start the aircraft and operator approval process and Project RLA 06/901 should check to see whether all States effectively initiate that process, in order to harmonize the activities of the States involved.

6.4. Establish a database of approved aircraft and operators and keep it up-to-date.

The SAM/IG shall establish a strategy for creating a database of aircraft and operators approved for RNAV-5 operations, as it did in the case of RVSM implementation, bearing in mind the following objectives:

- a) When the route network is to be completely restructured, and mainly in the case of an exclusive airspace, the process will rely on a minimum percentage of approved RNAV-5 operations. In this connection, the creation of the database will be essential for analyzing the minimum percentage.
- b) Verify whether the aircraft flying RNAV routes are effectively approved for RNAV-5 operations.

6.5. Check operations through the use of a continuous monitoring programme (aircraft and procedures).

6.6. Safety must be ensured by a continuous operational verification programme regulated by the States.

7. Standards and Procedures

7.1. Assess the regulations for GNSS use and, where appropriate, proceed to their publication.

GNSS application is of key importance for all PBN navigation specifications, considering that some aircraft possess only this equipment to meet the established performance requirements and that there are some specifications that only GNSS can satisfy.

The key issue is the State policy with regard to GNSS application as a means of navigation. In order for the system to be used fully, States must regulate its use as a primary means of navigation, even if this should require imposing some operational restrictions, such as, for example, requiring alternative aerodromes to provide for conventional approaches (VOR, NDB, ILS). Another aspect that should be considered is the need to establish a reversion to navigation mode if the GNSS signal is lost, requiring aircraft to be equipped with conventional air navigation systems.

States in the Region have already published some regulations for GNSS use. **Attachment 4** shows the current status of these regulations in the SAM Region. Regulation of GNSS use is essential for all navigation applications.

GNSS use as a means of navigation is of key importance for fulfilling RNAV-5 requirements, considering that some aircraft only have this type of RNAV equipment. As a result, SAM States should consider regulating GNSS use and make any changes they deem necessary.

7.2. Finalize WGS-84 implementation.

7.3. Prepare a model AIC to report PBN implementation plans.

The AIC reporting that PBN implementation will be effected within almost 2 years will give aircraft operators sufficient time to obtain RNAV-5 approval before that date.

7.4. Publish the AIC reporting the planning of PBN implementation.

States must publish the AIC reporting PBN implementation plans, based on the model prepared by Project RLA 06/901. These AICs must be published on the same date, to be determined by States at the SAM/IG meetings.

7.5. Prepare an AIP Supplement model containing applicable standards and procedures, including the corresponding in-flight contingencies.

The AIP Supplement will contain specific operational standards and procedures for RNAV-5 implementation. Project RLA 06/901 will prepare a model similar to that developed for RVSM implementation, whose use will be considered by States based on discussions at the SAM/IG meetings.

7.6. Publish an AIP Supplement containing applicable standards and procedures, including the corresponding flight contingencies.

7.7. States should publish the AIP Supplement, based on the model prepared by Project RLA/06/901, on a common date to be determined at the SAM/IG meetings.

7.8. Review the Procedural Handbook of ATS units involved.

The Procedural Handbook of ATS units gives a detailed account of their mode of operation, in an effort to harmonize the operational procedures applied by air traffic controllers. RNAV-5 implementation will require the review of these procedures, considering in particular:

- a) Aircraft separation;
- b) Contingency procedures;
- c) New route network or networks implemented, eliminated and/or realigned;
- d) Essential radio aids for the use of a given navigation specification;
- e) New air traffic routing models (new area circulation), including uni-directional and bi-directional routes and TMA feeding.

7.9. Update letters of agreement between ATS units

Letters of agreement between ATS units should be updated (between ACCs or between an ACC and an APP), in order to reflect the new airspace structure implemented and the procedures mentioned in the previous paragraph.

7.10. Prepare an amendment to regional documentation, if necessary.

SAM/IG meetings shall assess whether amendments to regional documentation will be necessary in the light of PBN implementation for en-route operations. RNAV route implementation, elimination and realignment will undoubtedly require the amendment of the Regional Air Navigation Plan – Volume I – Basic (Doc. 8733). Nonetheless, consideration should be given to inserting a specific chapter for RNAV-5 application to en-route operations in the Regional Supplementary Procedures (Doc. 7030 – SUPPS), if a complete reformulation of the route network is decided upon as a result of RNAV-5 implementation. Chapter 17 of the European part of Doc. 7030 – SUPPS, which establishes all applicable procedures for using BRNAV (RNAV-5) is an example of this documentation.

- 7.11. Channel the proposed amendment to Doc. 7030 in the right direction, if necessary.

The ICAO South American Regional Office will, if necessary, channel proposed amendments to Doc 7030 in the right direction in time to reach the implementation deadline.

- 7.12. Revise practices and procedures for improving fuel consumption management and environmental care

This should be an objective to be sought at all SAM/IG meetings, in accordance with the environmental policy of ICAO and of the SAM States.

8. Training

- 8.1. Prepare a training and documentation programme for operators (pilots, dispatchers and maintenance personnel).

The documentation and training leading to the operational approval of aircraft operators is normally part of the operational certification process guaranteeing the use of an air navigation application. Each aircraft operator must prepare a training programme for approval by the Civil Aviation Authority, in order to obtain approval for the use of an air navigation application. The PBN Manual, Volume II, Part B contains some general training guidelines designed for Aircraft Operators that cover each Navigation Specification.

Project 99/901 will develop a training document model for operators.

- 8.2. Prepare a training and documentation programme for air traffic controllers and AIS operators.

The PBN Manual, Volume II, Part B contains some general training guidelines designed for air traffic controllers that cover each Navigation Specification.

Project RLA/06/901 will prepare a training document model for air traffic controllers and AIS operators.

- 8.3. Prepare a training programme for regulators (aviation safety inspectors).

States should offer aviation safety inspectors the necessary training to equip them to check compliance with PBN specification norms.

- 8.4. Conduct training programmes

States, service providers and aircraft operators must conduct the necessary training programmes within the stipulated period in order to guarantee implementation by the established deadline.

8.5. Hold seminars designed for operators, indicating the plans and expected operational and economic benefits.

The main purpose for holding seminars targeting operators is to urge them to equip their aircraft in keeping with established navigation specifications, within an appropriate period of time, by presenting the objectives and benefits to be attained through the planned implementation.

9. Decision to Implement

At this point in the Action Plan, three basic questions must be answered:

- a) Is the aircraft operator ready for the implementation? (9.1 and 9.2)
- b) Is the air traffic service provider ready for the implementation? (9.1)
- c) Is the implementation safe? (9.3).

A specific meeting should be held to evaluate these three key points and reach a final decision to implement.

When a final decision has been reached, each State should publish the pertinent ATS documentation, including the trigger NOTAM, seven days before the planned implementation date, in order to confirm it.

9.1. Evaluate the available operational documentation (ATS, OPS/AIR).

9.2. Evaluate the percentage of approved aircraft and operators (overall equipment involved) .

9.3. Review the results of the safety assessment.

9.4. Publish the trigger NOTAM.

10. Performance monitoring system

Following the implementation of the Navigation Application, the SAM Region will enter the pre-operational phase for a one-year period. At the end of this period, if the evaluation is positive, the Region may embark upon the operational phase. During this period, a post-implementation operations monitoring programme must be established, primarily to assess safety. Even so, a performance assessment system shall also be implemented, as stipulated in item 2 of the Action Plan. Both the safety assessment and the performance evaluation shall be carried out as a single unit and on a permanent basis. The SAM/IG meetings must discuss the viability and way of implementing a performance assessment programme on a permanent basis.

10.1. Prepare a post-implementation monitoring system for en-route operations.

10.2. Carry out a post-implementation monitoring programme for en-route operations.

SHORT-TERM EN-ROUTE PBN ACTION PLAN (RNAV-5)
(GPIs 1, 4, 5, 7, 8, 10, 11, 12, 16, 21, 23)

1. Airspace concept	Start	End	Responsible party	Remarks
1.1 Establish and prioritize strategic objectives (safety, capacity, environment, etc.)	June/2008	SAM/IG/2	SAM/PBN/IG (Project RLA/06/901)	Completed
1.2 Collect traffic data in order to understand traffic flows in a given airspace	June/2008	SAM/IG/4	SAM/PBN/IG (Project RLA/06/901)	Completed
1.3 Analyze the navigation capacity of the aircraft fleet	June/2008	SAM/IG/7	SAM/PBN/IG (Projects RLA/06/901 and RLA/99/901) States IATA	Valid 95% of the fleet in the SAM Region is candidate for RNAV5 approval. States should continue their efforts to complete the data base (Conclusion SAM/IG/4-3)
1.4 Analyze ground-based means of communication, navigation (VOR, DME) and surveillance to meet navigation specifications and the navigation reversal mode	June/2008	SAM/IG/7	SAM/PBN/IG (Projects RLA/06/901 and RLA/99/901) States	Valid The work will be completed through a workshop in March 2011, in order to prove that the coverage and geometry corresponds to RNAV5. The support of RLA/06/901 will be requested to hire two experts and 1 fellowship per State participating in the project.
1.5 Optimize airspace structure, reorganizing the network or implementing new routes based on the strategic objectives of the airspace concept, taking into account airspace modelling, ATC simulations (fast time and/or real time), live tests, etc.	SAM/IG/2	SAM/IG/4	SAM/PBN/IG (Project RLA/06/901) States IATA	Transferred. The meeting reviewed this task and decided that it was more appropriate to incorporate to the SAM Region ATS routes network optimization action plan (2.2.5 SAM Region ATS routes network optimization action plan)

2 Safety assessment	Start	End	Responsible party	Remarks
2.1 Prepare safety assessment execution using a qualitative methodology through the application of SMS	SAM/IG/2	SAM/IG/6	CARSAMMA Project RLA/06/901 Regional Office	Completed

3 Establish a collaborative decision-making process (CDM)	Start	End	Responsible party	Remarks
3.1 Coordinate planning and implementation requirements with air navigation service providers, regulators, users, aircraft operators and military authorities	SAM/IG/2	SAM/IG/6	SAM/PBN/IG States	<p style="text-align: center;">Valid</p> Some States have published an initial AIC. Other States have not done so yet. A new AIC is required informing on the change of implementation date.
3.2 Establish the implementation date	SAM/IG/1	SAM/IG/4	SAM/PBN/IG States	<p style="text-align: center;">Completed.</p> 18 November 2009 was established as tentative date. States must analyse the feasibility of the tentative date in coordination with domestic operators and military authorities
3.3 Establish the documentation format in the SAM PBN website	SAM/IG/1	SAM/IG/2	SAM Regional Office	<p style="text-align: center;">Completed</p>
3.4 Report planning and implementation progress to the corresponding Regional Office. Conclusion to present national plans at SAM/IG/4	SAM/IG/2	SAM/IG/4	SAM/PBN/IG States	<p style="text-align: center;">Completed.</p> Eight SAM States presented a draft of their national PBN implementation plans and it was agreed that for 31 December 2009, States shall present the final version of the plan. The Secretariat was requested to as States that have not done so yet, submit their respective plans.

4 ATC automated systems	Start	End	Responsible party	Remarks
4.1 Assess PBN implementation in ATC automated systems, taking into account amendment 1 to the PANS/ATM (FPLSG). Note: It is not a requirement for RNAV5 implementation	June/2008	SAM/IG/4	SAM/PBN/IG (Project RLA/06/901)	Completed According to the programme presented in ICAO guidelines (WP/09), it is not a requirement for the RNAV5 implementation. CNS/ATM sub-group will revise this issue.
4.2 Implement necessary changes in automated ATC systems	SAM/IG/2	TBD	States	Completed

5 Aircraft and operator approval	Start	End	Responsible party	Remarks
5.1 Analyze aircraft and operator approval requirements (pilots, dispatchers and maintenance personnel) in keeping with the PBN manual, and develop the necessary documentation.	June/2008	SAM/IG/2	Regional Project RLA/99/901-Regional Safety Oversight Cooperation System	Completed
5.2 Publish national regulations for the implementation of the RNAV-5 navigation specification	SAM/IG/2	SAM/IG/7	States	Valid There are some States in development process of their regulations, and for this reason, this task is pending. Three States of the Region have published the regulations and 9 States informed that this task is in execution. No information is available from 2 States.
5.3 Begin the approval of aircraft and operators	SAM/IG/3	SAM/IG/7	States	Valid This is a continuous task that States have initiated and shall continue to carry out upon requirement of operators. Operators should be encouraged to initiate this process.
5.4 Establish and keep up to date a registry of approved aircraft and operators	SAM/IG/3	Permanent	CARSAMMA States Regional Office	Valid CARSAMMA has not received yet information on approvals. This is an activity being developed permanently by each one of the States.
5.5 Verify the operation of the continuous monitoring programme (aircraft and procedures)	Nov/2010	Permanent	States	Completed This is an activity being developed permanently by each on of the States and is considered in the surveillance plans.

6	Standards and procedures	Start	End	Responsible party	Remarks
6.1	Assess and, if applicable, publish the regulations on the use of GNSS.	June/2008	SAM/IG/2	SAM/PBN/IG (Project RLA/06/901) States	Completed
6.2	Finalize WGS-84 implementation	TBD	TBD	States	Completed States which have not done so, should provide the information
6.3	Develop an AIC model to report PBN implementation plans	June/2008	SAM/IG/2	SAM/PBN/IG (Project RLA/06/901)	Completed
6.4	Publish the AIC reporting PBN implementation plans	SAM/IG/2	SAM/IG/4	States	Completed States should publish on 9 April 2009
6.5	Develop an AIP Supplement model containing applicable standards and procedures, including the corresponding in-flight contingencies	SAM/IG/4	June 2010	SAM/PBN/IG (Project RLA/06/901)	Completed
6.6	Publish the AIP Supplement containing applicable standards and procedures, including the corresponding in-flight contingencies	SAM/IG/5	SAM/IG/7	States	Valid A format to publish RNAV ENR 3.3 routes was approved.
6.7	Review the Procedural Handbook of the ATS units involved	SAM/IG/5	SAM/IG/7	States	Valid
6.8	Update the letters of agreement between ATS units	SAM/IG/5	SAM/IG/7	States	Valid Several States have updated their LOAs. The process is on going.
6.9	Develop an amendment to regional documentation, if necessary	SAM/IG/3	June 2010	SAM/PBN/IG (Project RLA/06/901)	Completed
6.10	Submit a proposal of amendment to Doc. 7030, if necessary	SAM/IG/5	SAM/IG/6	SAM Regional Office	Completed

7. Training	Start	End	Responsible party	Remarks
7.1 Develop a training and documentation programme for operators (pilots, dispatchers and maintenance personnel)	SAM/IG/4	SAM/IG/5	Regional Project RLA/99/901	Completed The matters to be incorporated into each one of the training programmes of operators have been included in the corresponding advisory circulars
7.2 Develop a training and documentation programme for air traffic controllers and AIS operators	SAM/IG/4	SAM/IG/5	SAM/PBN/IG (Project RLA/06/901)	Completed
7.3 Develop a training programme for regulators (aviation safety inspectors)	SAM/IG/4	SAM/IG/5	RLA/99/901 States	Completed The SRVSOP technical committee has proposed a training programme oriented to the authorities
7.4 Conduct training programmes	SAM/IG/5	SAM/IG/7	States	Valid Only some States have initiated this process.
7.5 Conduct seminars for operators, explaining plans and expected operational and economic benefits	SAM/IG/1	SAM/IG/7	States	Valid There is information that only some States have initiated the guidance process to users, and therefore all States are encouraged to implement the dissemination programme among such users.

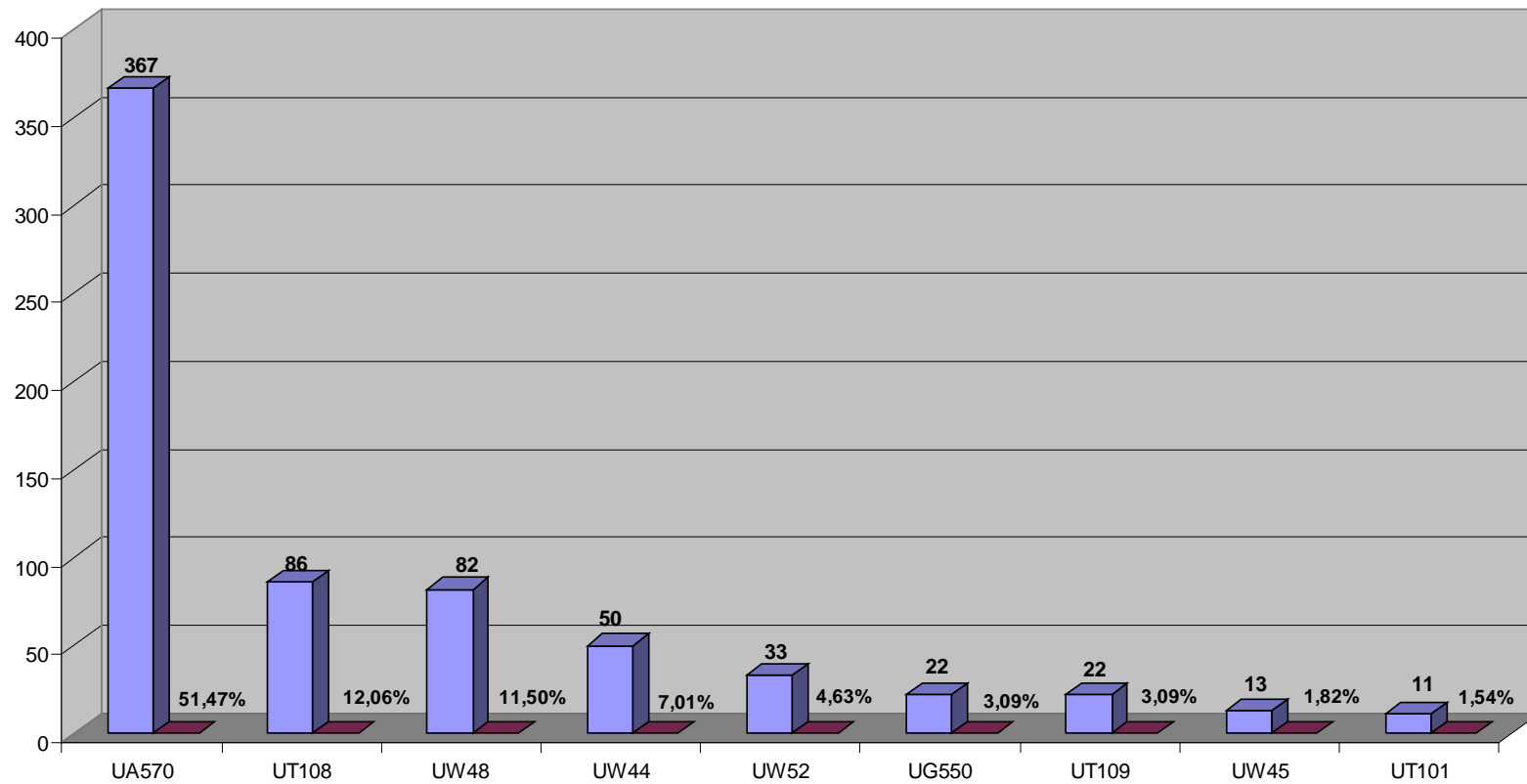
8. Implementation decision	Start	Responsible party	Remarks
8.1 Assess the available operational documentation (ATS, OPS/AIR)	SAM/IG/7	States	Valid
8.2 Assess the percentage of aircraft and operators (non-exclusionary airspace)	SAM/IG/7	States	<p>Valid</p> <p>It was decided to carry out a new air traffic data collection comprised within the period 1-15 July 2010. The data collection is expected to be revised regarding the amount of aircraft approved through the hiring of one expert by RLA/06/901</p>
8.3 Analyze the results of the safety assessment	SAM/IG/6	States	Completed
8.4 Publish trigger NOTAM	Sep/2011	States	Valid

9. Performance monitoring system	Start	End	Responsible party	Remarks
9.1 Develop a post-implementation en-route operations monitoring programme	SAM/IG/4	SAM/IG/6	SAM/PBN/IG (Project RLA/06/901)	Completed
9.2 Implement a post-implementation en-route operations monitoring programme	Sep 2010	Sep 2011	States	Valid
Pre-operational implementation date	22 September 2011	N/A		Valid SAM/IG/4 defined the tentative implementation date 18 November 2010.
Definitive implementation date	Sep 2012	N/A		

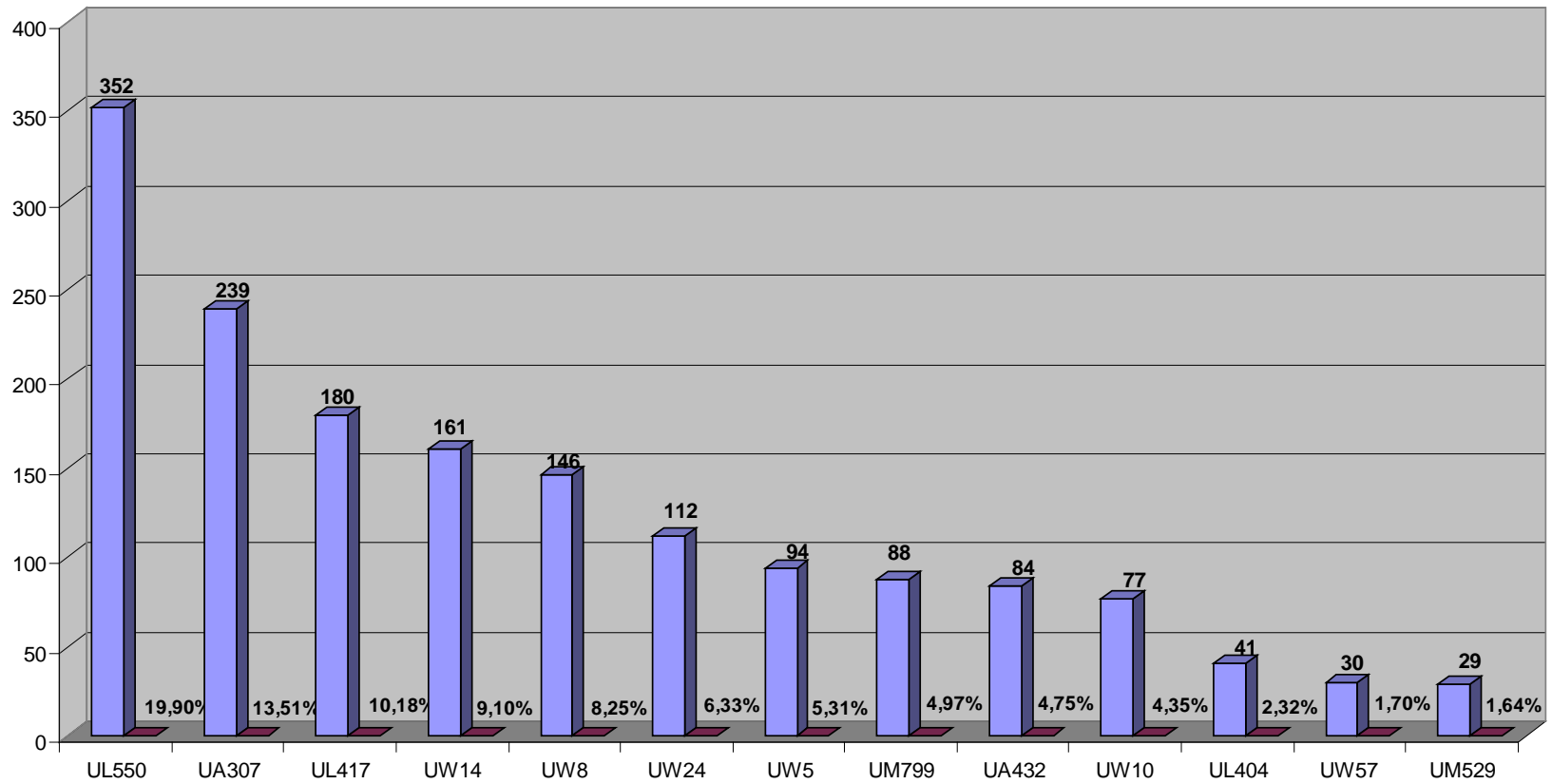
ADJUNTO 2 / ATTACHMENT 2

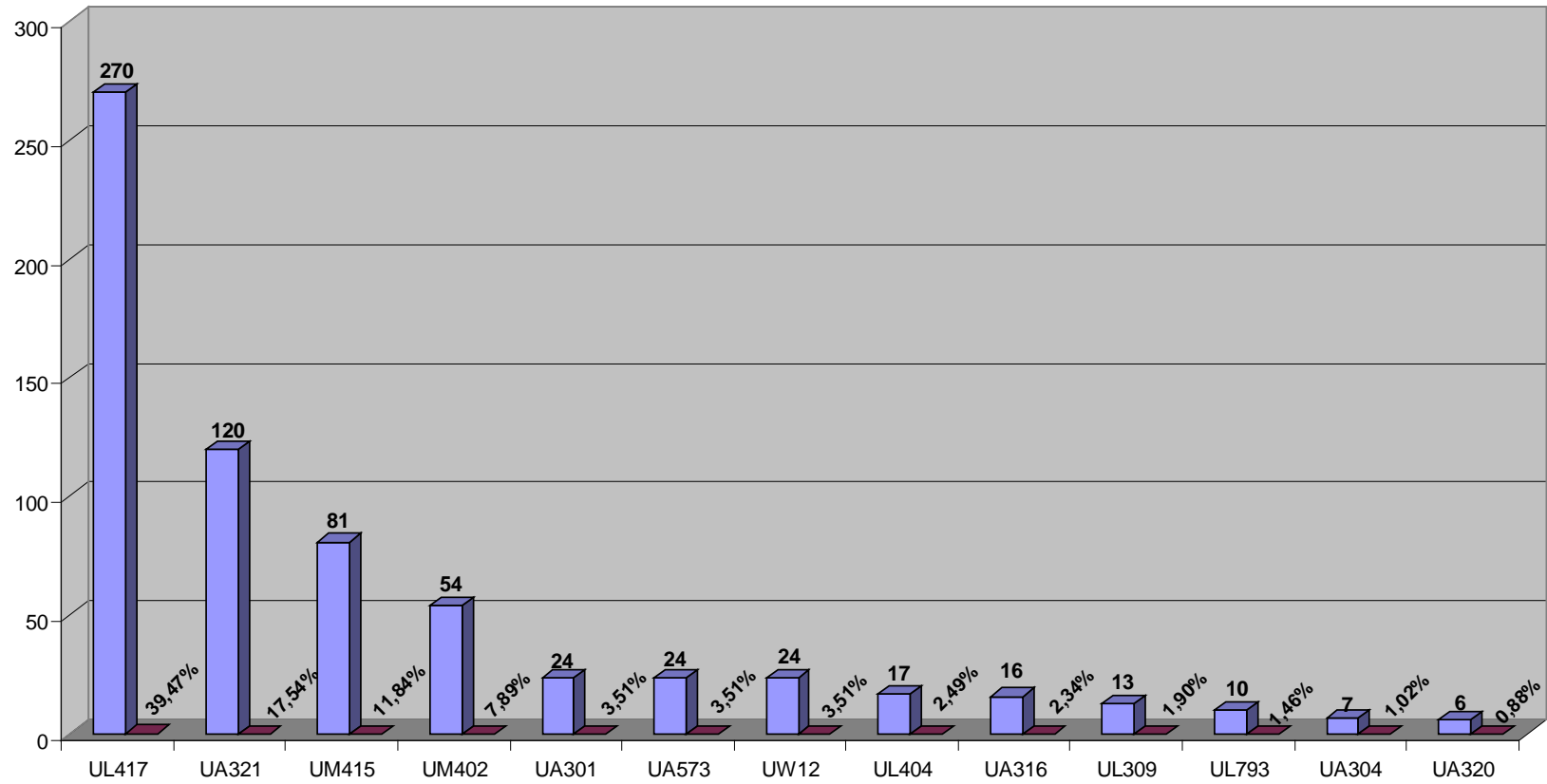
ATS ROUTES – SAM REGION / RUTAS ATS - REGIÓN SAM

ARGENTINA

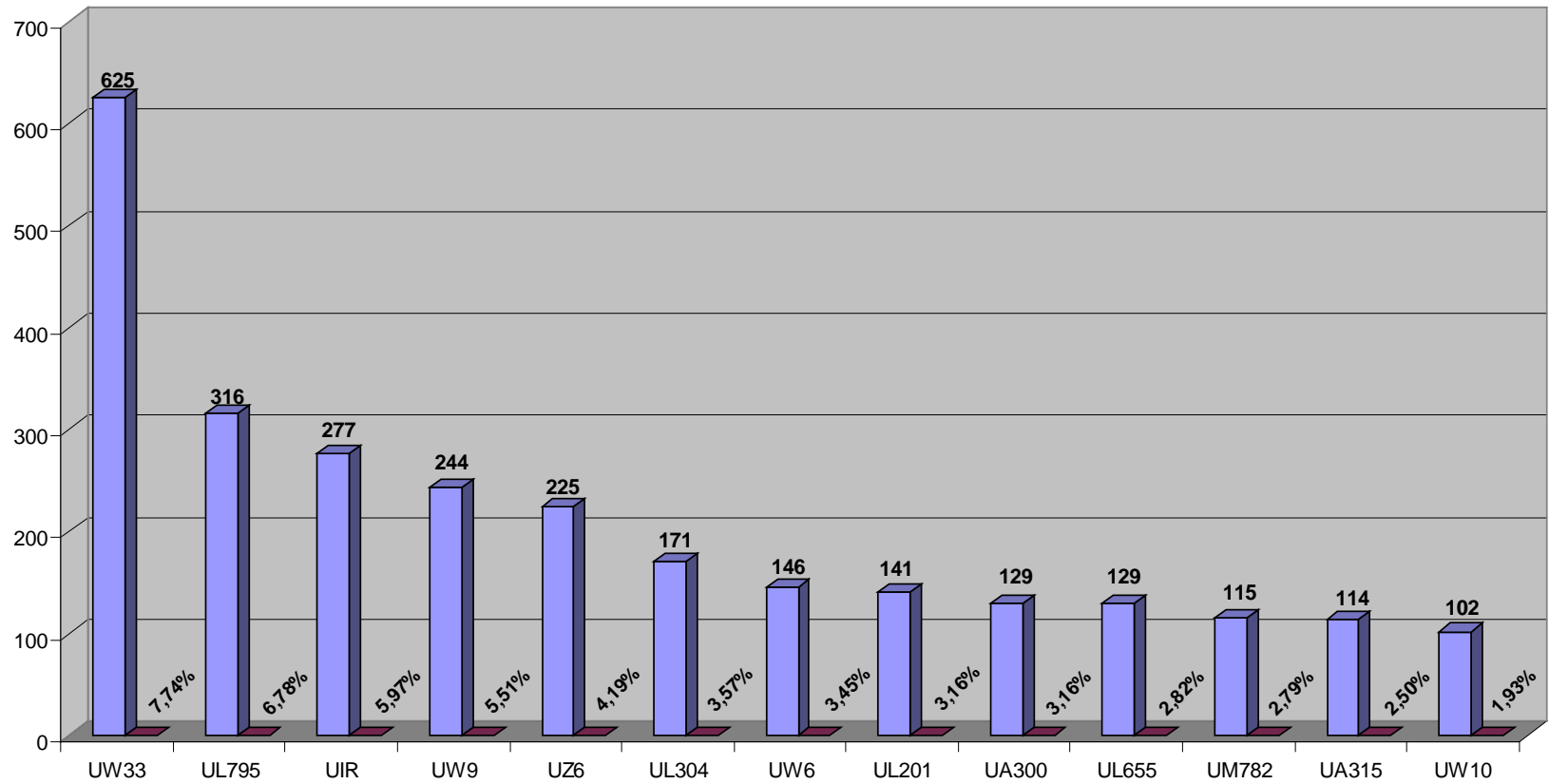
FIR COMODORO RIVADAVIA - RUTAS ATS
96% del tránsito de la muestra

