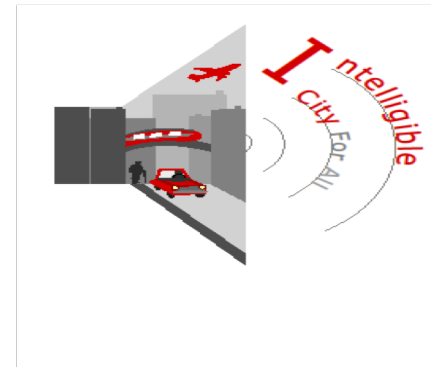




## D5.4 – Intelligibility City For All Recommendations



Project acronym I'CityForAll

Project name Age Sensitive ICT Systems for Intelligible City For All

Strategic objective: Socio-acusis ICT solutions for a better social well-being of Ederly People

Project Duration: July, 1st 2012 – Dec, 31th 2015 (42 months)

Co-ordinator: CEA: Commissariat à l'Energie Atomique et aux Energies Alternatives

Partners: UPD: Université Paris Descartes  
ENEA: Agenzia Nazionale per le Nuove tecnologie, l'Energia e lo sviluppo economico sostenibile  
TUM: Technische Universität München  
CRF: Centro Ricerche FIAT  
CENTICH: Centre d'Expertise National des Technologies de l'Information et de la Communication pour l'autonomie  
Active Audio

D5.4

Version: 1.00  
Delivery Date: 2015-10-20  
Due date: 201510-20  
Task:  
Leader: S.SEVESTRE  
Disseminationstatus: PU

This project is co-funded by the Ambient Assisted Living (AAL) Joint program, by the German BMBF, by the Agence Nationale de la Recherche – ANR, by Caisse Nationale de la Solidarité pour l'Autonomie – CNSA, by the Ministero dell'Istruzione dell'Università e della Ricerca – MIUR, and by Federal Office for Professional Education and Technology OPET

**Once completed please e-mail to WP leader with a copy to  
sylvie.ghalila@cea.fr**

D5.4	Executive Summary
<p>This deliverable offers us a global view on the proposed legislation in Europe for structures open to the public and cars. These provisions aim bearing the needs and realities of users. The l'City For All participating in this project will allow everyone to move freely in the city and between cities. All partners have worked on appropriate technologies promoting understanding signals: Voice announcements in stations and audible alarms in cars. From our studies we propose recommendations in order to meet the needs of all in these environments.</p>	
<p><b>Keywords:</b> In Vivo Tests, Railway Station, Car, Intelligibility, Presbycusic People</p>	

Dissemination Level of this deliverable ( <i>Source: l'CityForAll Technical Annex p20 &amp; 22</i> )	
PU	Public
Nature of this deliverable ( <i>Source: l'CityForAll Technical Annex p20 &amp; 22</i> )	
R	Report
<p><i>Even a demonstrator or a prototype shall be accompanied with a report, or which basic structure is explained on page 3.</i></p>	

Due date of deliverable	20/10/15
Actual submission date	20/10/15
Evidence of delivery	20/10/15

Date	Version	Reviewer	Recommendations
	1.0	Sylvie GHALILA, CEA-Linklab	

Authorization			
No.	Action	Company/Name	Date
1	Prepared	M.JAIDANE, S.SEVESTRE A,DRIDI CENTICH	20/10/15
2	Approved	S.SEVESTRE	20/10/15
3	Released	S.SEVESTRE	20/10/15

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## Table of Contents

<b>INTRODUCTION .....</b>	<b>3</b>
<b>I. Current recommendations relative to audio for elderlies : legal framework and global actions for accessibility to public spaces and in-car mobility. ....</b>	<b>3</b>
<b>1.1 Some Decrees relative to public spaces accessibility.....</b>	<b>4</b>
<b>1.2 Some Standards; ISO, IEC, AFNOR, ETSI on accessibility, Speech Transmission Index, Speech and multimedia Transmission Quality, and alarms perception .....</b>	<b>5</b>
<b>1.3 List of “for all” associations and centers .....</b>	<b>6</b>
<b>2. Summary of the tests of I'City for All solutions : intelligibility in public spaces and alarm localization for in-car mobility.....</b>	<b>7</b>
<b>3. I'CityForAll Recommendations.....</b>	<b>11</b>
<b>3.2 Long-term recommendations.....</b>	<b>11</b>
<b>CONCLUSION.....</b>	<b>12</b>

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## INTRODUCTION

This deliverable presents recommendations of the l'City for All project and is structured in three parts.

