SECRETARIA DOS TRANSPORTES
DEPARTAMENTO AUTÔNOMO DE ESTRADAS DE RODAGEM

DIRETORIA GERAL

PROREDES – BIRD – RS

TERMS OF REFERENCE FOR HIRING AN *INTERNATIONAL ROAD SAFETY ASSESSMENT PROGRAM (iRAP)* SUPPLIER TO SUPPORT ROAD SAFETY MANAGEMENT BY THE *DEPARTAMENTO AUTÔNOMO DE ESTRADAS DE RODAGEM - DAER* (AUTONOMOUS DEPARTMENT OF HIGHWAYS)

December/2016

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1. INTRODUCTION

The Brazilian State of Rio Grande do Sul has been making important efforts to improve road conditions. The Autonomous Department of Highways (DAER), an entity linked to the Rio Grande do Sul State Department of Transportation (ST), is in charge of this task. The State seeks to increase investments both in road construction and rehabilitation, and part of these efforts will be financed by the World Bank Loan Agreement nº 8155-BR.

The World Bank loan funds actions within the *Programa de Apoio à Retomada do Desenvolvimento Econômico e Social* (PROREDES BIRD), which aims at promoting the development of Rio Grande do Sul by supporting policies targeted to improving public management, including areas such as the environment, development of the private sector, technological innovation, public education, and transport, mainly maintenance and rehabilitation of roads.

The PROREDES BIRD transport component includes activities targeted to strengthening DAER's institutional capacity, which comprises improving road safety management. To achieve that, the World Bank suggested implementing iRAP (International Road Assessment Program) tools. The iRAP is a registered charity dedicated to saving lives by promoting safer roads; they work with government and non-government organizations.

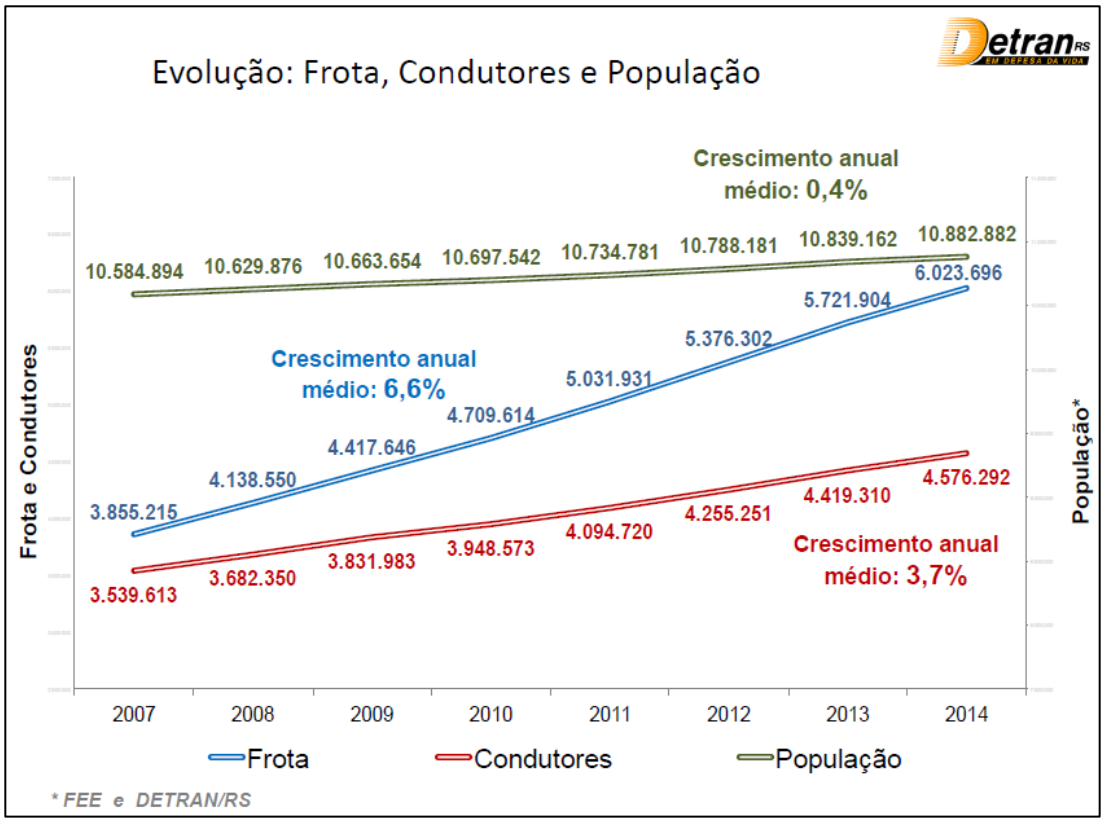
2. REASON FOR CONTRACTING - CONTEXT

It is estimated that more than 130,000 people die and approximately 6 million are injured yearly on the roads in Latin America. Brazilian roads are among the most dangerous ones in South America, yielding a death rate in 2013 of 20.12 per 100,000 people, according to data provided by the Death Information System (*Sistema de Informações sobre Mortalidade* - SIM), Ministry of Health. This rate is a little higher than the ones in India and China and much higher than the ones in developed countries, which are around 5 deaths per 100.000 people. The road fatalities rate in the State of Rio Grande do Sul is 18.7 per 100,000 people, according to data provided by the Rio Grande do Sul State Transit Department (DETRAN). Even though this rate is lower than the Brazilian average, it is well higher than the rates in developed countries.

According to data provided by DAER (www.daer.rs.gov.br/composicao-da-malha), Rio Grande do Sul has approximately 11.2 thousand km of state roads and 5.9 thousand km of federal roads, totaling 17.1 thousand km. The network of paved roads totals about 13.4 thousand km, of which 5.7 thousand km are federal and 7.7 thousand km are state roads.

According to DETRAN, the motorization in Rio Grande do Sul has grown 75.6% in the last 10 years. Between 2007 and 2014, there was an average annual growth of around 6.6% in the vehicle fleet, well above the population growth in the same period, which was 0.4%. The graphic below shows this growth:

Graph 1 – Annual Average Growth Rate of Vehicles, Drivers and Population



Source: http://www.detran.rs.gov.br/conteudo/33626/detran-rs-divulga-relatorio-da-acidentalidade-2014---/termosbusca=crescimento%20da%20frota (19/08/2015)

3. OBJETIVE – PROGRAM BACKGROUND

The main objective is to hire a consulting company to inspect and assess the safety of 1.498,60 km of state paved roads, using International Road Assessment Programme (iRAP) methodologies, and to provide input for the implementation of Safer Roads Management Plan for DAER.

For the purpose of this project, key stakeholders are:

- Autonomous Department of Highways – DAER;
- Rio Grande do Sul Department of Transportation – ST;
- Rio Grande do Sul State Government.

Suppliers undertaking iRAP-specification tasks play an important role in ensuring transparency and understanding of the analysis, assumptions and use of the results. Any project activities in Brazil should be undertaken in consultation with existing iRAP program partners. Details of the existing program, including contact details of the program leader, are available at http://irap.org/about-irap/about-us.

3.1 OVERALL PROGRAM SCHEDULE

Figure 1 – Overall Program Schedule

ACTIVITIES	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
1 - Official project launch / Work Plan						
2 - Road survey						
3 - Road Coding						
4 - Background Data						
5 - Preliminary Results of Star Rating and Safer Roads Investment Plan						
6 - Final Reports and Results Presentation						

3.2 ROAD SELECTION

Table 1 - LIst of roads

ROAD SELECTION FOR iRAP						
ROAD		ROAD SECTION		SINGLE CARRIAGEWAY EXTENSION (km)	DUAL CARRIAGEWAY EXTENSION (km)	ACCUMULATED EXTENSION (km)
ERS	020	VISTA_ALEGRE	ACESSO A TRÊS COROAS	64,54	2,64	69,82
ERS	030	ENTR._ERS-118_(P/VIAMÃO)	ENTR._ERS-786_(P/TRAMANDAÍ)	79,98	19,19	118,36
ERS	040	ARROIO_SABÃO_(PORTO_ALEGRE)	ENTR._ERS-118_(P/PASSO_DO_FIÚZA)	1,50	9,74	20,98
ERS	118	ENTR.BRS-290 (P/PORTO ALEGRE)	ENTR. ERS-040 (P/VIAMÃO)	16,00	0,00	16,00
ERS	122	ENTR._ERS-446_(P/SÃO_VENDELINO)	ENTR.RSC-453(A)_(P/FARROUPILHA)	20,83	0,00	20,83
ERS	124	HARMONIA	PÓLO_PETROQUÍMICO	41,25	0,00	41,25
ERS	223	ENTR._BRS-153/386_(P/SOLEDADE)	ENTR.BRS-377_(P/CRUZ_ALTA)	76,86	0,00	76,86
ERS	305	ENTR.ERS-344_(P/TUPARENDI)	ENTR.ERS-342(B)_(P/HORIZONTINA)	29,30	0,00	29,30
ERS	324	ENTR.ERS-406 (SERRARIA)	ENTR.BRS-470_(NOVA_PRATA)	229,68	0,00	229,68
ERS	342	HORIZONTINA_(FIM_TRV-MUN)	ENTR.BRS-158/377_(P/SANTA_MARIA)	136,74	0,00	136,74
ERS	344	ENTR.ERS-305_(TUPARENDI)	ENTR.BRS-285/392(B)_(P/S.LUIZ_GONZAGA)	76,00	0,00	76,00
ERS	389	ENTR.ERS-030_(OSÓRIO)	ENTR.RSC-453_(TORRES)	95,70	0,00	95,70
ERS	404	ENTR.BRS-386_(P/CARAZINHO)	ENTR.ERS-324(B)_(RONDA_ALTA)	23,83	0,00	23,83
ERS	407	ENTR.BRS-101_(MORRO_ALTO)	CAPÃO_DA_CANOA	15,74	0,00	15,74
ERS	444	ENTR.BRS-453_(P/FARROUPILHA)	SANTA TEREZA	34,10	0,00	34,10
ERS	446	ENTR.ERS-122_(P/SÃO_VENDELINO)	ENTR._BRS-470_(CARLOS_BARBOSA)	14,84	0,00	14,84
ERS	452	FELIZ	ENTR.BRS-116_(NOVA_PALMEIRA)	27,52	0,00	27,52
ERS	486	ENTR.BRS-453_(ARATINGA)	CURUMIM	53,03	0,00	53,03
ERS	509	INÍCIO_DA_DUPLICAÇÃO	ENTR.RSC-287_(CAMOBI)	0,00	3,00	6,00
ERS	734	CASSINO	RIO_GRANDE	6,84	10,68	28,20
ERS	786	ENTR.ERS-030_(P/OSÓRIO)	JARDIM_DO_ÉDEN	15,00	5,40	25,80
RSC	153	ENTR.BRS-285(B)/ERS-324(A)_(P/CARAZINHO)	ENTR.RSC-471(B)_(CONT. BARROS CASSAL)	83,41	2,80	89,01
RSC	287	ENTR.RSC-470(A)/ERS-124(A)/240_(MONTENEGRO)	ENTR.ERS-509_(CAMOBI)	77,35	0,00	77,35
RSC	453	ENTR.BRS-470(B)_(P/BENTO_GONÇALVES)	ENTR.ERS-486_(ARANTIGA)	149,30	11,18	171,66
TOTAL EXTENSION - general for all iRAP program				1.369,34	64,63	**1.498,60**

Note: accumulated extension = single carriageway extension + 2 x dual carriageway extension

Note: see Annex C for the list of roads per section, according to the State Roads System (*Sistema Rodoviário Estadual - SRE*, 2016/Dec.).

4. SCOPE OF WORK

- Survey 1.498,60 km of paved state roads in the state of Rio Grande do Sul and code the video survey data according to the iRAP Survey and Coding specification;
- Collect crash, traffic flow and speed data for the selected roads according to the iRAP Data Analysis and Reporting Specification, for all necessary elements not supplied by DAER (see item 4.6.7);
- Produce an iRAP input file which includes all road attributes and collected data;
- Produce Star Rating results and Safer Roads Investment Plan to identify areas of high risk and to shape future road safety investment;
- Train the client (DAER) on iRAP methodology, processes and results;
- Produce a detailed technical report in accordance with iRAP Data Analysis and Reporting Specification.

4.1 iRAP ACCREDITATION AND TRAINING

To be qualified to undertake the Road Survey and Coding components of the iRAP Star Rating and Investment Plan protocol, the supplier must have successfully completed the following iRAP capacity training courses that are available for on-line education and accreditation at http://capacity.irap.org and subsequent refresher training as required.