FIR CORDOBA - RUTAS ATS
92% del tránsito de la muestra

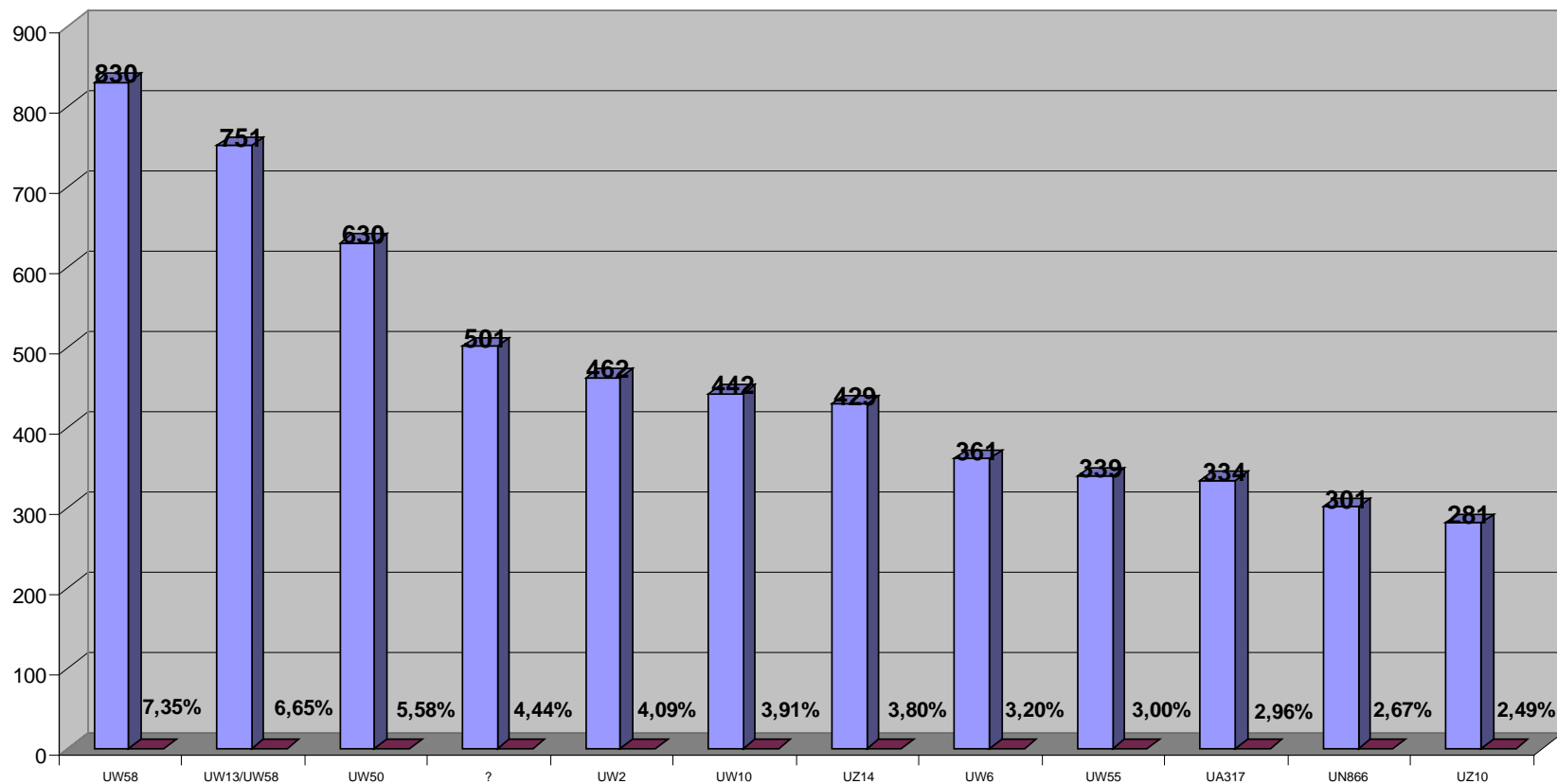


BOLIVIA**FIR LA PAZ - RUTAS ATS**
97% del tránsito de la muestra

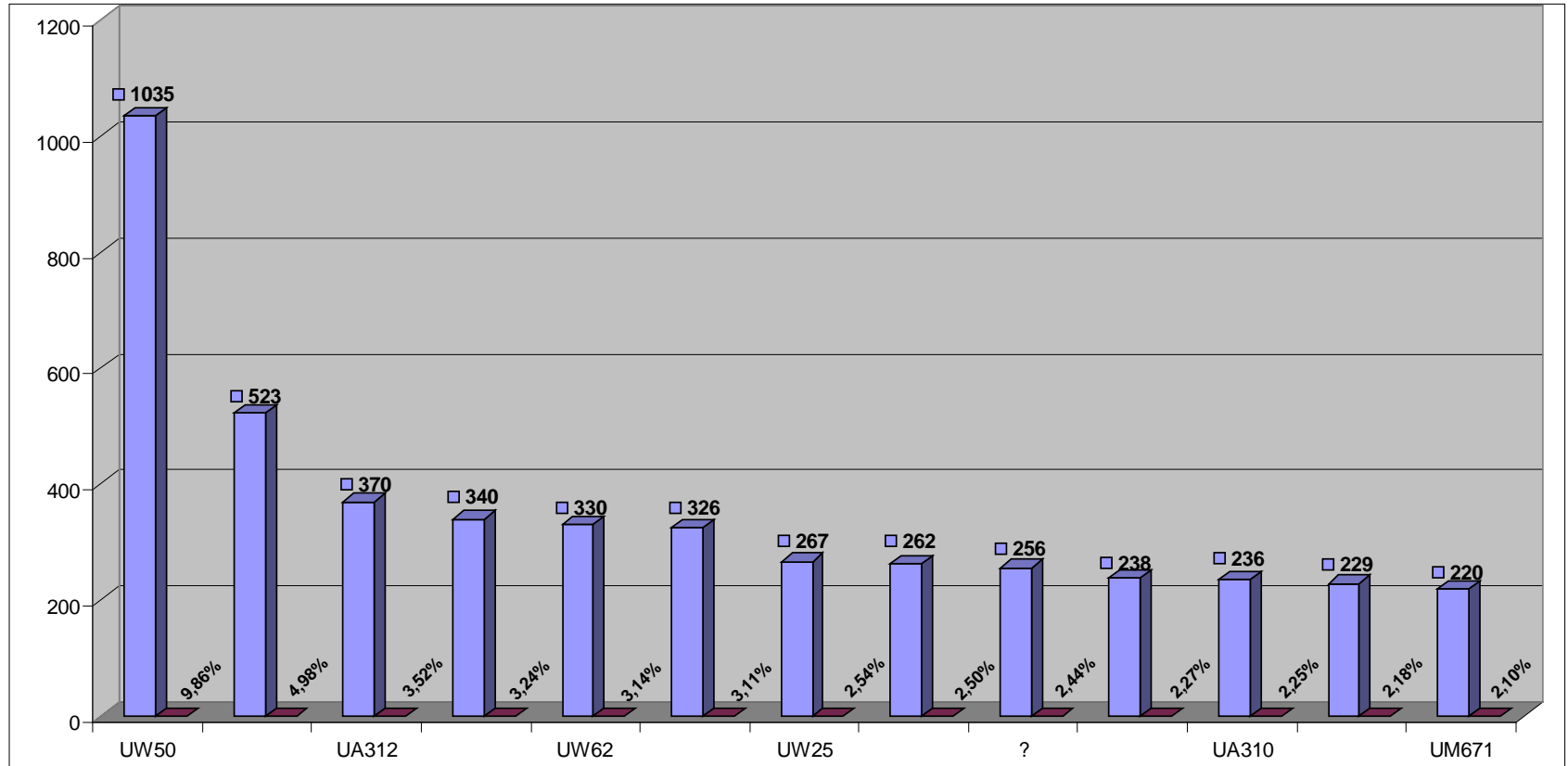
BRAZIL / BRASIL

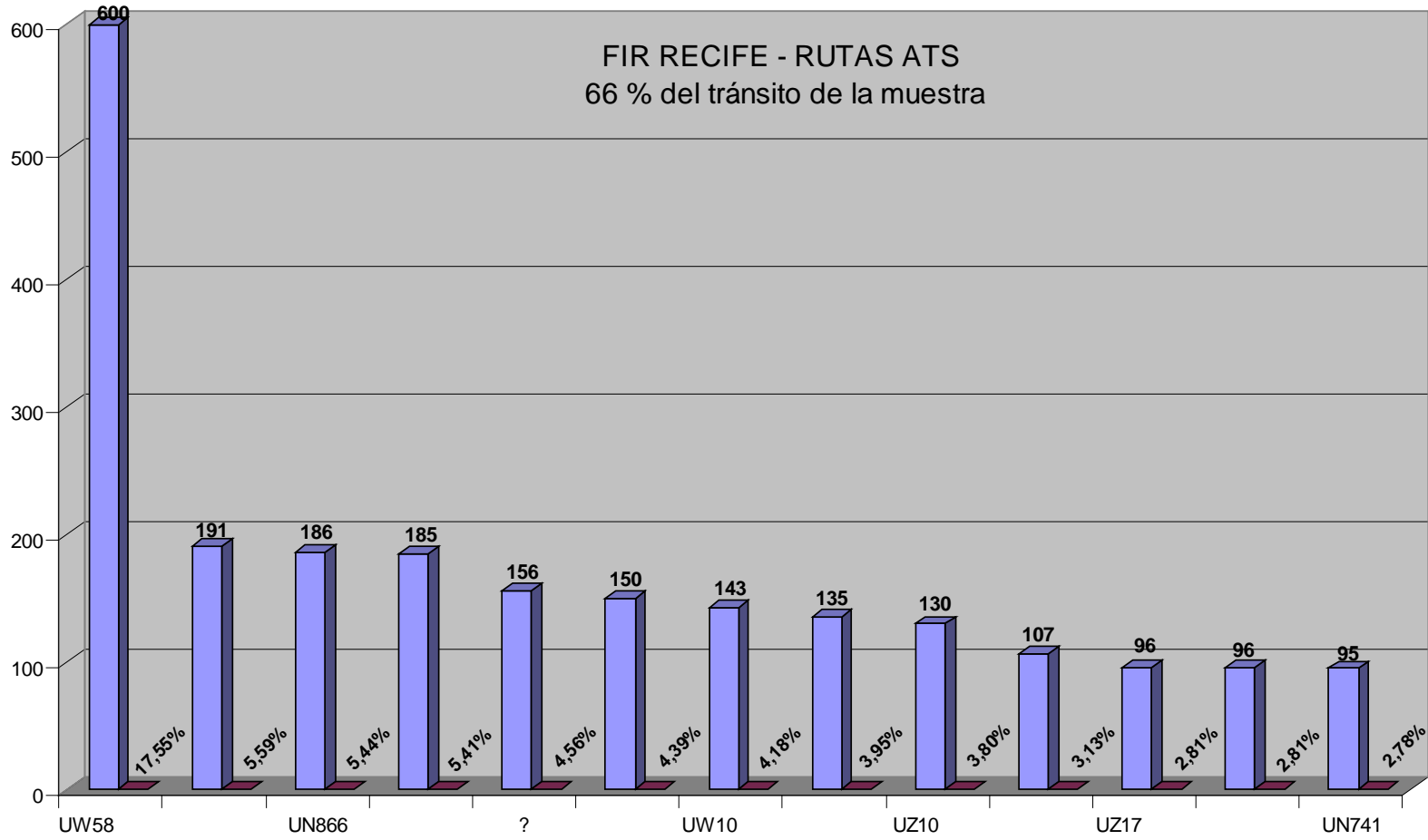
FIR Amazónica - RUTAS ATS
67 % del tránsito de la muestra

FIR BRASÍLIA - RUTAS ATS
50% del tránsito de la muestra

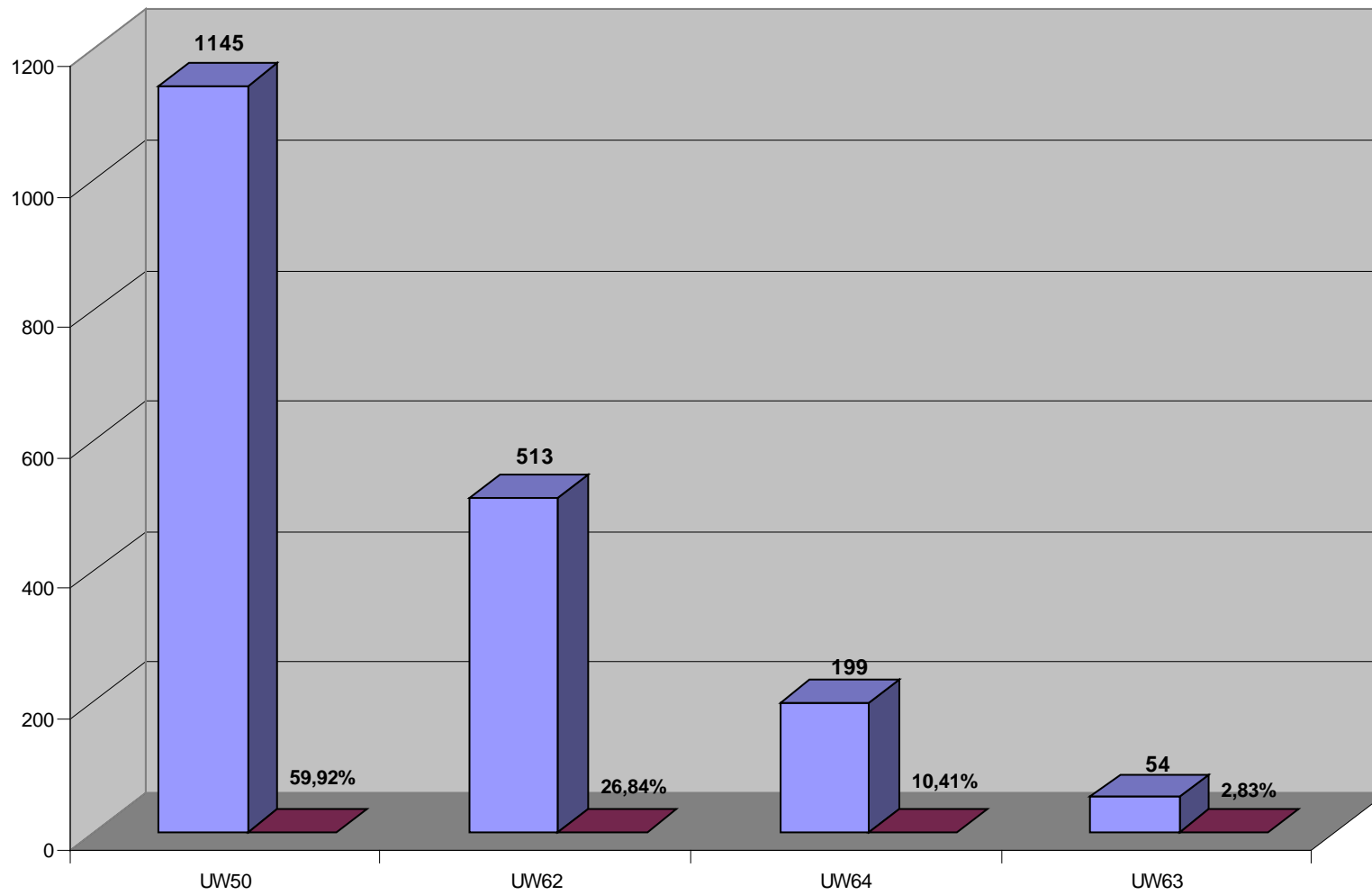


FIR CURITIBA - RUTA ATS
44% del tránsito de la muestra

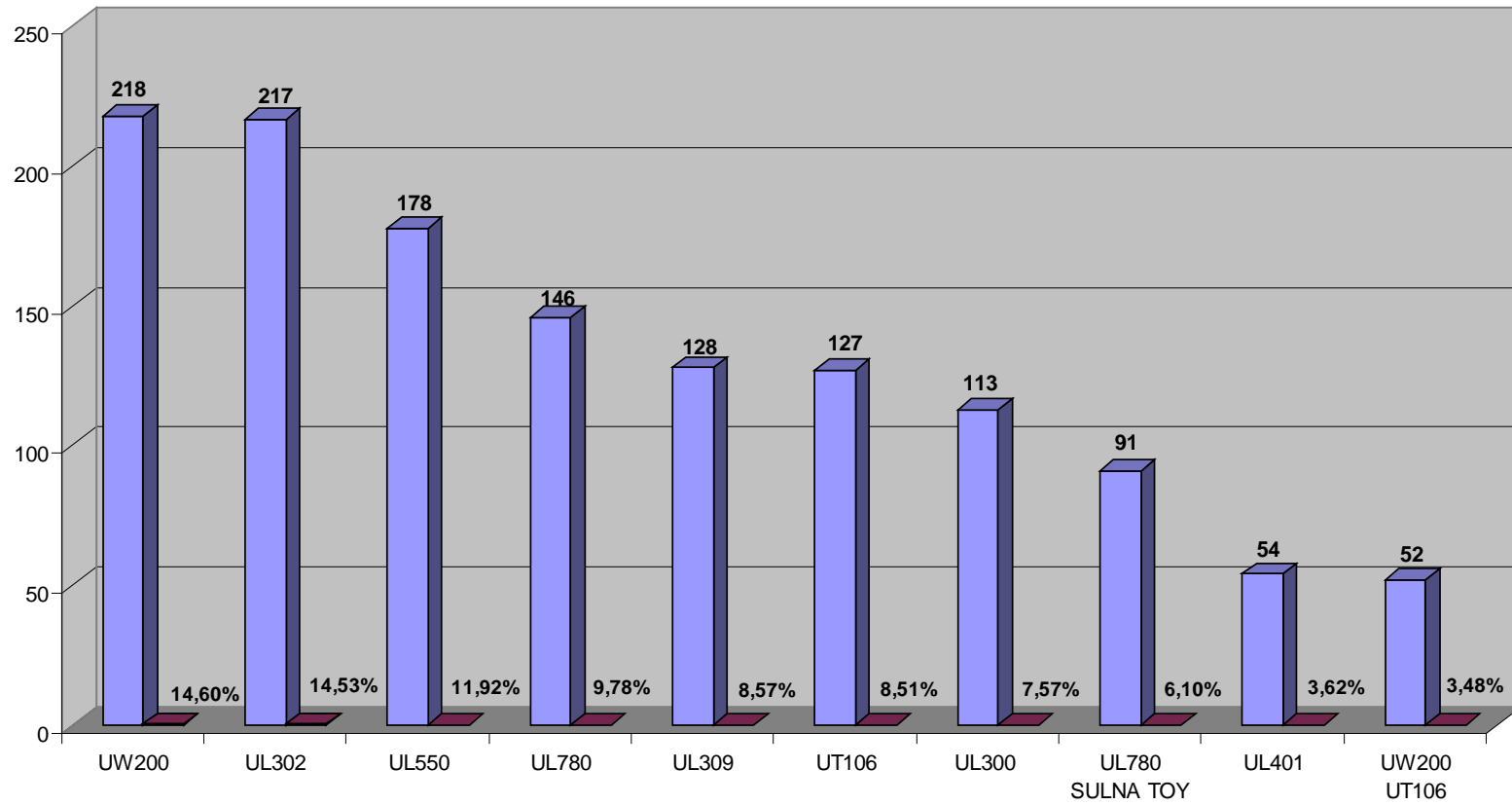




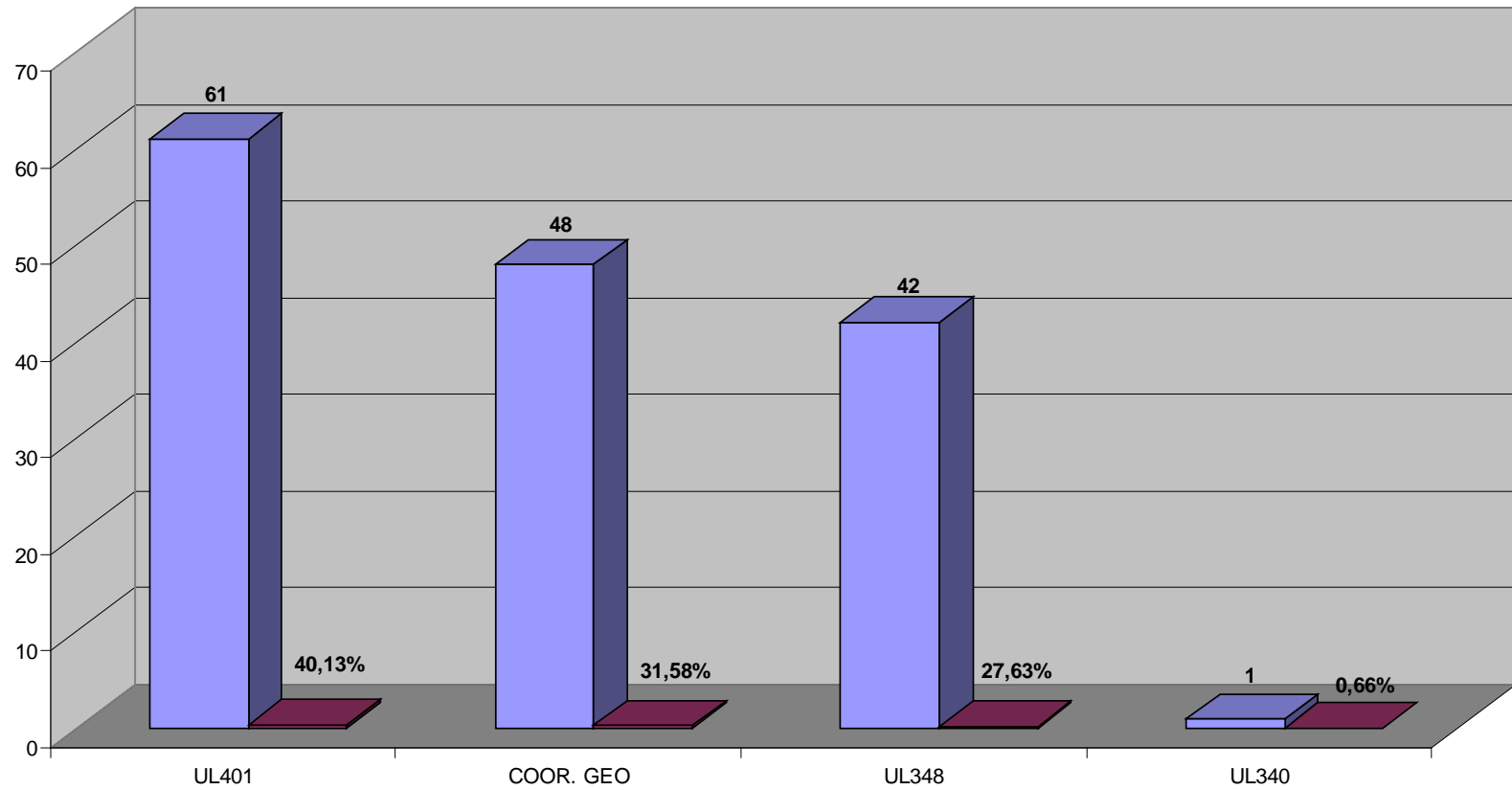
TMA SÃO PAULO - RUTAS ATS
100% del tránsito de la muestra



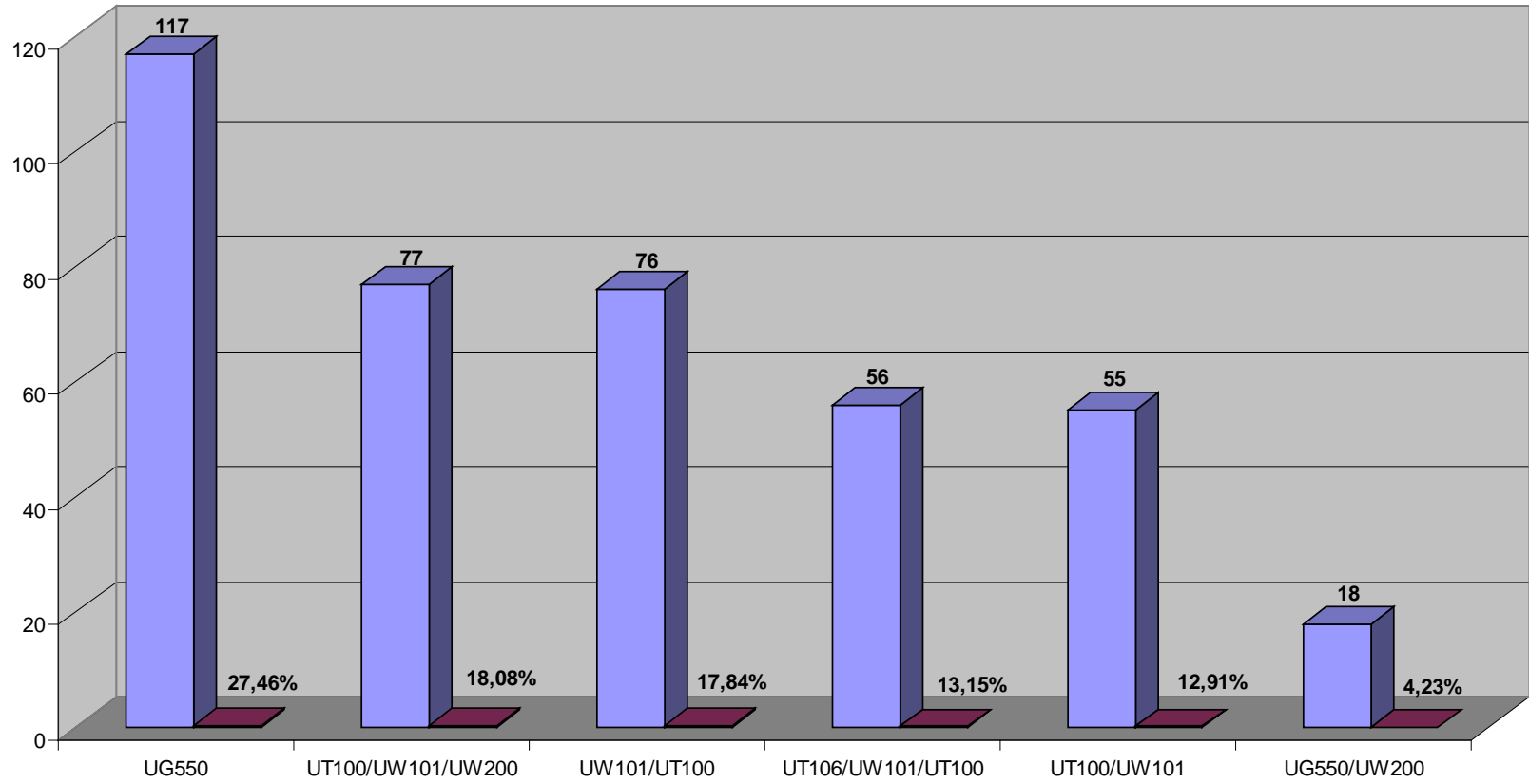
CHILE

FIR ANTOFOGASTA - RUTAS ATS
89% del tránsito de la muestra

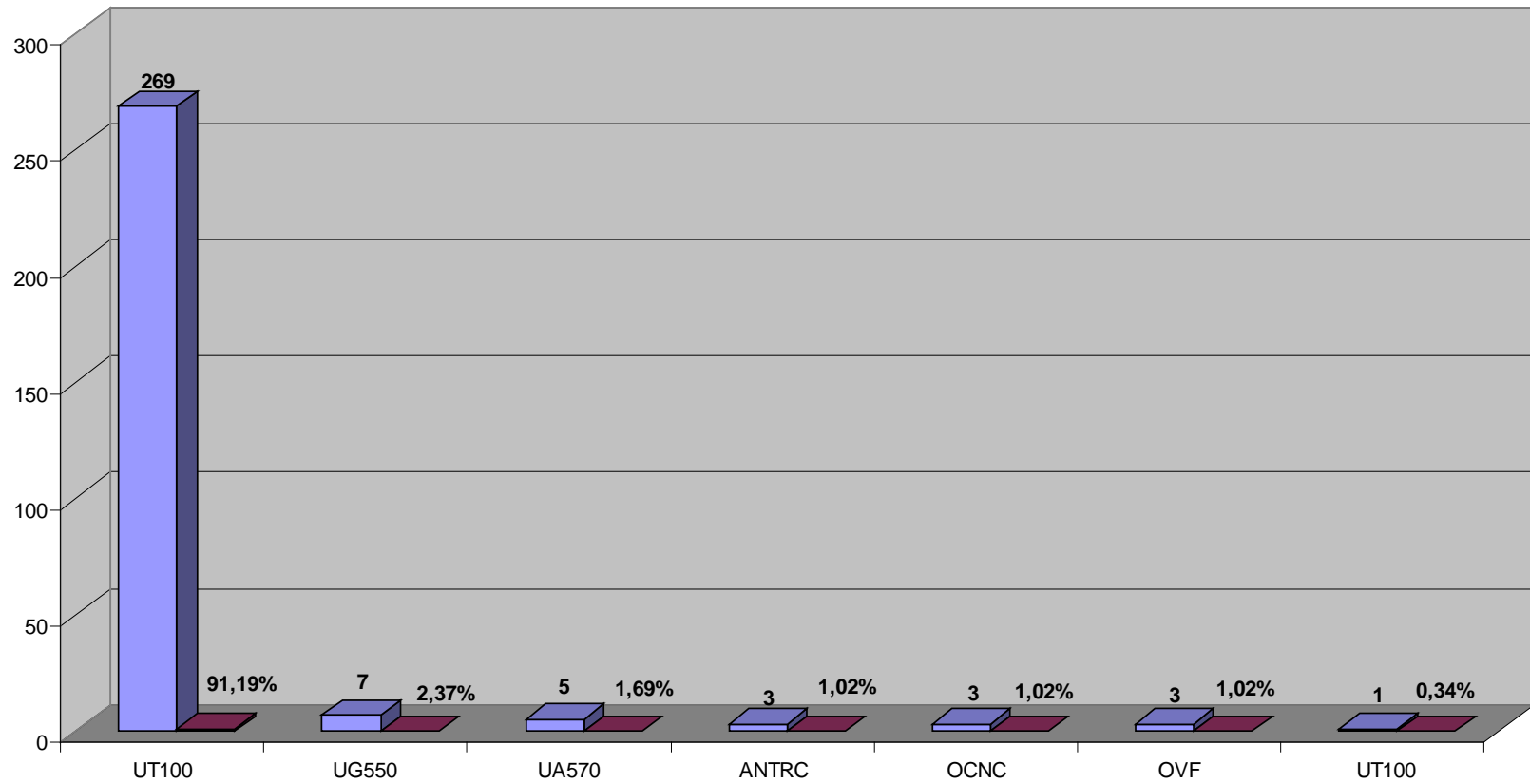
FIR PASCUA - RUTAS ATS
100% del tránsito de la muestra