In Part 1, current recommendations dealing with elderly-related audio (legal and normative framework, associative framework and global actions for public places accessibility and mobility in the car) are listed. This first part shows that elderly audio profile is still insufficiently taken into account and is not dealt with specifically nor within a 'for all' integration approach despite the challenges that it represents. Even though some efforts are being done towards the promotion of intelligibility in public spaces, scarce recommendations are being formulated explicitly for mobility in cars despite its undeniable impact on security.

Part 2 of this deliverable is a summary of in lab and in vivo tests performed in the project over nearly 300 person of over 50 years old, half of them are hearing impaired recruited in France, Switzerland and Italy. These tests exhibited the added value of the l'CityForAll solutions with lies in *bringing -for a presbycusic- the intelligibility of voice announcements in public places as well as the perception of internal car alarms, to those of a normo-hearing person. Moreover, the proposed solutions improve by nearly 50% the localization of external alarms while reducing the reaction time by 1 second of the driver.*

This synthesis allows Part 3 and final part of the deliverable to propose specific recommendations related to intelligibility in public places and alarms localization for mobility in cars. This is achieved within a "for all" approach when it comes to intelligibility in public places, and within an audio-profile oriented approach for the case of personal use in vehicle.

### **I. Current recommendations relative to audio for elderlies : legal framework and global actions for accessibility to public spaces and in-car mobility.**

One can consider the United Nations Recommendations on ageing population as the starting point.

It is estimated that the proportion of the world population over 60 years will double to reach 2 billion people by 2050<sup>1</sup>. The growing of the elderly population has a major impact on social and economic levels, leading to an increasing priority to promote their physical and social well-being. Recommendations for actions were emphasized by The Madrid International Plan of Action on Aging (MIPA)<sup>2</sup>. The MIPA, adopted at the second World Assembly on Aging, focuses on different priority areas including the well-being into old age. One of the reported recommendations was to make public spaces, transportation and other services accessible to elderly people.

Question : What about audio and hearing losses related accessibilities of elderlies either in public spaces or in vehicle ? What recommendations are to be done based on l'CityforAll solutions?

We know that hearing loss is the most widespread sensory impairment in aging population. As mentioned in recent work supported by European Community's Seventh

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<sup>1</sup>United Nations, Department of Economic and Social Affairs Population Division, "World population ageing," 2013.

<sup>2</sup>United Nations, "Political declaration and Madrid international plan of action on ageing," April 2002.

Framework Program Project "AHEAD III: Assessment of Hearing in the Elderly (2008–2011)"<sup>3</sup>  
"In contrast to epidemiological data of other continents, the prevalence of age-related hearing loss (ARHL) in Europe is not well defined, due in part to the use of different classification systems."<sup>4</sup>

Despite the existence of a standard ISO 7029 International Standards—ISO 7029-2000 (2000) Acoustics— statistical distribution of hearing thresholds as a function of age, hearing losses for elderly are not explicitly considered as a topic of interest on its own. In fact, very scarce decrees concerns hearing losses for this specific population and there is almost nothing regarding the "for all" that explicitly takes into account hearing losses aspects. Moreover, hearing impaired drivers are left behind comparing to normo-hearing drivers because of unsuitable alarming systems that doesn't consider their peculiar auditory profile. Despite this lack of visibility in standards, hearing impaired users issues are being tackled and raised by associations at different levels.

In what follows, we give a non exhaustive manner list of decrees at the national and European level, the standards ISO, ETSI as well as a list of associations including 'for all'. We conclude by giving some thoughts related to labeling at the national level.

### 1.1 Some Decrees relative to public spaces accessibility<sup>5</sup>

- Decree of 1 August 2006 setting out the arrangements for the application of Articles R. 111-19 to R. 111-19-3 and R. 111-19-6 of the code of construction and housing related to the accessibility for disabled persons in public buildings and facilities open to the public during their construction or their creation.

- Decree of 8 December 2014<sup>6</sup> setting out the arrangements for the application of Articles R. 111-19-7 to R. 111-19-11 of the Code of Construction and Housing and Article 14 of Decree No 2006-555 for the accessibility to disabled people of public buildings located within an existing built environment and existing installations open to the public.

The decrees require that the person with a visual or hearing impairments can locate himself/herself, move and reach the building safely, use magnetic induction loop.

It should manage the regulation of the values reverberation time, indicate by a pictogram or visual signal all information.