Surveying and Coding:

- Introduction to iRAP Course.
- Star Rating and Inspection Course.
- Road Attribute Coding Course.

Analysis and Reporting:

- Introduction to iRAP Course.
- Project Leader's Course.
- Star Rating and Inspection Course.
- Safer Roads Investment Plans Course.
- Understanding Risk Course (optional).

4.2 LICENCE

The successful supplier will be licensed to use the appropriate iRAP Protocols, Technology and Methods for the duration of the project.

4.3 GENERAL REQUIREMENTS

The supplier shall acknowledge that iRAP has a zero tolerance policy towards bribery and corruption and hereby agrees to adopt the same approach as described in the iRAP Anti-bribery and Corruption Policy[1] with all parties with whom it deals in relation to this work.

1. iRAP assessments are typically focused on the highest risk roads and the supplier shall ensure they are informed and manage all risks associated with the completion of the project. The supplier will ensure that operational working hours, road travel, inspections and data collection, specific requirements including immunizations and security arrangements, training and all other required operational activities are conducted in a safe manner. The supplier shall be responsible for the safe undertaking of the project deliverables. Prior to the commencement of the road survey, the supplier will be required to present to the client (DAER) a Health and Safety Plan for the duration of the project.

2. Incidental costs (such as customs duties, fees, toll fares, fuel, insurance and vehicle operating costs, accommodation, survey staff per diem allowances and permits) shall be covered by the supplier. The supplier will be required to submit all relevant insurance documents to the client prior to the commencement of the road survey.

3. Mobilization and demobilization costs associated with the project shall be covered by the supplier. It is the responsibility of the supplier to adhere to all customs duties, rules and regulations as applicable. Note that failure to properly comply with customs rules can result in seizure of goods and civil and criminal penalties against involved parties.

4. All data, reports, plans, manuals, processes specific to the project and all documents or reports prepared or developed as part of the project shall be the property of the client (DAER). The intellectual property of such documents belongs to the client (DAER). The supplier can make use of or refer to such documents for marketing and/or other project purposes after obtaining written consent from the client (DAER).

5. Other documents including data, maps and reports supplied to the supplier by the client (DAER), the World Bank, or other organizations to assist with the study shall be returned to the respective organization at the end of the project.

6. No public communication of results shall be undertaken without the express written approval of the client (DAER).

7. The supplier shall ensure they are well informed and aware of the complexity, time and cost implications of all aspects of the temporary importation of survey equipment to the country concerned. Project timelines should reflect the shipping and customs related requirements for the country concerned. Key issues for the supplier to be aware of include and are not limited to:
    a. Shipping and/or transportation costs and time implications for the project.

[1] Anti-bribery and Corruption Policy http://www.irap.net/about-irap-3/annual-reports-and-governance?download=65:anti-bribery-and-corruption-policy

b. Legal, time and cost obligations related to the temporary or permanent importation of the survey equipment.
c. Legal requirements or restrictions for the type of equipment used (e.g. lasers, GPS, accelerometers).

8. A written Health and Safety Plan shall be provided by the supplier to the client (DAER).

5. PRODUCTS AND SUBPRODUCTS

5.1 WORK PLAN

The supplier shall present a work plan to the client (DAER). In the work plan the supplier shall at least describe the development of the activities, the methodology to be used and a list with all the professionals for each phase of the work, as well as present a schedule outlining the project activities and deliverables.

5.1.1 WORK PLAN - PRODUCT R1

The supplier shall present to the client (DAER) a Work Plan, or Report 1, two printed and one digital version, according to section 6 - PRODUCTS, SUBPRODUCTS AND DEADLINES.

5.2 ROAD SURVEY ESPECIFICATIONS

The road survey shall be carried out in accordance with the following requirements:

5.2.1 INSPECTION SYSTEM SPECIFICATIONS

The requirements for road survey data collection are as follows:

1. The survey data is to be collected in accordance with an iRAP class B or C inspection system (refer to RAP-SR-2.[2] *Star Rating Inspection System Accreditation Specification and Record*).

   a. The digital images (video or other equivalent photographic images) shall be collected with a minimum resolution of 1280 x 960 pixels while the vehicle is operating at highway speeds compatible with the road survey service.

   b. The digital images shall be collected with a minimum 160 degree field of view (preferably 180 degrees), centered on the travel lane, at a maximum of 20 meter intervals. This may be accomplished with either a single or with multiple high resolution cameras (1280 x 960 pixels), with overlapping fields of view.

   c. Geo-referencing data shall be provided for each digital image, including distance along road (from established start point), unique image number, latitude, longitude and altitude (using the Geocentric Reference System for the

[2] RAP-SR-2.3: http://downloads.irap.org/docs/RAP-SR-2-3_Inspection_System_Accreditation_Specification_&_Record.doc

Americas - SIRGAS2000 and decimal degree format, 12 digits), date and time. Coordinate data shall be acquired using Global Navigation Satellite System (GNSS) equipment, dual frequency RTK or similar, which shall achieve metrical precision (+/- 1 meter) for at least 90% of the digital images. The supplier shall be responsible for correcting data and any drop-outs as required to provide geo-referencing data for 100% of the network and images.

d. All images shall be calibrated for the width measurement of attributes during the coding phase. Calibrations should be undertaken with the vehicle loaded as expected for the survey and check calibrations should be completed throughout the survey to ensure accuracy of calibration.

e. The inspection system shall have compatible software for coding and review of coding data as required by the Road Coding - Software Specifications.

2. All geo-referenced digital images shall be provided to the client in a suitable electronic format and structured and named in a format to be agreed with the client (DAER).

3. Capability to include digital images from a rear-facing camera at the same locations (at 100 meter intervals) as the images from the forward-facing camera(s).

The following inspection system capabilities are desirable but not mandatory, hence will not be evaluated:

4. Capability to provide automated measurements of radius of curvature for horizontal curves and percent grade for vertical grades.

5. Capability to measure traffic speeds and traffic volumes on the roads while undertaking the survey.

6. Ability to collect road roughness (International Roughness Index), rutting and surface texture data and undertake analysis and reporting in accordance with DAER specifications.

5.2.2 ROAD SURVEY - VEHICLE SPECIFICATIONS

1. The survey vehicle must be in a safe, well-maintained condition. Vehicle safety details should be highlighted in the supplier's health and safety plan (e.g. seat-belts for all passengers, air-bags and safe mounting of equipment).

2. The survey vehicle shall meet all license and registration requirements (e.g. width, height, and signage) and shall be fully insured for operation in Brazil.

3. The survey vehicle must be clean and presentable).

4. The supplier shall arrange for high quality logos of the stakeholder organizations (including but not limited to DAER/RS, iRAP) to be placed on the survey vehicle for the duration of the road survey.

5. The road survey vehicle must have sufficient space for the necessary survey team plus provision for additional stakeholder personnel and their luggage who may participate in parts of the road survey. These additional personnel may assist in navigation, local awareness-raising among project stakeholders and additional information throughout the duration of the project.

6. The vehicle shall be available for viewing and inspection during the commencement mission and official project launch at DAER's headquarters in Porto Alegre, RS.

7. The client (DAER) will arrange for police escort for the survey vehicle only when it is surveying below the established speed limit, but this should not be seen as a guarantee for security and the bidders should take into consideration in their bid the risk of conducting the survey of the specified roads.

8. If the selected Supplier does not have a survey vehicle in Brazil or cannot import one, he is responsible for arranging for such vehicle in Brazil and installing the equipment in it.

5.2.3 ROAD SURVEY - TEAM REQUIREMENTS

1. The road survey team shall include:

   a. Professional or suitably trained driver to operate the survey vehicle.

   b. Film editor, with appropriate technical qualification, to assure the quality of the images collected during the road survey process.

   c. Survey vehicle specialist with appropriate technical qualifications and 5 years related experience.

   d. Project leader: person responsible for representing the Project and presenting basic information at stakeholder briefings throughout the survey period. Fluency in Portuguese is desirable. The job description is presented in item 8.1.1.

2. The road survey team may be required to conduct demonstrations of the survey vehicle during stakeholder briefings.

3. All road survey team personnel shall have necessary travel documentation, approvals and required insurance coverage for operation in Brazil.

4. The road survey team shall be suitably attired to participate in stakeholder briefings and demonstrations as required.

5. Road survey team members shall be responsible for, and act in accordance with, the supplier's health and safety plan and ensure all safety and security issues are adequately addressed.

6. Up to two stakeholder personnel may help the inspection team with navigation and local-awareness-raising. The relevant authority will meet all costs associated with these people travelling with the survey team.

5.2.4 ROAD SURVEY - PROCESS SPECIFICATION

1. The forward space within the images shall be kept clear as much as possible to ensure the required attributes can be viewed and assessed. This may require an escort for congested urban areas, which the supplier shall arrange.

2. The exact start and end points for road sections shall be determined by the supplier in consultation with the client(DAER). Road surveys shall record data for a minimum of 500 meters before the start point and 500 meters after the end point of each section of road.

3. The supplier shall provide details on how key issues that may impact image quality, GPS location and other attributes will be managed. This may relate to but is not limited to sun glare, shade/sun rapid change, rain, fog, tunnels and built-up areas.

4. All divided carriageways road lengths shall be separately surveyed (surveyed in both directions) regardless of length. The definition of a divided carriageway road for the purposes of this project is all road sections where the median type is classified as code 1-7, 12, 15 as provided in ANNEX A – Attributes and categories.

5. The road survey sections are to be segmented in accordance with advice from the client (DAER).

6. The supplier shall provide an estimated survey schedule prior to commencement of the road survey, including the divided carriageway sections and any other information or local demonstrations, which shall be accepted by the client (DAER).

7. The Supplier shall deliver the first two days of digital image and longitude and latitude data collected (in digital media or, if possible, by the internet) to an iRAP certified organization for immediate quality review according to iRAP protocols.

8. The Supplier shall provide a weekly email progress report on the road survey process and outcomes at the completion of the road survey. This report shall be provided to the client (DAER).

9. One copy of the full road survey data set shall be provided to the client upon completion of the survey. The supplier shall retain a copy of all data with appropriate back-up in place for a period of 7 years.

5.2.5 ROAD SURVEY - QUALITY ASSURANCE AND REPORTING

1. Final acceptance and completion of the road survey will be subject to the full coverage of the required network and quality review by an iRAP certified organization to ensure that data is suitable for coding according to iRAP protocols.

2. The Supplier shall provide to the client (DAER) and to an iRAP certified organization a detailed report of the road survey including details of:

   a. The survey activities.
   b. Launches, local stakeholder briefings and site visits (including photos).
   c. Dates of road surveys, calibration activities, start and end points for all segments, key landmarks and road reference points and any relevant events (e.g. rain, major congestion, incidents).
   d. Any notable issues encountered during the road survey.

3. The video data shall be submitted on a hard drive together with the appropriate viewing software to DAER and an iRAP certified organization.

4. The Supplier should be prepared to correct road survey data should DAER or an iRAP certified organization identify errors or deficiencies.

5. The quality of the products delivered during the road survey shall be assured by means of a specific document, issued by an iRAP certified organization.

5.2.6 ROAD SURVEY - PRODUCT R2

The supplier shall present to the client (DAER) two printed and one digital version of Report 2 (R2), about the road survey, The Report shall contain, at least, all the road data collected during the survey, survey reports and a copy of the document that assures the quality of the survey, according to section 6 - PRODUCTS, SUBPRODUCTS AND DEADLINES.

5.3 ROAD CODING

The road coding shall be carried out in accordance with the following specifications:

5.3.1 ROAD COADING - SOFTWARE SPECIFICATIONS

The road coding system must have compatible software that is capable of being used by independent teams in an office environment to conduct coding of the road geometry and roadside features. The coding software must meet the following specifications:

1. The coding software must be capable of simultaneously displaying to the coder a digital image/s for a particular location and a coding form (spreadsheet) into which the coder can enter observations and/or measurements from the digital image.

2. The coding software must be capable of displaying digital images at 100 meter intervals and the ability to view the images at 20 meter intervals.

3. Both the digital image and the coding form (spreadsheet) must be displayed in a size large enough for effective use by a coder; this may require display across two computer monitor screens to obtain displays of suitable size, clarity and resolution.

4. Where multiple cameras are used to obtain the 160- to 180-degree field of view requirement, it must be possible to align the separate digital images on the display screen to obtain a continuous panoramic view of the roadway and roadside at the location of interest.

5. The coding form (spreadsheet) must be capable of including the road attributes listed in the ANNEX A – Attributes and categories, including entry of numeric or alphanumeric data, drop-down menus or attribute buttons, as appropriate. The labeling of attributes in the coding software must match the wording of the attributes in the Portuguese version coding manual

6. The coding software must be capable of storing coding data for digital images at 100 meter intervals. It must be capable of automatically advancing to the next 100 meter digital image in a convenient fashion, preferably with a single mouse click or hot key.