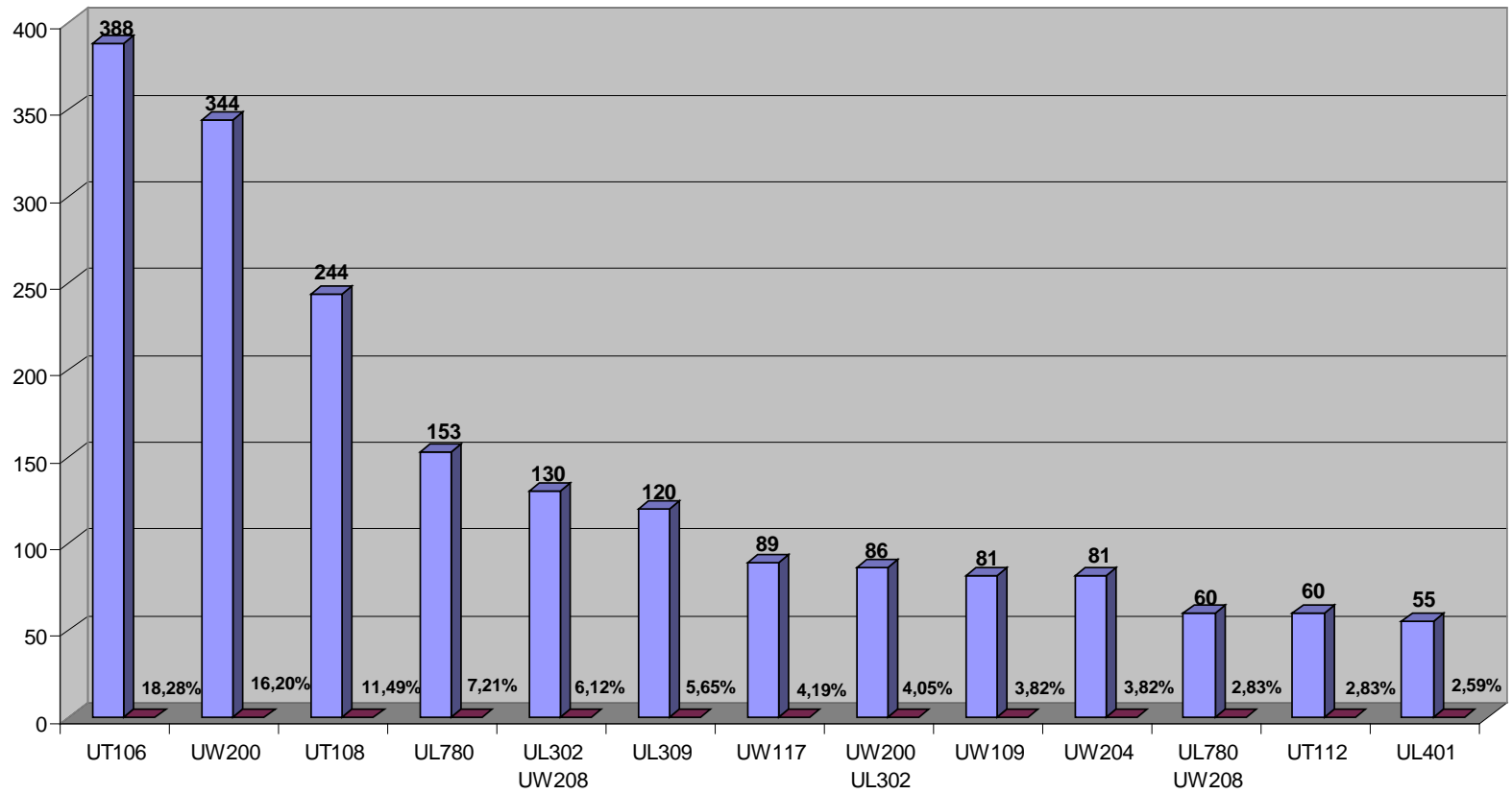
FIR PUERTO MONTT - RUTAS ATS
94% del tránsito de la muestra



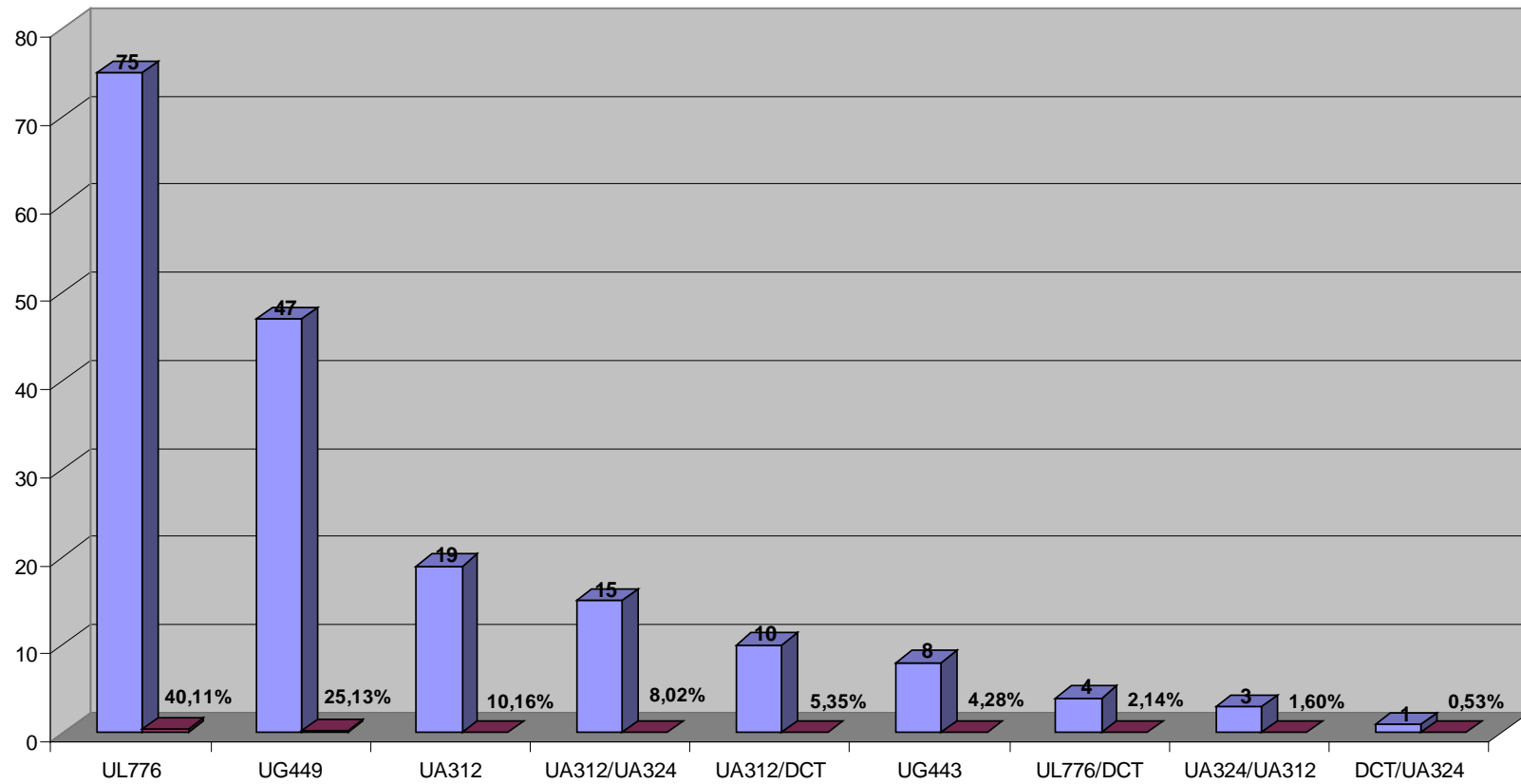
FIR PUNTA ARENAS - RUTAS ATS
98% del tránsito de la muestra



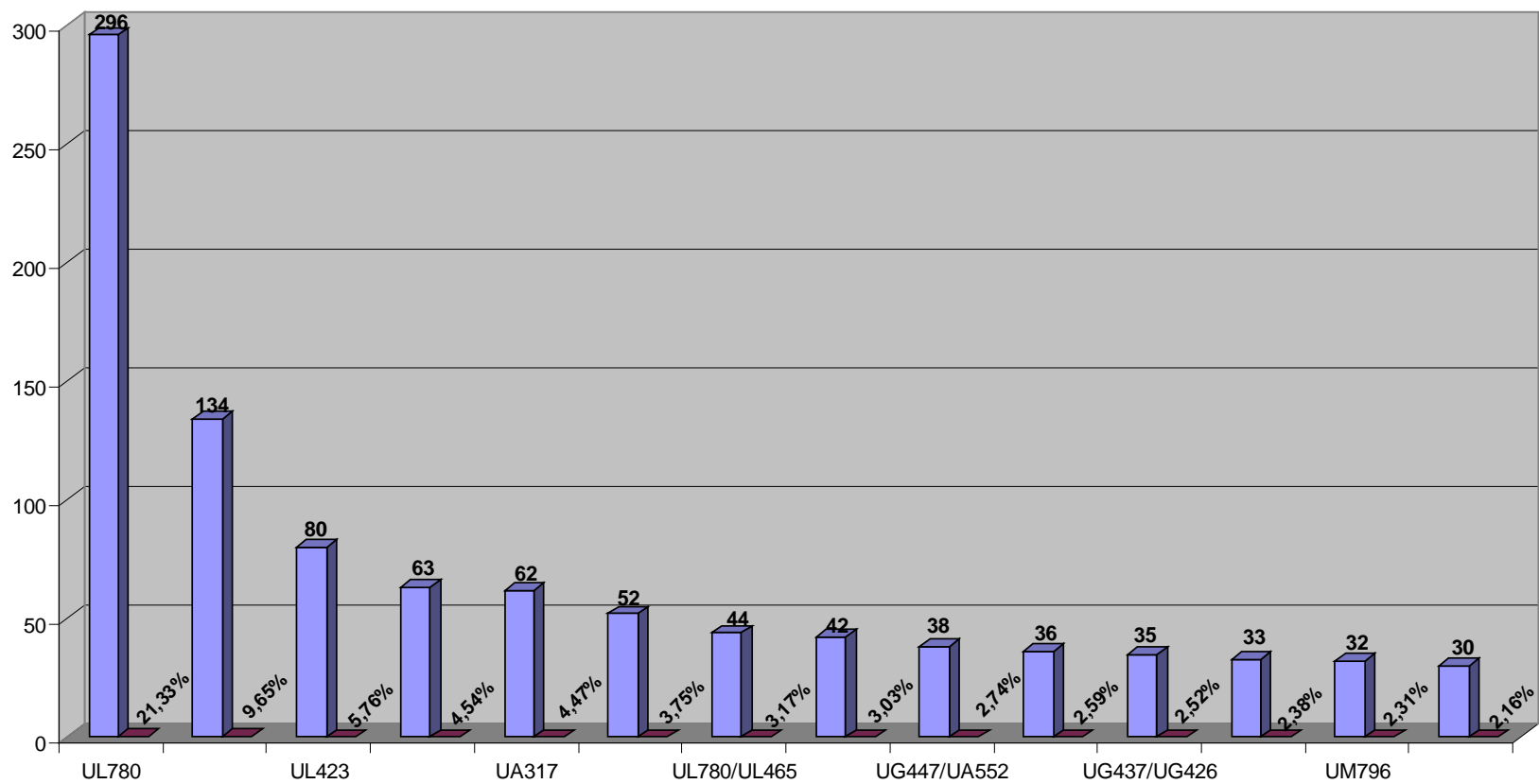
FIR SANTIAGO - RUTAS ATS
89% del tránsito de la muestra



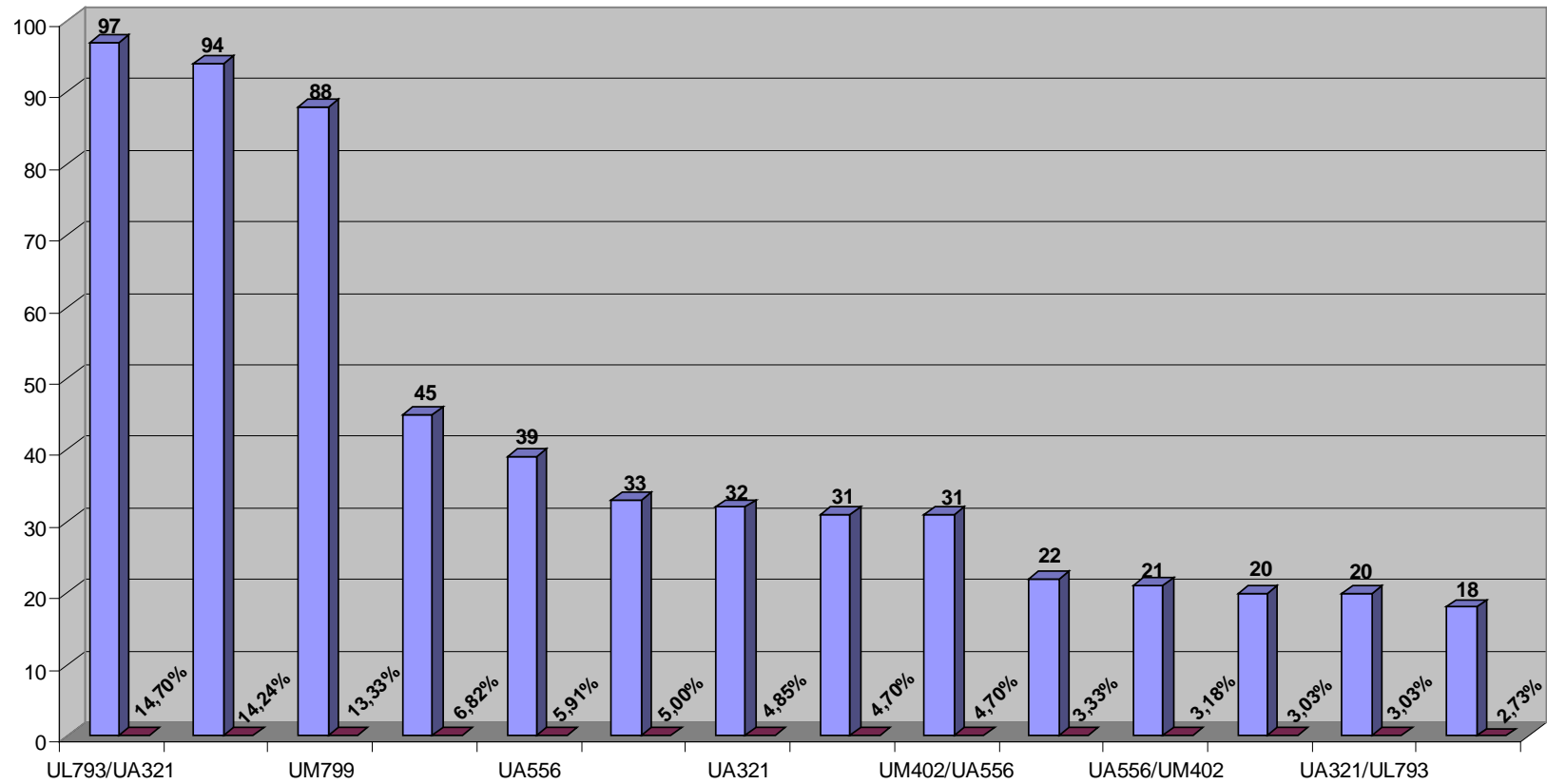
GUYANA

FIR GEORGETOWN - RUTAS ATS
97% del tránsito de la muestra

PANAMA

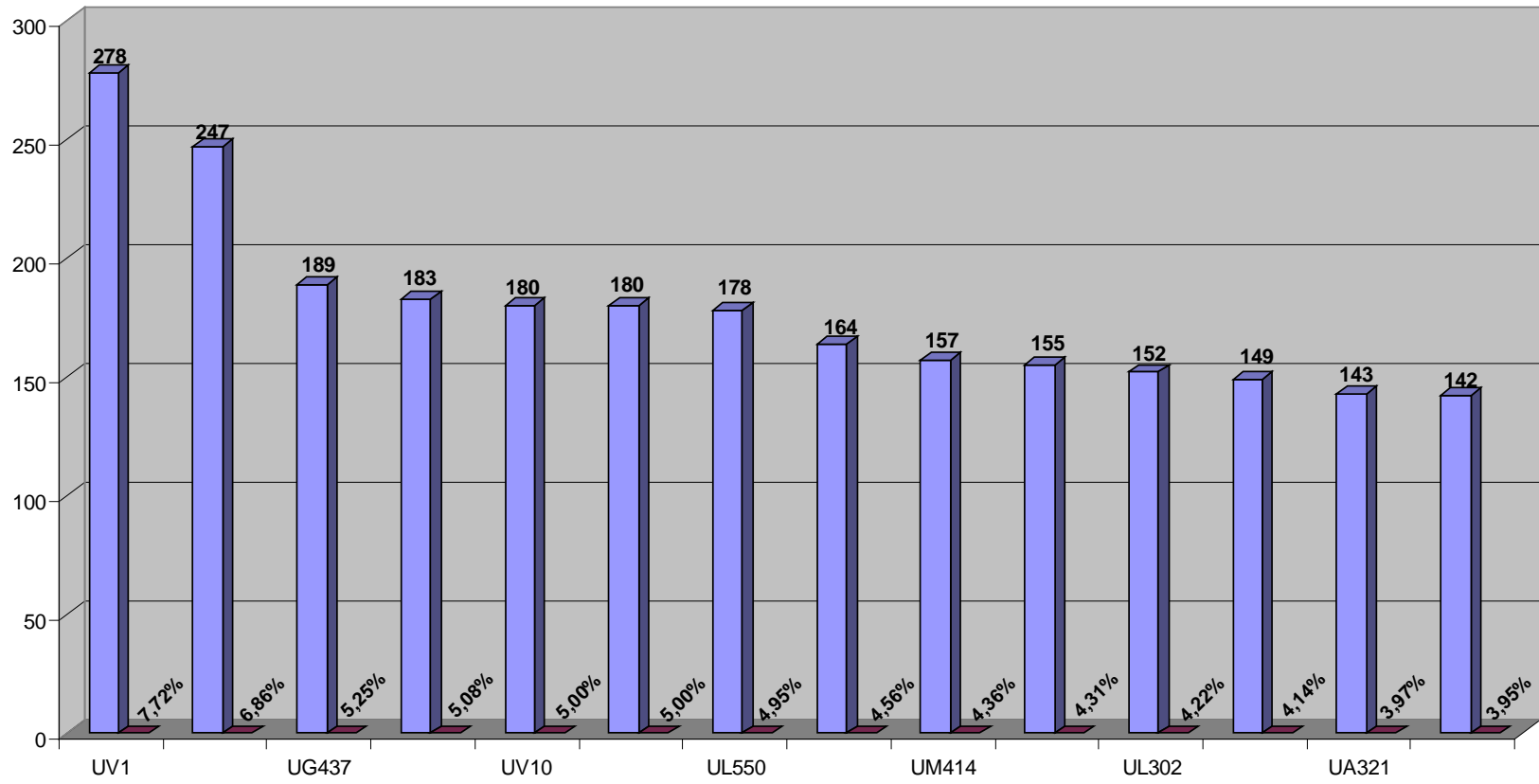
FIR PANAMA - RUTAS ATS
70% del tránsito de la muestra

PARAGUAY

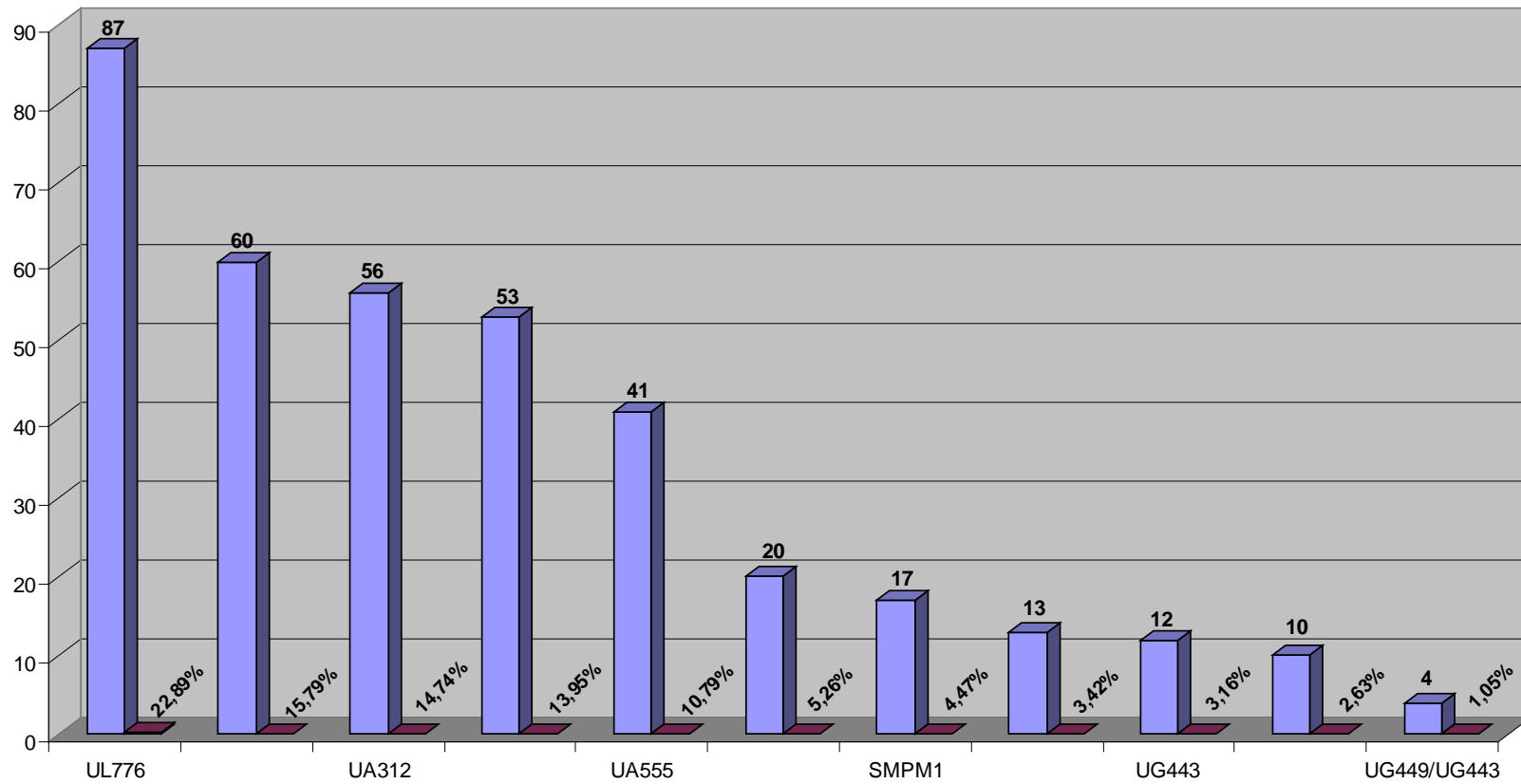
FIR ASUNCIÓN - RUTAS ATS
90% del tránsito de la muestra

PERU

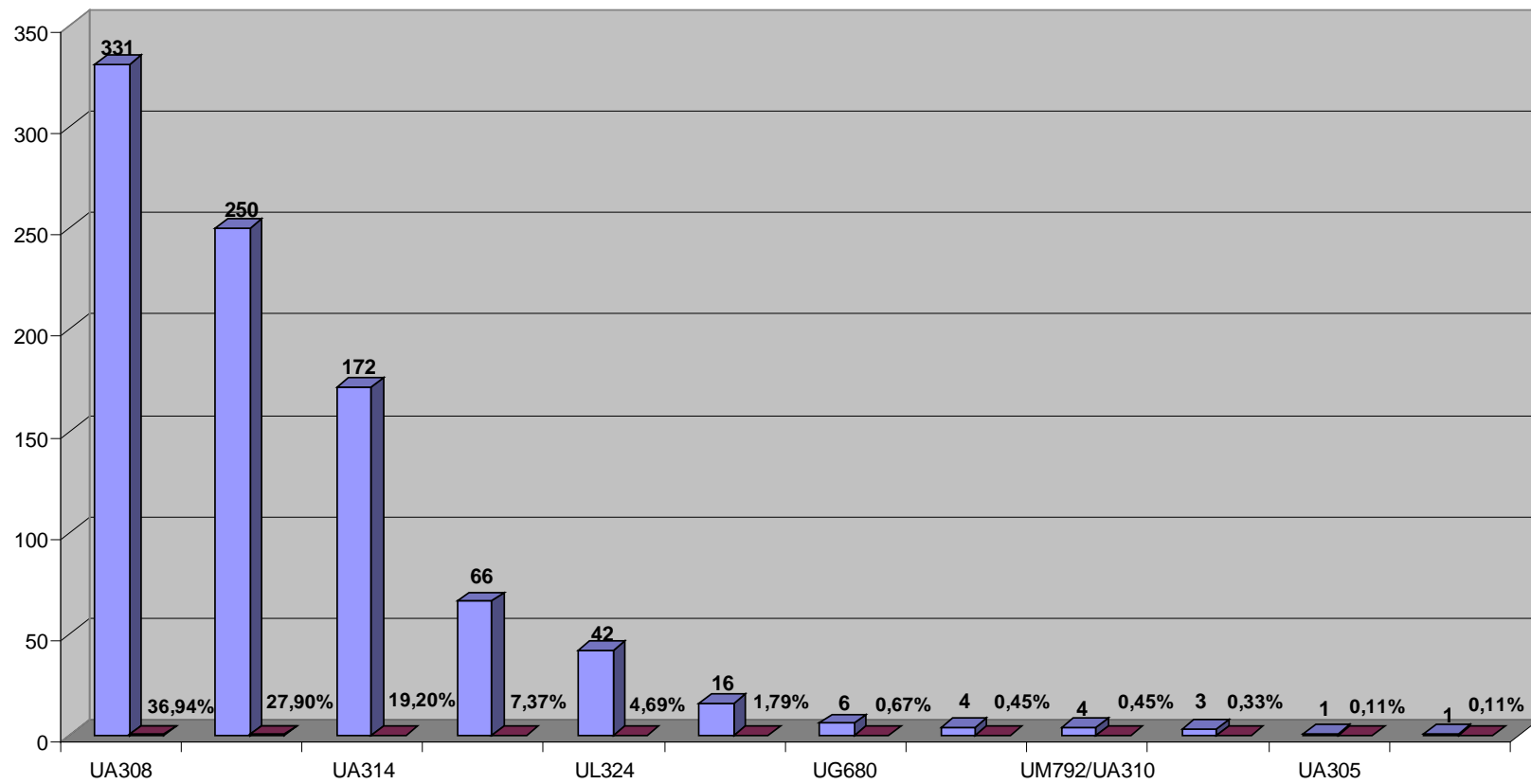
FIR LIMA - RUTAS ATS
69% del tránsito de la muestra



SURINAME

FIR PARAMARIBO - ROTAS ATS
98% del tránsito de la muestra

URUGUAY

FIR MONTEVIDEO - RUTAS ATS
100% del tránsito de la muestra

ADJUNTO 3 / ATTACHMENT 3

Región SAM
Pares de Ciudades

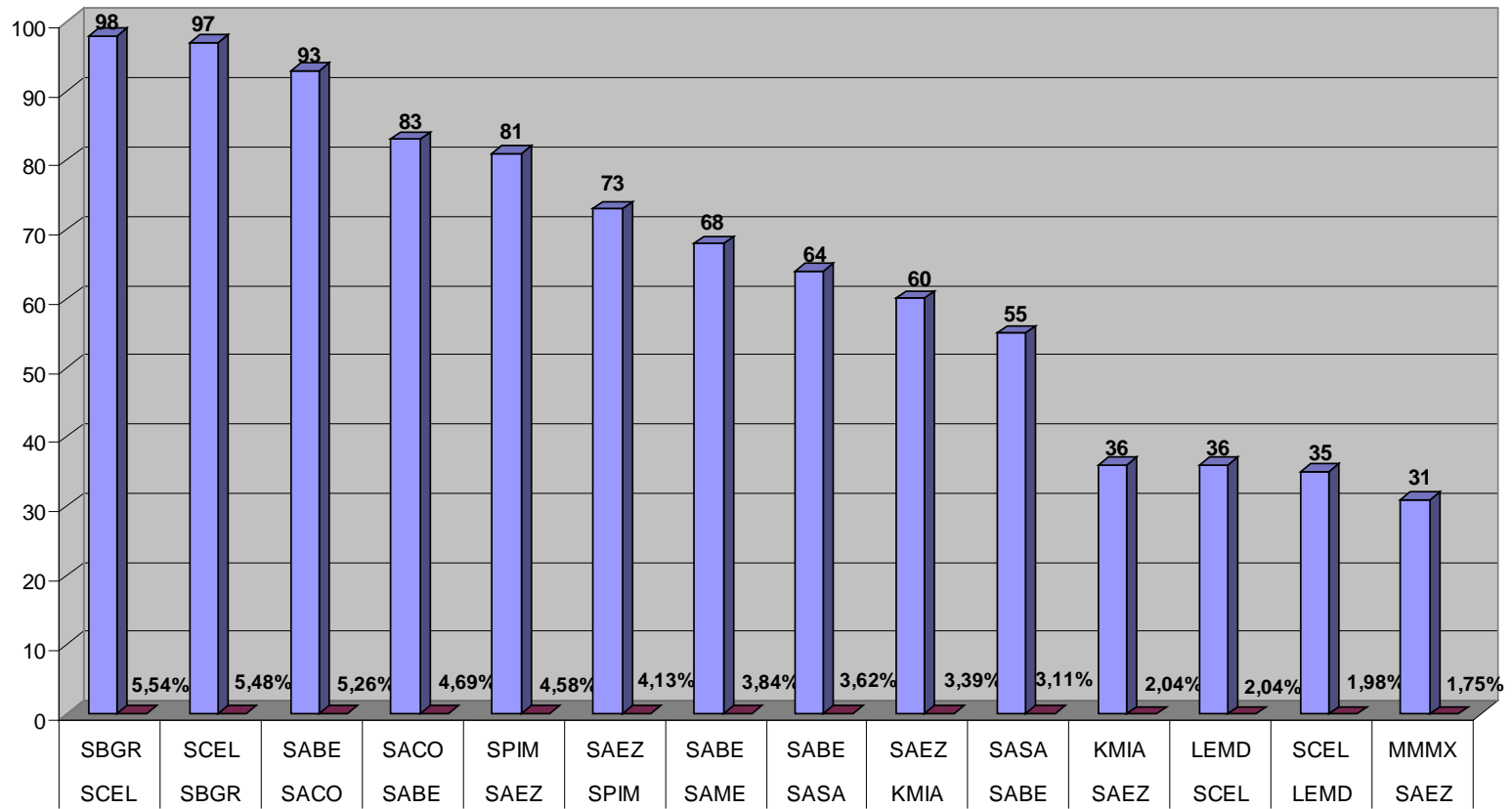
SAM Region
Pairs of Cities

ARGENTINA

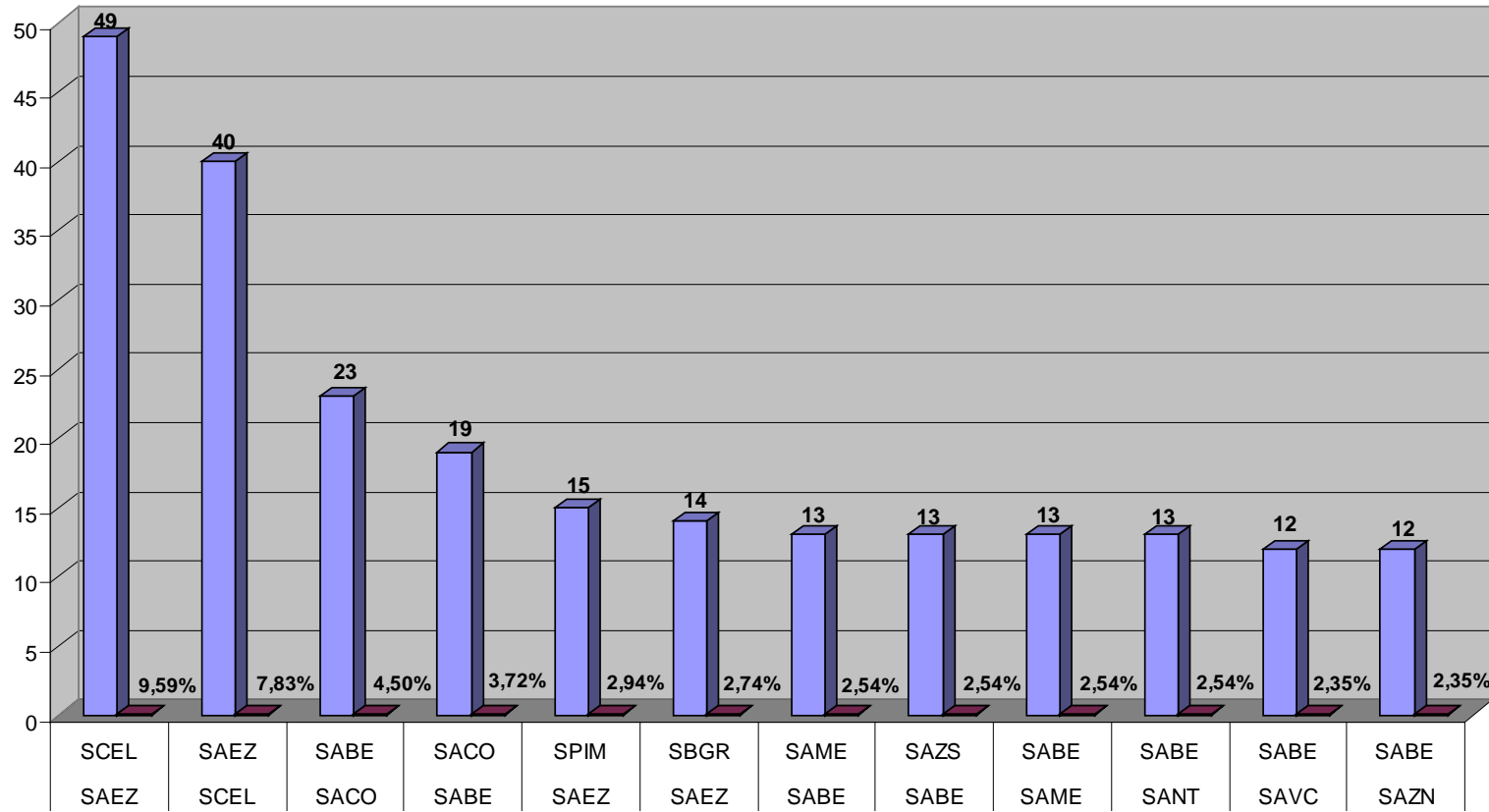
FIR COMODORO RIVADAVIA - Pares de Ciudades
65% del tránsito de la muestra