The sound pressure level of the sound message is tailored to site conditions.

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<sup>3</sup> Programme Project "AHEAD III: Assessment of Hearing in the Elderly: Aging and Degeneration— Integration through Immediate Intervention" (2008–2011 (contract No. HEALTH-F2-2008-200835). For further information see the weblink at <http://www.ahead.polimi.it>.

<sup>4</sup> Dirk Hanebuth, Rudolf Probst, Prevalence of age-related hearing loss in Europe: a review Thomas Niklaus Roth · Eur Arch Otorhinolaryngol (2011) 268:1101–1107 DOI 10.1007/s00405-011-1597-8

<sup>5</sup> They are unilateral administrative acts.

<sup>6</sup> Arrêté du 8 décembre 2014 fixant les dispositions prises pour l'application des articles R. 111-19-7 à R. 111-19-11 du code de la construction et de l'habitation et de l'article 14 du décret no 2006-555 relatives à l'accessibilité aux personnes handicapées des établissements recevant du public situés dans un cadre bâti existant et des installations existantes ouvertes au public. Retrieved from <http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000029893131>

## 1.2 Some Standards; ISO, IEC, AFNOR, ETSI on accessibility, Speech Transmission Index, Speech and multimedia Transmission Quality, and alarms perception

ISO: International Standard Organization

ISO/IEC: International Electrotechnical Commission

AFNOR: Agence Française de Normalisation

ETSI: European Telecommunications Standards Institute

Standards on accessibility

- ISO 24504:2014(fr)Ergonomie - Conception accessible - Niveaux de pression acoustique des annonces vocales pour les produits et systèmes de sonorisation

- ISO 21542:2011(fr)Construction immobilière -- Accessibilité et facilité d'utilisation de l'environnement bâti

- ISO 21542:2011Construction immobilière -- Accessibilité et facilité d'utilisation de l'environnement bâti

- ISO/IEC Guide 71:2014Guide pour l'intégration de l'accessibilité dans les normes Technologies de l'information -- Accessibilité du composant interface utilisateur -- Partie 21: Directives sur les descriptions audio

### Standards on speech transmission index (STI)

- IEC 60268-16:2011 Title: Sound system equipment - Part 16: Objective rating of speech intelligibility by speech transmission index<sup>7</sup>

- IEC 60268-16:2011 "Effect of age-related hearing loss and hearing impairment on speech intelligibility" of STI standard :in this standard it is stated that: "The STI method cannot give reliable results for all types of hearing impairment and, in general, it is recommended that subject-based tests are used. For listeners beyond 50 years old, hearing levels and the spread between individuals increases considerably. Nevertheless, age-related hearing impairment shows good correlation between intelligibility and hearing loss.

the main point is "As a rule of thumb, to reach intelligibility at critical point of 50% sentence intelligibility, hearing impaired listeners require 4.5 dB higher SNR for 20 dBHL."

### Standards ETSI on Speech and multimedia Transmission Quality STQ

- ETSI DTS/STQ-222<sup>8</sup>. It is interesting to note that ETSI has formed taskforces (Technical Body in Charge on STQ) in order to work on standards dealing with quality and

<sup>7</sup>IEC 60268-16:2011 specifies objective methods for rating the transmission quality of speech with respect to intelligibility. It provides a comprehensive manual for all types of users of the STI method in the fields of audio, communications and acoustics. Three methods are presented, which are closely related and are referred to as STI, STIPA, and STITEL. The first two methods are intended for rating speech transmission performance with or without sound systems. The STITEL method has more restricted uses. This fourth edition cancels and replaces the third edition, published in 2003, and constitutes a technical revision. It includes the following significant technical changes with respect to the previous edition:

- development of more comprehensive, complete and unambiguous standardization of the STI methodology;
- the term STIr is discontinued. A new function for the prediction of auditory masking effects is introduced;
- the concept of 'speech level' and the setting of the level of the test signal have been introduced;
- additional information has been included on prediction and measurement procedures. The French version of this standard has not been voted upon.

<sup>8</sup>Scope and field of application: "Studies have shown that Hearing impaired people are suffering of insufficient intelligibility of transmitted speech, due to background noises, transmission impairments, shapes of receivers, tandemming of speech processing and coupling between earphones and hearing aids. It has also been seen that wideband bandwidth provides improved quality than achieved with narrowband for hearing impaired people using

intelligibility for presbycusis. To date, the achieved work is still in the draft state and is titled: "*Speech and multimedia Transmission Quality (STQ); Transmission quality and speech intelligibility for hearing impaired people*".