7. The coding software must enable the coder to easily review coding data for all digital images at any time with and without making amendments to the data.

8. The coding software must be capable of automatically incorporating the geo-referencing data associated with each digital image (see the ANNEX A – Attributes and categories) into the stored coding data, without the need for the coder to manually rekey the geo-referencing data.

9. The coding form (spreadsheet) must be capable of retaining the values entered in selected coding fields from one 100 meter data set to the next, so that coders only need to modify those coding fields that have changed.

10. The coding software must be capable of converting the stored coding data to an Excel/.csv format at 100 meter intervals including both the coded road attributes and the geo-referencing data.

11. A minimum of four (4) permanent licensed copies of software shall be provided to DAER at the commencement of the project. The licensed copies will be distributed as follows:

- Three (3) copies for the coding computers.
- One (1) copy for an iRAP certified organization for the purposes of quality assurance and ongoing analysis, according to iRAP protocols.

12. The software may include an on-screen tool to accurately measure the height and width of roadway and roadside features, based on field calibration as specified in the previous section.

13. The coding software should be compatible with Microsoft Windows 7, 8 and 10.

14. The coders (or the coding supervisor) should be able to modify or update the coding form (spreadsheet), as appropriate.

5.3.2 ROAD CODING – WORKSTATIONS

1. The supplier shall purchase three new workstations. Each shall present the following minimum configuration: desktop processor i7/6th generation, 16GB of RAM, Nvidia video card of 4GB, 1TB hard disk, keyboard and mouse combo in Portuguese, CD/DVD reader/burner, wireless/bluetooth/ethernet network card, integrated sound card, two 27-inch LED monitors, Windows 10 operating system in Portuguese, Microsoft Office, and specific software installed for the purposes of road coding and subsequent review of results. The supplier shall provide DAER with the sales receipts related to the items above.

2. These computers and associated software will be retained by the client (DAER) upon completion of the project.

5.3.3 ROAD CODING – CODING MANUAL

1. The supplier shall use the RAP-SR-2.2 Star Rating and Investment Plan Coding Manual[3] to create a local RAP-SR-2.2 in consultation with DAER. This shall include:

[3] RAP-SR-2.2: http://downloads.irap.org/docs/RAP-SR-2-2_Star_Rating_coding_manual.docx

a. Any necessary updates to the introductory text;
b. Ensuring all information is consistent with driving on the right-hand side of the road;
c. Adding photos and images using local examples where appropriate.

2. The supplier shall not alter the manual beyond this without guidance from iRAP.

3. The supplier shall seek approval of the local RAP-SR-2.2 Star Rating and Investment Plan Coding Manual (Portuguese Edition) from iRAP prior to undertaking the coding process[4].

5.3.4 ROAD CODING – PROCESS SPECIFICATIONS

1. The supplier shall be responsible for coding all the road attributes specified in RAP-SR-2.2 Star Rating Investment Plan Coding Manual and in accordance with the software specifications, at 100 meter intervals along each selected road.

2. The supplier shall ensure that the coding process be undertaken by a coding team of appropriate size. All salary costs associated with the coding team members shall be met by the supplier.

3. The supplier shall provide all necessary training for his road coding team in the use of the coding software and in the Road Attribute Coding course on RAP capacity[5].

4. The supplier should prepare a training plan, in consultation with iRAP, to carry out the training course. iRAP might provide a staff member to assist in the training course. iRAP will provide generic training materials that can be amended by the supplier to reflect the localized version of the coding manual.

5. The coding team shall be supervised at all times by a suitably qualified staff member from the supplier. The supplier supervisor shall undertake regular quality assurance reviews of the coding in accordance with the RAP-SR-2.4 Road Inspection Quality Assurance Guide[6].

6. If the supplier has not successfully undertaken iRAP road coder training or supervision previously, then they will be required to complete the coding training course in iRAP capacity and two or three-day coder supervisor and trainer course (depending on skills and experience). This will be undertaken at the supplier's cost and not covered by this contract.

[4]http://irap.net/en/about-irap-3/specifications?download=261:manual-de-codificacao-para-classificacao-por-estrelas
[5]RAP capacity: http://capacity.irap.org
[6] RAP-SR-2.4: http://downloads.irap.org/docs/RAP-SR-2-4_Road_Coding_QA_Guide.docx

7. The supplier shall provide all coding data in an Excel/.csv format including both the coded road attributes and the linked geo-referencing data to the client (DAER).

8. The supplier shall provide the client (DAER) and an iRAP certified organization with a progress report on coding at the end of each week. The reports should contain details of who is involved in the coding, photos, descriptions of any issues that have arisen (such as sections of road that were difficult to code) and length of road coded. The reports should include an analysis of actual levels of coding accuracy for each road attribute, as specified in RAP-SR-2.4 Road Inspection Quality Assurance Guide[7]. These reports shall be provided to the client (DAER) for immediate review upon completion.

9. The full coded data set shall be provided to DAER upon completion of the road coding process. The supplier shall retain a copy of all data with appropriate back-up in place for a period of 7 years.

10. The supplier shall provide training to DAER on the process of coding so that up to 9 DAER staff can appreciate the mechanics of coding, what is required in coding, use the coding software and have an understanding of the context of coding within the road assessment process and preparation of the Safer Roads Investment Plan. This training will be accomplished over a period of at least 15 hours.

5.3.5 ROAD CODING – QUALITY ASSURANCE

1. Final acceptance and completion of the coding phase will be subject to the full coverage of the required network and quality review by an iRAP certified organization to ensure that data is suitable for analysis and complies with the standards described the RAP-SR-2.4 Road Inspection Quality Assurance Guide[8].
2. The supplier should be prepared to correct coding should an iRAP certified organization identify any errors or deficiencies.
3. The quality of the products delivered during the coding phase shall be assured by means of a specific document, issued by an iRAP certified organization.

5.3.6 ROAD CODING – TEAM COMPOSITION

The qualifications for the required positions are as follows:

[7] RAP-SR-2.4: http://downloads.irap.org/docs/RAP-SR-2-4_Road_Coding_QA_Guide.docx
[8] RAP-SR-2.4: http://downloads.irap.org/docs/RAP-SR-2-4_Road_Coding_QA_Guide.docx

a. Project leader - the activities related to the coding team will be supervised by the project leader. The job description is presented in item 8.
b. Road coding trainer and supervisor - appropriate technical qualifications and 5 year-related experience.
c. Coding team - a team of adequate size and training, composed of at least 3 coders, with experience on road data collection and GIS mapping.

5.3.7 ROAD CODING – PRODUCT R3

The supplier shall present to the client (DAER) two printed and one digital version of Report 3 (R3), about the road coding. The Report shall contain, at least, all the road coding data, iRAP Coding Manual (in Portuguese), iRAP specification containing the road coding attributes, coding data in excel (.csv), photos related to road coding, training certificates of the road coding course offered to DAER staff, and a copy of the document that assures the quality of the road coding, according to section 6 - PRODUCTS, SUBPRODUCTS AND DEADLINES. The supplier also needs to provide DAER with four licenses to use the coding software and sales receipts related to the three workstations.

5.4 SUPPORTING DATA, STAR RATING, INVESTMENT PLAN AND FINAL REPORTS

Product 4 consists of supporting data collection, data processing, Star Rating and Investment Plan preliminary results and the project final reports.

5.4.1 SUPPORTING DATA

To ensure the iRAP Star Rating and Investment Plan project outcomes reflect local conditions, practice and experience, a range of supporting data is required in addition to the road survey and coding data. The Supplier will be required to work with road authorities, their district offices, police and local stakeholders to secure the necessary data.

This supporting data should include, but is not limited to, the following: vehicle speed data, vehicle volume, motorcycle vehicle volume, pedestrian and bicyclist volume, crash data (number of deaths and serious injuries by road user type and crash type), local construction and maintenance costs for countermeasures, plus the necessary data needed to estimate the economic cost of a death and serious injury, as per the iRAP methodology.

The template for this data is provided inRAP-SR-3.2 Supporting data template[9].

5.4.1.1 SUPPORTING DATA - ECONOMIC DATA REQUIREMENTS

[9] RAP-SR-3.2: http://downloads.irap.org/docs/RAP-SR-3-2_Supporting_Data_Template.xlsm

The Supplier shall collect the following data to enable the economic analysis. Ideally the data sourced should permit the completion of the "Demographics and Economics" template provided as part of RAP-SR-3.2 Supporting data template**Erro! Indicador não definido.**. A summary of the data to be collected includes:

a. Side of the road driven on: reflect the side of the road that vehicles drive on. In Brazil the traffic pattern is on the right side of the road.
b. Analysis Period: the number of years over which the economic benefits of the Safer Roads Investment Plan is calculated. The period adopted is 20 years.
c. Gross Domestic Product (GDP): Per capita, current prices, in national currency for year of survey. Refer to IMF World Economic Outlook Databases[10]. This figure is used to estimate the economic value of life in the event that there is not an official value of life used in the country.
d. Discount Rate (%): it is used to estimate net present values. The discount rate is typically set to 12% however this can be adjusted depending on the usual practice in each country.
e. Minimum Attractive Rate of Return: it is the minimum rate of return that the client (DAER) is willing to accept before investing in the various road engineering countermeasures. The default is provided as the discount rate divided by 100.
f. Internal Rate of Return: The Internal Rate of Return (IRR) is a measure of the profitability of investments. The minimum Internal Rate of Return threshold may be used in iRAP assessments to determine whether a countermeasure is included in the Safer Roads Investment Plan.
g. Value of Life Multiplier: The iRAP research paper "The True Cost of Road Crashes" provides an estimate of the value of life in a country based on a multiplier of GDP per capita recorded above. This provides the basis of all economic assessments and is recommended as 70 x PIB per capita where an official figure for value of life is not available.
h. Value of Life: The figure will be based on the iRAP methodology.
i. Value of Serious Injury Multiplier: The iRAP research paper "The True Cost of Road Crashes" provides an estimate of the value of serious injury in a country based on a multiplier of the value of life recorded above. This provides the basis of all economic assessments and is recommended as 0.25 x Value of Life where an official figure for value of life is not available.
j. Value of Serious Injury: The figure should reflect the official national or jurisdiction value of serious injury if available. If not available the default value of 0.25 x Value of Life multiplier can be used.
k. Serious Injury to Fatalities Ratio: Is the number of serious injuries to each fatal. The default is 10. This may be changed based on supporting evidence.

[10] http://www.imf.org/external/data.htm

The Safe Road System comment fields are optional and are provided to allow a discussion and appreciation of the key factors influencing all aspects of the safe road system. Comments on data systems and crash and traffic records, speed limit and behaviour, alcohol and drug driving, helmet wearing, seat belt wearing, vehicle fleet standards and post crash care and trauma response can be documented. This may help understand and explain the varying crash performance experienced on road networks or sections of similar star ratings from one country to another.

5.4.1.2 SUPPORTING DATA - VEHICLE VOLUME REQUIREMENTS

Vehicle volume data will be provided by the client (DAER).

5.4.1.3 SUPPORTING DATA - SPEED DATA REQUIREMENTS

The supplier will estimate travel speed based on visual observation during road survey.

5.4.1.4 SUPPORTING DATA - PEDESTRIAN & BICYCLE COUNT REQUIREMENTS

The supplier will estimate bicycle and pedestrian counts based on visual observation during road survey and land-use in the surroundings of the road.

5.4.1.5 SUPPORTING DATA - CRASH DATA REQUIREMENTS

The iRAP Star Rating and Investment Plan protocol is designed to work within the known limitations of crash data availability. Where more detailed crash data is available that should be collected and analyzed to determine appropriate deaths across the network being assessed.

5.4.1.5.1 Fatal crash data collection

The Supplier, in coordination with the client (DAER), shall contact the relevant authorities and collect the available crash data on the selected roads. Ideally the data sourced should permit the completion of the fatality data template provided as part of RAP-SR-3.2 Supporting data template.[11]

The key data fields required across the surveyed road network are:

- Crash Outcome (fatality, serious injury – crash severity definitions used should be documented).

[11] RAP-SR-3.2: http://downloads.irap.org/docs/RAP-SR-3-2_Supporting_Data_Template.xlsm

- Crash User Types (vehicle, motorcyclist, bicyclist, pedestrian).
- Crash Type (head-on, run-off road, intersection, rear/end side/swipe, hit cyclist, hit pedestrian).
- Crash Type Detailed (overtaking, loss of control, crossing road etc.).
- Sample Period (3 years).