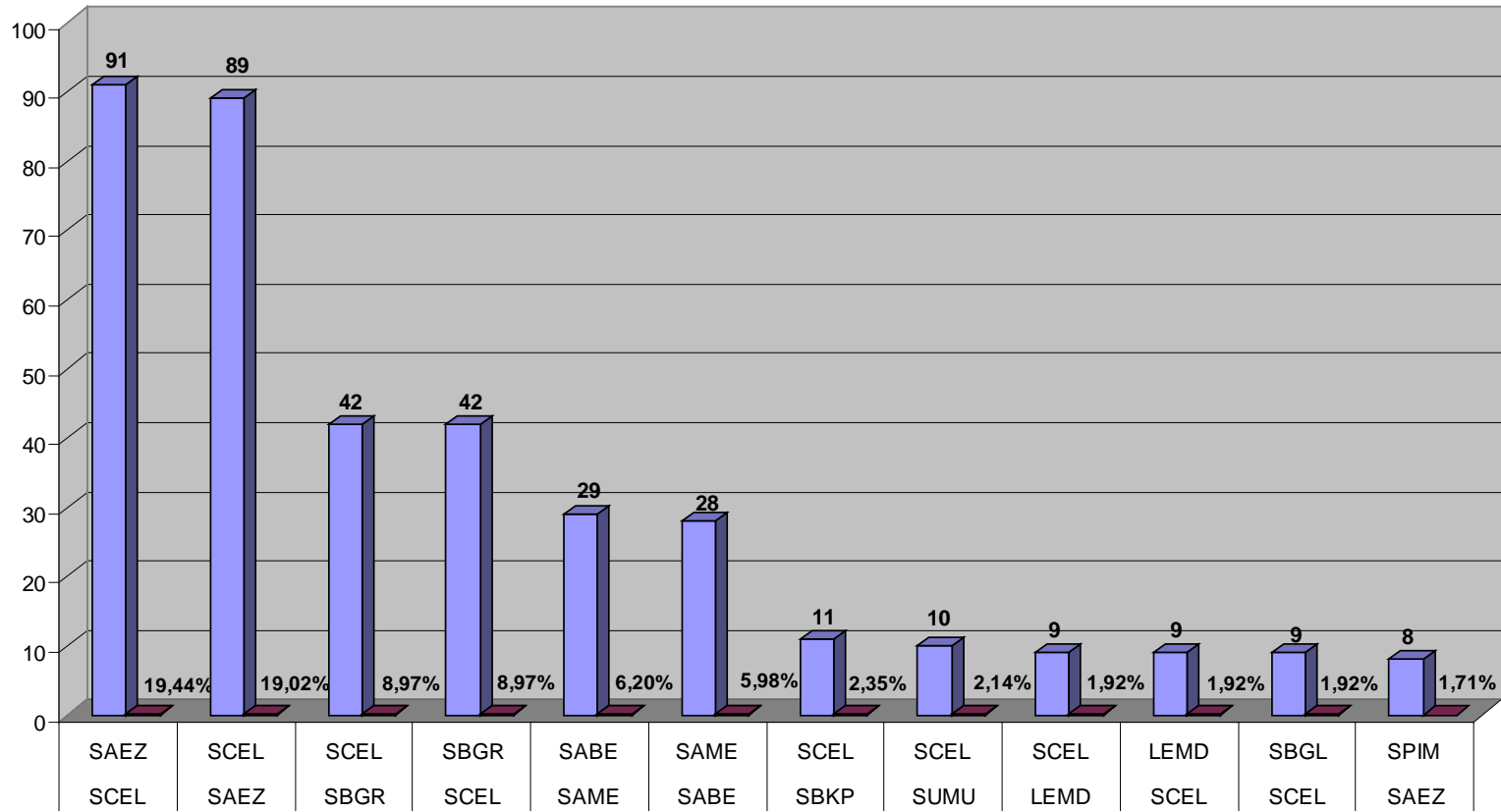
FIR CORDOBA - Pares de Ciudades
51% del tránsito de la muestra



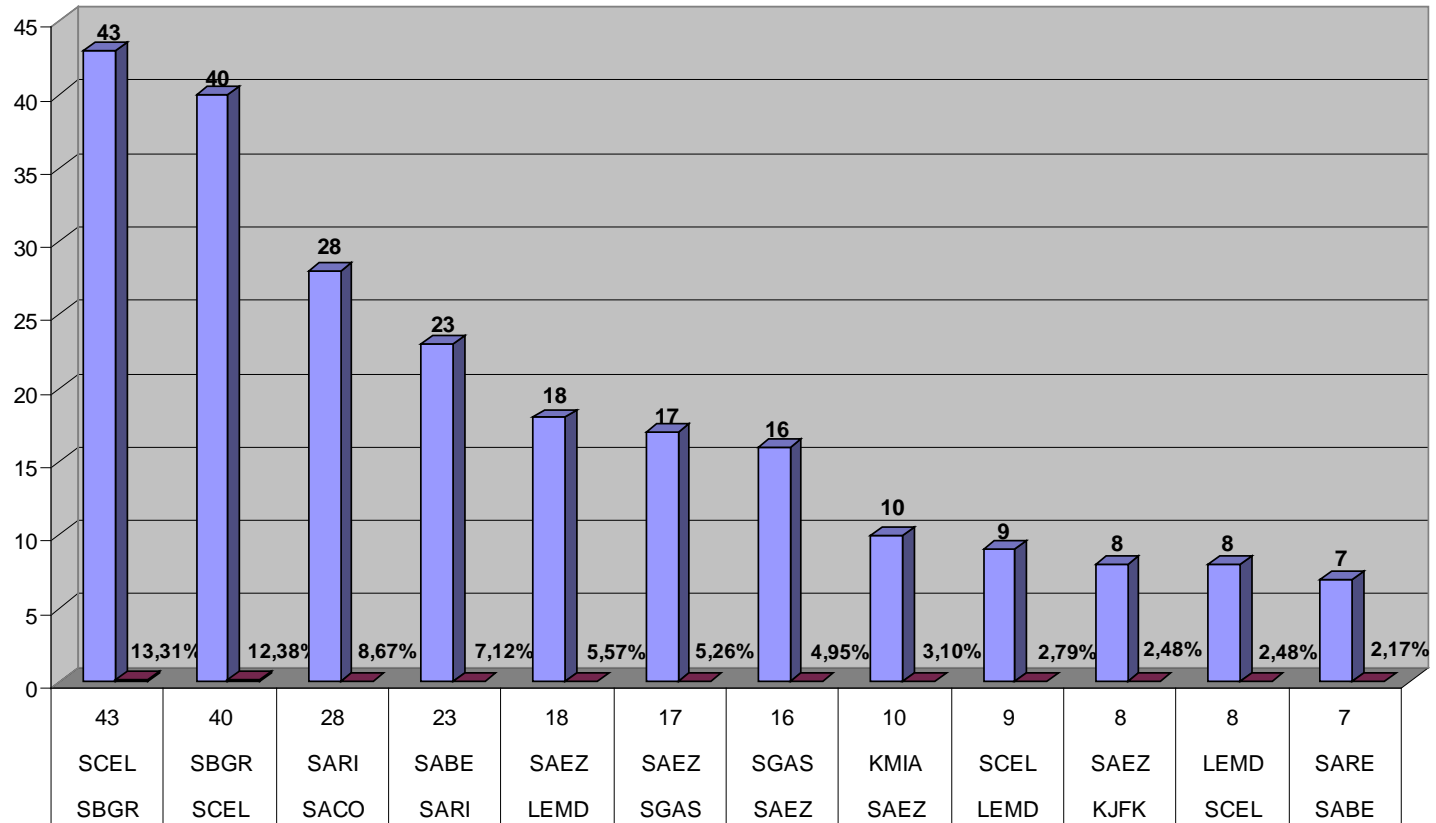
FIR EZEIZA - Pares de Ciudades
46% del tránsito de la muestra



FIR MENDOZA - Pares de Ciudades
80% del tránsito de la muestra

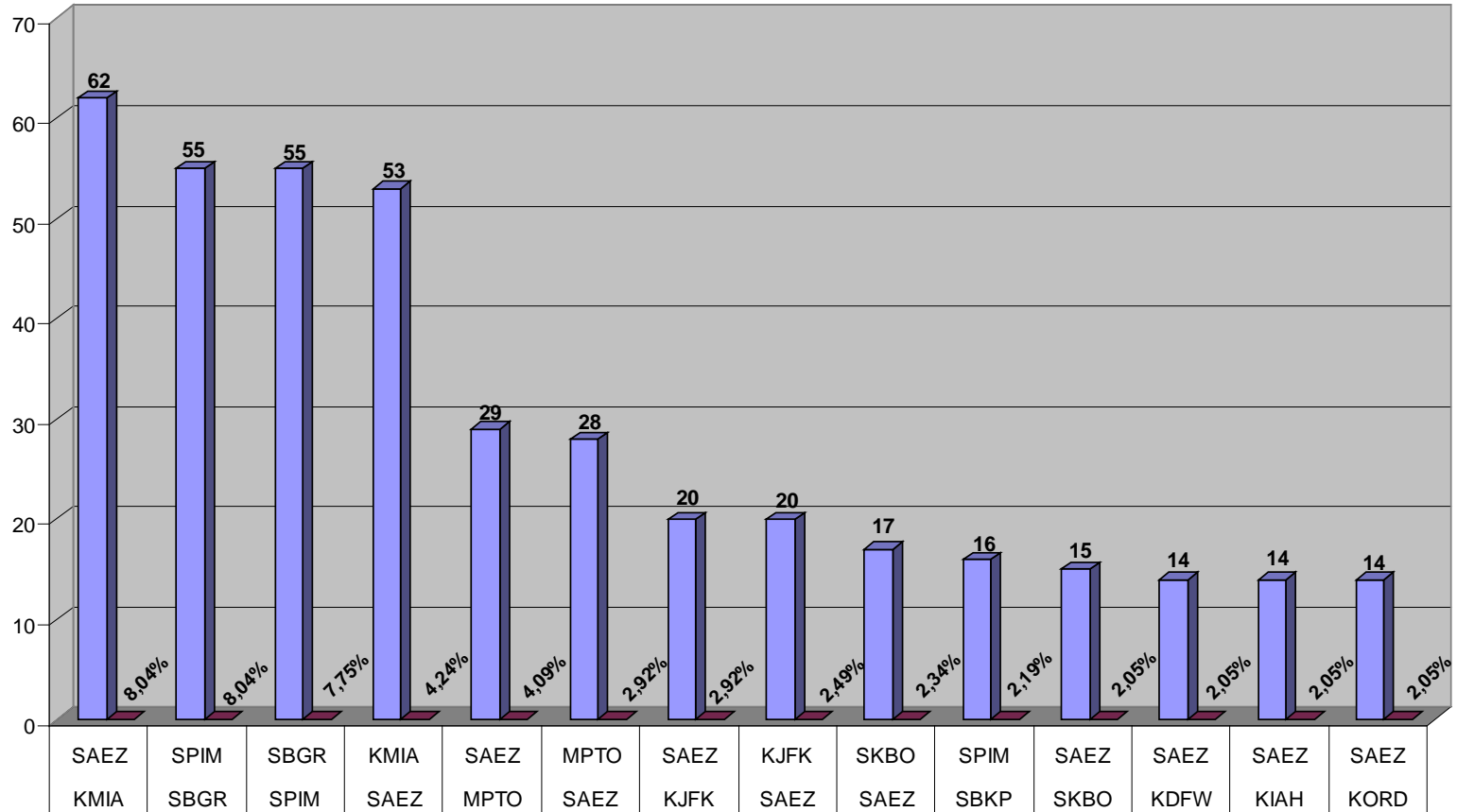


FIR RESISTENCIA - Pares de Ciudades
70% del tránsito de la muestra



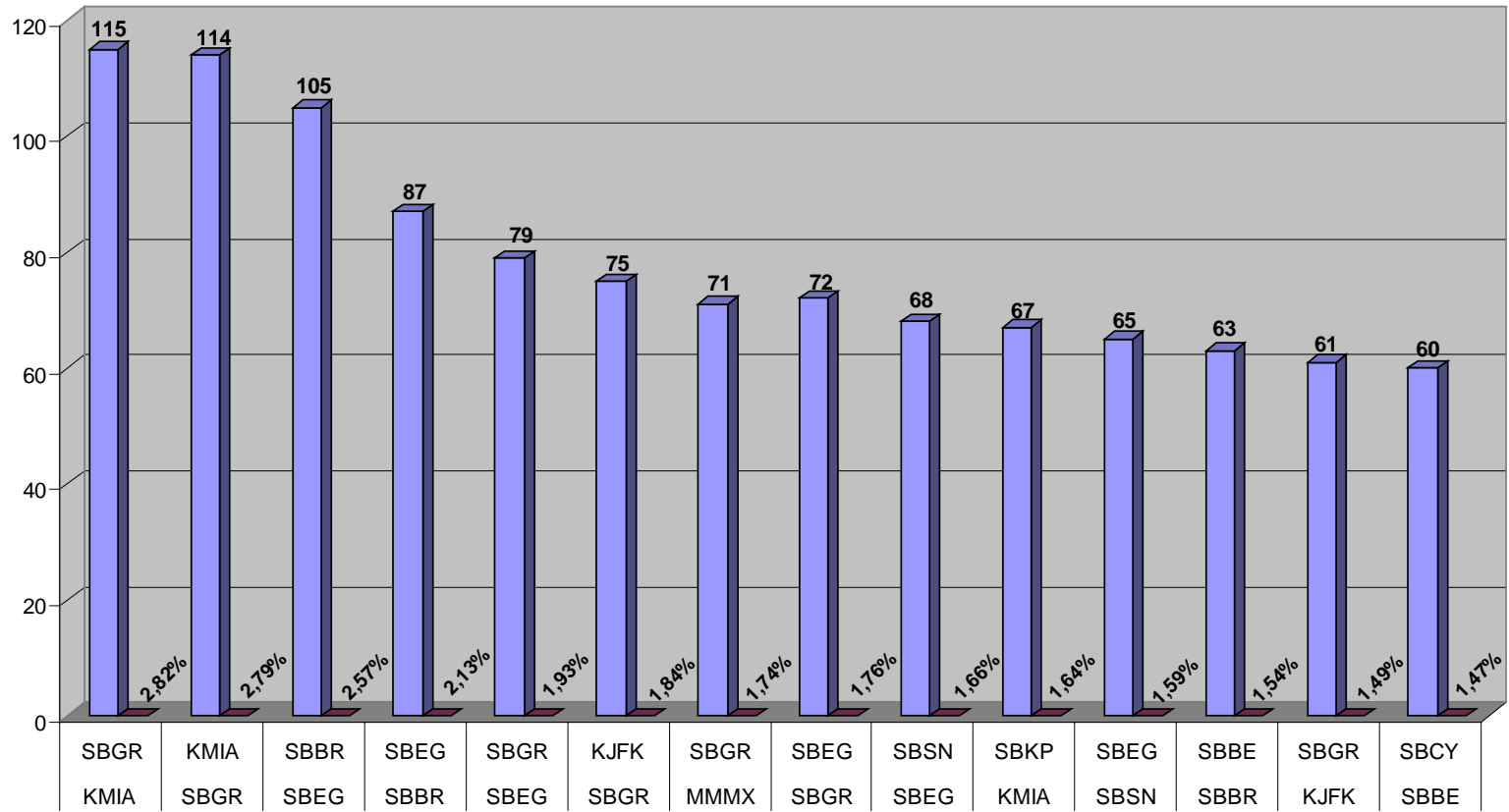
BOLIVIA

FIR LA PAZ - Pares de Ciudades
60% del tránsito de la muestra

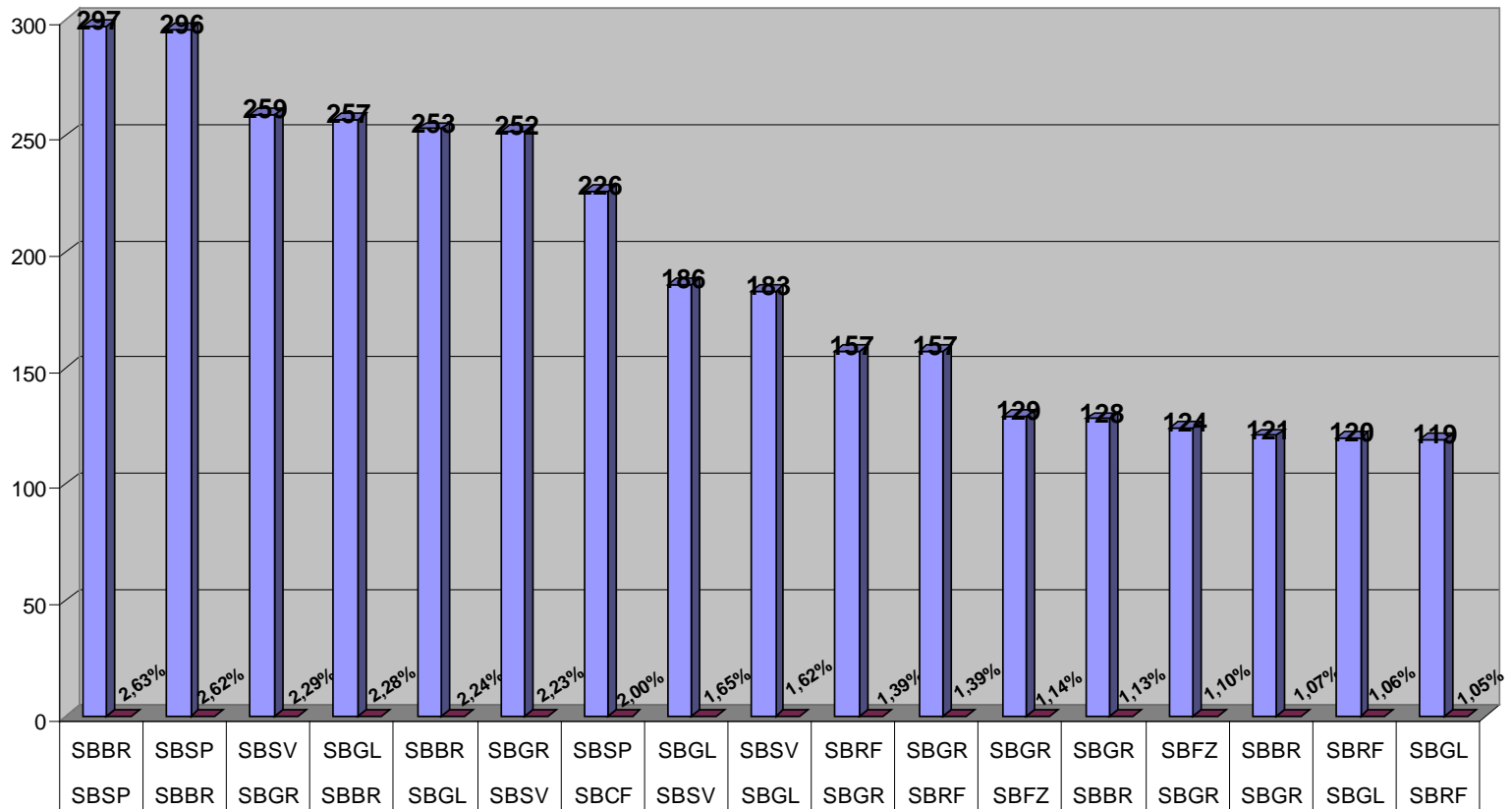


BRAZIL

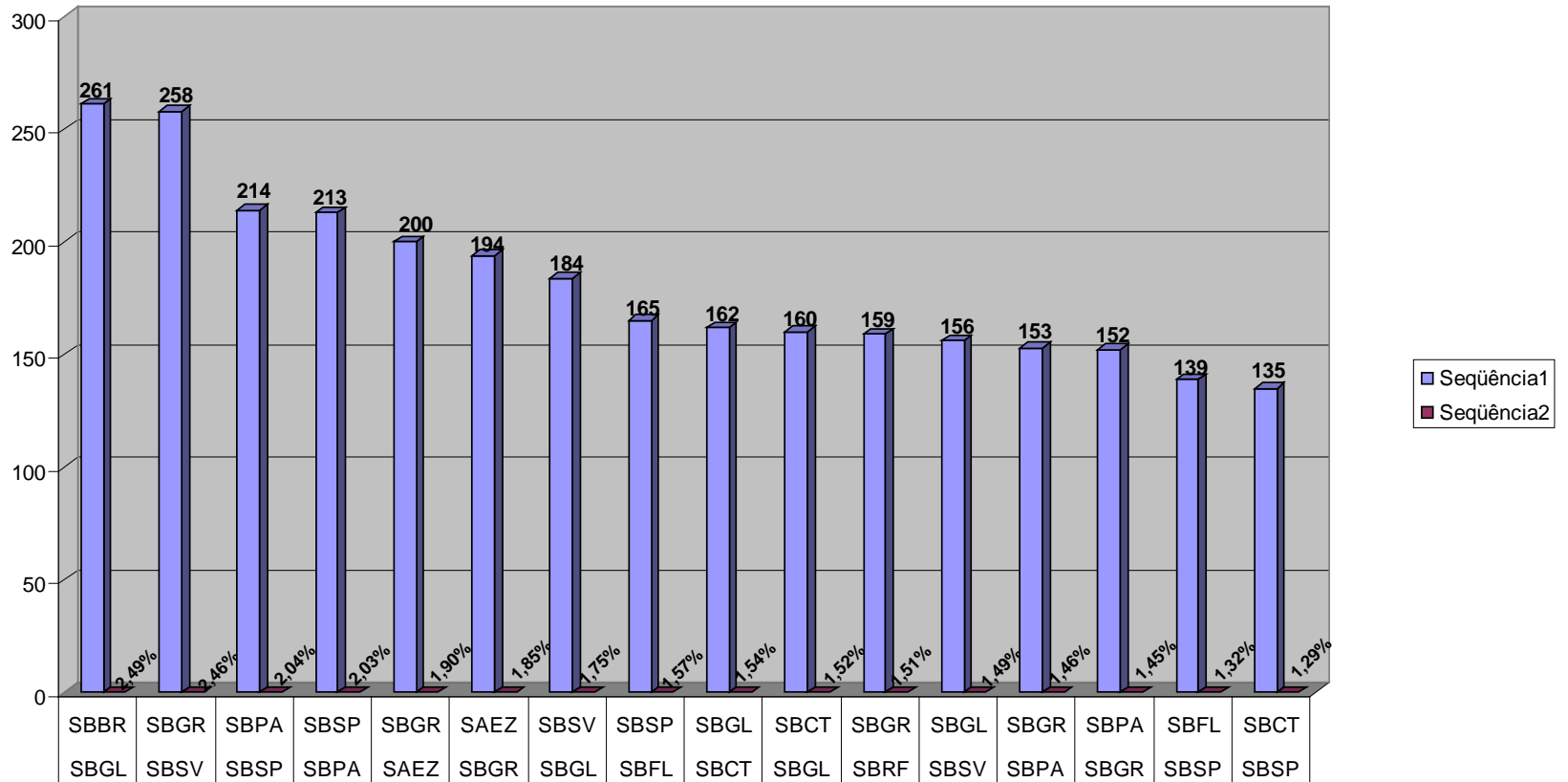
FIR AMAZONICA - Pares de Ciudades
27% del tránsito de la muestra



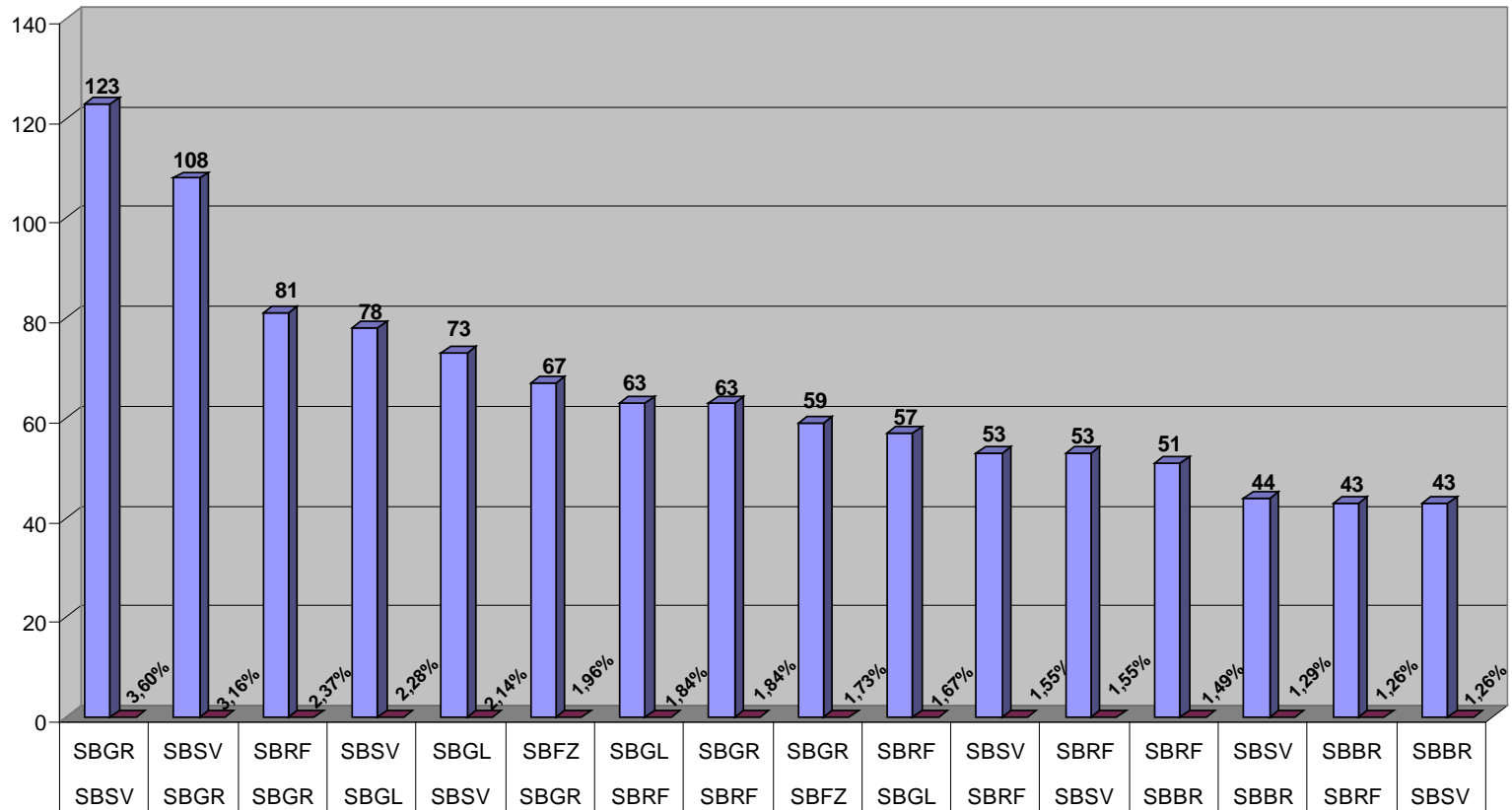
FIR BRASÍLIA - Pares de Ciudades
28% del tránsito de la muestra



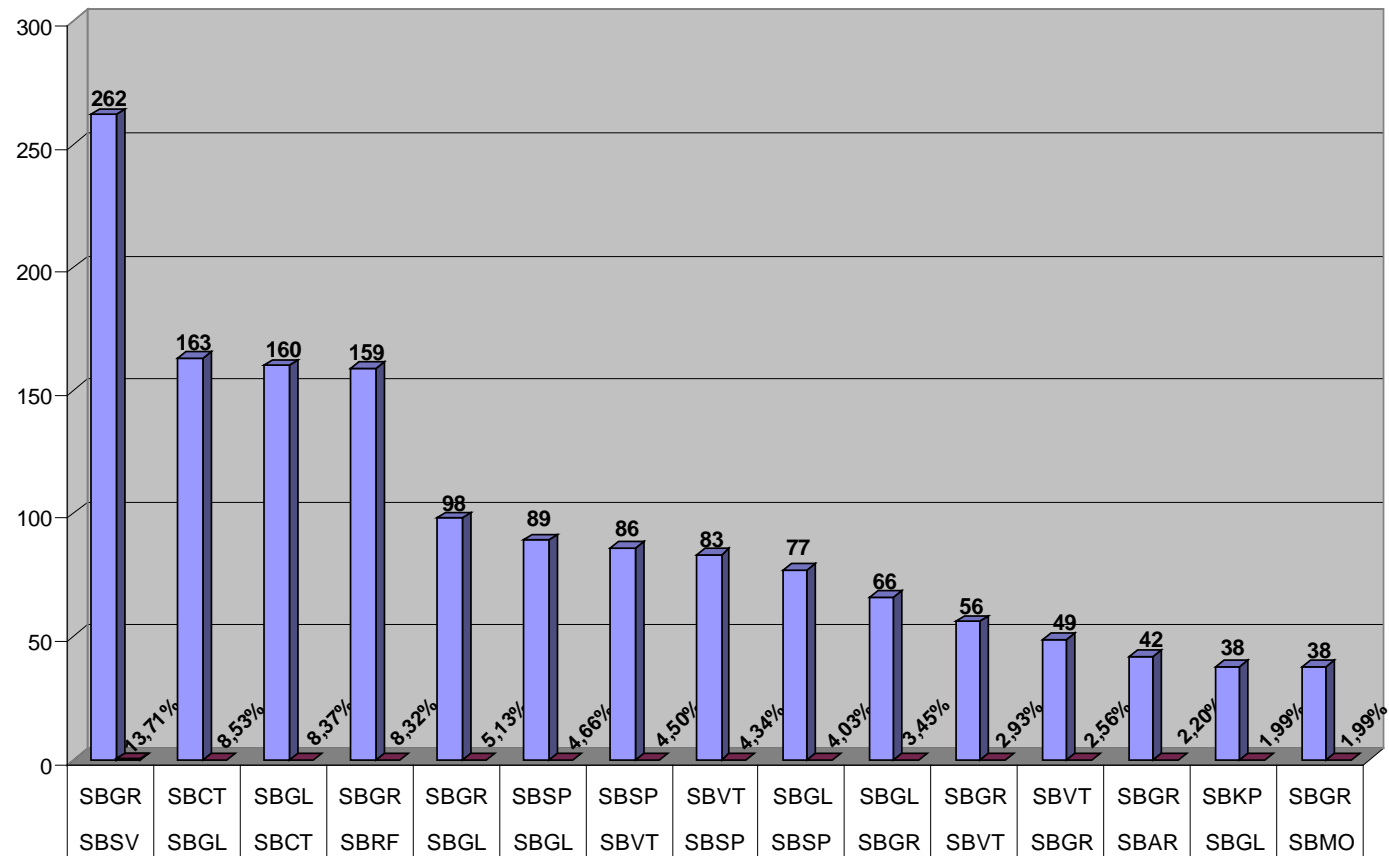
FIR CURITIBA - PARES DE CIUDADES
28% del tránsito de la muestra



