



This project has received funding from the Shift2Rail Joint Undertaking (JU) under grant agreement No 881779. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Shift2Rail JU members other than the Union.



**Language Tool
for removing Language barriers
Functional and Technical specification**

RailNetEurope
Oelzeltgasse 3/9
AT-1030 Vienna, Austria

Phone: +43 1 907 62 72 00
mailbox@rne.eu
www.rne.eu

Table of Contents

Abbreviations	3
Language Tool – Functional and Technical specification	4
1 Definitions	5
2 Requirements	7
2.1 Communication overview and scope.....	7
3 Language Tool Solution	8
3.1 The Starting Concept approach – Tablet solution prototype.....	8
3.2 Requirements for a Language Tool.....	10
4 Proposal for evaluation of the offers.....	14

Abbreviations

Consortium	RNE and UIC
ERA	European Union Agency for Railways
ERFA	European Rail Freight Association
GDPR	General Data Policy Regulation
GSM-R	Global System for Mobil Communication - Railway
IM	Infrastructure manager
ITC	IT Company
LT	Language Tool
LP	Language Programme
NSA	National Safety Authority
PDM / PDMs	Predefined message / Predefined messages
Pilot	The phase of the preparation, testing and upgrading the LT
RNE	RailNetEurope
RU	Railway Undertaking
TD	Train Driver
T4R	Translate4Rail project
UIC	International Union for Railways (Union Internationale des Chemins de fer)

Language Tool – Functional and Technical specification

The work on the Language Tool solution is covered by the Translate4Rail project, in the way of Starting concept. The aim of the Translate4Rail project is to offer drivers a fully comprehensive set of predefined standardised messages which encompass all they have to exchange with an infrastructure manager traffic controller in normal or exceptional operational situations in a country where they do not understand nor speak the local language.

The Translate4Rail project aims to wipe off the language barrier to enable any driver to continue to drive safely its train in a country where he does not speak the national language. It refers to the elements contained in the Decision 2012/757/UE of 14 November 2012 - TSI “Operations and traffic management” to ensure that the project complies with the requirements of that decision. The project aims at developing a simple but effective solution which will be shown on field tests.

A Language tool will then be implemented to enable the driver and the traffic controller to understand each other even though each of them speaks in his/her native language.

The goal is at least maintaining the level of safety, increase the traffic flow in international operation and to increase the competitiveness of the rail sector.

Offering a train driver and controller with a Language tool opening the possibility to successfully communicate within international traffic.

The development of the Language Tool prototype, scheduled to be completed by the end of August 2020, would be followed by laboratory tests and finally a with field test, with the subsequent adaptation of the tool according to the test's findings. The implementation of the Language Tool prototype shall be carried out in three specific phases, as follows.

- Development 05/2020 – 08/2020
- Laboratory test 09/2020 – 02/2021
- Field test 03/2021 – 09/2021

The Language tool, in its prototype version, is expected to be procured as a tablet solution according to the requirements stated in chapter 3 and is verified through the pilot testing in specific phases.

1 Definitions

The following definitions should be useful for a Language tool prototype preparation:

Controller

An individual responsible for the conduct of some aspect of train operations (also known as a dispatcher). For the purposes of this specification the following functional roles of controllers are defined:

- primary controller
- secondary controller
- traffic controller
- power supply controller

Dependent upon local circumstances, a number of functional roles can be carried out by a single controller or a single functional role can be carried out by a number of controllers.

Group call

A call made to all members of a pre-defined group within a local geographical area. Only one member of the group may talk at any instant with all other group members listening only.

Infrastructure manager

Means any body or undertaking that is responsible in particular for establishing and maintaining railway infrastructure, or part thereof, as defined in Article 3 of Directive 91/440/EEC, which may also include the management of infrastructure control and safety systems. The functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or undertakings.

ITC

Information Technologies Company

Operational communications

These are railway communications directly concerned with train movements or train operation. For example, controller-driver communications.

Primary controller

The location and direction of movement of any particular train permit the unique identification of a Primary Controller. The Primary Controller is currently the co-ordinator of train emergency calls.

The Primary Controller usually is responsible for the operation of a designated area of the track. The exact responsibilities of the Primary Controller are determined on a national basis.

Railway emergency call

A call of the highest priority for warning drivers, controllers and other concerned personnel of a dangerous situation in a pre-defined area. Two types of Railway emergency calls are defined:

- Train emergency calls (for Railway emergencies while not involved in Shunting operations).
- Shunting emergency calls (for Railway emergencies whilst involved in Shunting operations).