5.4.1.5.2 Estimation of fatality data

Where the quality of available crash is insufficient then the Supplier shall engage with suitable experts in country to develop reasonable and well-documented assumptions to enable the completion of The "Fatality Data Summary" sheet provided in RAP-SR-3.2 Supporting data template[12].

Sources of information include, but are not limited to:

- The available crash data with adjustments made as required;
- Consultations with Police, Road Safety Professionals and Health Professionals;
- The latest version of the "Global Status Report on Road Safety" by the World Health Organization;
- Data on average fatal and/or serious injury crash rates from within the country or similar countries;
- Experience from iRAP's around the World

5.4.1.6 SUPPPORTING DATA - COUNTERMEASURE COST REQUIREMENTS

The Supplier shall collect countermeasure cost data in consultation with DAER. Details on the cost and treatment life of various countermeasures are recorded within the Countermeasure Costs worksheet within RAP-SR-3.2 Supporting data template. This data must meet the following criteria for upload to ViDA:

a. Format: CSV file;
b. Costs in local currency;
c. Countermeasure ID (a unique code assigned to the countermeasure type);
d. Countermeasure name (a unique name assigned to the countermeasure type);
e. Carriageway code (reflects whether the treatment is specific to an undivided road, an individual carriageway, or multi carriageways);
f. Unit of cost (the basis for determining costs for each countermeasure. This allows the costs to reflect the actual site conditions e.g. lane widening will apply to each lane and its cost per lane km);
g. Service life (the length of time that the countermeasure will last before requiring replacement or full refurbishment);

[12] RAP-SR-3.2: http://downloads.irap.org/docs/RAP-SR-3-2_Supporting_Data_Template.xlsm

h. Rural Low Upgrade Cost– the cost for treatments at rural locations where the upgrade cost field as defined in RAP-SR-2.2 Star Rating and Investment Plan Coding Manual[13] has been recorded as low;
i. Rural Medium Upgrade Cost – the cost for treatments at rural locations where the upgrade cost field as defined in RAP-SR-2.2 Star Rating and Investment Plan Coding Manual has been recorded as medium;
j. Rural High Upgrade Cost – the cost for treatments at rural locations where the upgrade cost field as defined in RAP-SR-2.2 Star Rating and Investment Plan Coding Manual has been recorded as high;
k. Urban Low Upgrade Cost – the cost for treatments at urban locations where the upgrade cost field as defined in RAP-SR-2.2 Star Rating and Investment Plan Coding Manual has been recorded as low;
l. Urban Medium Upgrade Cost – the cost for treatments at urban locations where the upgrade cost field as defined in RAP-SR-2.2 Star Rating and Investment Plan coding manual has been recorded as medium;
m. Urban High Upgrade Cost – the cost for treatments at urban locations where the upgrade cost field as defined in RAP-SR-2.2 Star Rating and Investment Plan Coding Manual has been recorded as high;
n. Divided Carriageway Cost Multiplier – A cost multiplier that defaults to 1, but allows for a cost multiplier to be applied to site-specific "Multi-carriageway" treatments like intersections and pedestrian crossings that have triggered on divided roads and where the fact the road is divided will significantly increase the costs as compared to a treatment on an undivided road.
o. Hide – Where the treatment is triggered but the results are hidden until further investigation (e.g. speed management);
p. Ignore – The treatment is deemed inappropriate and it is removed from the analysis completely such that it will not trigger or be considered for implementation anywhere across the network.

5.4.1.7 SUPPORTING DATA TO BE PROVIDED BY DAER TO THE SUPPLIER

DAER will provide the following data for the selected roads:

a. Initial and final geographical reference for each road section, according to the State Road System (Sistema Rodoviário Estadual - SRE);
b. Results of traffic counts realized in the last years;
c. Crash data.

5.4.1.8 SUPPORTING DATA - SUBPRODUCT R4

[13]RAP-SR-2.2: http://downloads.irap.org/docs/RAP-SR-2-2_Star_Rating_coding_manual.pdf

The supplier shall present to the client (DAER) two printed and one digital version of Report 4 (R4). The Report shall contain, at least, the supporting data and excel spreadsheets, according to section 6 - PRODUCTS, SUBPRODUCTS AND DEADLINES.

5.4.2 STAR RATING AND INVESTMENT PLAN PRELIMINARY RESULTS

The Supplier shall process the data using the following steps. RAP capacity[14]provides guidance as part of the Star Rating and Investment Plan data handling module of the Star Rating and Investment Plans from Inspection course.

1. Convert the coded data into iRAP upload file format (as defined in RAP-SR-3.3 Upload file specification [15]).
2. Create road sections in accordance with iRAP methodology and in consultation with the client (DAER).
3. Add vehicle flow and the motorcycle percentage, plus speed data to the upload file.
4. Estimate the pedestrian and bicycle flow and compare with pedestrian and bicyclist vehicle volume data collected in the supporting data. Enter the flow data into the upload file.
5. Set up a project within the iRAP online software[16], completing the project setup, initial fatality estimation variables, economic variables and countermeasure costs.
6. Upload data set to iRAP online software.
7. Calibrate the fatality estimation in line with crash data collected for the network and reprocess the data.
8. Analyze results and amend upload file and reprocess the data as necessary.
9. The supplier shall provide training to DAER on data processing and analysis using the online iRAP VIDA software, so that up to 9 DAER staff are trained to carry out the road assessment process and to prepare the Safer Roads Investment Plan. This training will be accomplished over a period of at least 10 hours.

The supplier shall undertake a quality assurance review of the iRAP upload file, Star Rating results and Safer Roads Investment Plan.

[14]RAP capacity: http://capacity.irap.org
[15] RAP-SR-3.3: http://downloads.irap.org/docs/RAP-SR-3-3_Upload_file_specification.pdf
[16]ViDA: http://vida.irap.org

In addition, the supplier shall undertake an in-country review of the preliminary results with local stakeholders and amend the results based on this review as necessary. Typically, the local stakeholders who participated in the road coding process will also participate in the review. The purpose of this review is to ensure that:

- Stakeholders learn to use the iRAP online software.
- Stakeholders are familiar with iRAP results.
- Stakeholders understand the iRAP methodology, limitations and required engineering action.
- The proposed countermeasures are feasible (both in terms of engineering and applicability to the country).
- The proposed countermeasure costs are reasonable.
- The vehicle volumes and pedestrian estimates are reasonable.
- The potential need for complementary road safety education and enforcement initiatives is identified.

In order to complete the project analysis the supplier must have undertaken the Introduction to iRAP, Star Rating from inspection and the Safer Roads Investment Plan courses on RAP capacity[17]. Suppliers responding to this specification who have not completed such training should make provision for completing these courses in their proposal.

Upload file must be completed in accordance with RAP-SR-3.3 Upload file specification[18].

The preliminary results must be submitted to the client (DAER) for review prior to results being provided to local stakeholders. The Supplier should be prepared to amend and reprocess the data should the independent quality review identify errors or deficiencies. Suppliers should allow approximately ten days for the analysis.

5.4.2.1 PRELIMINARY RESULTS – SUBPRODUCT R5

The supplier shall present to the client (DAER) two printed and one digital version of Report 5(R5), consisting of, at least, the preliminary results, revised by the client (DAER), and iRAP VIDA software training certificates, according to section 6 - PRODUCTS, SUBPRODUCTS AND DEADLINES.

5.4.3 FINAL REPORTS - RESULTS PRESENTATION

The supplier shall produce two formal reports, a full technical report and a summary report. Both reports shall be produced using appropriate format to be agreed with the client (DAER)

[17]RAP capacity: http://capacity.irap.org
[18]RAP-SR-3.3: http://downloads.irap.org/docs/RAP-SR-3-3_Upload_file_specification.pdf

and following iRAP brand guidelines[19]. The supplier must hand in 4 printed copies of each report to the client (DAER) as well as a digital version.

The full technical report shall include:

- Full details of project background, tasks and objectives.
- A list of the surveyed road network.
- Details of recorded road attributes.
- Details (inc. source) of all supporting data used along with any assumptions made.
- Star rating table.
- Star rating maps.
- Safer Roads Investment Plan.
- Details of training provision, workshops and demonstrations performed during the project.

The summary report shall include:

- A brief description of the project background and objectives.
- A list of the surveyed road network
- Star rating table.
- Star rating maps.
- Safer Roads Investment Plan

Sample reports are available to use as a guide and are provided as part of the RAP capacity training resources:

- iRAP Vietnam Technical Report[20]
- iRAP Vietnam Project Summary[21]

5.4.3.1 FINAL REPORTS - SUBPRODUCT R6

The final reports, subproduct R6, consist of the full technical report and the summary report, according to the description above.

6 PRODUCTS, SUBPRODUCTS AND DEADLINES

The total implementation period is six months from the date of the Service Order issued by the client (DAER).

[19] iRAP Brand guidelines: http://downloads.irap.org/docs/iRAP_Brand_guidelines iRAP.pdf
[20] iRAP Vietnam Technical Report:http://downloads.irap.org/docs/iRAP_Vietnam_Technical_Report.pdf
[21] iRAP Vietnam Project Summary: http://downloads.irap.org/docs/iRAP_Vietnam_Summary_Report.pdf

The products and subproducts and their delivery deadline are shown below:

Figure 3 – Products, subproducts and deadlines

	PRODUCTS / SUBPRODUCTS	DEADLINES
1	The supplier shall present a work plan to the client (DAER). In the work plan the supplier shall at least describe the development of the activities, the methodology to be used and a list with all the professionals for each phase of the work, as well as present a schedule outlining the project activities and deliverables, according to section 5.1 above.	Contract signing[22] + 1 month
2	Road survey package, including: Road Survey Video Data, Road Survey Database and Supporting Software, Detailed Report of the Road Survey and document assuring that data is suitable for coding, according to section 5.2 above.	Contract signing + 2months
3	Road Coding Package, including: Road Coding Log, iRAP Coding Manual (edition in Portuguese), iRAP Road Attribute Code Specifications, Exported Coding File (.csv), Road Coding Photographs and Training to DAER on the Coding Software, and document assuring the coding quality, according to section 5.3 above.	Contract signing + 3 months
4	Supporting Data in Excel Format according to RAP-SR-3-2 and section 5.4.1 above.	Contract signing + 4 months
5	Preliminary results of the iRAP Star Rating and Investment Plan for Safer Roads, according to RAP-SR-3-3 and section 5.4.2 above.	Contract signing + 5 months
6	Full Technical Report and a Summary Report according to Section 5.4.3 above.	Contract signing + 6 months

7 PAYMENT SCHEDULE

The payment schedule is the following:

- 5% on Supplier's submission and the client's acceptance of Report 1 (R1);
- 15% on Supplier's submission and the Client's acceptance of Report 2 (R2);
- 15% on Supplier's submission and the Client's acceptance of Report 3 (R3);
- 10% on Supplier's submission and the Client's acceptance of Report 4 (R4);
- 15% on Supplier's submission and the Client's acceptance of Report 5 (R5);
- 40% on Supplier's submission and the Client's acceptance of Report 6 (R6).

8 TEAM COMPOSITION

The supplier should establish a strong core team of specialists, preferably with Portuguese-speaking personnel. The supplier is solely responsible for proposing an organizational setup of the assignment and the staffing / team composition which in his view is appropriate for

[22] After publication in the State Official Journal.

carrying out the assignment, fulfilling the Terms of Reference and producing the required outputs. The client (DAER) has nevertheless some general ideas and suggestions about the organizational setup, and primary skills and specialties of the team, which reflect the client's knowledge of the local situation and desired outcomes, as detailed further on.

The overall proposed Project Team should be able to cover the areas listed below:

- Main team

a. Road Specialist (Project leader)

The project leader is responsible for coordinating all the activities carried out in the iRAP program, so as to assure quality of the results of the *Star Rating and Safer Roads Investment Plan*. The project leader shall hold a bachelor degree in Civil Engineering or in other field (provided he or she holds a Specialization, a Master or a Doctorate degree in road engineering), with at least 10-year experience on project management with multidisciplinary teams and at least one project using iRAP methodology.

b. Road Safety Specialist

He or she shall hold a bachelor degree in Civil Engineering or in other field (provided he or she holds a Specialization, a Master or a Doctorate degree in road engineering), with at least 10-year experience and at least one project using iRAP methodology.

c. Road Engineer with experience in Road Safety (Consultant)

He or she shall hold a bachelor degree in Civil Engineering (provided he or she holds a Specialization, a Master or a Doctorate degree in road engineering), with at least 10-year experience on road safety assessment.

It is necessary for the road safety specialist to have prior experience in implementing an International Road Assessment Program in a developing country. It is preferable for the specialist to have experience on GIS (Geographic Information System), mainly on mapping of road safety data.