FIR RECIFE - Pares de Ciudades
31% del tránsito de la muestra

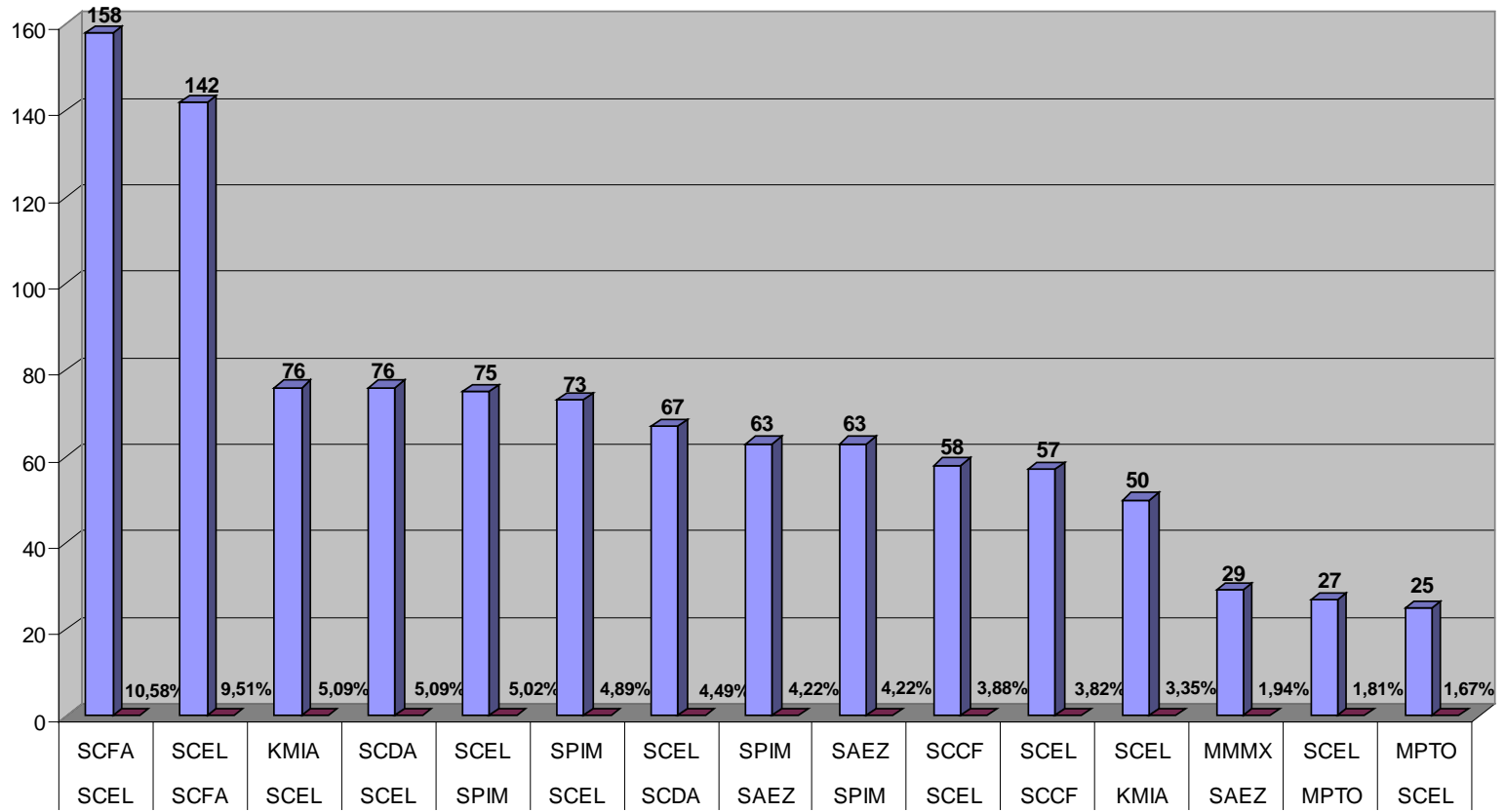


TMA SÃO PAULO - Pares de Ciudades
76% del tránsito de la muestra

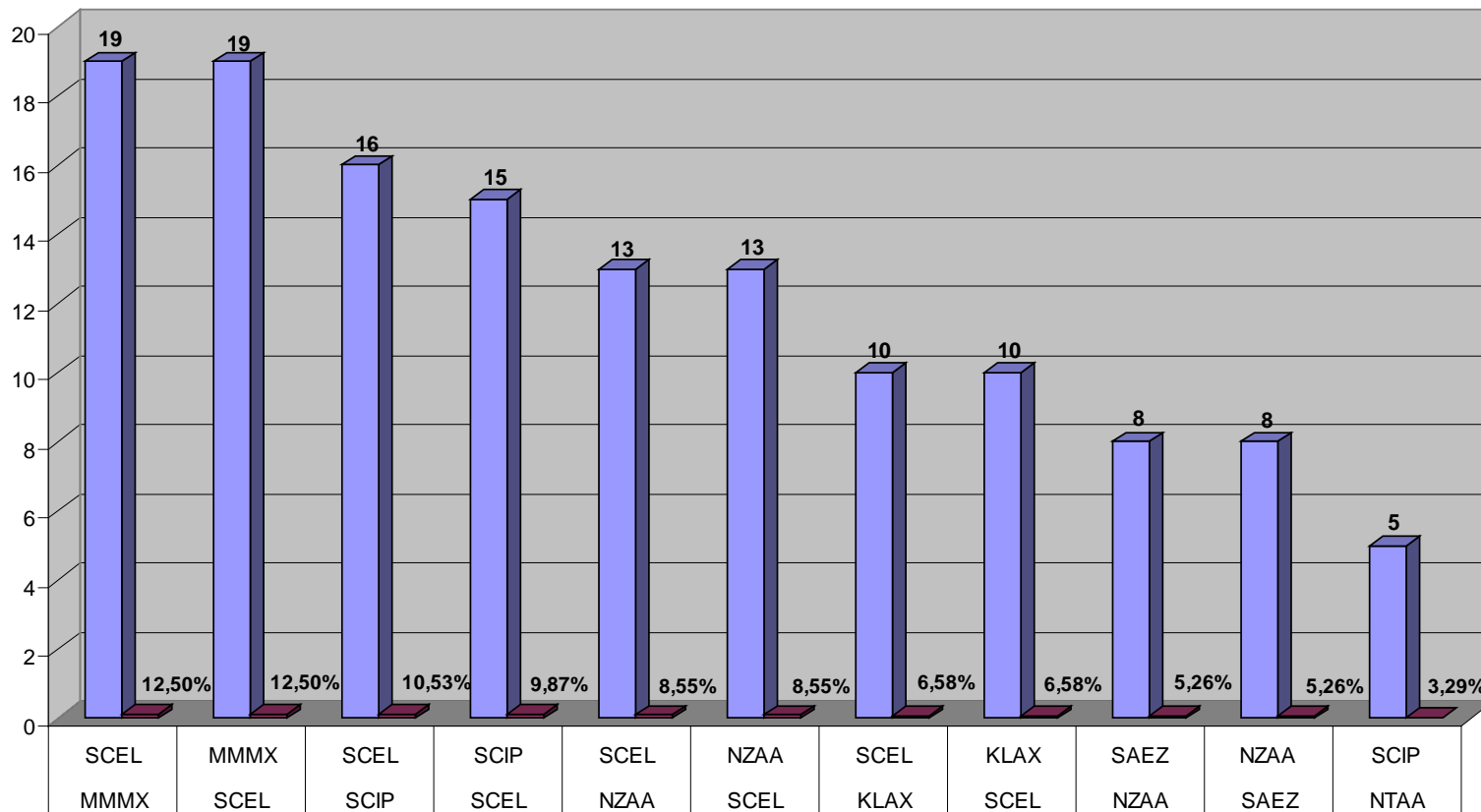


CHILE

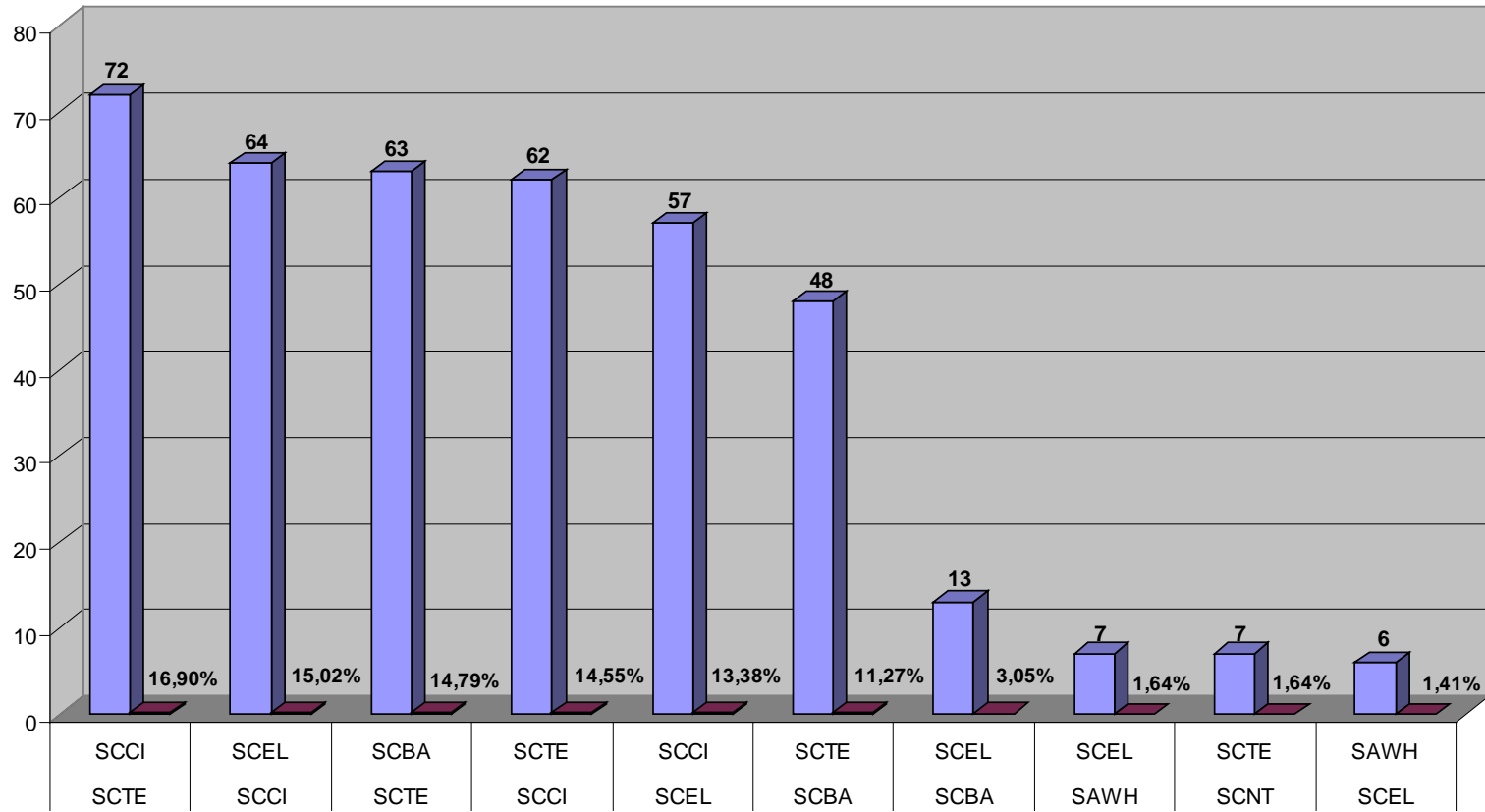
FIR ANTOFOGASTA - Pares de Ciudades
70% del tránsito de la muestra



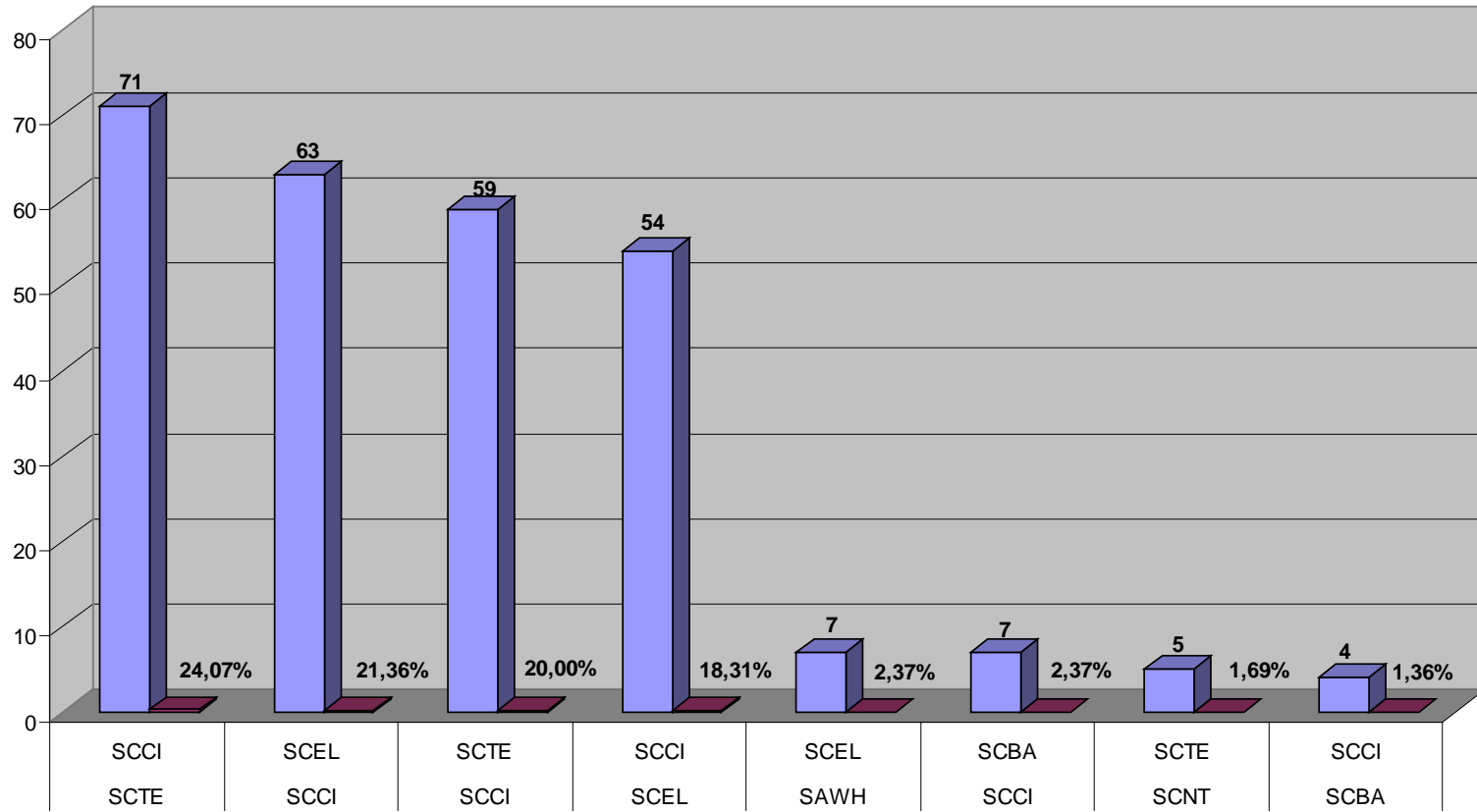
FIR PASCUA - PARES DE CIUDADES
89% del tránsito de la muestra



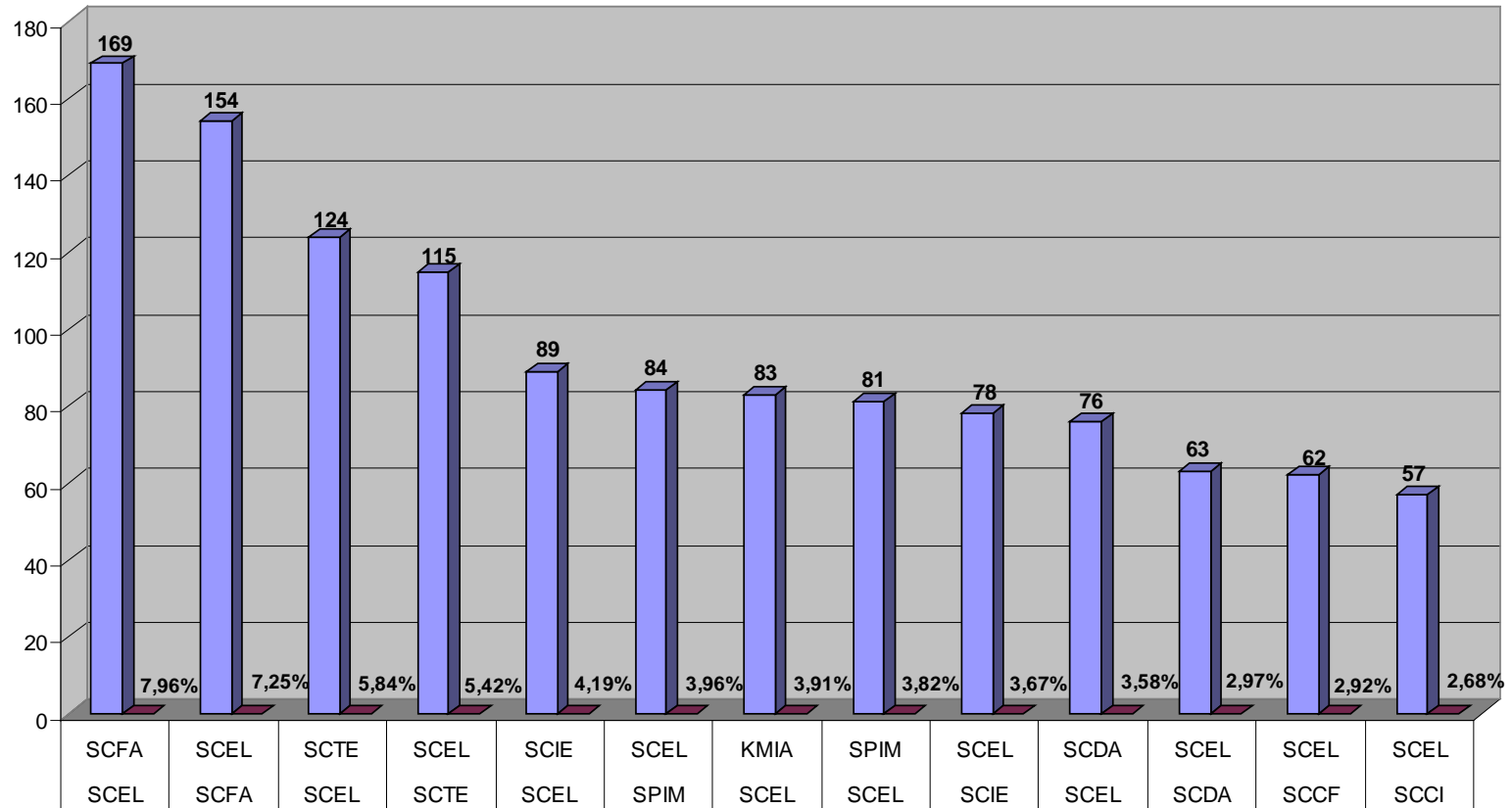
FIR PUERTO MONTT - PARES DE CIUDADES
94% del tránsito de la muestra