Railway undertaking

Means any railway undertaking as defined in Directive 2001/14/EC of the European Parliament and of the Council of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure, and any other public or private undertaking, the activity of which is to provide transport of goods and/or passengers by rail on the basis that the undertaking must ensure traction. The term also includes undertakings which provide traction only.

Traffic controller

A controller who has responsibility for the scheduling of trains and the 'flow' of trains over the network. For example, traffic control personnel are responsible for such activities as holding connecting services and minimising disruption to the timetable. The traffic control function has no formal safety responsibility.

Train controller

A controller who has responsibility for the safe movement of trains.

Train driver

Train driver' means a person capable and authorised to drive trains, including locomotives, shunting locomotives, work trains, maintenance railway vehicles or trains for the carriage of passengers or goods by rail in an autonomous, responsible and safe manner.

User

For the purpose of this document, the "User" is a common designation for train driver and controller.

2 Requirements

The Language tool, in its prototype version, should be developed as a tablet solution according to the requirements included in this document. The tool usability should be verified through the pilot testing in specific phases.

The tenderer is asked to provide a price offer with three prices according to the structure presented in the MS Excel file “LT Price sheet”. Only the first price is required in the context of the T4R tender in case it would be decided to select a tenderer. The all inclusive available budget for the first price (mandatory part) is 50 000 €. The second and the third prices, related to different language packages and pilot testing, are considered optional and would not be binding for RNE. RNE can decide to take advantage of the optional price/prices by the end of the price offer validity. In case that RNE decides for the optional price/prices, the tenderer is obliged to deliver the services related to them.

2.1 Communication overview and scope

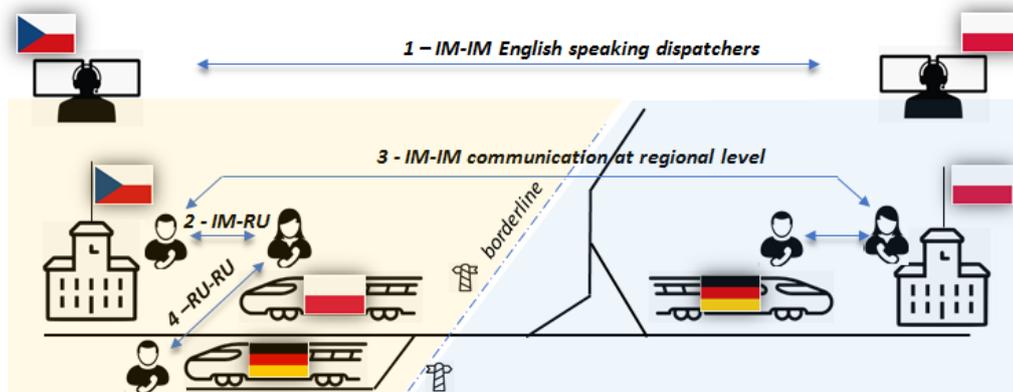


Figure 1: Call scenarios to be translated

Generally, the railway sector Language Program deals with all four types of communication presented in Figure . For this tender, only use-case number 2 is relevant: **the communication between IM and RU users.**

3 Language Tool Solution

Language tool solution and communication principles could be described in the following way:

- using of pre-defined messages;
- using of pre-defined messages and so-called variables (figures and names of railway infrastructure parts);
- free speech.

3.1 The Starting Concept approach – Tablet solution prototype

The starting concept architecture concentrates on the requirements MVP (minimum viable product) for such a Pilot with the following priorities:

- Integrates the most important functions for a Language tool (functional experience);
- Integrates easily into existing IM infrastructure and operational rules (easiness of pilot participation);
- Omits costly development without critical added value for the Pilot (probability of cost management).

The Starting Concept approach takes a train driver's personal tablet as an intermediate device to solve the translation problem:

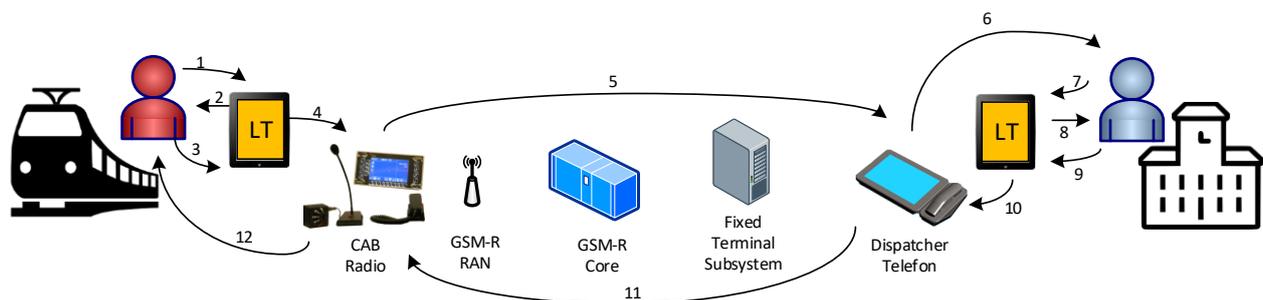


Figure 2: Voice-Local Tablet Translation

The Starting Concept covers communication between users. Basically, the train driver can pre-select the destination language on his tablet. Talk his PDMs into the tablet via a goose-neck microphone, check the displayed transcription in his own language, and then press the button to let the tablet read this message in the translated language with a neutral voice. The train driver must handle this tablet functions together with the call setup and find a suitable way, that the voice from the tablet

enters the microphone of the cab-radio well. Either the noise level in the cabin is low enough for the tablet may well sit aside in a holder and the voice output is still received by the cab-radio or some special audio output equipment from the tablet should be arranged with the cab-radios microphone to couple the voice transmission well enough. A similar procedure is also on the part of the controller, as communication is possible in both directions.

To simplify the expected solution, the following schema shows the basic principles of the “Tablet solution” prototype:

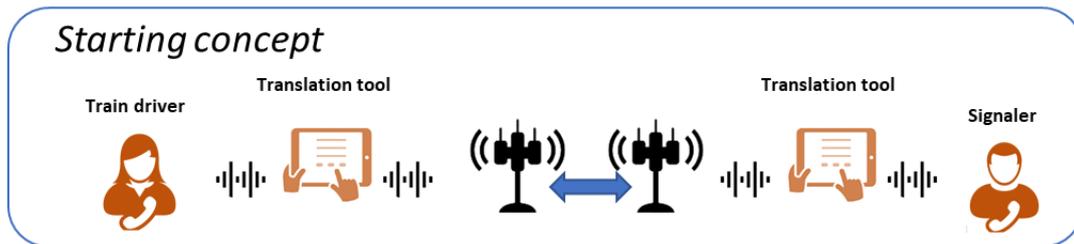


Figure 3: Starting concept schema

Concept approach

- A conceptual approach to keep the safety level and reach the required functionality;
- Speech recognition from the very beginning;
- Gradual development with requested reliability.

Concept approach criteria

- Safety;
- GDPR;
- Agility;
- Cost;
- Translation Latency;
- Acceptability;
- Speed of implementation.

Pilot testing concept approach (example)