This specialist should have 10 years professional experience working in road safety inspection and data analysis, ability to work with transport and road specialists, and familiarity with road safety assessments.

The Consultant should complement the team skills based on his or her professional experience in road safety in Brazil and /or abroad.

- Road survey (section 5.2.3):

a. Professional driver (survey vehicle);

b. Survey vehicle specialist;

c. Film editor;

d. Project leader.

- Road coding (section 5.3.3:

a. Road coding trainer and supervisor;

b. Coding team;

c. Project leader.

The inputs of all key specialists shall be clearly indicated in the proposal, as it is anticipated that the majority of the work program would be carried out by individuals highly experienced in their professional fields and aligned with the tasks assigned.

In the proposal, the Supplier shall name the individuals to participate in specific roles within the Project Team and provide full curricula vitae and any other information considered relevant. The Supplier shall name the project leader, and the other core team members and key short-term specialists, and provide an assurance that all members of the proposed team will be made available as specified in the proposal, if the Supplier is selected.

The Supplier shall have experience with the iRAP methodology. The team members should have experience in road safety assessment, preferably in Brazil and South America. Familiarity with the Brazilian road sector is an asset.

The expected duration of the services by the individual experts should be clearly defined in the Supplier's proposal. The Supplier is expected to make full use, where possible, of appropriately qualified local staff, and work closely with and transfer knowledge to the Client staff (DAER). The Supplier team will be required to provide its own computers, printers, office supplies, vehicles, offices, etc. The Supplier will also have to make appropriate security arrangements, describe those in his technical proposal and price those arrangements in the financial proposal.

9 SUPERVISION OF THE SERVICES

The Client will be the Departamento Autônomo de Estradas de Rodagem do Rio Grande do Sul/Autonomous Departament of Highways (DAER/RS). DAER will define a team to supervise the services.

ANNEX A – ATTRIBUTES AND CATEGORIES

Figure 4 lists the road attributes and categories required for assessment and the task during which the data is collected. Definitions of the categories are provided in the RAP-SR-2.2 *Star Rating Code Manual*[23].

The supplier should note that iRAP may make minor changes to these attributes as part of ongoing research and development.

Figure 4 – Attributes and Categories

Task	Col	Attribute	ID	Category
Road coding	1	Coder name	NA	Text
Road coding	2	Coding date	NA	Text (format dd/mm/yyyy)
Road survey	3	Road survey date	NA	Text (format dd/mm/yyyy)
Road survey	4	Image reference	NA	Text
Road survey	5	Road name	NA	Text
Road survey	6	Section	NA	Text
Road survey	7	Distance	NA	Number (unit km)
Road survey	8	Length	NA	Number (unit km)
Road survey	9	Latitude	NA	Number (format decimal degree, 12 digits, WGS84)
Road survey	10	Longitude	NA	Number (format decimal degree, 12 digits, WGS84)
Road coding	11	Landmark	NA	Text
Road coding	12	Comments	NA	Text
Road coding	13	Carriageway label	1	Carriageway A of a divided road
			2	Carriageway B of a divided road
			3	Undivided road
			4	Carriageway A of a motorcycle facility
			5	Carriageway B of a motorcycle facility
Road coding	14	Upgrade cost	1	Low
			2	Medium
			3	High
Road coding	15	Motorcycle observed flow	1	None
			2	1 motorcycle observed
			3	2 to 3 motorcycles observed
			4	4 to 5 motorcycles observed
			5	6 to 7 motorcycles observed

[23] RAP-SR-2.2: http://downloads.irap.org/docs/RAP-SR-2-2_Star_Rating_coding_manual_Portuguese.pdf

Task	Col	Attribute	ID	Category
			6	8+ motorcycles observed
Road coding	16	Bicycle observed flow	1	None
			2	1 bicycle observed
			3	2 to 3 bicycles observed
			4	4 to 5 bicycles observed
			5	6 to 7 bicycles observed
			6	8+ bicycles observed
Road coding	17	Pedestrian observed flow across the road	1	None
			2	1 pedestrian crossing observed
			3	2 to 3 pedestrians crossing observed
			4	4 to 5 pedestrians crossing observed
			5	6 to 7 pedestrians crossing observed
			6	8+ pedestrians crossing observed
Road coding	18	Pedestrian observed flow along the road driver-side	1	None
			2	1 pedestrian along driver-side observed
			3	2 to 3 pedestrians along driver-side observed
			4	4 to 5 pedestrians along driver-side observed
			5	6 to 7 pedestrians along driver-side observed
			6	8+ pedestrians along driver-side observed
Road coding	19	Pedestrian observed flow along the road passenger-side	1	None
			2	1 pedestrian along passenger-side observed
			3	2 to 3 pedestrians along passenger-side observed
			4	4 to 5 pedestrians along passenger-side observed
			5	6 to 7 pedestrians along passenger-side observed
			6	8+ pedestrians along passenger-side observed
Road coding	20	Land use - driver-side	1	Undeveloped areas
			2	Farming and agricultural
			3	Residential
			4	Commercial
			5	Not Recorded
			6	Educational
			7	Industrial and manufacturing

Task	Col	Attribute	ID	Category
Road coding	21	Land use - passenger-side	1	Undeveloped areas
			2	Farming and agricultural
			3	Residential
			4	Commercial
			5	Not Recorded
			6	Educational
			7	Industrial and manufacturing
Road coding	22	Area type	1	Rural / open area
			2	Urban / rural town or village
Road coding	23	Speed limit	1	<30km/h
			3	40km/h
			5	50km/h
			7	60km/h
			9	70km/h
			11	80km/h
			13	90km/h
			15	100km/h
			17	110km/h
			19	120km/h
			21	130km/h
			23	140km/h
			25	≥150km/h
			31	<20mph
			33	30mph
			35	40mph
			37	50mph
			39	60mph
			41	70mph
			43	80mph
			45	≥90mph
Road coding	24	Motorcycle speed limit	1	<30km/h
			3	40km/h
			5	50km/h
			7	60km/h
			9	70km/h
			11	80km/h
			13	90km/h
			15	100km/h

Task	Col	Attribute	ID	Category
			17	110km/h
			19	120km/h
			21	130km/h
			23	140km/h
			25	≥150km/h
			31	<20mph
			33	30mph
			35	40mph
			37	50mph
			39	60mph
			41	70mph
			43	80mph
			45	≥90mph
Road coding	25	Truck speed limit	1	<30km/h
			3	40km/h
			5	50km/h
			7	60km/h
			9	70km/h
			11	80km/h
			13	90km/h
			15	100km/h
			17	110km/h
			19	120km/h
			21	130km/h
			23	140km/h
			25	≥150km/h
			31	<20mph
			33	30mph
			35	40mph
			37	50mph
			39	60mph
			41	70mph
			43	80mph
			45	≥90mph
Road coding	26	Differential speed limits	1	Not present
			2	Present
Road coding	27	Median type	1	Safety barrier – metal
			2	Safety barrier – concrete

Task	Col	Attribute	ID	Category
			3	Physical median width ≥ 20.0m
			4	Physical median width ≥ 10.0m to < 20.0m
			5	Physical median width ≥ 5.0m to < 10.0m
			6	Physical median width ≥ 1.0m to < 5.0m
			7	Physical median width ≥ 0m to < 1.0m
			8	Continuous central turning lane
			9	Flexipost
			10	Central hatching (>1m)
			11	Centre line
			12	Safety barrier - motorcycle friendly
			13	One way
			14	Wide centre line (0.3m to 1m)
			15	Safety barrier - wire rope
Road coding	28	Centreline rumble strips code	1	Not present
			2	Present
Road coding	29	Roadside severity - driver-side distance	1	0 to <1m
			2	1 to <5m
			3	5 to <10m
			4	≥ 10m
Road coding	30	Roadside severity - driver-side object	1	Safety barrier - metal
			2	Safety barrier – concrete
			3	Safety barrier - motorcycle friendly
			4	Safety barrier - wire rope
			5	Aggressive vertical face
			6	Upwards slope - (15° to 75°)
			7	Upwards slope - (>= 75°)
			8	Deep drainage ditch
			9	Downwards slope (> -15°)
			10	Cliff
			11	Tree ≥ 10cm
			12	Sign, post or pole ≥ 10cm
			13	Non-frangible structure/bridge or building
			14	Frangible structure or building
			15	Unprotected safety barrier end
			16	Large boulders ≥ 20cm high
			17	No object

Task	Col	Attribute	ID	Category
Road coding	31	Roadside severity - passenger-side distance	1	0 to <1m
			2	1 to <5m
			3	5 to <10m
			4	≥10m
Road coding	32	Roadside severity - passenger-side object	1	Safety barrier – metal
			2	Safety barrier – concrete
			3	Safety barrier - motorcycle friendly
			4	Safety barrier - wire rope
			5	Aggressive vertical face
			6	Upwards slope - (15° to 75°)
			7	Upwards slope - (>= 75°)
			8	Deep drainage ditch
			9	Downwards slope (> -15°)
			10	Cliff
			11	Tree ≥ 10cm
			12	Sign, post or pole ≥ 10cm
			13	Non-frangible structure/bridge or building
			14	Frangible structure or building
			15	Unprotected safety barrier end
			16	Large boulders ≥ 20cm high
			17	No object
Road coding	33	Shoulder rumble strips	1	Not present
			2	Present
Road coding	34	Paved shoulder - driver-side	1	Wide (≥ 2.4m)
			2	Medium (≥ 1.0m to < 2.4m)
			3	Narrow (≥ 0m to < 1.0m)
			4	None
Road coding	35	Paved shoulder - passenger-side	1	Wide (≥ 2.4m)
			2	Medium (≥ 1.0m to < 2.4m)
			3	Narrow (≥ 0m to < 1.0m)
			4	None
Road coding	36	Intersection type	1	Merge lane
			2	Roundabout
			3	3-leg unsignalised with protected turn lane
			4	3-leg unsignalised with no protected turn

Task	Col	Attribute	ID	Category
				lane
			5	3-leg signalised with protected turn lane
			6	3-leg signalised with no protected turn lane
			7	4-leg unsignalised with protected turn lane
			8	4-leg unsignalised with no protected turn lane
			9	4-leg signalised with protected turn lane
			10	4-leg signalised with no protected turn lane
			11	Do not use this code
			12	None
			13	Railway Crossing - passive (signs only)
			14	Railway Crossing - active (flashing lights / boom gates)
			15	Median crossing point - informal
			16	Median crossing point – formal
			17	Mini roundabout
Road coding	37	Intersection channelization	1	Not present
			2	Present
Road coding	38	Intersecting road volume	1	≥15,000 vehicles
			2	10,000 to 15,000 vehicles
			3	5,000 to 10,000 vehicles
			4	1,000 to 5,000 vehicles
			5	100 to 1,000 vehicles
			6	1 to 100 vehicles
			7	Not applicable
Road coding	39	Intersection quality	1	Adequate
			2	Poor
			3	Not applicable
Road coding	40	Property access points	1	Commercial Access 1+
			2	Residential Access 3+
			3	Residential Access 1 or 2
			4	None
Road coding	41	Number of lanes	1	One
			2	Two
			3	Three
			4	Four or more
			5	Two and one
			6	Three and two

Task	Col	Attribute	ID	Category
Road coding	42	Lane width	1	Wide (≥ 3.25m)
			2	Medium (≥ 2.75m to < 3.25m)
			3	Narrow (≥ 0m to < 2.75m)
Road coding	43	Curvature	1	Straight or gently curving
			2	Moderate
			3	Sharp
			4	Very sharp
Road coding	44	Quality of curve	1	Adequate
			2	Poor
			3	Not applicable
Road coding	45	Grade	1	≥ 0% to <4%
			2	≥ 4% to <5%
			3	≥ 5% to <7.5%
			4	≥ 7.5% to <10%
			5	≥ 10%
Road coding	46	Road condition	1	Good
			2	Medium
			3	Poor
Road coding	47	Skid resistance / grip	1	Sealed – adequate
			2	Sealed – medium
			3	Sealed – poor
			4	Unsealed – adequate
			5	Unsealed – poor
Road coding	48	Delineation	1	Adequate
			2	Poor
Road coding	49	Street lighting	1	Not present
			2	Present
Road coding	50	Pedestrian crossing - inspected road	1	Grade separated facility
			2	Signalised with refuge
			3	Signalised without refuge
			4	Unsignalised marked crossing with refuge
			5	Unsignalised marked crossing without a refuge
			6	Refuge only
			7	No facility
Road coding	51	Pedestrian crossing quality	1	Adequate
			2	Poor