FIR PUNTA ARENAS - PARES DE CIUDADES
92% del tránsito de la muestra

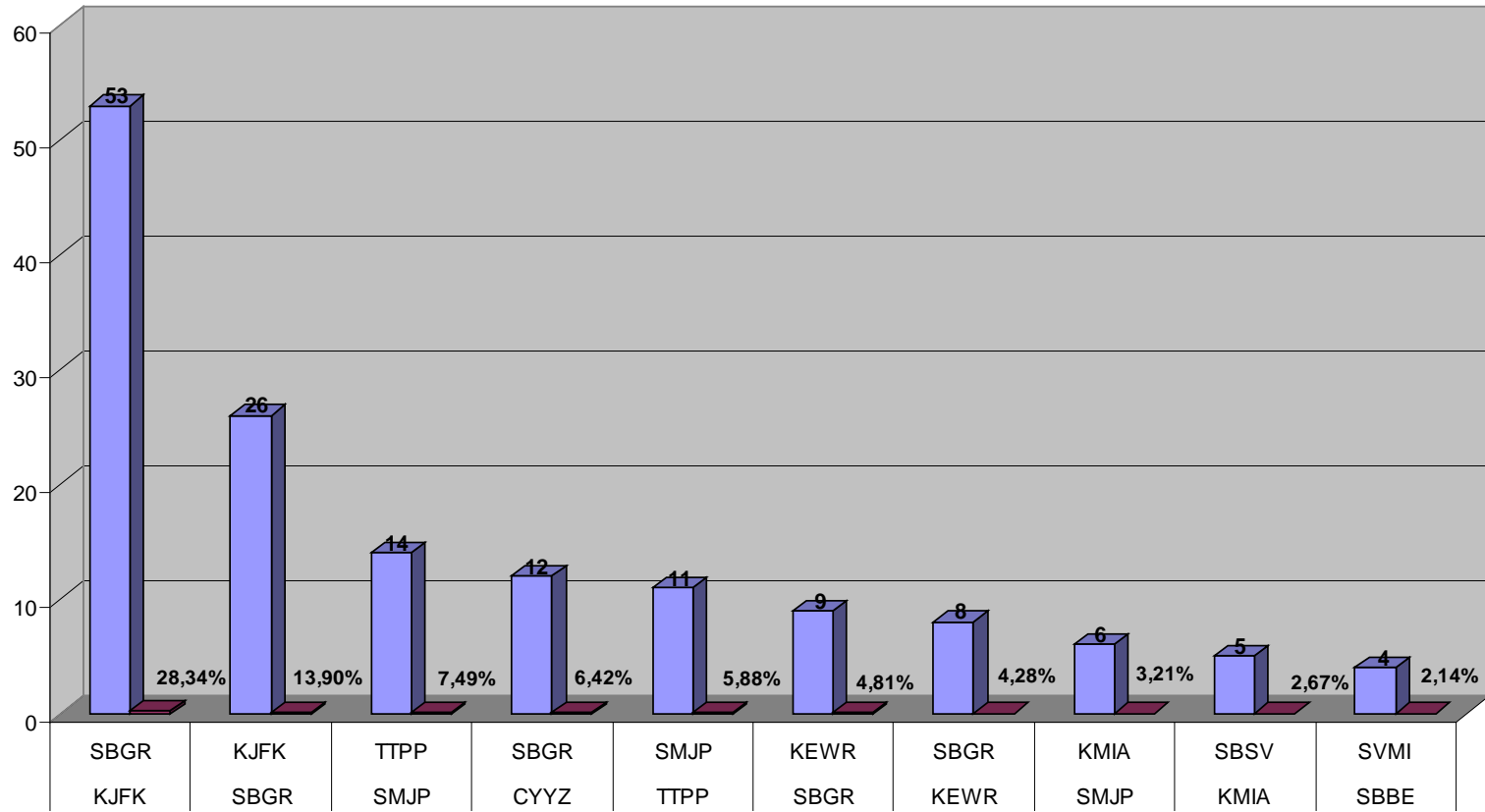


FIR SANTIAGO - PARES DE CIUDADES
58% del tránsito de la muestra



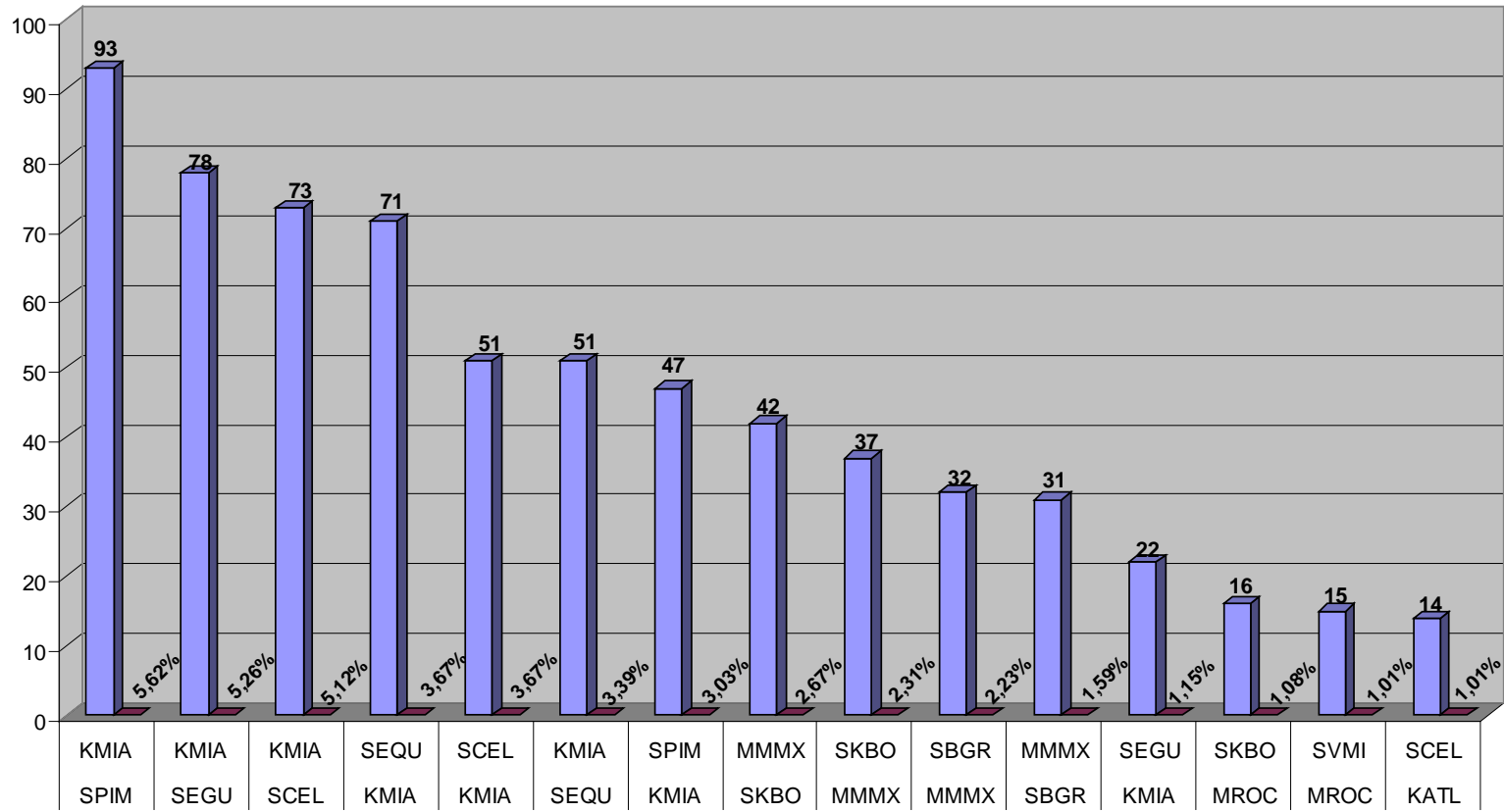
GUYANA

FIR GEORGETOWN - PARES DE CIUDADES
79% del tránsito de la muestra



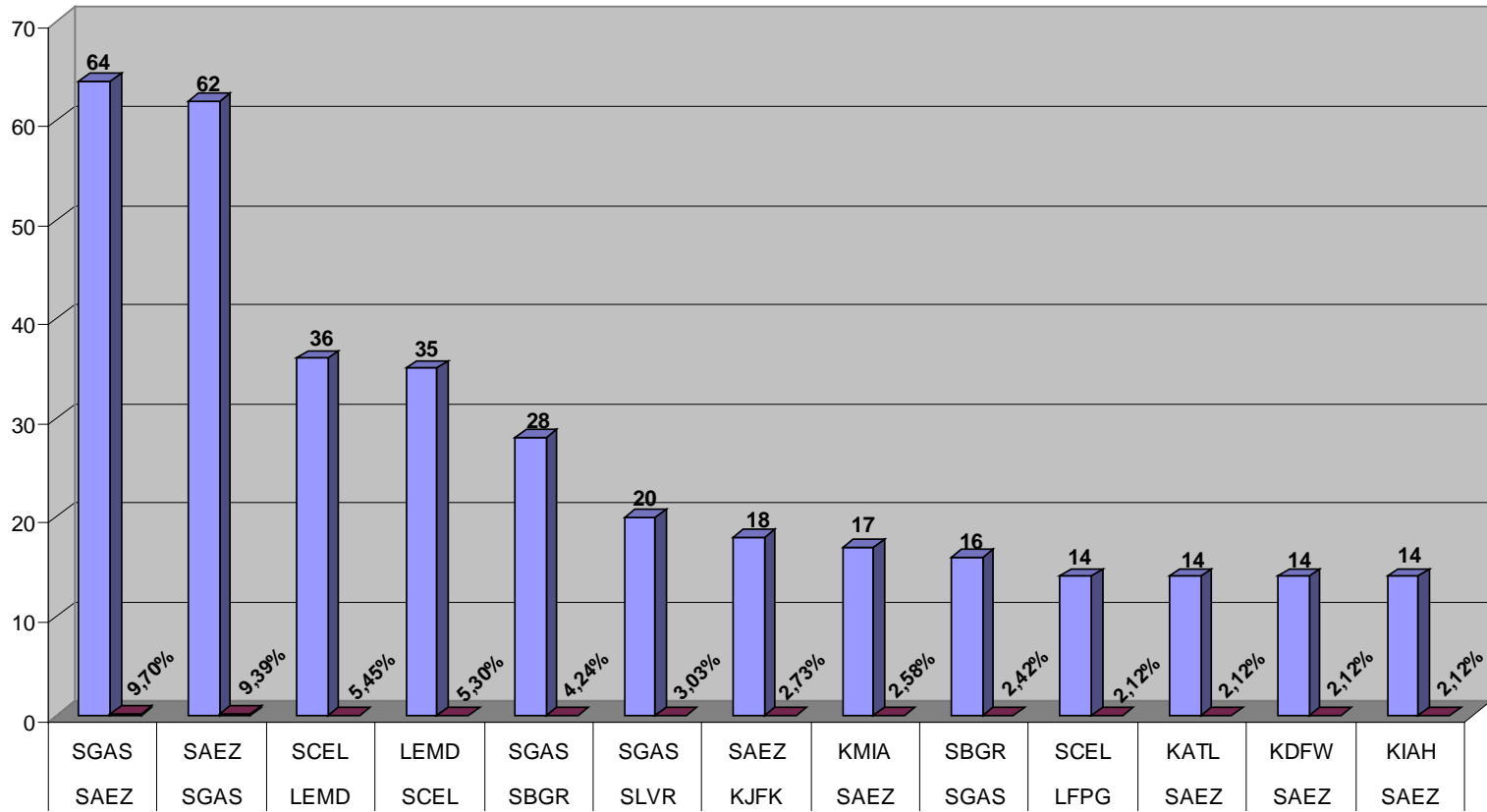
PANAMA

FIR PANAMA - PARES DE CIUDADES
48% del tránsito de la muestra



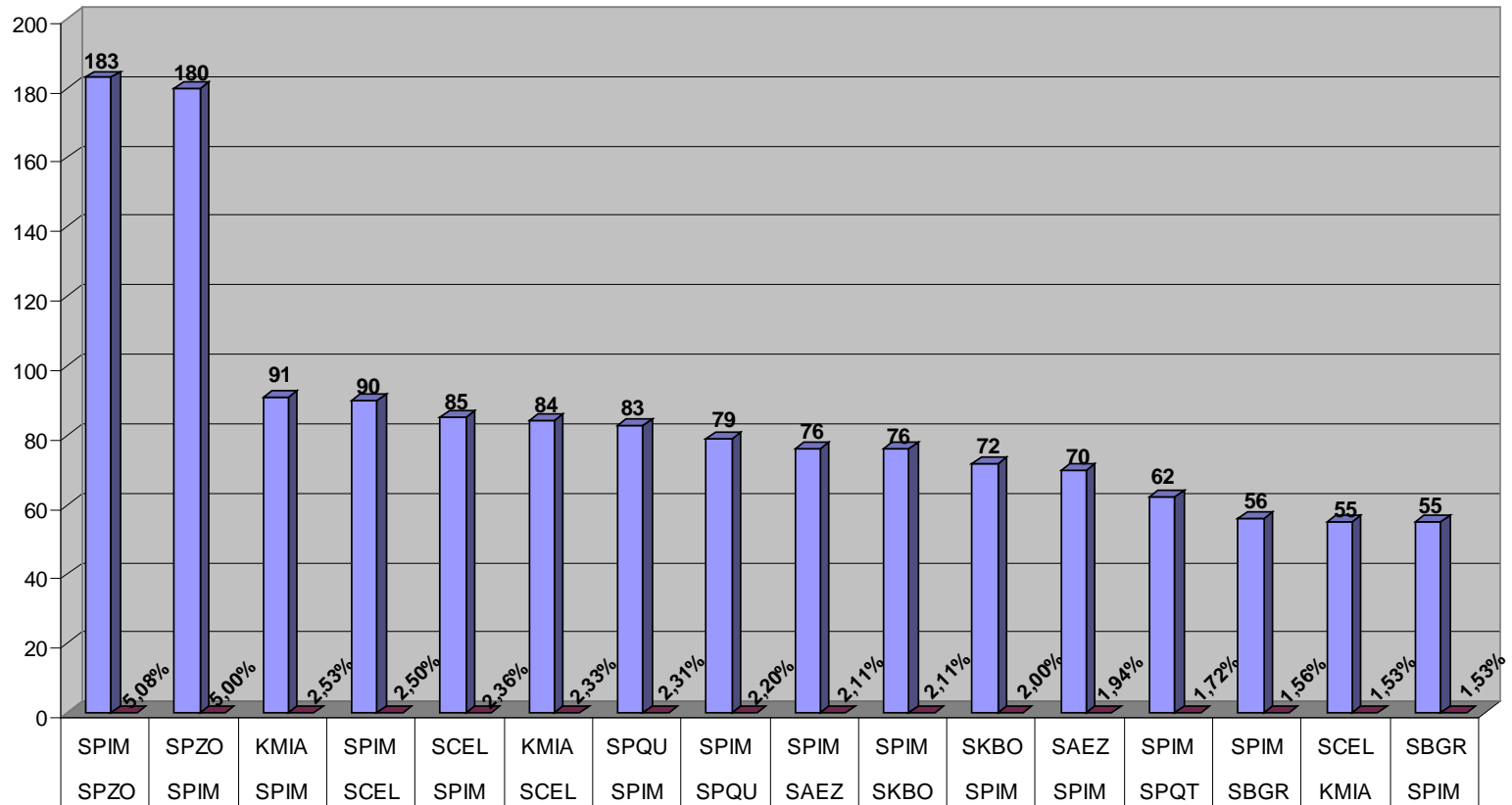
PARAGUAY

FIR ASUNCIÓN - PARES DE CIUDADES
53% del tránsito de la muestra



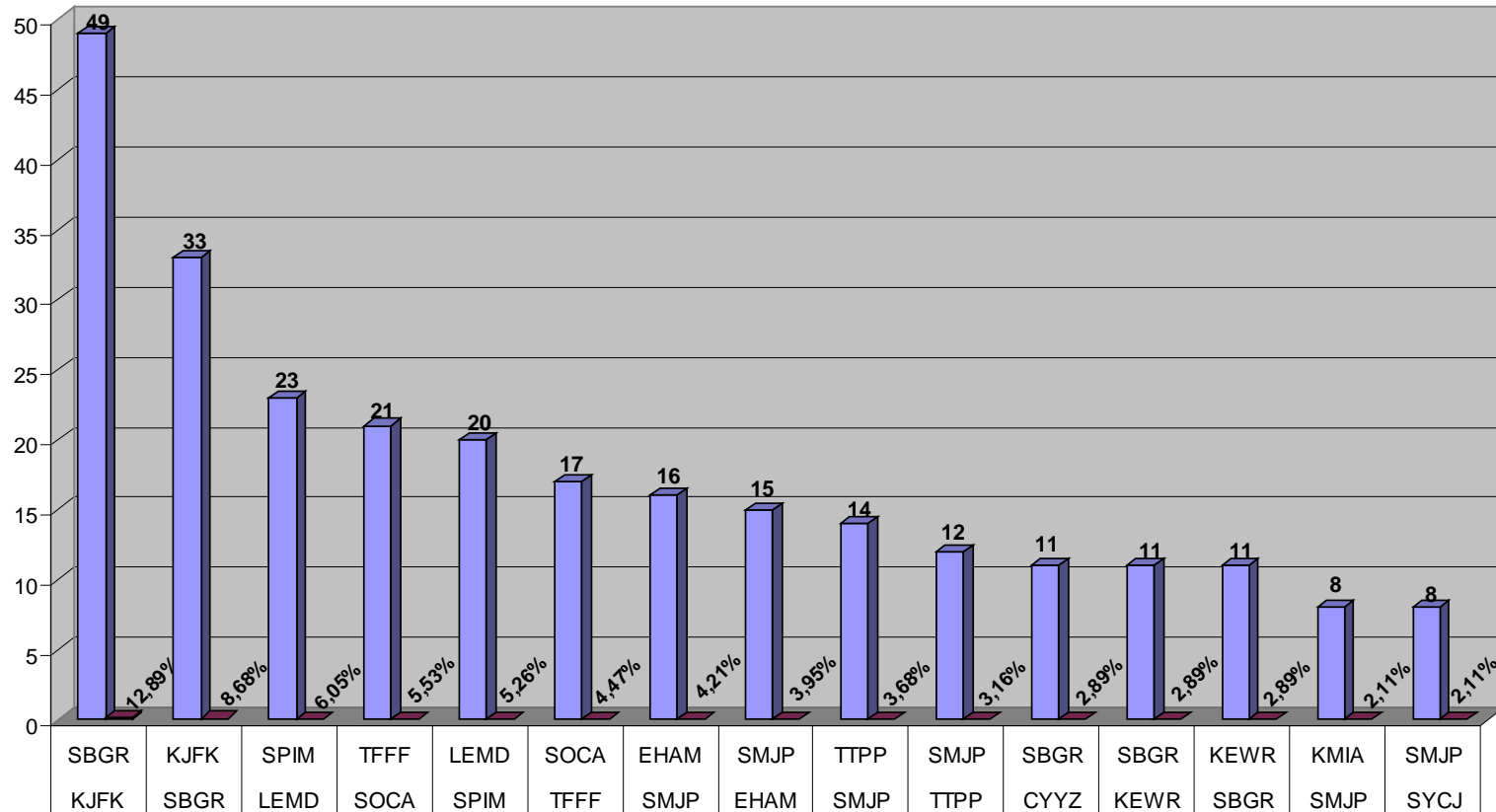
PERU

FIR LIMA - PARES DE CIUDADES
39% del tránsito de la muestra



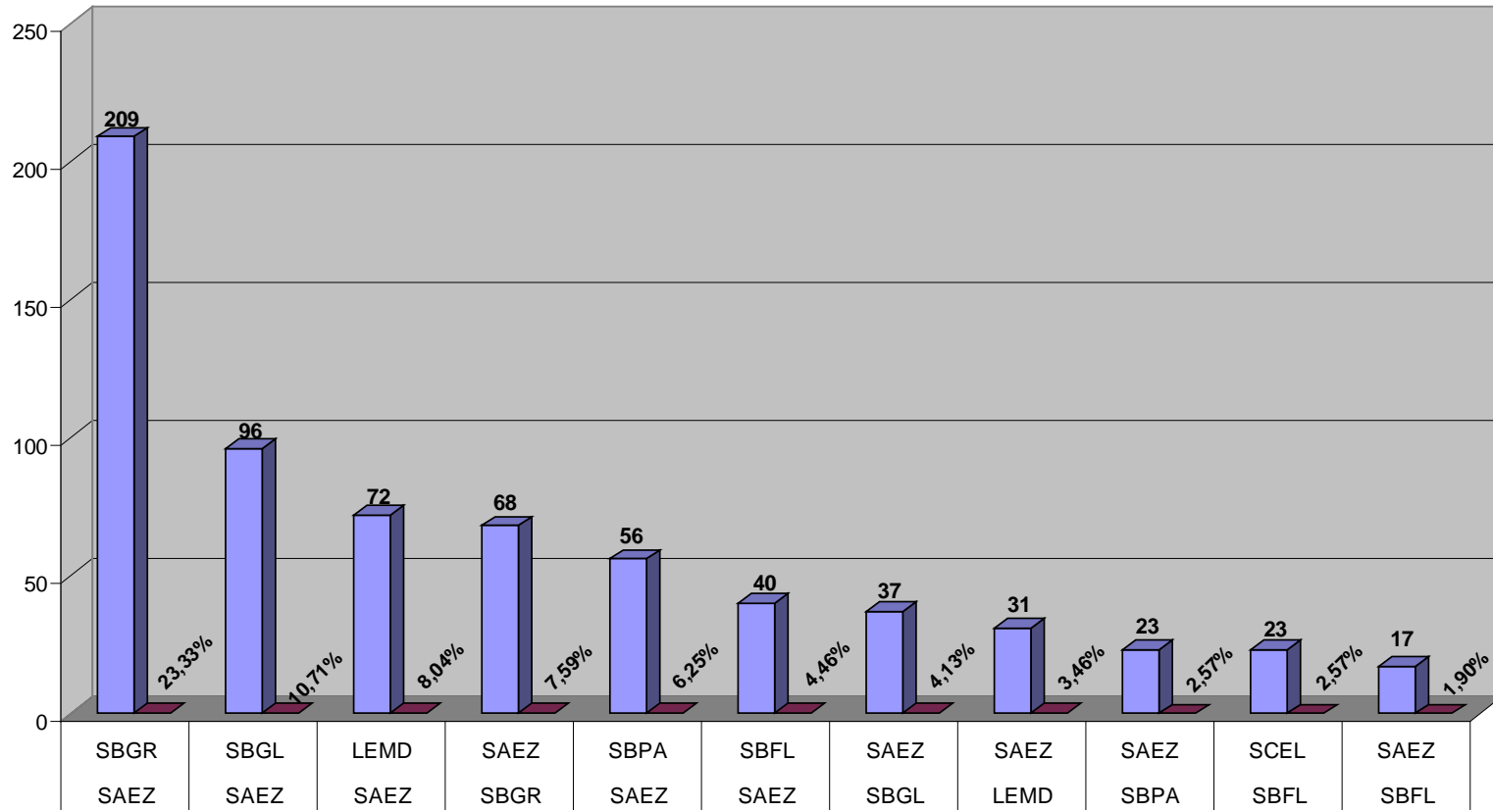
SURINAME

FIR PARAMARIBO - PARES DE CIUDADES
71% del tránsito de la muestra



URUGUAY

FIR MONTEVIDEO - PARES DE CIUDADES
75% del tránsito de la muestra



ATTACHMENT 4**STATUS OF GNSS REGULATIONS IN SAM STATES****ARGENTINA**

The use of GNSS was approved as a primary means of navigation in VFR and IFR flights in oceanic routes, ATS routes, TMA and non-precision approach procedures (NPA) through provision CRA N 55/07. The resolution is published in section ENR 4-2 of the AIP.

BOLIVIA

Regulatory Bulletin N° DGAC/08/2002 (Operational Use of the Global Positioning System - GPS) establishes operational criteria for the use of GNSS in the Bolivian territory as a supplementary and primary means of air navigation.

BRAZIL

IAC 3512 91/121/135, which became effective 26 April 2001, and AIC 12/99 contain guidelines for the use of GPS equipment in en-route IFR operations, TMAs and non-precision approach procedures in the Brazilian airspace. The documentation is being updated in order to meet PBN requirements. The aforementioned documents can be found at the following websites:

http://www.aisweb.aer.mil.br/aisweb_files/publicacoes/aic_a/aic_1999_a12.pdf

<http://www.anac.gov.br/biblioteca/iac/IAC3512.pdf>

CHILE

The first amendment to the third edition of DAP 0613 (Operational Use of the GPS System) was published in Resolution DGAC n 2474 of 18 October 2006, setting the operational criteria for the use of the GPS system as a primary/supplementary means of air navigation in Chilean airspace, as appropriate.

Norm DAN 0805 (Resolution N° 0709 of 19 April 2004) regulates the installation of GPS systems on board aircraft with Chilean registry.

Norm DAN 06 21 (Exempt Resolution N° 1204 of 31 May 2007) establishes the technical and operational requirements for the approval of operators that wish to apply RNAV/GNSS procedures in TMA and non-precision approaches.

The aforementioned documents may be found at:

<http://www.dgac.cl/images/IMG/pdf/otros/dap/dap0613.pdf>

<http://www.dgac.cl/images/IMG/pdf/otros/dan/DAN%2008%2005.pdf>

<http://www.dgac.cl/images/IMG/pdf/otros/dan/dan0621.zip>

COLOMBIA

AICs C06 and A01, Global Positioning System, dated 10 September 1996, set forth the operational criteria for the use of GPS as a supplementary means of air navigation in Colombian airspace. The Aeronautical Regulations of Colombia, Part 6, Air Traffic Management, Section 6.10.3, establishes RNAV (GNSS) operations through standard arrival and departure (STAR/SID) procedures and non-precision instrument procedures at the following airports: SKAS, SKUI, SKUC SKYP.

ECUADOR

Aeronautical Information Circular of 14 May 2007, which supersedes AIC 07/96 of 3 December 1996, defines the regulations for applying the GNSS system. The circular establishes the use of GNSS in RNAV navigation for instrument arrival (STAR) and departure (SID) procedures and non-precision approaches.

GUYANA

Through AIC of 25 November 2004, the use of GPS in the Georgetown FIR airspace was approved. GPS may be used for departure, approach and en-route IFR navigation.

FRENCH GUIANA

The regulations enabling the use of GNSS RNAV equipment for non-precision approaches were published in Resolution N° F-2007-01, of 26 April 2007, which superseded Resolution N° F-2005-01.

PANAMA

AIC 04/07, Operational Criteria for the Use of GNSS in Panamanian Airspace, was published on 15 March 2007. The circular was aimed at establishing the criteria for the use of GPS as a primary means of navigation in the airspace over the national territory and its jurisdictional waters, particularly the implementation of STARS and SIDs developed for the international airports of Howard and Tocumen.

PARAGUAY

Resolution 169/2000, which authorizes the use of the global positioning system (GPS) in the Republic of Paraguay, was published on 12 May 2000.

PERU

The use of GPS as a supplementary means of navigation was authorized through AIC 02/96, GPS System, dated 17/05/96.

SURINAME

On 31 March 2008, AIP supplement 01/08 on the use of GPS as a primary means of IFR navigation in the Paramaribo FIR, was published.

URUGUAY

In the airspace under the jurisdiction of the Republic of Uruguay, GPS can be used as a supplementary means of navigation for en-route operations and as a primary means of navigation in oceanic airspace. There is a NOTAM, issued for a period of 60 days, enabling the use of GPS as a primary means of navigation in continental areas.

VENEZUELA

AIC A01/C01, dated 2 January 1997, defines the operational criteria for using the Global Positioning System (GPS) as a supplementary means of navigation in the upper airspace (Maiquetía FIR/UTA).

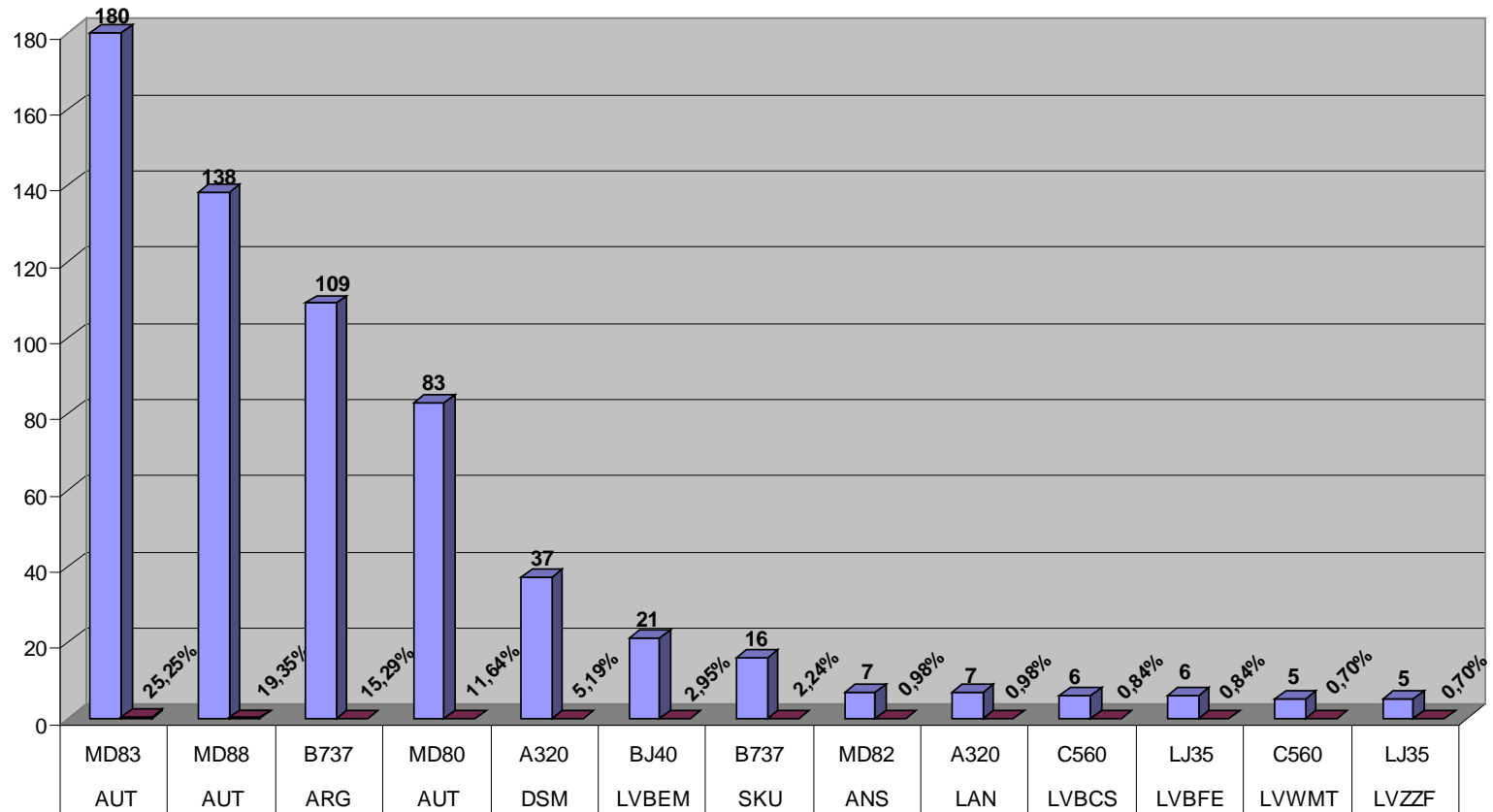
ADJUNTO 5 / ATTACHMENT 5

**Región SAM
Aerolínea/Tipo/**

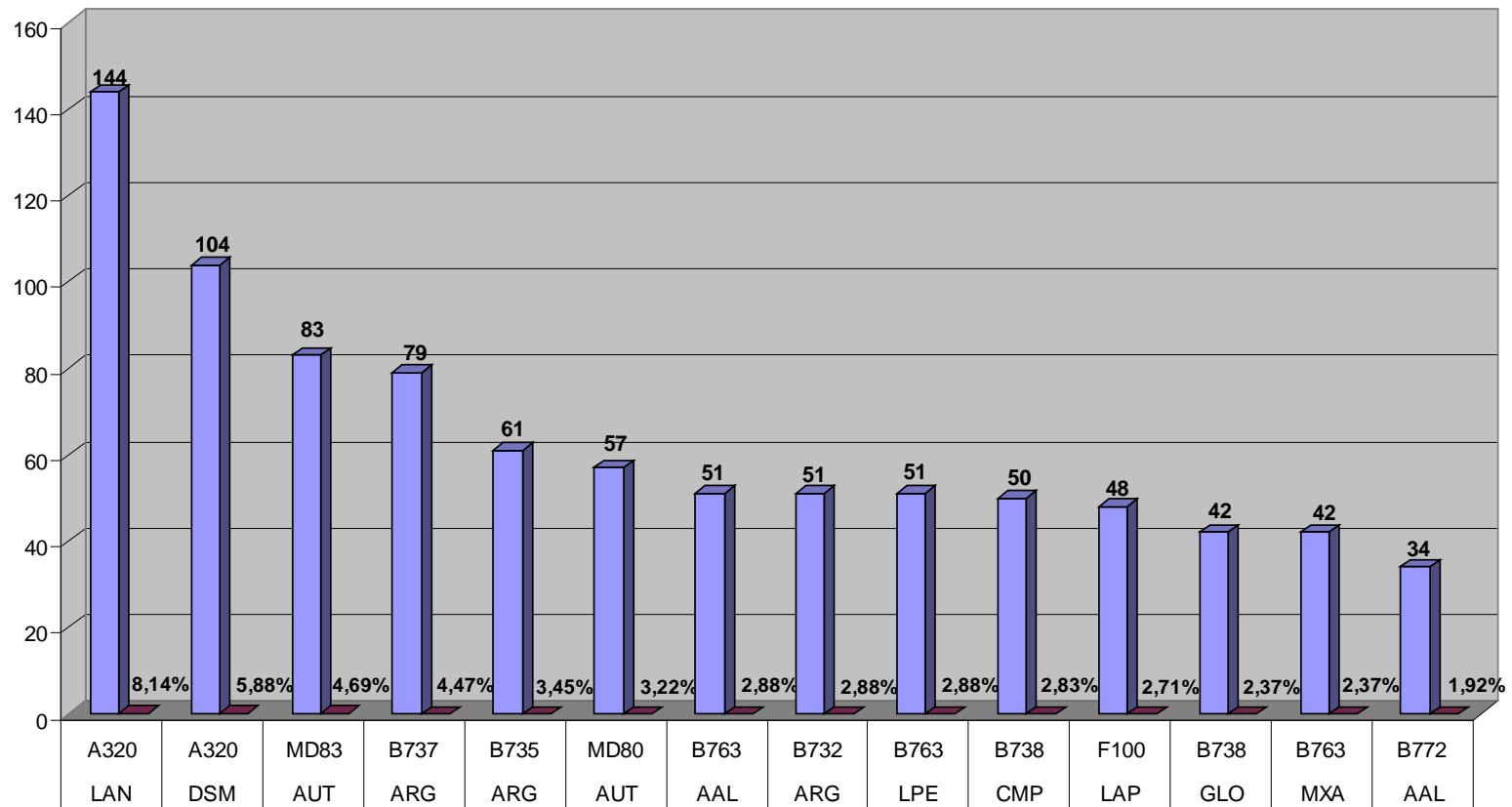
**SAM Region
Airline/Type**

ARGENTINA

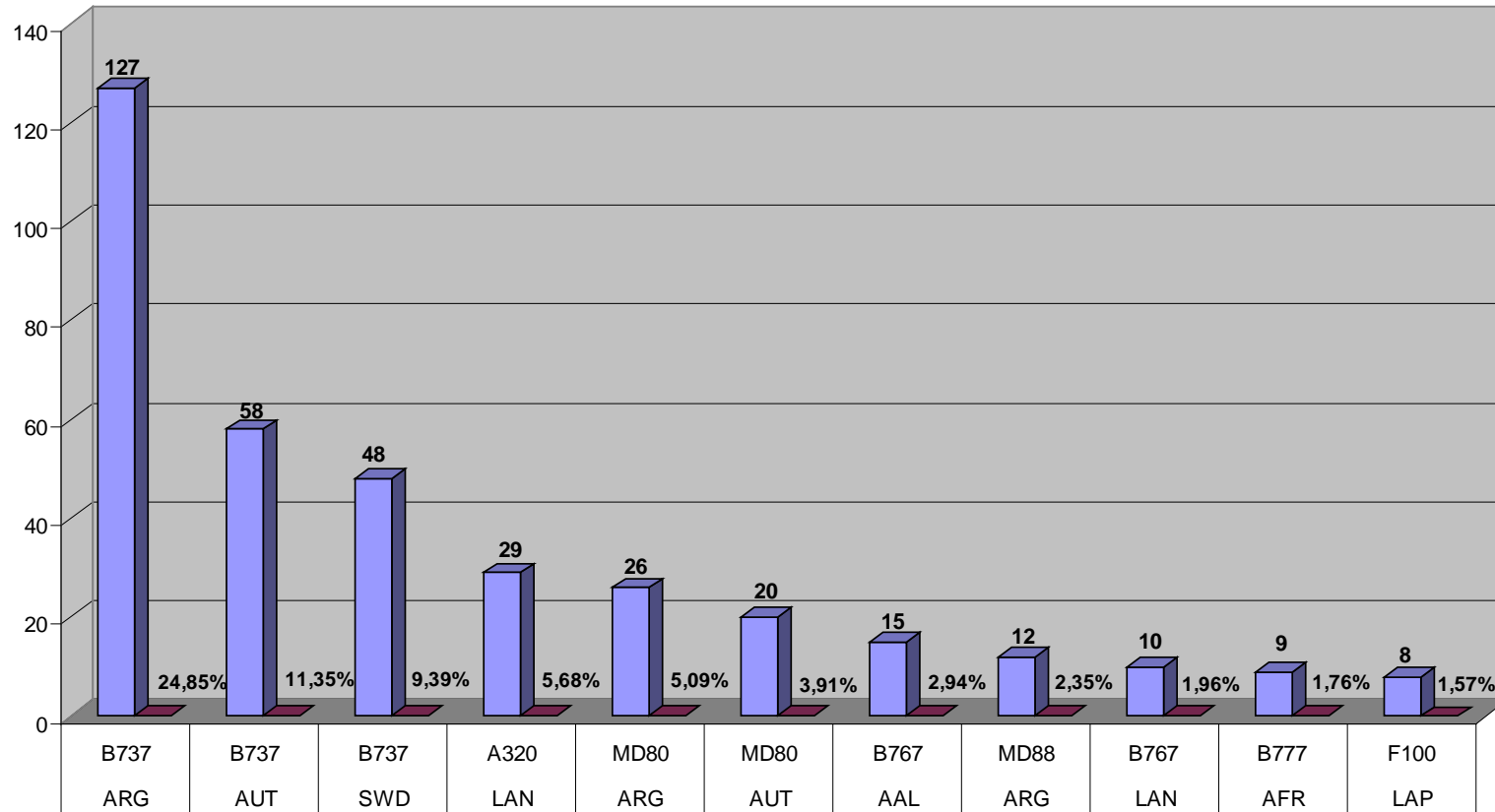
FIR COMODORO RIVADAVIA - Aerolínea/Tipo
87% del tránsito de la muestra



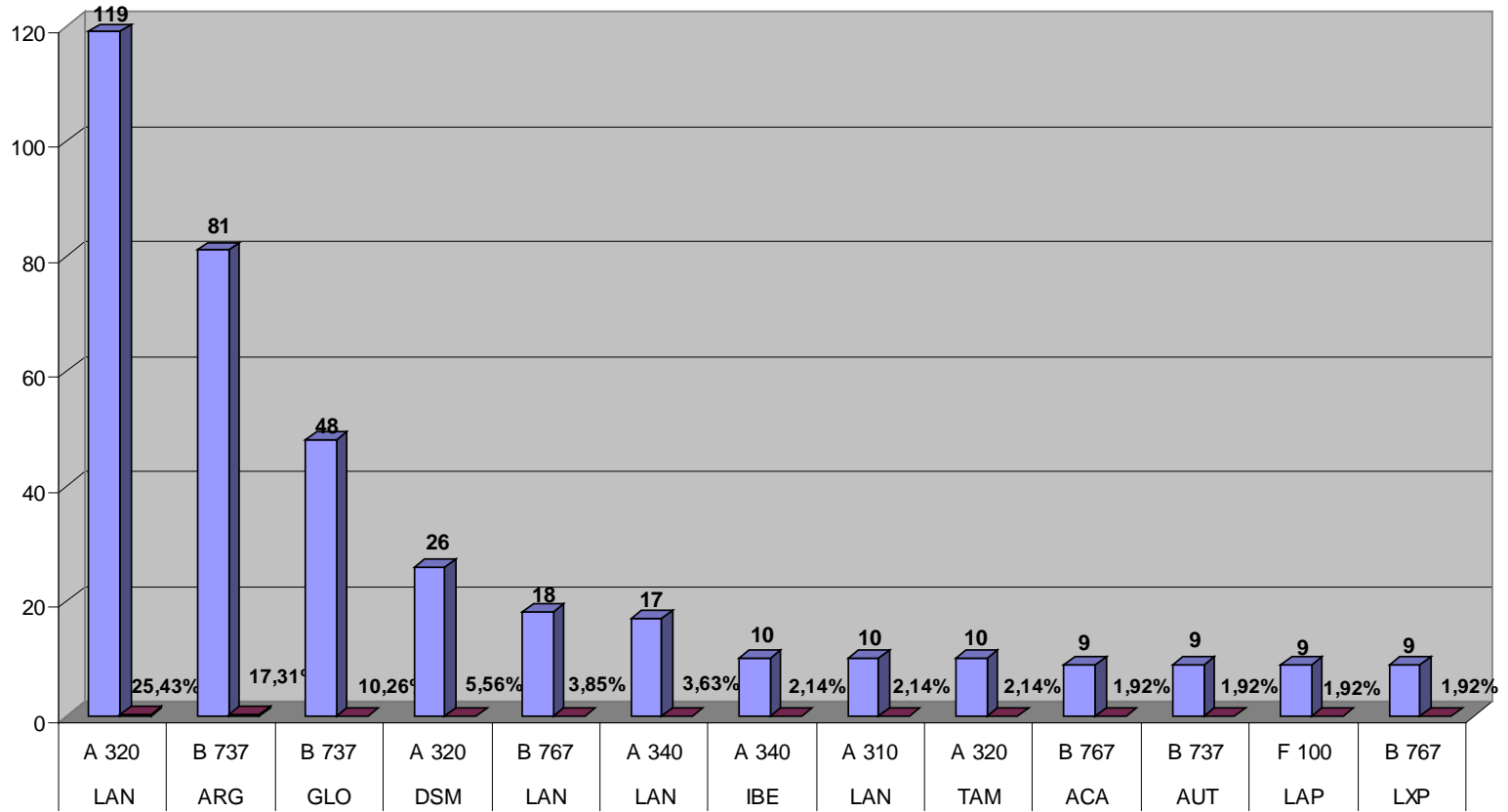
FIR CORDOBA - Aerolínea/Tipo
50% del tránsito de la muestra