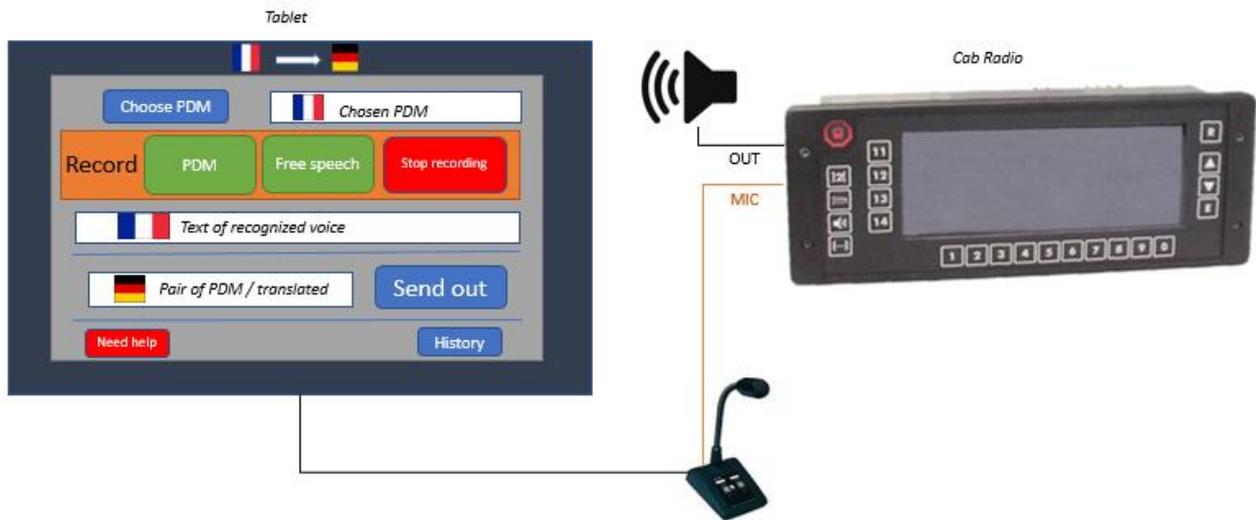


Figure 4: Tablet solution expectation

Expected benefits

- Language of the driver is preselected with the tablet and language of IM can be set once when entering a new country (on IM controllers tablet the train drivers language still has to be evaluated with each conversation);
- GDPR sensible data of users voice template is only stored locally on the drivers own device (under the direct control of driver);
- Possibility of additional interaction with printed PDMs on the tablet or later on, directly digitally transmitted messages over other channels than the GSM-R voice call;
- Visual Feedback of voice recognition and message transcription on the tablet before sending a message over to the other side.

3.2 Requirements for a Language Tool

Type of requirement - Requirement

Requirements for the LT Pilot

- The ITC will take part in the pilot testing to the extent necessary to be able to adapt the LT according to the Pilot findings and requests of the T4R partners.
- The following requirements are part of the offer and must be realised within budget. The ITC must show that they have the capabilities to fulfil these requirements (Tenderers declaration).
- The Pilot will be developed in an agile process together with the client. In discussions with the client and interactions, the effectively next features are specified in detail.

- Each pilot testing consists from laboratory and field test carried out in both countries near or in the border stations.

General, speech recognition

- The LT will translate between two distinct languages (both ways)
- ITC will provide the consortium with all necessary information relating to the toll which is needed for its approval, certification, operation and maintenance.
- ITC will provide the consortium with written manual in electronic form for installation, operation and maintenance of the LT.
- ITC guarantees 2 years lifetime service provision for the tool in the case of the consortium interest which will be covered with separate contract and financing.
- ITC disclaims any proprietary rights to the language tool.
- ITC will cooperate with all subjects participating in the pilot testing (pilot testing teams). Pilot testing teams, in case of need, will provide to ITC with relevant requirements also from competent authorities.
- Speaker independent: The tool is preferred to be independent of the different accent, pronunciation, articulation, roughness, nasality, pitch, volume and speed.
- The tool should be based on machine learning algorithms as well as has the possibility to be based on predefined messages and words (such as station names).
- The software should take into account the environmental noise (such as the engine, rain etc.) and acoustical distortion (such as microphone and GSM-R sound distortion) (it is already included in the requirements, but it could be integrated).
- We expect from the tenderers a live demonstration during the evaluation round. For a live demonstration, tenderers can use their existing tool to prove their ability to ensure the fulfilment of this offer.

LT basic functionality

- The language recognition will be initiated manually by pressing a "record a PDM" or "record free speech" button on the tablet. It will be stopped manually by pressing a "stop" button on the tablet or automatically. A notification will be shown on the tablet in the case of a match with a PDM has been reached.
- Match notification: In case a match with a PDM has been reached, a notification sound and display notification could help the speaker to stop to speak.
- The LT must log all actions: Buttons pushed, transcribed messages, editing of messages, translation of messages etc.

- LT needs to be able to recognise common communication extended with railway jargon (represented by PDMs).
- LT needs to be able to work reliably at the noise level present in the train driver cab at a standstill or train running as well as signaller office noise or outside at a railway station environment.
- LT needs to be able to recognise the PDMs in any range of words and sentences.
- LT needs to be able to combine PDMs with variables (figures, letters and its variations) and constants (any fix names related to the railway line section).
- The Consortium will have full access to the dictionary for service purposes to edit (add/delete/substitute) - word, word pairs, words sections, sentences.
- ITC company will provide the hardware with standard audio connectivity and touchscreen display.

LT development, HW specification and GDPR

- ITC will develop the prototype by 31/08/2020. This prototype needs to have the required functionality. Subsequently, the language tool will be tuned by ITC according to the pilot findings to get to the phase when can responsibly recognise the speech and translate it in two way.
- ITC will assist the whole pilot testing which can last until 31/12/2021.
- It should be shown how user profiling or user training and machine learning processes may significantly enhance the correct speech recognition.
- It has to be shown how the GDPR requirements are being met.
- The LT will run on a standard tablet computer not bigger than A4 with normal environmental requirements. The UI interacts with finger touch on the surface. The company has to deploy four tablets with the LT installed. The tablet may use the operating systems of Android, Apple or Microsoft.