- Standards on alarms

- ISO 7731 "Ergonomics Danger signals" for public and work areas, "Auditory danger signals" mention that "*In case of person wearing hearing protection or having hearing loss, sufficient signal energy should present in the frequency below 1500Hz*".

They note "*Due to the internal masking of the hearing organ, low-frequency components of the ambient noise may mask higher frequency components of the danger signal. Hearing loss can also show an effect that may be additional to the masking effect.*"

- Some recent studies<sup>9</sup>, although not standards, have shown that "*The choice of an age for the hearing threshold has a big impact on the detectability distance of a siren. That is, the lower the hearing threshold (the lower the age of the population considered), the larger the detectability distance.*"

### 1.3 List of "for all" associations and centers

There is no "Audio for All" label but rather European initiatives for noise measurements (attached harmonica reference) aiming to address the issue of noise, acoustic and materials in order to better take into account the hearing and the intelligibility in public spaces.

There are also recognized associations considered to be of public utility such as: *Le Centre information et de documentation sur le bruit (CIDB)* in France which constitutes a hub of resources mining and dissemination that promotes the quality of the acoustic environment.

The CIDB main missions are to inform, raise awareness and raise document about the acoustic environment protection. Created in 1978 by the ministry of the environment, the CIDB is the privileged contact of general public and around 1000 public institutions as well as private actors all for them involved in the acoustic environment management.

There are also professional initiatives such as the BIAP: *Bureau international d'audiophonologie* which publishes recommendations (about auditory education, noise etc...) and gathers learned societies such as:

- IALP - International Association of Logopedics and Phoniatrics
- AEA - Association of the European Hearing aid Acousticians
- ACFOS - Action Connaissance Formation pour la Surdit 
- ISA - International Society of Audiology
- UNSAF - Syndicat National des Audioproth sistes fran ais

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hearing aids, cochlear implants. The work item is intended to define requirements and measurement methods for - Improved listening quality for hearing impaired people, with or without hearing devices (including loudness, equalization,...) - Impact of the different transmission impairments on intelligibility and definition of a model to assess objectively speech intelligibility The impairments from the distant send side may also have impacts on intelligibility of received speech, needing performance improvements. The work item will define scenarios in order to conduct subjective tests on intelligibility for hearing impaired people and is intended to define and validate an objective model to predict speech intelligibility."

<sup>9</sup> A. Balastegui , J. Romeu, A. Clot, S.R. Mart n. "New siren tones optimised for increased detectability distances of emergency concern vehicles", Applied Acoustics 74 (2013) 803–811

The Design For All Europe network<sup>10</sup> and the Design For All foundation<sup>11</sup>, define the design For All as the intervention in the built environments, services and products to ensure accessibility for everyone. However, few systems have been designed to address the accessibility issues in public spaces for hearing impaired people, such as the audio induction loop systems.

The CENTICH (*Centre d'Expertise National des Technologies de information et de la Communication pour l'autonomie*) : a french expertise center that focuses on making novel ICT technologies accessible for elderly people.

ESCOOP: The European Social Cooperative is based on the principles of national and international mutuality and excludes any purpose of private speculation.

ESCOOP has the purpose to pursue the general interest of the community, towards human advancement and the social integration of citizens through the management of:

- socio-health, education and training services for the benefit of underprivileged people
- productive activities in which the working integration and/or work placement of socially underprivileged people would be realized.

**Conclusion** : Two main criteria are not taken into account. The first one is elderlies as a population subgroup. The second criteria is the For All aspect. This is being done somewhat for intelligibility regarding comfort and accessibility but not for cars when it comes to safety even though the back/front confusion is the cause of serious accidents.

## **2. Summary of the tests of l'City for All solutions : intelligibility in public spaces and alarm localization for in-car mobility**

In table 1, we present a summary of the different tests performed during the project and their associated results. These tests have been conducted in both in-vivo and in lab contexts by involving a total of 294 elderlies from France, Switzerland and Italy having an average age of 60 year-old, including 162 hearing impaired people and 164 women and showing the relevance of the solutions developed by l'Cityforall.

Tests of solutions developed by l'City For All

Intelligibility of vocal announcements for presbycusic persons is raised to the level of normo-hearing ones (figure 1).