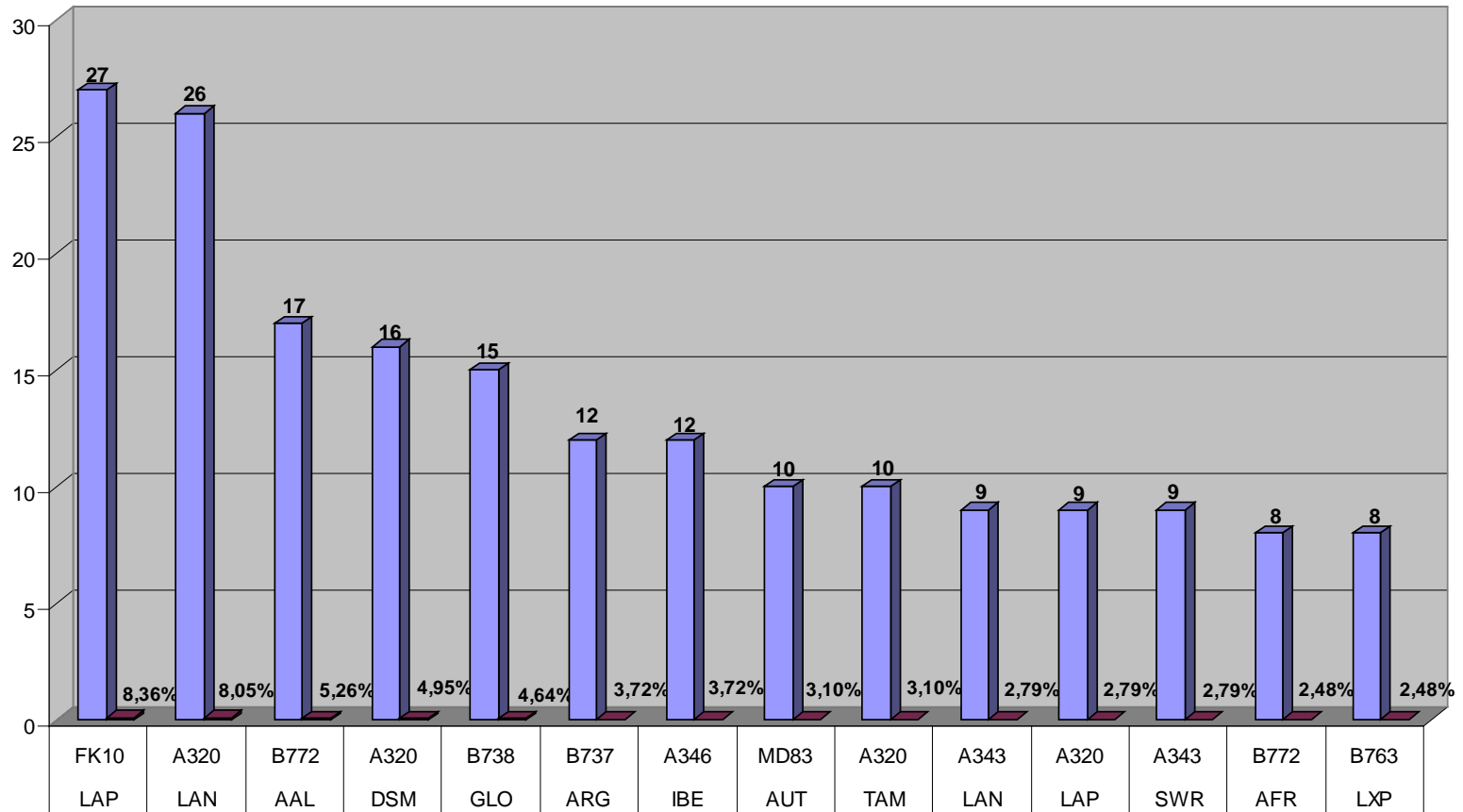
FIR EZEIZA - Aerolínea/Tipo
71% del tránsito de la muestra



FIR MENDOZA - Aerolínea/Tipo
80% del tránsito de la muestra

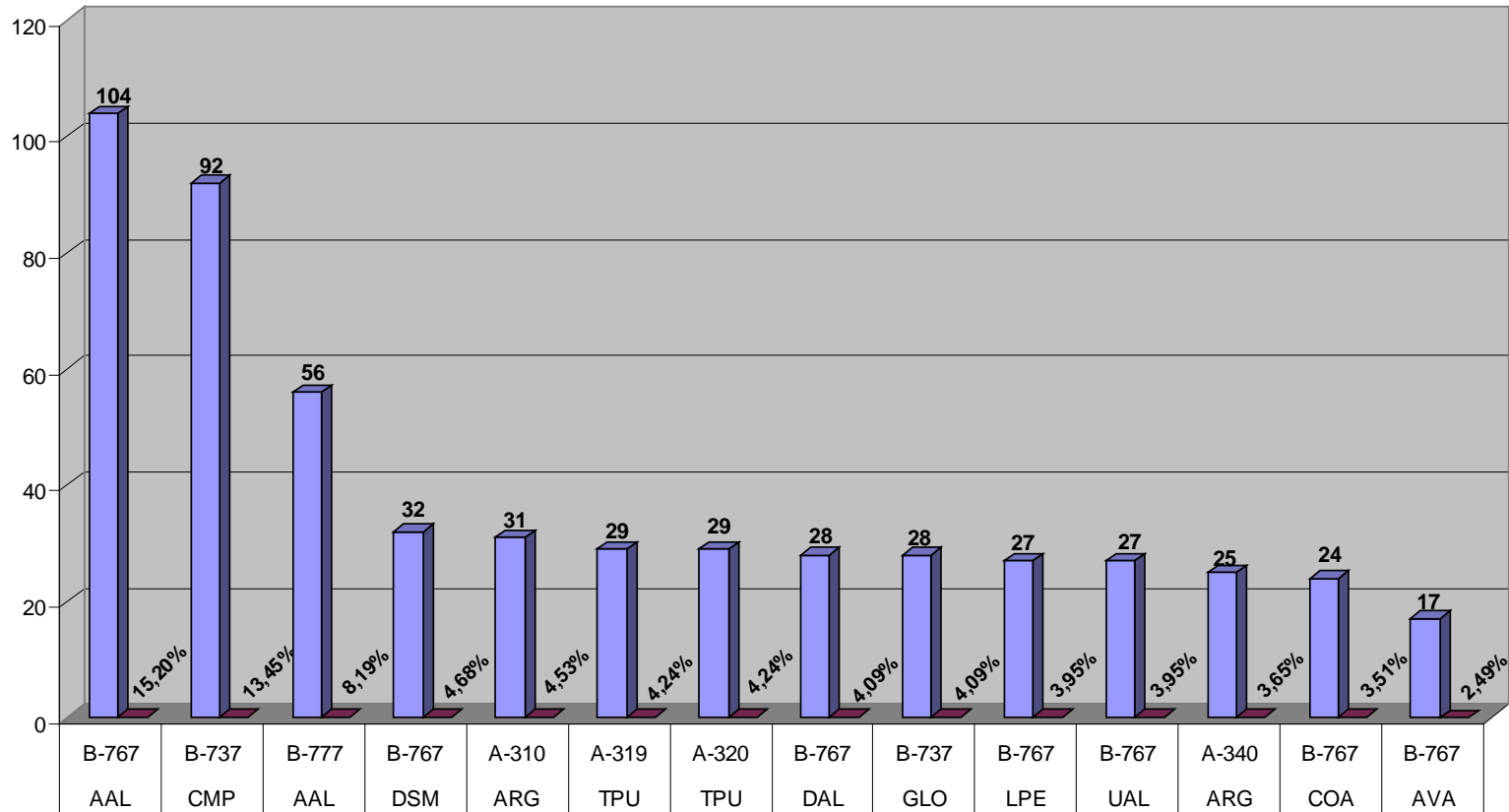


FIR RESISTENCIA - Aerolínea/Tipo
58% del tránsito de la muestra



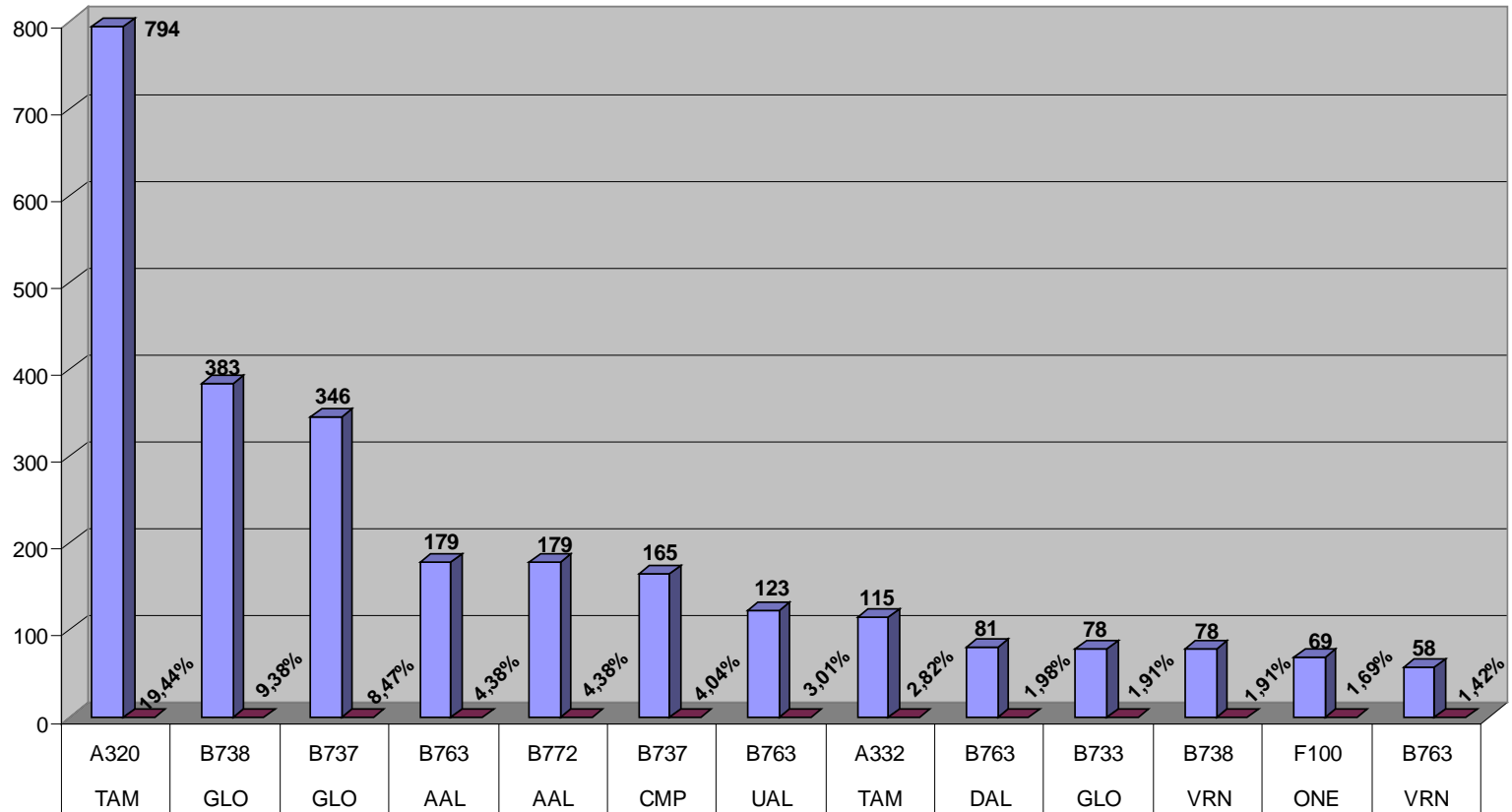
BOLIVIA

FIR LA PAZ - Aerolínea/Tipo
80% del tránsito de la muestra

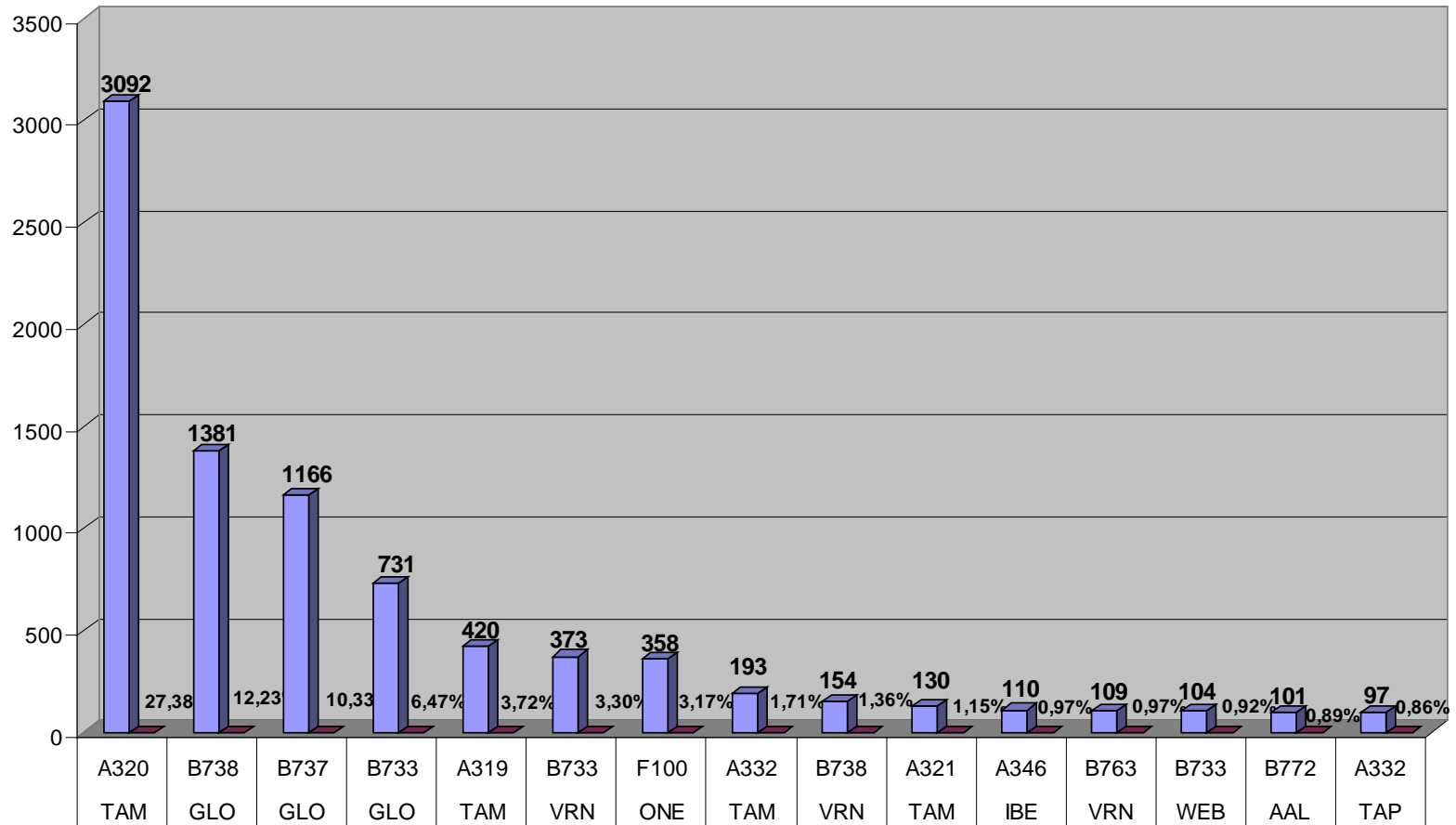


BRAZIL

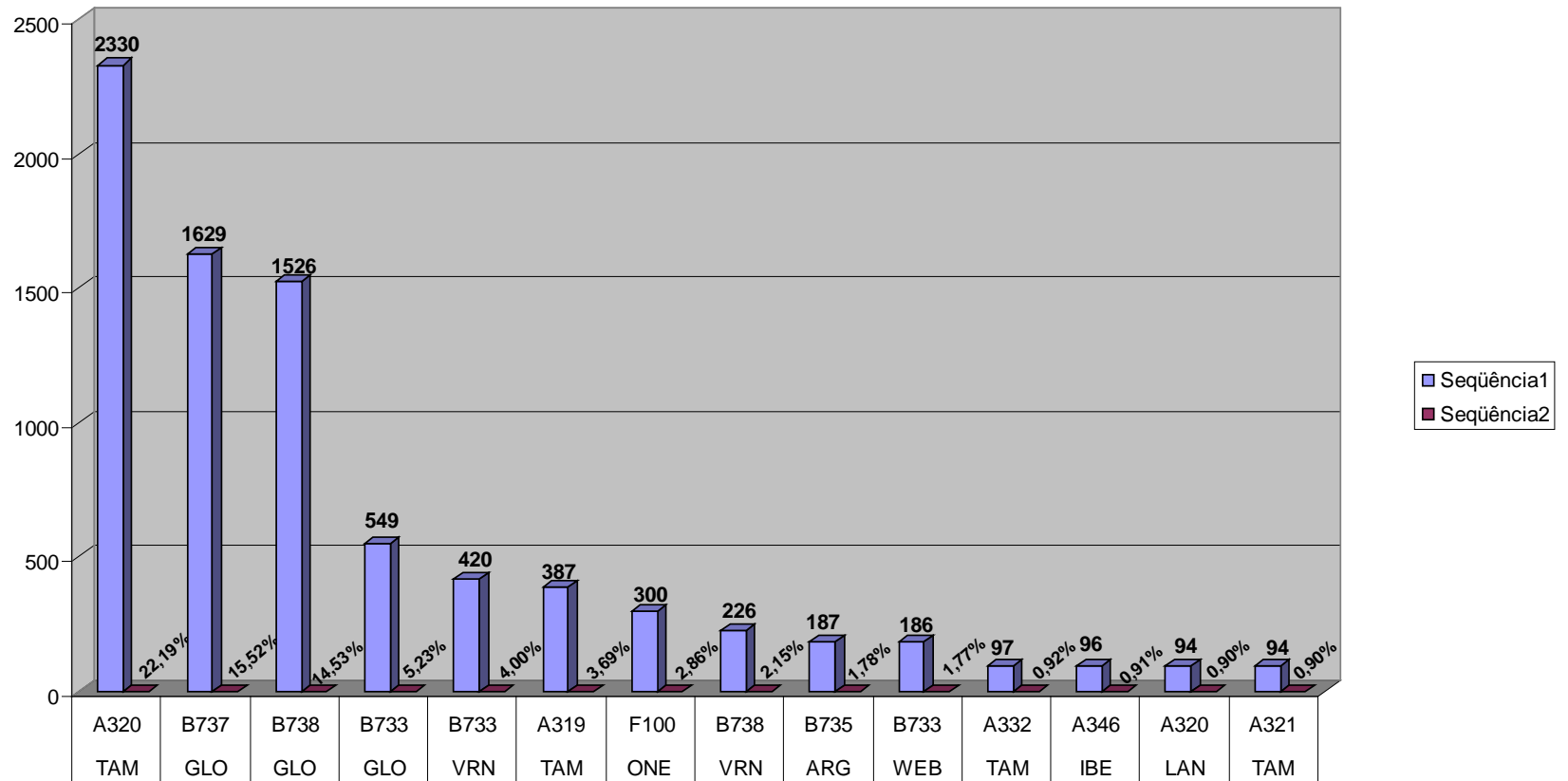
FIR AMAZONICA - Aerolínea/Tipo
65% del tránsito de la muestra

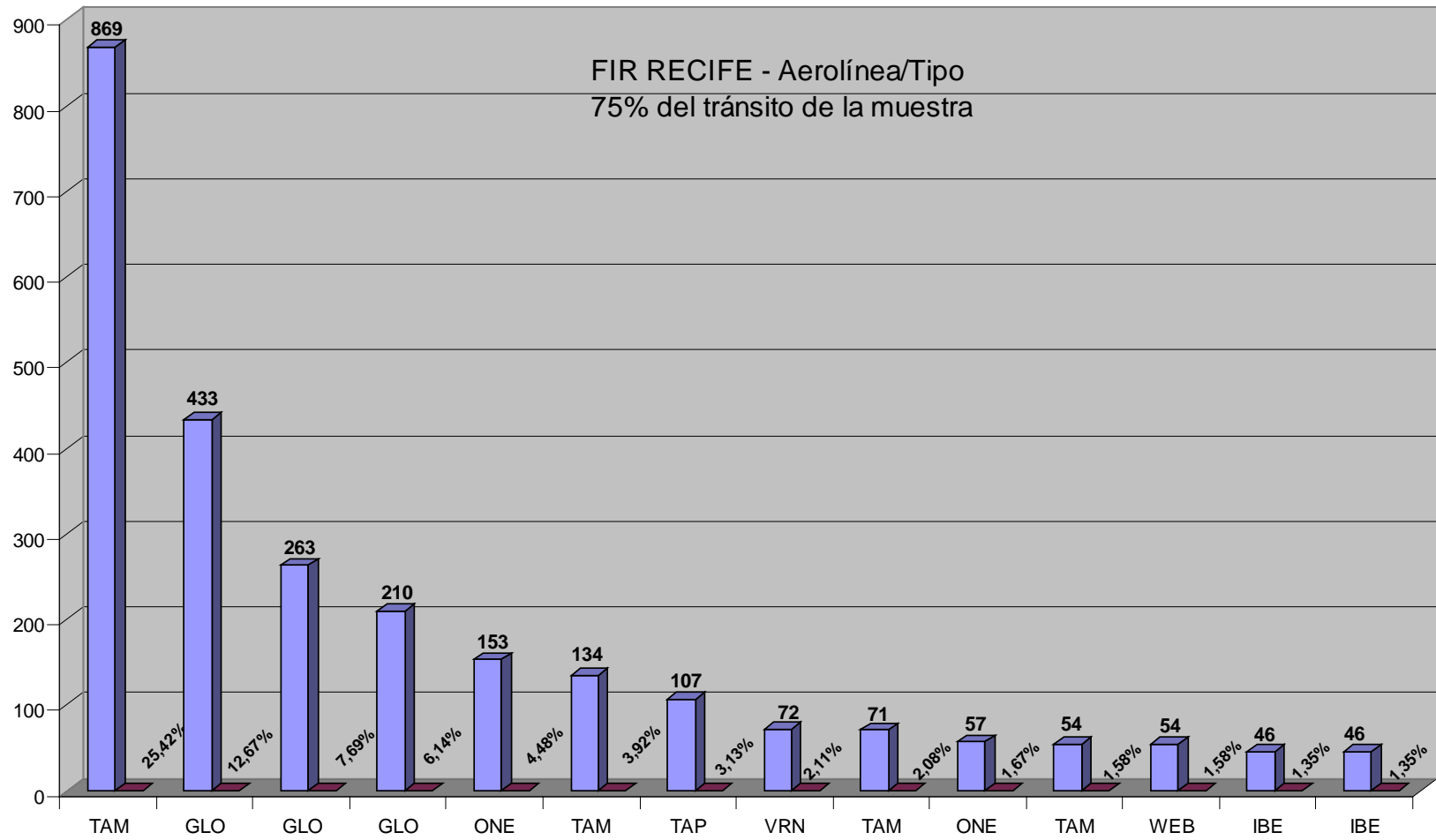


FIR BRASILIA - Aerolínea/Tipo
75% del tránsito de la muestra

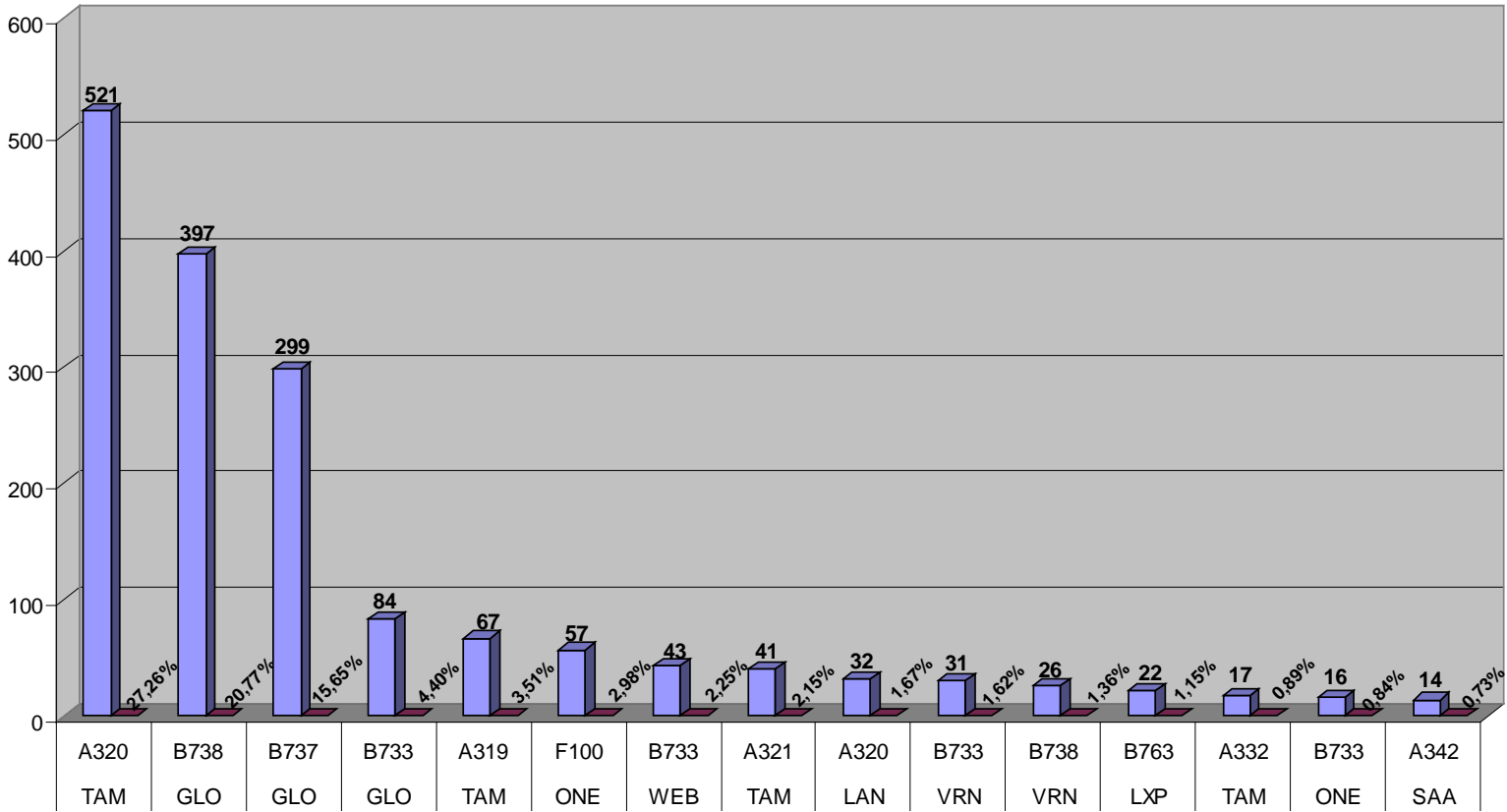


FIR CURITIBA - Aerolínea/Tipo
77% del tránsito de la muestra



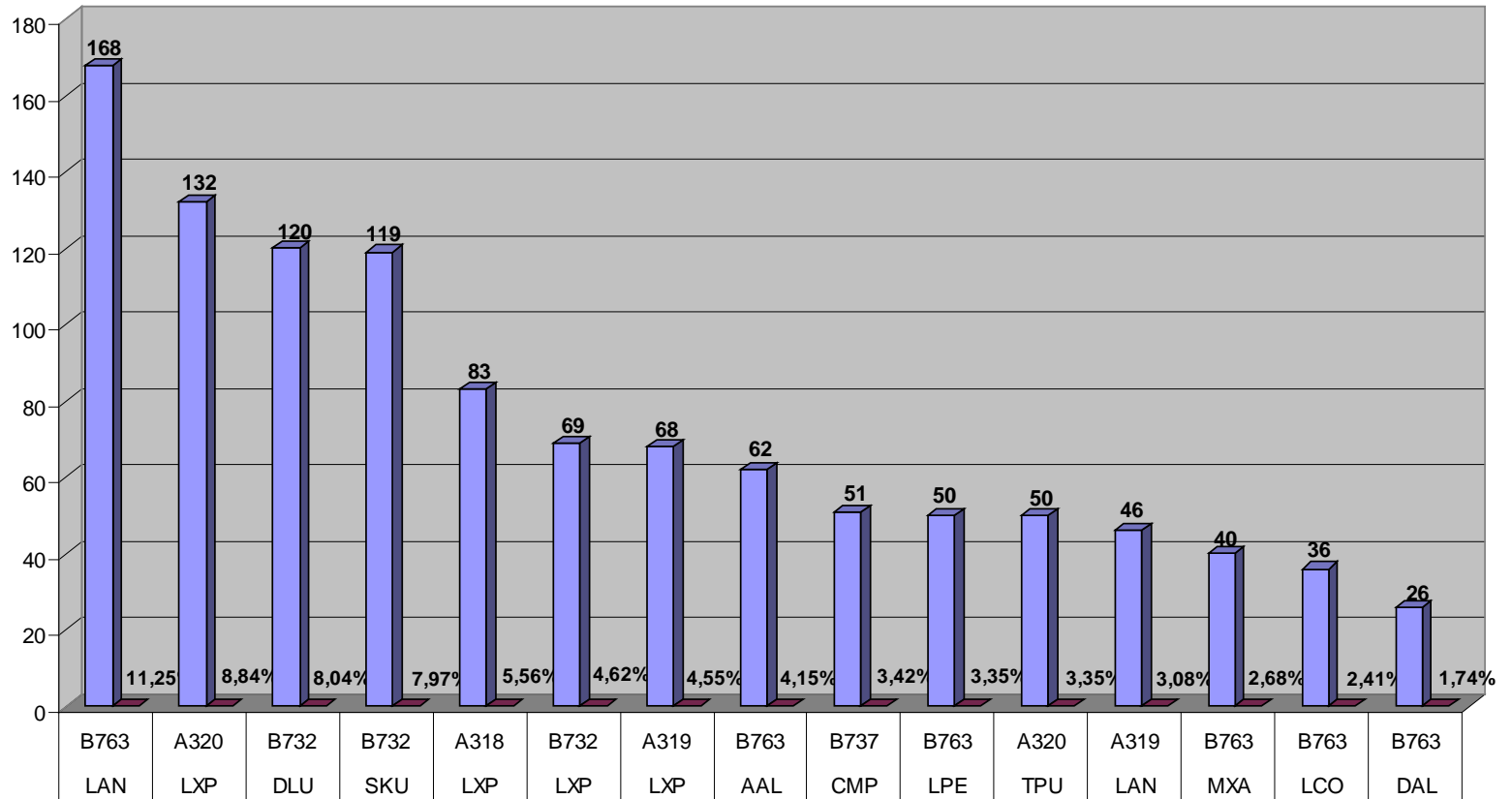


TMA SÃO PAULO - Aerolínea/Tipo
87% del tránsito de la muestra

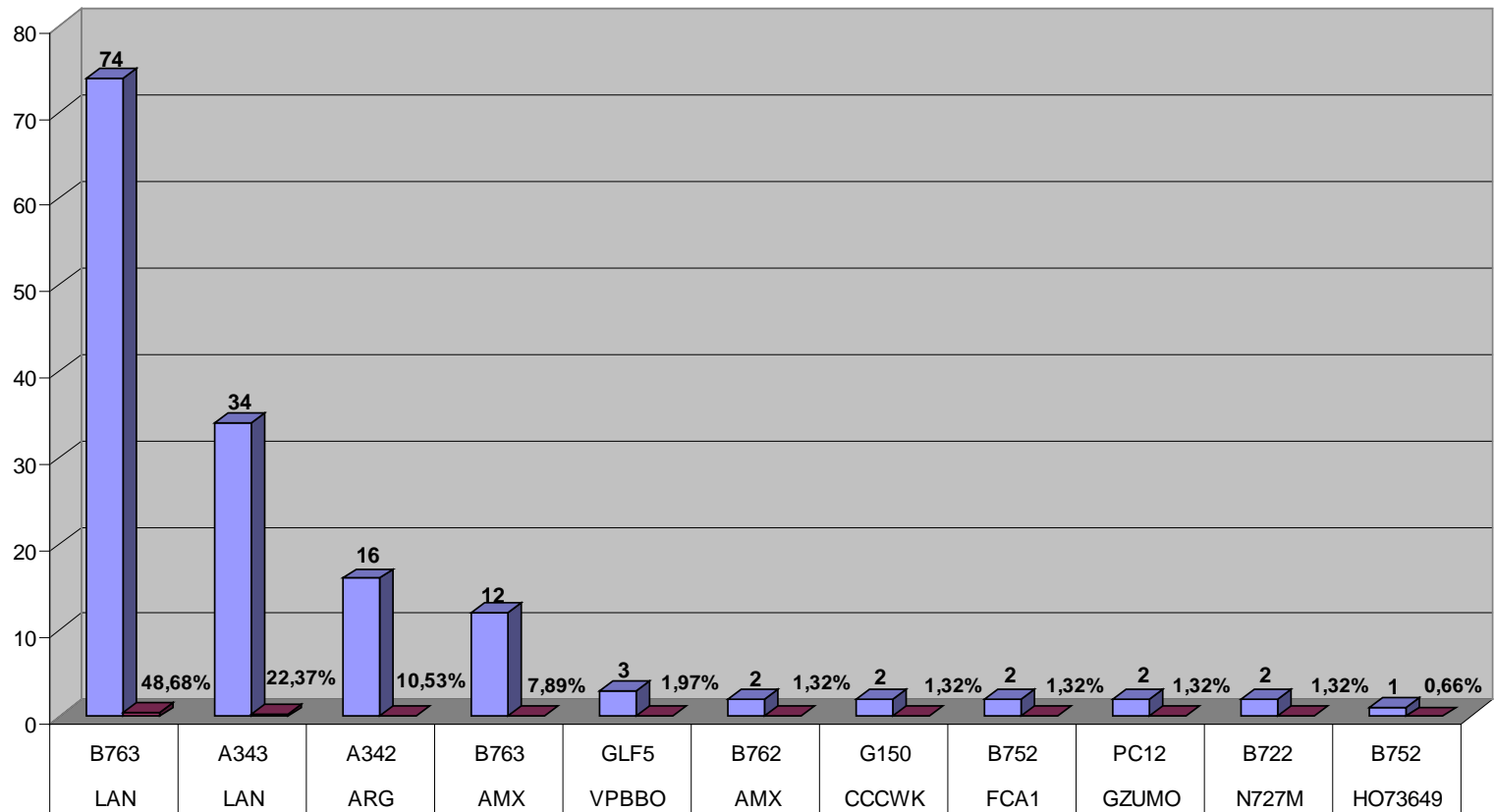


CHILE

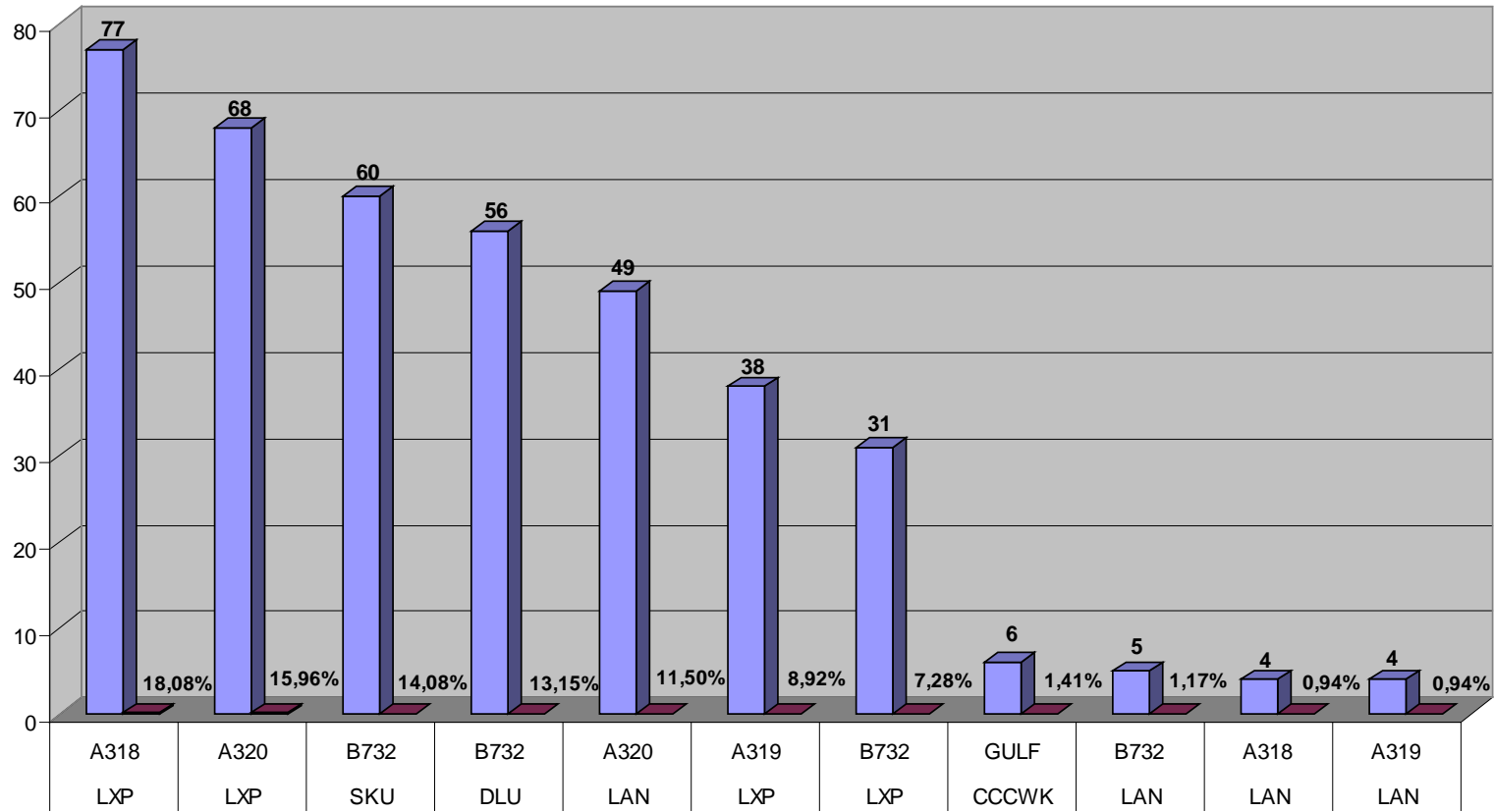
FIR ANTOFOGASTA - Aerolínea/Tipo
75% del tránsito de la muestra