Task	Col	Attribute	ID	Category
			3	Not applicable
Road coding	52	Pedestrian crossing facilities - side road	1	Grade separated facility
			2	Signalised with refuge
			3	Signalised without refuge
			4	Unsignalised marked crossing with refuge
			5	Unsignalised marked crossing without a refuge
			6	Refuge only
			7	No facility
Road coding	53	Pedestrian fencing	1	Not present
			2	Present
Road coding	54	Speed management / traffic calming	1	Not present
			2	Present
Road coding	55	Vehicle parking	1	None
			2	One side
			3	Two sides
Road coding	56	Sidewalk - driver-side	1	Physical barrier
			2	Non-physical separation ≥ 3.0m
			3	Non-physical separation 1.0m to <3.0m
			4	Non-physical separation 0m to <1.0m
			5	None
			6	Informal path ≥ 1.0m
			7	Informal path 0m to <1.0m
Road coding	57	Sidewalk - passenger-side	1	Physical barrier
			2	Non-physical separation ≥ 3.0m
			3	Non-physical separation 1.0m to <3.0m
			4	Non-physical separation 0m to <1.0m
			5	None
			6	Informal path ≥ 1.0m
			7	Informal path 0m to <1.0m
Road coding	58	Service road	1	Not present
			2	Present
Road coding	59	Motorcycle facilities	1	Exclusive one way motorcycle path with barrier
			2	Exclusive one way motorcycle path without barrier
			3	Exclusive two way motorcycle path with

Task	Col	Attribute	ID	Category
				barrier
			4	Exclusive two way motorcycle path without barrier
			5	Inclusive motorcycle lane on roadway
			6	None
Road coding	60	Bicycle facility	1	Off-road path with barrier
			2	Off-road path
			3	On-road lane
			4	None
			5	Extra wide outside (≥4.2m)
			6	Signed shared roadway
			7	Shared use path
Road coding	61	Roadworks	1	No road works
			2	Minor road works in progress
			3	Major road works in progress
Road coding	62	Sight distance	1	Adequate
			2	Poor
Supporting data	63	Vehicle flow (AADT)	NA	NA
Supporting data	64	Motorcycle %	1	Not recorded
			2	0%
			3	1% - 5%
			4	6% - 10%
			5	11% - 20%
			6	21% - 40%
			7	41% - 60%
			8	61% - 80%
			9	81% - 99%
			10	100%
Supporting data	65	Pedestrian peak hour flow across the road	1	0
			2	1 to 5
			3	6 to 25
			4	26 to 50
			5	51 to 100
			6	101 to 200
			7	201 to 300
			8	301 to 400

Task	Col	Attribute	ID	Category
			9	401 to 500
			10	501 to 900
			11	900+
Supporting data	66	Pedestrian peak hour flow along the road driver-side	1	0
			2	1 to 5
			3	6 to 25
			4	26 to 50
			5	51 to 100
			6	101 to 200
			7	201 to 300
			8	301 to 400
			9	401 to 500
			10	501 to 900
			11	900+
Supporting data	67	Pedestrian peak hour flow along the road passenger-side	1	0
			2	1 to 5
			3	6 to 25
			4	26 to 50
			5	51 to 100
			6	101 to 200
			7	201 to 300
			8	301 to 400
			9	401 to 500
			10	501 to 900
			11	900+
Supporting data	68	Bicycle peak hour flow	1	None
			2	1 to 5
			3	6 to 25
			4	26 to 50
			5	51 to 100
			6	101 to 200
			7	201 to 300
			8	301 to 400
			9	401 to 500
			10	501 to 900

Task	Col	Attribute	ID	Category
			11	900+
Supporting data	69	Operating Speed (85th percentile)	1	<30km/h
			2	35km/h
			3	40km/h
			4	45km/h
			5	50km/h
			6	55km/h
			7	60km/h
			8	65km/h
			9	70km/h
			10	75km/h
			11	80km/h
			12	85km/h
			13	90km/h
			14	95km/h
			15	100km/h
			16	105km/h
			17	110km/h
			18	115km/h
			19	120km/h
			20	125km/h
			21	130km/h
			22	135km/h
			23	140km/h
			24	145km/h
			25	≥150km/h
			31	<24mph
			32	25mph
			33	30mph
			34	35mph
			35	40mph
			36	45mph
			37	50mph
			38	55mph
			39	60mph
			40	65mph
			41	70mph

Task	Col	Attribute	ID	Category
			42	75mph
			43	80mph
			44	85mph
			45	≥90mph
Supporting data	70	Operating Speed (mean)	1	<30km/h
			2	35km/h
			3	40km/h
			4	45km/h
			5	50km/h
			6	55km/h
			7	60km/h
			8	65km/h
			9	70km/h
			10	75km/h
			11	80km/h
			12	85km/h
			13	90km/h
			14	95km/h
			15	100km/h
			16	105km/h
			17	110km/h
			18	115km/h
			19	120km/h
			20	125km/h
			21	130km/h
			22	135km/h
			23	140km/h
			24	145km/h
			25	≥150km/h
			31	<24mph
			32	25mph
			33	30mph
			34	35mph
			35	40mph
			36	45mph
			37	50mph
			38	55mph

Task	Col	Attribute	ID	Category
			39	60mph
			40	65mph
			41	70mph
			42	75mph
			43	80mph
			44	85mph
			45	≥90mph
Analysis	71	Roads that cars can read	1	Meets specification
			2	Does not meet specification
Analysis	72	Car Star Rating Policy Target	1	1 Star
			2	2 Star
			3	3 Star
			4	4 Star
			5	5 Star
			6	Not applicable
Analysis	73	Motorcycle Star Rating Policy Target	1	1 Star
			2	2 Star
			3	3 Star
			4	4 Star
			5	5 Star
			6	Not applicable
Analysis	74	Pedestrian Star Rating Policy Target	1	1 Star
			2	2 Star
			3	3 Star
			4	4 Star
			5	5 Star
			6	Not applicable
Analysis	75	Bicycle Star Rating Policy Target	1	1 Star
			2	2 Star
			3	3 Star
			4	4 Star
			5	5 Star
			6	Not applicable

ANNEX B – CRASH ESTIMATE GUIDE

To assist countries with poor crash data iRAP has compiled typical fatal and serious injury crash rates to form a starting point for an analysis or estimation of fatalities on an existing road network being surveyed.

Figure 5 – Fatal and Serious Injury indicative Crash Types by Road Type / Star Rating

	Low – Middle Income countries	High Income countries*
Motorway (high standard 4 or 5 star rating)	10-20 FSI's per billion vkt	5-10 FSI's per billion vkt
Dual Carriageway (low 4 or high 3 star rating)	30-60 FSI's per billion vkt	15-20 FSI's per billion vkt
Single Carriageway (low 3 star or high 2 star rating)	80-160 FSI's per billion vkt	30-40 FSI's per billion vkt
Low standard Single Carriageway (low 2 star or 1 star rating)	200-600 FSI's per billion vkt	60-80 FSI's per billion vkt

(FSI = Fatality and serious injury outcomes; vkt = vehicle kilometers travelled)

* High income variance in high income countries is typically related to road user behavior and vehicle standard related issues.

To apply the estimates across an existing road network the following steps are recommended:

1. Review the typical crash rates above with local data and knowledge and adjust as required
2. Undertake the iRAP star rating analysis in ViDA and generate the "core data" download file
3. Based on the vehicle star rating results record the relevant crash rate as determined in step 1 (e.g. using a lookup table)
4. Using the traffic volume (AADT) from the download file multiplied by the segment length determine the equivalent vkt (vehicle kilometers travelled) for each segment.
5. Multiply the vkt (vehicle kilometers travelled) by the relevant crash rate determined in step 3.
6. Sum the total fatalities and serious injuries across the network.
7. To convert to fatalities only divide result of item 6 by 11 (that is for every fatality there is 10 serious injuries as outlined in the True Cost of Road Crashes[24] paper.

[24] True Cost of Road Crashes, Dahdah, McMahon 2007 : http://www.irap.net/about-irap-3/research-and-technical-papers?download=45:the-true-cost-of-road-crashes-valuing-life-and-the-cost-of-a-serious-injury-espaol

ANNEX C – LIST OF ROAD SECTIONS

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
ERS	020	020ERS0030	VISTA ALEGRE	ENTR. ERS-118 (P/ GRAVATAÍ)	STATE-DAER	0,00	3,95	3,95		3,95
ERS	020	020ERS0050	ENTR. ERS-118 (P/ GRAVATAÍ)	MORUNGAVA	STATE-DAER	3,95	18,13	14,18		14,18
ERS	020	020ERS0070	MORUNGAVA	ENTR. ERS-242 (P/ SANTO ANTÔNIO DA PATRULHA)	STATE-DAER	18,13	44,19	26,06		26,06
ERS	020	020ERS0080	ENTR. ERS-242 (P/ SANTO ANTÔNIO DA PATRULHA)	ENTR. ERS-239(A) (P/ ROLANTE)	STATE-DAER	44,19	48,28	4,09		4,09
ERS	020	020ERS0085	ENTR. ERS-239(A) (P/ ROLANTE)	ENTR. ERS-239(B) (P/ SAPIRANGA)	STATE-EGR	48,28	48,69	0,41	0,41	
ERS	020	020ERS0090	ENTR. ERS-239(B) (P/ SAPIRANGA)	TAQUARA	STATE-DAER	48,69	50,92	2,23	2,23	
ERS	020	020ERS0110	TAQUARA	ACESSO A TRÊS COROAS	STATE-DAER	50,92	67,18	16,26		16,26
ERS	030	030ERS0050	ENTR. ERS-118 (P/ VIAMÃO)	GRAVATAÍ	STATE-DAER	0,00	2,06	2,06		2,06
ERS	030	030ERS0060	GRAVATAÍ	GRAVATAÍ (PARQUE DOS ANJOS)	STATE-DAER	2,06	3,09	1,03	1,03	
ERS	030	030ERS0070	GRAVATAÍ (PARQUE DOS ANJOS)	GLORINHA	STATE-DAER	3,09	23,42	20,33		20,33
ERS	030	030ERS0090	GLORINHA	ENTR. ERS-474 (P/	STATE-DAER	23,42	50,30	26,88		26,88

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
				ROLANTE)						
ERS	030	030ERS0110	ENTR. ERS-474 (P/ ROLANTE)	SANTO ANTÔNIO DA PATRULHA	STATE-DAER	50,30	52,73	2,43		2,43
ERS	030	030ERS0130	SANTO ANTÔNIO DA PATRULHA	ENTR. RSC-101(A) (P/ CAPIVARI DO SUL)	STATE-DAER	52,73	76,86	24,13		24,13
ERS	030	030ERS0150	ENTR. RSC-101(A) (P/ CAPIVARI DO SUL)	ENTR. BRS-101(B)/290 (OSÓRIO-INÍCIO TRV-MUN)	STATE-DAER	76,86	81,01	4,15		4,15
ERS	030	030ERS0180	ACESSO A TRAMANDAÍ (FIM TRV-MUN)	ENTR. ERS-389 (P/ MARIÁPOLIS)	STATE-DAER	82,80	83,80	1,00	1,00	
ERS	030	030ERS0190	ENTR. ERS-389 (P/ MARIÁPOLIS)	ENTR. ERS-786 (P/ TRAMANDAÍ)	STATE-DAER	83,80	98,88	15,08	15,08	
ERS	030	030ERS9090	ENTR. ERS-030 (OSÓRIO)	ENTR. BRS-290 (P/ PORTOALEGRE)	STATE-DAER	0,00	2,08	2,08	2,08	
ERS	040	040ERS0010	ARROIO DO SABÃO (PORTO ALEGRE)	VIAMÃO	STATE-DAER	0,00	9,74	9,74	9,74	
ERS	040	040ERS0030	VIAMÃO	ENTR. ERS-118 (P/ PASSO DO FIÚZA)	STATE-DAER	9,74	11,24	1,50		1,50
ERS	118	118ERS0110	ENTR. BRS-290 (P/ PORTO ALEGRE)	ACESSO A ALVORADA	STATE-DAER	22,23	27,20	4,97		4,97
ERS	118	118ERS0120	ACESSO A ALVORADA	ENTR. ERS-762 (P/ AUTÓDROMO DE TARUMÃ)	STATE-DAER	27,20	34,68	7,48		7,48
ERS	118	118ERS0130	ENTR. ERS-762 (P/ AUTÓDROMO DE	ENTR. ERS-040 (P/ VIAMÃO)	STATE-DAER	34,68	38,23	3,55		3,55