Internal alarms perception for presbycusic persons is raised to the level of normo-hearing (figure 2)

External alarms localization is improved by 20% while the reaction time in car for a presbycusic person is divided by 2 (figure 3 )

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<sup>10</sup> [www.designforalleurope.org](http://www.designforalleurope.org)

<sup>11</sup> [2www.designforall.org](http://2www.designforall.org)



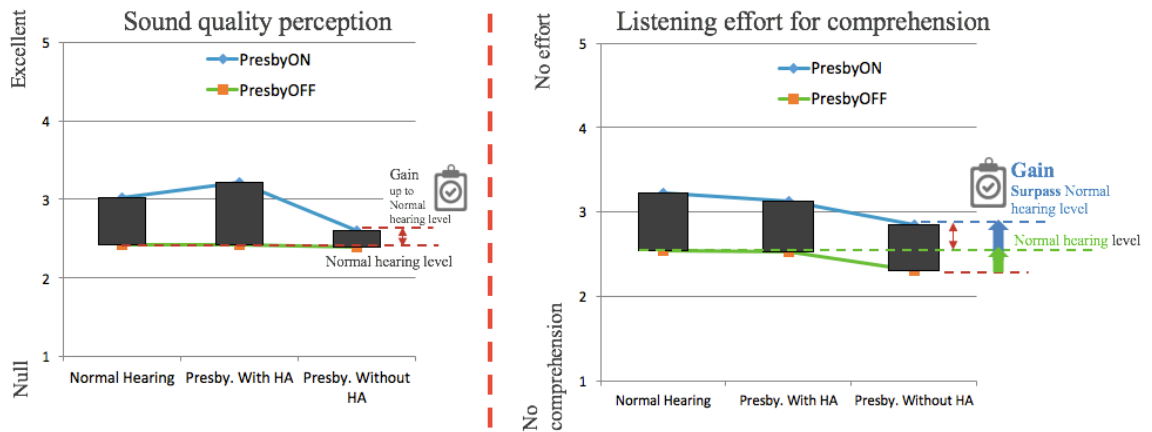


Figure 1: Intelligibility of vocal announcements

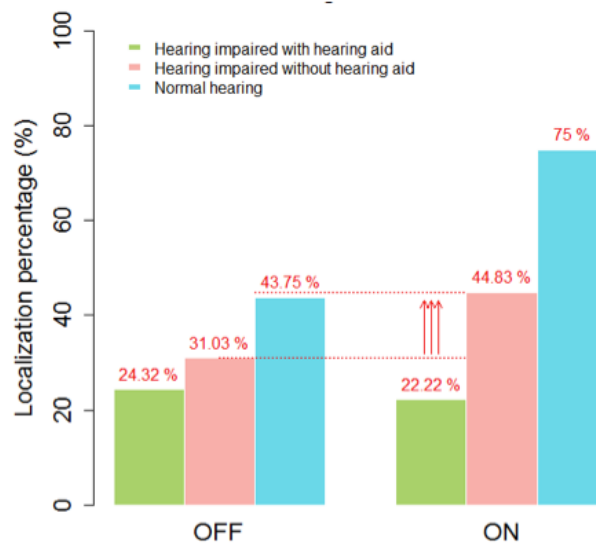


Figure 2: Internal alarms perception

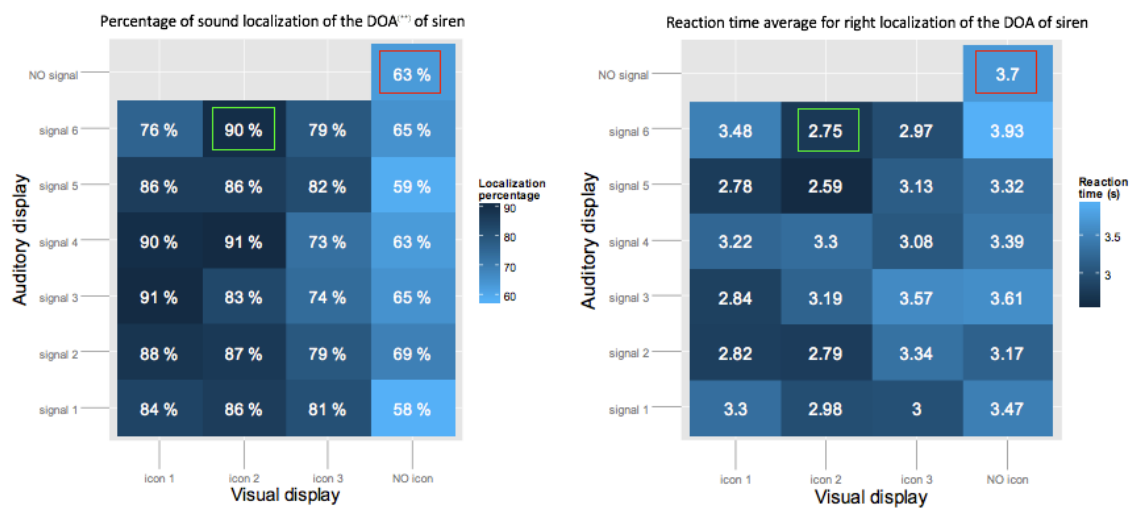


Figure 3: External alarms localizatio

Where	Who	Product tested	For what	Results
France (CENTICH) Italy (ESCOOP)	Normal hearing in Italy), Presby without hearing aids (HA). (22 in France, 23 in Italy), Presby with hearing aids (18 in France, 6 in Italy) Total= 40 in France and 49 in Italy. Average age 68 y.o	Pre-compensator for alarms localization (first version of <b>PerceivAll</b> )	Collecting <b>user requirements</b> and <b>preliminary tests</b> .  Based on:  a/ 2 surveys.  b/ Degradations of sentences intelligibility, sound detectability and localization.	<ul style="list-style-type: none"> <li>- Intelligibility decreases for all Presby at peak hours</li> <li>- Presby are the most hurt by loud sounds and noise</li> <li>- Jingles help paying attention to the vocal announces for all persons.</li> <li>- Feeling of stress and discomfort is more noticeable for Normal hearing persons</li> <li>- Difficulties met in hearing and understanding information diffused by loudspeakers are mainly attributable to the bad quality of the loudspeakers.</li> <li>- All persons have difficulties to estimate the distance of the coming alarm, with higher frequency for Presby. with HA</li> <li>- Front/back and left/right confusion is a common difficulty for Presby.</li> <li>- For left/right confusion, Presby-HA have more difficulty to localize the alarm</li> <li>- Hearing aids clearly disturb the localization and the pre-compensation of an alarm doesn't facilitate the correct localization but increase the reaction's speed.</li> </ul>