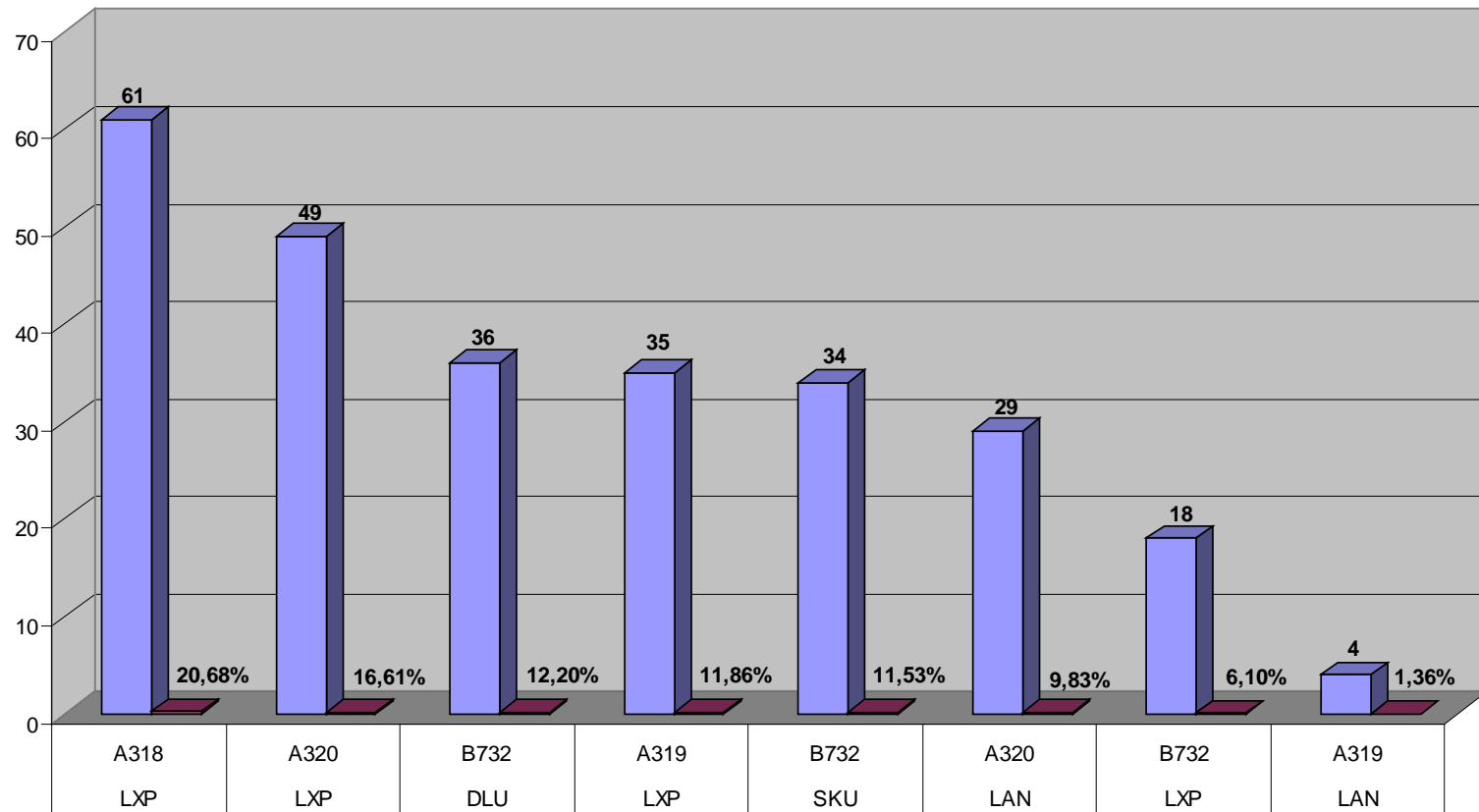
FIR PASCUA - Aerolinea / Tipo
99% del tránsito de la muestra



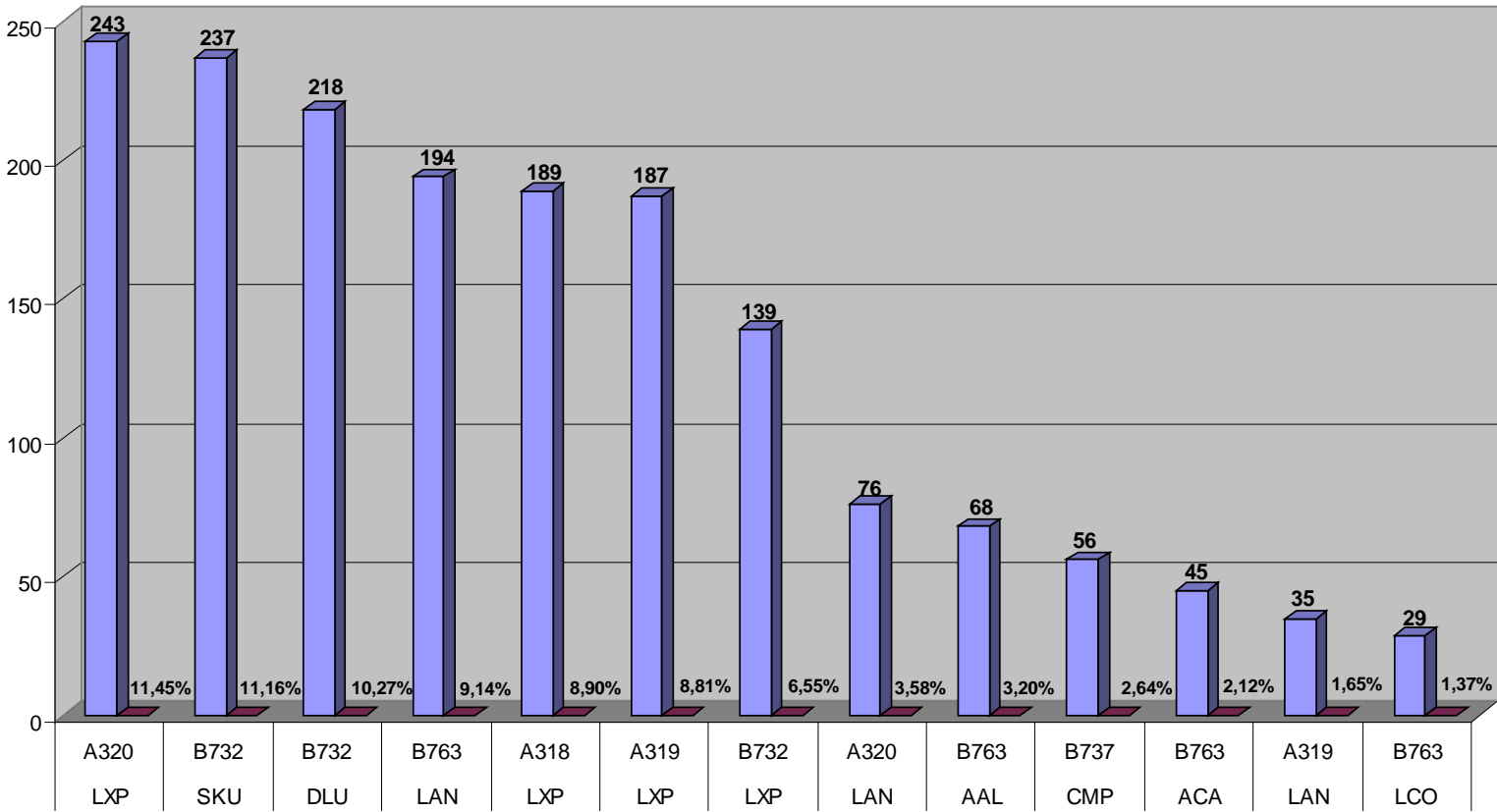
FIR PUERTO MONTT - Aerolíneas / Tipo
93% del tránsito de la muestra



FIR PUNTA ARENAS - Aerolínea / Tipo
90% del tránsito de la muestra

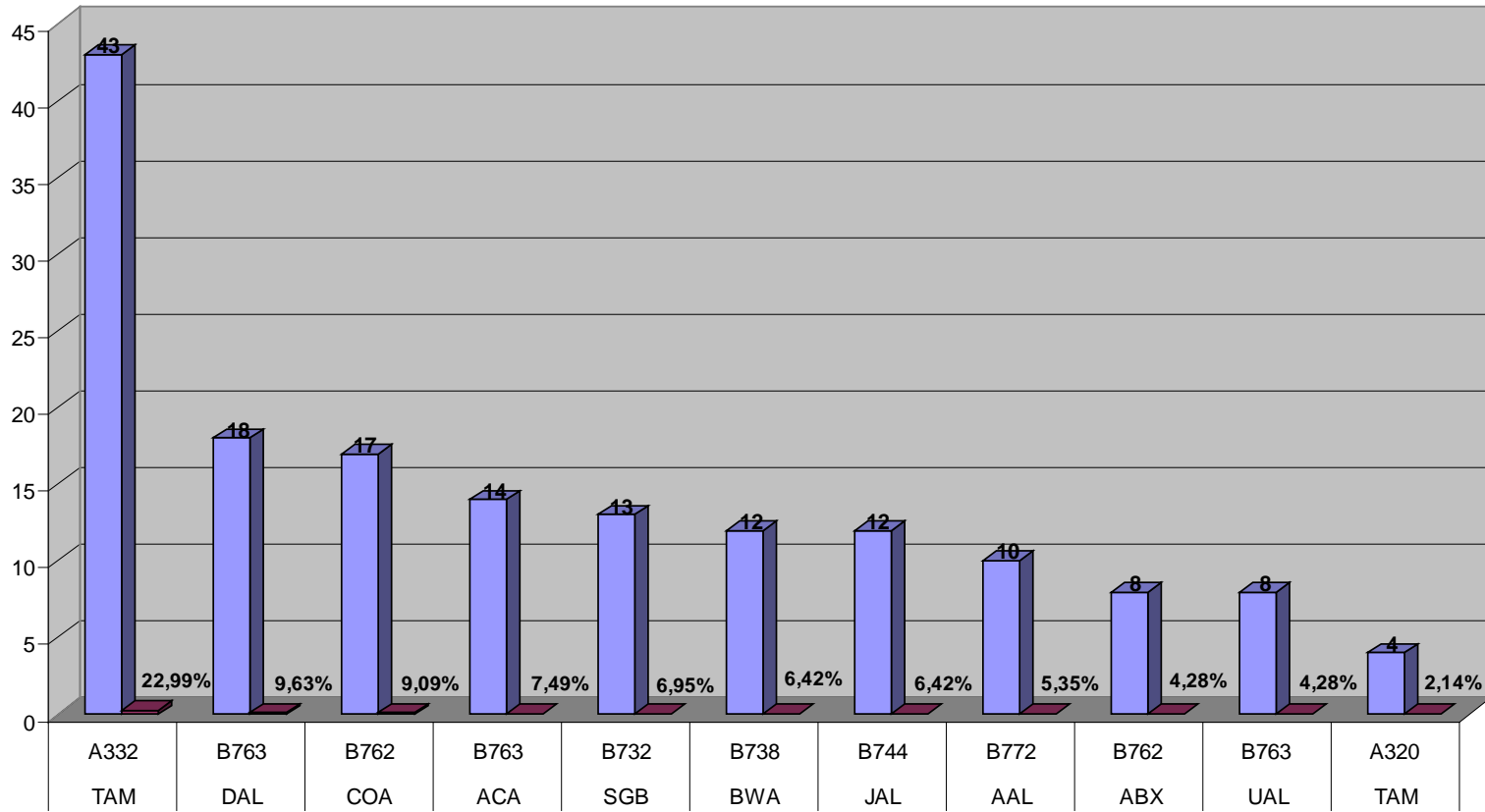


FIR SANTIAGO - Aerolíneas / Tipo
81% del tránsito de la muestra



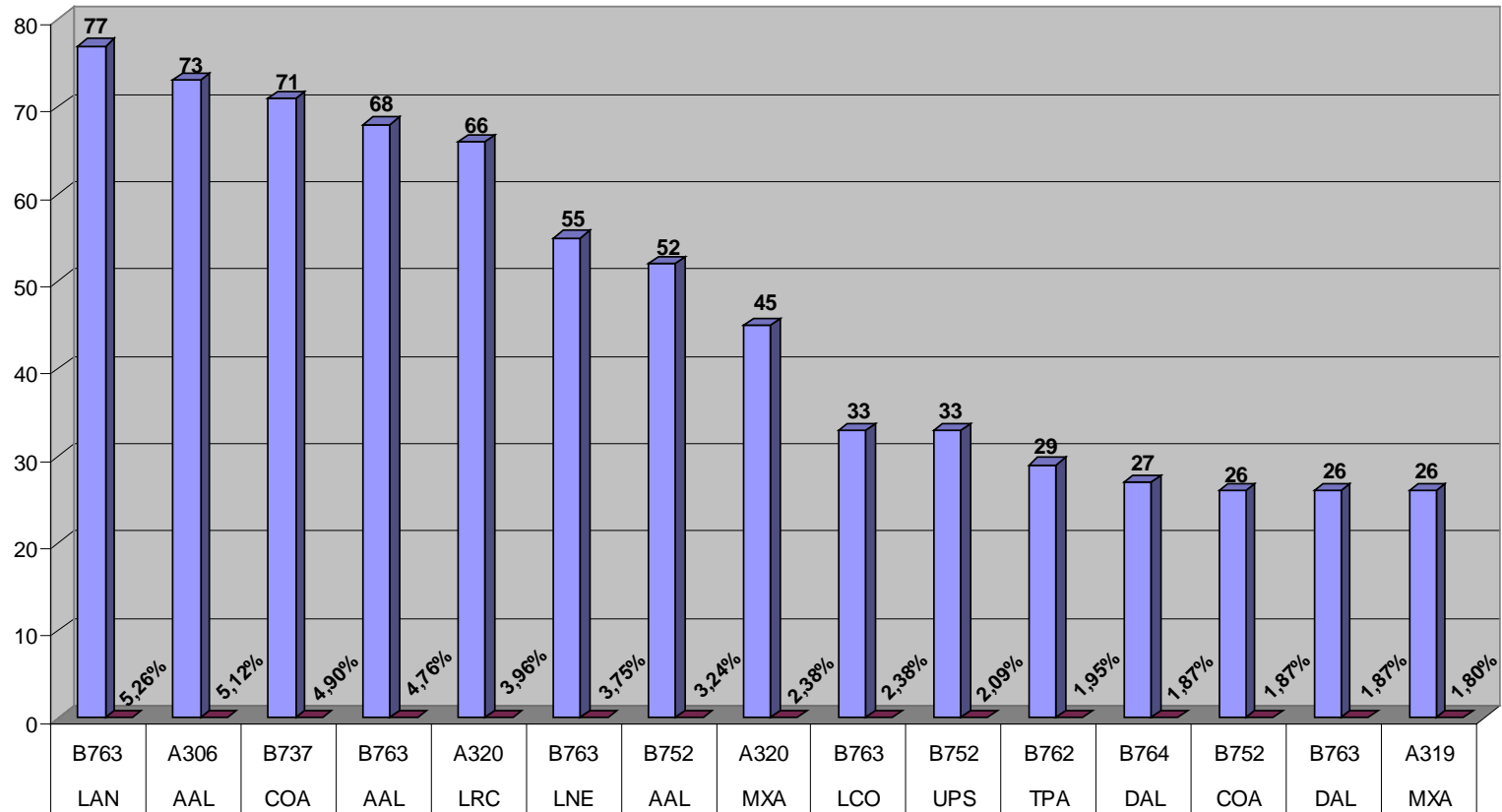
GUYANA

FIR GEORGETOWN - Aerolínea/Tipo
85% del tránsito de la muestra



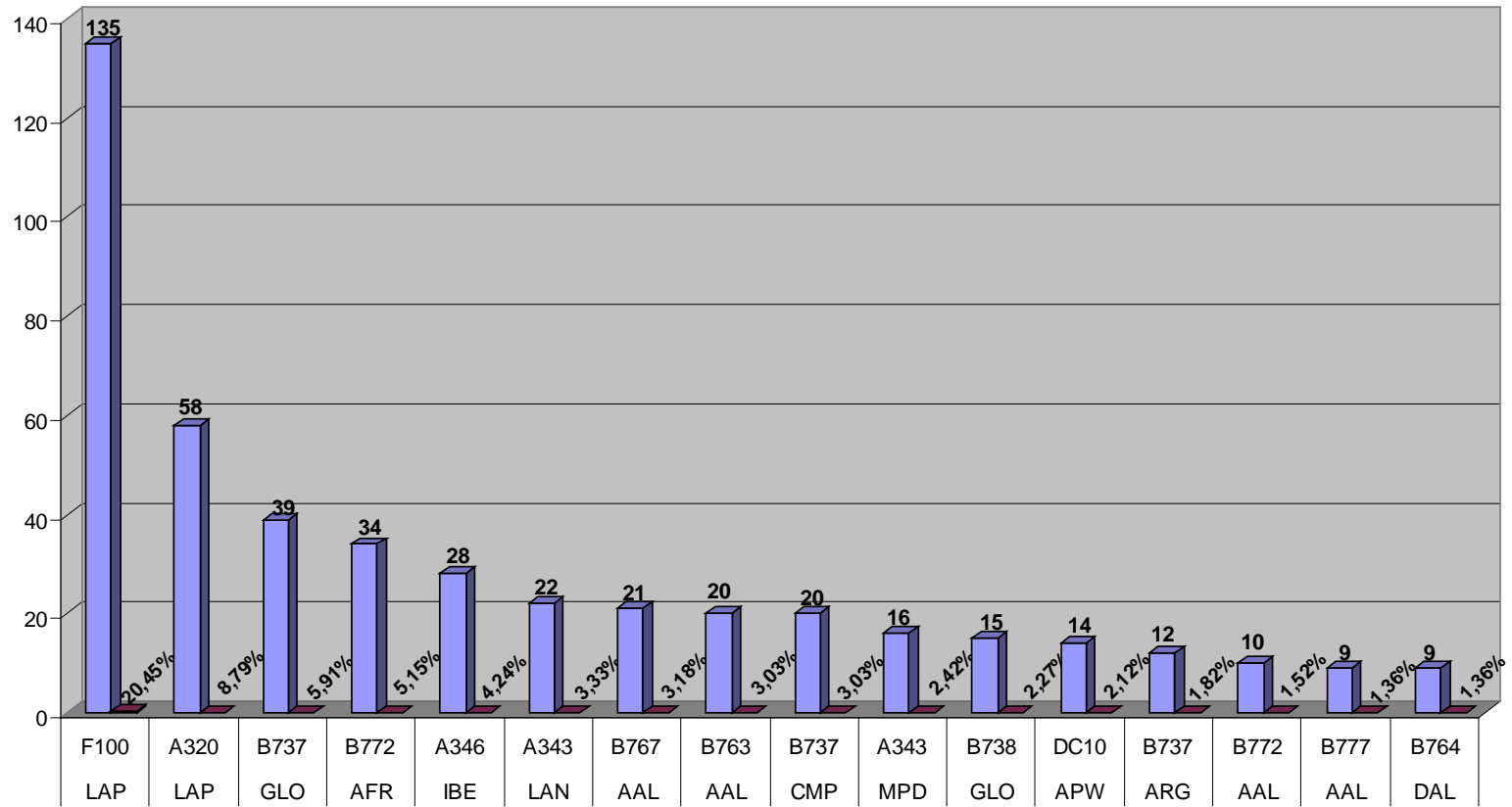
PANAMA

FIR PANAMA - Aerolínea / Tipo
51% del tránsito de la muestra



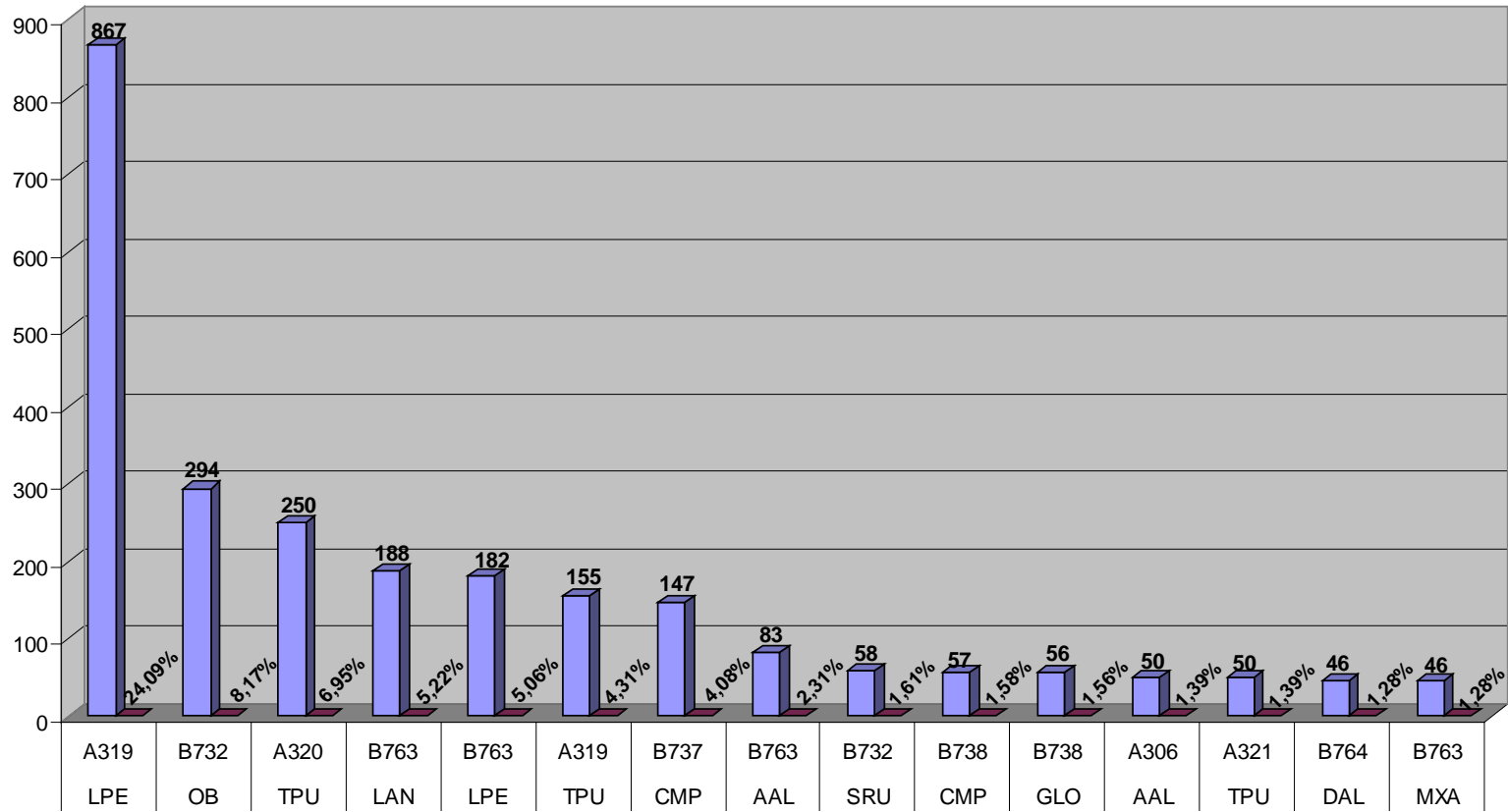
PARAGUAY

FIR ASUNCIÓN - Aerolínea / Tipo
70% del tránsito de la muestra



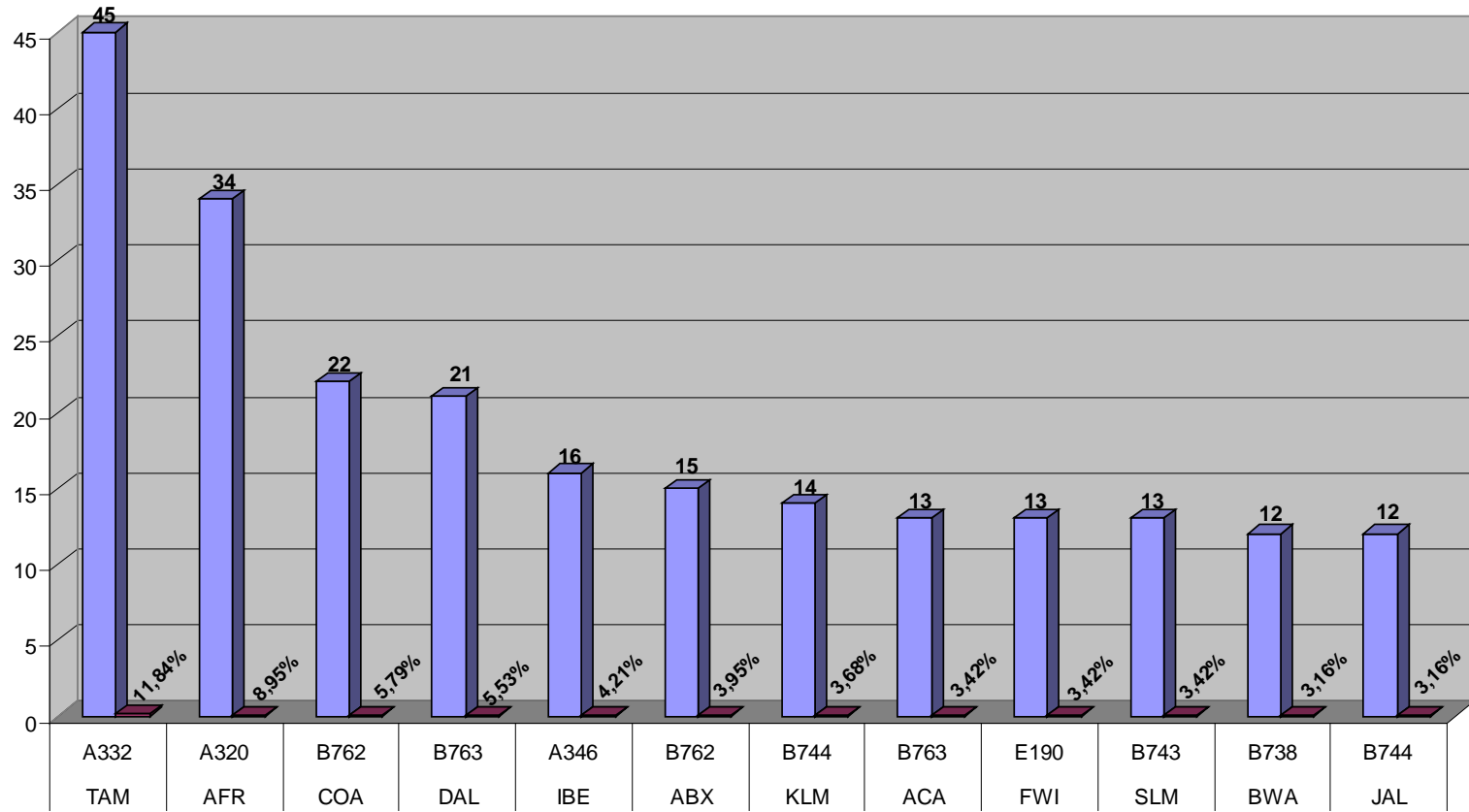
PERU

FIR LIMA - Aerolínea / Tipo
70% del tránsito de la muestra



SURINAME

FIR PARAMARIBO - Aerolínea / Tipo
61% del tránsito de la muestra



URUGUAY

FIR MONTEVIDEO - Aerolínea / Tipo
75% del tránsito de la muestra