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
			TARUMÃ)							
ERS	122	122ERS0070	ENTR. ERS-446 (P/ SÃO VENDELINO)	ENTR. RSC-453(A) (P/ FARROUPILHA)	STATE-DAER	39,09	59,92	20,83		20,83
ERS	124	124ERS0010	HARMONIA	ACESSO A SÃO SEBASTIÃO DO CAÍ	STATE-DAER	0,00	5,41	5,41		5,41
ERS	124	124ERS0030	ACESSO A SÃO SEBASTIÃO DO CAÍ	ACESSO A PARECI NOVO	STATE-DAER	5,41	12,14	6,73		6,73
ERS	124	124ERS0050	ACESSO A PARECI NOVO	ENTR. ERS-240(A) (P/ MONTENEGRO)	STATE-DAER	12,14	17,98	5,84		5,84
ERS	124	124ERS0060	ENTR. ERS-240(A) (P/ MONTENEGRO)	ENTR. RSC-287/BRS-470(A)/ERS-240(B) (MONTENEGRO)	STATE-EGR	17,98	19,76	1,78		1,78
ERS	124	124ERS0080	ENTR. RSC-287(B) (P/ TABAÍ)	ENTR. BRS-470 (P/ TRIUNFO)	STATE-DAER	25,52	29,13	3,61		3,61
ERS	124	124ERS0085	ENTR. BRS-470 (P/ TRIUNFO)	ENTR. BRS-386 (P/ PÓLO PETROQUÍMICO)	STATE-DAER	29,13	42,79	13,66		13,66
ERS	124	124ERS0090	ENTR. BRS-386 (P/ PÓLO PETROQUÍMICO)	PÓLO PETROQUÍMICO	STATE-DAER	42,79	47,01	4,22		4,22
ERS	223	223ERS0010	ENTR. BRS-153-386 (P/ SOLEDADE)	ENTR. ERS-142 (P/ VICTOR GRAEFF)	STATE-DAER	0,00	14,25	14,25		14,25
ERS	223	223ERS0030	ENTR. ERS-142 (P/ VICTOR GRAEFF)	ENTR. ERS-332(A) (P/ NÃO-ME-TOQUE)	STATE-DAER	14,25	27,14	12,89		12,89

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
ERS	223	223ERS0040	ENTR. ERS-332(A) (P/ NÃO-ME-TOQUE)	ENTR. ERS-332(B) (P/ ESPUMOSO)	STATE-DAER	27,14	28,08	0,94		0,94
ERS	223	223ERS0050	ENTR. ERS-332(B) (P/ ESPUMOSO)	ENTR. ERS-402 (SELBACH)	STATE-DAER	28,08	38,17	10,09		10,09
ERS	223	223ERS0070	ENTR. ERS-402 (SELBACH)	ENTR. VRS-824 (P/ QUINZE DE NOVEMBRO)	STATE-DAER	38,17	51,06	12,89		12,89
ERS	223	223ERS0080	ENTR. VRS-824 (P/ QUINZE DE NOVEMBRO)	ENTR. ERS-506 (IBIRUBÁ)	STATE-DAER	51,06	51,93	0,87		0,87
ERS	223	223ERS0090	ENTR. ERS-506 (IBIRUBÁ)	ENTR. ERS-510 (ESQUINA MOZER)	STATE-DAER	51,93	72,05	20,12		20,12
ERS	223	223ERS0110	ENTR. ERS-510 (ESQUINA MOZER)	ENTR. BRS-377 (P/ CRUZ ALTA)	STATE-DAER	72,05	76,86	4,81		4,81
ERS	305	305ERS0010	ENTR. ERS-344 (P/ TUPARENDI)	TUCUNDUVA	STATE-DAER	0,00	11,67	11,67		11,67
ERS	305	305ERS0020	TUCUNDUVA	ENTR. VRS-837 (ESQUINA TUCUNDUVA)	STATE-DAER	11,67	17,21	5,54		5,54
ERS	305	305ERS0030	ENTR. VRS-837 (ESQUINA TUCUNDUVA)	ENTR. ERS-342(A) (P/ DOUTOR MAURÍCIO CARDOSO)	STATE-DAER	17,21	27,25	10,04		10,04
ERS	305	305ERS0040	ENTR. ERS-342(A) (P/ DOUTOR MAURÍCIO CARDOSO)	ENTR. ERS-342(B) (P/ HORIZONTINA)	STATE-DAER	27,25	29,30	2,05		2,05
ERS	324	324ERS0050	ENTR. ERS-406 (SERRARIA)	ENTR. ERS-483 (TRÊS	STATE-DAER	56,00	83,53	27,53		27,53

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
				PALMEIRAS)						
ERS	324	324ERS0060	ENTR. ERS-483 (TRÊS PALMEIRAS)	ENTR. ERS-404(A) (RONDA ALTA)	STATE-DAER	83,53	101,69	18,16		18,16
ERS	324	324ERS0065	ENTR. ERS-404(A) (RONDA ALTA)	ENTR. ERS-404(B)(P/ RONDINHA-INÍCIO DO CONTORNO)	STATE-DAER	101,69	104,89	3,20		3,20
ERS	324	324ERS0067	ENTR. ERS-404(B) (P/ RONDINHA-INÍCIO DO CONTORNO)	ACESSO A RONDA ALTA	STATE-DAER	104,89	107,64	2,75		2,75
ERS	324	324ERS0068	ACESSO A RONDA ALTA	ENTR. ERS-211 (P/ BARRAGEM DE PASSO FUNDO)	STATE-DAER	107,64	115,84	8,20		8,20
ERS	324	324ERS0070	ENTR. ERS-211 (P/ BARRAGEM DE PASSO FUNDO)	NATALINO	STATE-DAER	115,84	122,73	6,89		6,89
ERS	324	324ERS0090	NATALINO	PONTÃO	STATE-DAER	122,73	141,26	18,53		18,53
ERS	324	324ERS0100	PONTÃO	LAGOA BONITA	STATE-DAER	141,26	158,65	17,39		17,39
ERS	324	324ERS0110	LAGOA BONITA	ENTR. BRS-153(A)/285 (P/ CARAZINHO)	STATE-DAER	158,65	173,06	14,41		14,41
ERS	324	324ERS0130	ENTR. BRS-153(A)/285 (P/ CARAZINHO)	ENTR. RSC-153(B) (P/ ERNESTINA)	STATE-DAER	173,06	179,51	6,45		6,45
ERS	324	324ERS0150	ENTR. RSC-153(B) (P/ ERNESTINA)	ENTR. ERS-135 (PASSO FUNDO)	STATE-DAER	179,51	188,12	8,61		8,61
ERS	324	324ERS0170	ENTR. ERS-135	ACESSO NORTE A	STATE-DAER	188,12	212,04	23,92		23,92

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
			(PASSO FUNDO)	MARAU						
ERS	324	324ERS0190	ACESSO NORTE A MARAU	ACESSO SUL A MARAU	STATE-DAER	212,04	217,82	5,78		5,78
ERS	324	324ERS0210	ACESSO SUL A MARAU	ENTR. ERS-132 (P/ CAMARGO)	STATE-DAER	217,82	224,75	6,93		6,93
ERS	324	324ERS0215	ENTR. ERS-132 (P/ CAMARGO)	ENTR. ERS-129(A) (CASCA)	STATE-DAER	224,75	246,34	21,59		21,59
ERS	324	324ERS0220	ENTR. ERS-129(A) (CASCA)	ENTR. ERS-129(B) (P/ GUAPORÉ)	STATE-DAER	246,34	248,81	2,47		2,47
ERS	324	324ERS0230	ENTR. ERS-129(B) (P/ GUAPORÉ)	ENTR. ERS-438 (P/ PARAÍ)	STATE-DAER	248,81	265,57	16,76		16,76
ERS	324	324ERS0250	ENTR. ERS-438 (P/ PARAÍ)	NOVA ARAÇÁ	STATE-DAER	265,57	273,65	8,08		8,08
ERS	324	324ERS0255	NOVA ARAÇÁ	ACESSO A NOVA BASSANO	STATE-DAER	273,65	282,18	8,53		8,53
ERS	324	324ERS0260	ACESSO A NOVA BASSANO	ENTR. BRS-470 (NOVA PRATA)	STATE-DAER	282,18	292,13	9,95		9,95
ERS	342	342ERS0008	HORIZONTINA (FIM TRV-MUN)	ENTR. VRS-837 (P/ TUCUNDUVA)	STATE-DAER	20,42	23,38	2,96		2,96
ERS	342	342ERS0009	ENTR. VRS-837 (P/ TUCUNDUVA)	ENTR. VRS-838 (P/ VILA PROGRESSO)	STATE-DAER	23,38	27,94	4,56		4,56
ERS	342	342ERS0010	ENTR. VRS-838 (P/ VILA PROGRESSO)	ENTR. BRS-472 (P/ TRÊS DE MAIO)	STATE-DAER	27,94	32,59	4,65		4,65
ERS	342	342ERS0020	ENTR. BRS-472 (P/ TRÊS DE MAIO)	ACESSO A TRÊS DE MAIO	STATE-DAER	32,59	35,06	2,47		2,47
ERS	342	342ERS0030	ACESSO A TRÊS DE MAIO	INDEPENDÊNCIA	STATE-DAER	35,06	44,56	9,50		9,50

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
ERS	342	342ERS0050	INDEPENDÊNCIA	ENTR. ERS-315 (P/ INHACORÁ)	STATE-DAER	44,56	57,21	12,65		12,65
ERS	342	342ERS0060	ENTR. ERS-315 (P/ INHACORÁ)	ACESSO A CATUÍPE	STATE-DAER	57,21	94,17	36,96		36,96
ERS	342	342ERS0070	ACESSO A CATUÍPE	ENTR. ERS-218 (P/ SANTO ÂNGELO)	STATE-DAER	94,17	96,69	2,52		2,52
ERS	342	342ERS0090	ENTR. ERS-218 (P/ SANTO ÂNGELO)	ACESSO A IJUÍ	STATE-DAER	96,69	106,37	9,68		9,68
ERS	342	342ERS0110	ACESSO A IJUÍ	ENTR. BRS-285(A) (P/ SÃO LUIZ GONZAGA)	STATE-DAER	106,37	112,47	6,10		6,10
ERS	342	342ERS0130	ENTR. BRS-285(A) (P/ SÃO LUIZ GONZAGA)	ENTR. BRS-285(B)/ERS-522 (P/ AUGUSTO PESTANA)	FEDERAL-DNIT					
ERS	342	342ERS0150	ENTR. BRS-285(B)/ERS-522 (P/ AUGUSTO PESTANA)	ACESSO A CRUZ ALTA	STATE-DAER	116,82	154,16	37,34		37,34
ERS	342	342ERS0170	ACESSO A CRUZ ALTA	ENTR. BRS-158/377 (P/ SANTA MARIA)	STATE-DAER	154,16	161,51	7,35		7,35
ERS	344	344ERS0030	ENTR. ERS-305 (TUPARENDI)	ENTR. BRS-472(A) (P/ CRUZEIRO)	STATE-DAER	28,37	37,99	9,62		9,62
ERS	344	344ERS0050	ENTR. RSC-472(A) (P/ CRUZEIRO)	ENTR. RSC-472(B) (P/ SANTO CRISTO)	STATE-DAER	37,99	40,42	2,43		2,43
ERS	344	344ERS0070	ENTR. BRS-472(B) (P/ SANTO CRISTO)	ENTR. ERS-162/307 (P/ SANTA	STATE-DAER	40,42	42,87	2,45		2,45