LT connectivity, translation engine and output voice

- The tablet must be able to work in daily operation without an internet connection. It can be expected, that the tablet will have an Internet connection at least once a day for updates and download of all communication in the form of recognized and translated texts.
- In a first approach, the LT has to use a language engine that supports at least AUSTRIAN GERMAN and ITALIAN languages and is able to translate in both directions
- The LT must be able to be later on extended with different language packs
- The neutral voice should be customizable during project development. It should be a clear voice that is easy to understand in the surrounding noise of the train cabin and could be easy to be recorded and translated by the tablet on the receiving side.

- After recording a message to be translated, the message will be transcribed by the LT.
- The output neutral voice must be clear and fluent in the addressed language.
- Optional - In addition, the LT should be able to be extended with additional GERMAN (GERMAN) - FRENCH language pack or European language packs, together with assistance. In these cases, the additional language packs and assistance will not be mandatory for a contractor but he can decide to take advantage of the offer.
- Optional - ITC will be able to develop and maintain a Language Tool and provide supporting services (assistance) in case of request of implement additional language pack(s) for any cross-border sections of RNE members. For this case, "Mono-Pilot" (one IM / one RU) and/or "Duo Pilot" (two IMs / two RUs) are possible to be running. ITC will calculate the additional costs for include the additional language pack(s).

LT messages

- For free speech, there should be an easy way to support the user to edit parts of the transcribed message if some words have errors. There should be an option word by word by tapping on it to get some supported help. A dropdown menu could offer the choice from dictionary help or a list of predefined station names or numbers.
- Messages acknowledged by the user should be translated to the destination language by the LT. The LT will translate the message with the help of the predefined messages or its dictionary. The translated message is being read out to the standard audio output with a universal voice.
- Alternatively, to recording voice messages from the user, the user should be able to select directly PDMs in some intuitive way. There should be an area where the user could select visually PDMs with icons or symbols and by clicking the symbol he will be guided visually as much as possible through a process where the PDM is completed with all necessary information (variables).
- PDMs is a set of static sentences with 0..x variables that could be station names, conditions, or numbers. For each variable in a PDM, there is a set of values (Strings) or range (Numbers).

Safety requirements

- User has to acknowledge a message to be ready for translation and going "on-air".
- Safety autocorrect tool: In case of PDMs translation matching accuracy could be set up to ask for repetition in case of lower accuracy.
- Confirmation loop: For every communication, the software should ask for the confirmation of the message (free speech or PDM).

4 Proposal for evaluation of the offers

The current situation in Europe regarding the travel restriction due to the coronavirus spreading has an impact also on the evaluation process of the offers, which is now proposed in the following way:

- The presentation of tenderers will be via videoconference according to the rules stated in the tender's documentation;
- The "Voice test patterns" – this file is the part of the Tender documentation and tenderer will have an opportunity to use these pre-prepared sentences to set-up a tool (not a final version nor prototype) and present a potential tool/approach to Evaluation Committee via videoconference (according to the rules described in the document "LT Evaluation criteria");
- The tenderer will have an opportunity to present a potential solution according to the following schema:

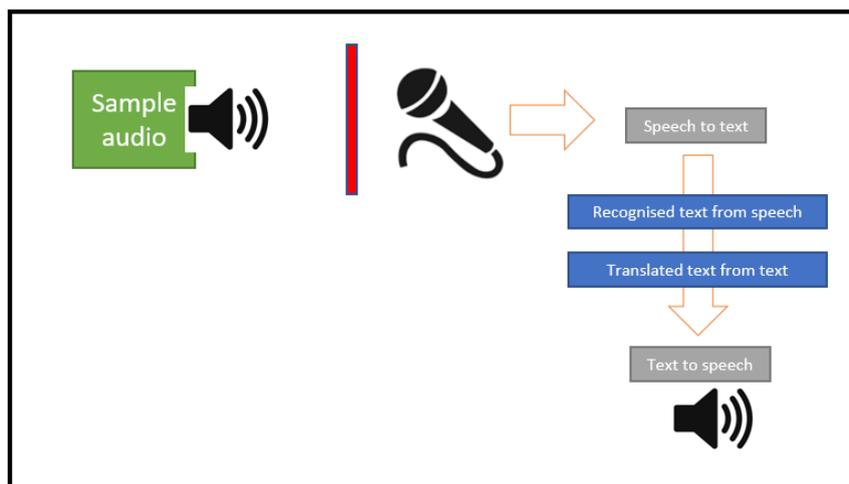


Figure 5: Potential solution presentation

After the first round of evaluations with the first part done via videoconference, which is scheduled for 20-22 April 2020, the selected candidates will be invited for the second round to present their offers via videoconference calls. The second round is scheduled for 28 April 2020. The Language tool development starts from 1st May 2020.