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
				ROSA)						
ERS	344	344ERS0090	ENTR. ERS-162/307 (P/ SANTA ROSA)	ACESSO A VILA CRUZEIRO	STATE-DAER	42,87	46,72	3,85		3,85
ERS	344	344ERS0100	ACESSO A VILA CRUZEIRO	ACESSO A GIRUÁ	STATE-DAER	46,72	63,78	17,06		17,06
ERS	344	344ERS0110	ACESSO A GIRUÁ	ENTR. BRS-392(A) (P/ GUARANI DAS MISSÕES)	STATE-DAER	63,78	82,97	19,19		19,19
ERS	344	344ERS0130	ENTR. BRS-392(A) (P/ GUARANI DAS MISSÕES)	ENTR. ERS-218 (P/ SANTO ÂNGELO)	STATE-DAER	82,97	95,21	12,24		12,24
ERS	344	344ERS0150	ENTR. ERS-218 (P/ SANTO ÂNGELO)	ENTR. BRS-285/392(B) (P/ SÃO LUIZ GONZAGA)	STATE-DAER	95,21	104,37	9,16		9,16
ERS	389	389ERS0010	ENTR. ERS-030 (OSÓRIO)	ENTR. ERS-786 (P/ MARIÁPOLIS)	STATE-DAER	0,00	18,64	18,64		18,64
ERS	389	389ERS0020	ENTR. ERS-786 (P/ MARIÁPOLIS)	ENTR. ERS-407 (P/ CAPÃO DA CANOA)	STATE-DAER	18,64	31,54	12,90		12,90
ERS	389	389ERS0030	ENTR. ERS-407 (P/ CAPÃO DA CANOA)	ENTR. ERS-486 (P/ CURUMIM)	STATE-DAER	31,54	51,51	19,97		19,97
ERS	389	389ERS0040	ENTR. ERS-486 (P/ CURUMIM)	ENTR. RSC-453 (TORRES)	STATE-DAER	51,51	90,30	38,79		38,79
ERS	389	389ERS9090	ENTR. ERS-389 (OSÓRIO)	ENTR. RSC-101	STATE-DAER	0,00	5,40	5,40		5,40
ERS	404	404ERS0010	ENTR. BRS-386 (P/ CARAZINHO)	ACESSO A SARANDI	STATE-DAER	0,00	2,16	2,16		2,16
ERS	404	404ERS0030	ACESSO A SARANDI	ENTR. ERS-143	STATE-DAER	2,16	14,09	11,93		11,93

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
				(RONDINHA)						
ERS	404	404ERS0050	ENTR. ERS-143 (RONDINHA)	ENTR. ERS-324(A) (P/RONDA ALTA)	STATE-DAER	14,09	23,83	9,74		9,74
ERS	407	407ERS0010	ENTR. BRS-101 (MORRO ALTO)	ENTR. ERS-389 (P/ TORRES)	STATE-DAER	0,00	12,00	12,00		12,00
ERS	407	407ERS0030	ENTR. ERS-389 (P/ TORRES)	CAPÃO DA CANOA	STATE-DAER	12,00	15,74	3,74		3,74
ERS	444	444ERS0010	ENTR. RSC-453 (P/ FARROUPILHA)	BARRACÃO	STATE-DAER	0,00	4,28	4,28		4,28
ERS	444	444ERS0020	BARRACÃO	BENTO GONÇALVES (INÍCIO TRV-MUN)	STATE-DAER	4,28	5,45	1,17		1,17
ERS	444	444ERS0022	BENTO GONÇALVES (INÍCIO TRV-MUN)	BENTO GONÇALVES (FIM/INÍCIO TRV-MUN)	MUNICIPAL					
ERS	444	444ERS0023	BENTO GONÇALVES (FIM/INÍCIO TRV-MUN)	ENTR. BRS-470(A) BENTO GONÇALVES (FIM TRV-MUN)	MUNICIPAL					
ERS	444	444ERS0025	ENTR. BRS-470(A) BENTO GONÇALVES (FIM TRV-MUN)	ENTR. BRS-470(B) (P/ GARIBALDI)	FEDERAL-DNIT					
ERS	444	444ERS0030	ENTR. BRS-470(B) (P/ GARIBALDI)	ACESSO A SUVALAN	STATE-DAER	13,35	20,57	7,22		7,22
ERS	444	444ERS0040	ACESSO A SUVALAN	ACESSO A MONTE BELO DO SUL	STATE-DAER	20,57	26,21	5,64		5,64
ERS	444	444ERS0050	ACESSO A MONTE	SANTA TEREZA	STATE-DAER	26,21	40,74	14,53		14,53

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
			BELO DO SUL							
ERS	444	444ERS9020	ENTR. ERS-444	SUVALAN	STATE-DAER	0,00	1,26	1,26		1,26
ERS	446	446ERS0010	ENTR. ERS-122 (P/ SÃO VENDELINO)	ACESSO A SÃO VENDELINO	STATE-DAER	0,00	0,92	0,92		0,92
ERS	446	446ERS0020	ACESSO A SÃO VENDELINO	ENTR. BRS-470 (CARLOS BARBOSA)	STATE-DAER	0,92	14,84	13,92		13,92
ERS	452	452ERS0010	ENTR. ERS-122 (P/ BOM PRINCÍPIO)	FELIZ	STATE-DAER	0,00	5,44	5,44		5,44
ERS	452	452ERS0020	FELIZ	ENTR. VRS-826 (P/ ALTO FELIZ)	STATE-DAER	5,44	9,53	4,09		4,09
ERS	452	452ERS0030	ENTR. VRS-826 (P/ ALTO FELIZ)	ENTR. BRS-116 (NOVA PALMIRA)	STATE-DAER	9,53	27,52	17,99		17,99
ERS	486	486ERS0010	ENTR. RSC-453 (ARATINGA)	ENTR. ERS-417 (ITATI)	STATE-DAER	0,00	27,22	27,22		27,22
ERS	486	486ERS0030	ENTR. ERS-417 (ITATI)	ENTR. BRS-101 (TERRA DE AREIA)	STATE-DAER	27,22	38,66	11,44		11,44
ERS	486	486ERS0050	ENTR. BRS-101 (TERRA DE AREIA)	ENTR. ERS-389 (P/ CAPÃO DA CANOA)	STATE-DAER	38,66	51,16	12,50		12,50
ERS	486	486ERS0060	ENTR. ERS-389 (P/ CAPÃO DA CANOA)	CURUMIM	STATE-DAER	51,16	53,03	1,87		1,87
ERS	509	509ERS0030	INÍCIO DA DUPLICAÇÃO	ENTR. BRS-287(CAMOBI-FIM DA DUPLICAÇÃO)	STATE-DAER	4,03	7,03	3,00	3,00	
ERS	734	734ERS0010	CASSINO	ENTR. BRS-392 (VIEIRA)	STATE-DAER	0,00	10,68	10,68	10,68	
ERS	734	734ERS0030	ENTR. BRS-392	RIO GRANDE	STATE-DAER	10,68	17,52	6,84		6,84

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
			(VIEIRA)							
ERS	786	786ERS0050	ENTR. ERS-030 (P/ OSÓRIO)	JARDIM DO ÉDEN	STATE-DAER	17,52	25,30	7,78	3,00	4,78
ERS	786	786ERS0070	JARDIM DO ÉDEN	ENTR. ERS-784 (CIDREIRA)	STATE-DAER	25,30	37,92	12,62	2,40	10,22
RSC	153	153RSC1680	ENTR. ERS-324(B) (CONTORNO DE PASSO FUNDO)	FIM DA DUPLICAÇÃO	STATE-DAER	130,66	133,46	2,80	2,80	
RSC	153	153RSC1690	FIM DA DUPLICAÇÃO	ENTR. BRS-386(A)/ERS-223 (P/ TAPERA)	STATE-DAER	133,46	169,37	35,91		35,91
RSC	153	153RSC1720	ENTR. BRS-386(B)/ERS-332(A) (P/ SOLEDADE)	ENTR. RSC-471(A)/ERS-332(B) (CONT. SOLEDADE)	STATE-DAER	203,66	209,50	5,84		5,84
RSC	153	153RSC1730	ENTR. RSC-471(A)/ERS-332(B) (CONT. SOLEDADE)	ENTR. RSC-471(B) (CONT. BARROS CASSAL)	STATE-DAER	209,50	244,71	35,21		35,21
RSC	287	287RSC0010	ENTR. RSC-470(A)/ERS-124(A)/240 (MONTENEGRO)	ENTR. RSC-470(B) (P/ TRIUNFO)	STATE-DAER	0,00	3,23	3,23		3,23
RSC	287	287RSC0020	ENTR. RSC-470(B) (P/ TRIUNFO)	ENTR. ERS-124(B) (P/ PÓLO PETROQUÍMICO)	STATE-DAER	3,23	5,76	2,53		2,53
RSC	287	287RSC0025	ENTR. ERS-124(B) (P/ PÓLO PETROQUÍMICO)	ENTR. ERS-411 (P/ BROCHIER)	STATE-DAER	5,76	7,11	1,35		1,35
RSC	287	287RSC0027	ENTR. ERS-411 (P/	ENTR. BRS-	STATE-DAER	7,11	21,49	14,38		14,38

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
			BROCHIER)	386(A)/ERS-440 (P/ TRIUNFO)						
RSC	287	287RSC0172	ENTR. ERS-502 (CONTENDA)	ENTR. ERS-348(A) (P/ PORTO ALVES)	STATE-DAER	176,68	184,49	7,81		7,81
RSC	287	287RSC0174	ENTR. ERS-348(A) (P/ PORTO ALVES)	ENTR. ERS-348(B) (P/ AGUDO)	STATE-DAER	184,49	187,13	2,64		2,64
RSC	287	287RSC0175	ENTR. ERS-348(B) (P/ AGUDO)	ENTR. ERS-149(A) (P/ RESTINGA SECA)	STATE-DAER	187,13	197,21	10,08		10,08
RSC	287	287RSC0190	ENTR. ERS-149(A) (P/ RESTINGA SECA)	ENTR. ERS-149(B) (P/ FAXINAL DO SOTURNO)	STATE-DAER	197,21	213,22	16,01		16,01
RSC	287	287RSC0200	ENTR. ERS-149(B) (P/ FAXINAL DO SOTURNO)	ENTR. ERS-509 (CAMOBI)	STATE-DAER	213,22	232,54	19,32		19,32
RSC	453	453RSC0150	ENTR. BRS-470(B) (P/ BENTO GONÇALVES)	ENTR. ERS-444 (P/ BENTO GONÇALVES)	STATE-DAER	101,43	107,26	5,83		5,83
RSC	453	453RSC0160	ENTR. ERS-444 (P/ BENTO GONÇALVES)	ENTR. ERS-448 (P/ NOVA ROMA DO SUL)	STATE-DAER	107,26	113,91	6,65		6,65
RSC	453	453RSC0170	ENTR. ERS-448 (P/ NOVA ROMA DO SUL)	ACESSO A CARAVAGGIO	STATE-DAER	113,91	119,39	5,48		5,48
RSC	453	453RSC0180	ACESSO A CARAVAGGIO	ENTR. ERS-122(A) (P/ FARROUPILHA)	STATE-DAER	119,39	121,41	2,02	2,02	
RSC	453	453RSC0190	ENTR. ERS-122(A) (P/ FARROUPILHA)	ACESSO A CAXIAS DO SUL	STATE-DAER	121,41	130,57	9,16	9,16	

SECRETARIA DOS TRANSPORTES
DEPARTAMENTO AUTÔNOMO DE ESTRADAS DE RODAGEM

DIRETORIA GERAL

NAME		CODE	SECTION START	SECTION END	AUTHORITY	INICIAL km	FINAL km	EXTENSION (km)	DUAL CARRIAGEWAY	SINGLE CARRIAGEWAY
RSC	453	453RSC0210	ACESSO A CAXIAS DO SUL	ENTR. ERS-122(B) (CAXIAS DO SUL)	STATE-DAER	130,57	141,53	10,96		10,96
RSC	453	453RSC0230	ENTR. ERS-122(B) (CAXIAS DO SUL)	ENTR. BRS-116 (P/ SÃO MARCOS)	STATE-DAER	141,53	147,89	6,36		6,36
RSC	453	453RSC0250	ENTR. BRS-116 (P/ SÃO MARCOS)	EBERLE	STATE-DAER	147,89	148,39	0,50		0,50
RSC	453	453RSC0290	EBERLE	ENTR. ERS-476 (LAJEADO GRANDE)	STATE-DAER	148,39	200,81	52,42		52,42
RSC	453	453RSC0310	ENTR. ERS-476 (LAJEADO GRANDE)	ENTR. ERS-110 (VÁRZEA DO CEDRO)	STATE-DAER	200,81	223,30	22,49		22,49
RSC	453	453RSC0330	ENTR. ERS-110 (VÁRZEA DO CEDRO)	ENTR. ERS-020(A) (P/ TAINHAS)	STATE-DAER	223,30	240,26	16,96		16,96
RSC	453	453RSC0350	ENTR. ERS-020(A) (P/ TAINHAS)	ENTR. ERS-020(B) (P/ CAMBARÁ DO SUL)	STATE-DAER	240,26	242,17	1,91		1,91
RSC	453	453RSC0370	ENTR. ERS-020(B) (P/ CAMBARÁ DO SUL)	ENTR. ERS-486 (ARATINGA)	STATE-DAER	242,17	255,75	13,58		13,58
RSC	453	453RSC9145	ENTR. RSC-453	NOSSA SENHORA DO CARAVAGGIO	STATE-DAER	0,00	6,16	6,16		6,16
TOTAL (km)								1433,97	64,63	1369,34
ACCUMULATED EXTENSION (SINGLE CARRIAGEWAY EXT. + 2 x DUAL CARRIAGEWAY)									1498,60	