Switzerland (EPFL) In lab	Normo-hearing (10) Presby without HA (10). Average age: 48 y.o Total=20	-Pre compensator ( <b>Perceivall</b> )  -Objective criteria ( <b>SIM<sup>forAll</sup></b> )	To assess the two products with headphones using normalized sentences (HINT database).	<ul style="list-style-type: none"> <li>Level 1 and 2 of pre-compensation enhance the intelligibility by 20% for a population for all.</li> <li>- In best case; the level 1 can enhance the intelligibility by 50 % for NH and 30% for HI</li> <li>- Good correlation between subjective intelligibility and SIM<sup>forAll</sup> scores.</li> </ul>
France (Active Audio) In lab	Normal hearing (17), Presby without hearing aids (17), Presby with hearing aids (10). Average age 63 y.o. Total = 44	<b>PerceivAll</b> <b>Speech conformer</b> with frozen Automatic Gain Control in ambient noise <b>SIM<sup>forAll</sup></b>	<b>Ecological tests</b> of intelligibility with vocal announcements.	<ul style="list-style-type: none"> <li>-The results exhibit significant positive effects for all the classes when: Precompensator of PerceivAll On and SpeechConformer Off using SNR gain and if sonorisation is Ps (standard sound projectors) or/and Female speaker using UDR gain</li> <li>- Good correlation between subjective intelligibility and SIM<sup>forAll</sup> scores: coherent results with those of EPFL</li> </ul>
Italy (ESCOOP) In-vivo	Normal hearing (12), Presby without hearing aids (15), Presby with hearing aids (9) Total = 36 Average age 64 y.o.	<b>PerceivAll</b>  <b>Speech conformer</b>	Intelligibility tests with vocal announcements in Foggia railway station. It is based on preprocessed announcements signals in ambient noise.	<ul style="list-style-type: none"> <li>- Sound quality is better when the conformer is OFF and this for all three groups.</li> <li>- Sound quality is better when the Presby. Precompensator is ON and this is true for the three groups</li> <li>- Listening effort is higher when the Speech conformer is ON.</li> <li>- Listening effort is higher when the Precompensator is OFF.</li> <li>The tests do not allow us to conclude on a solution "for all" in the two variables: sound quality and listening effort. However, the position «Precompensator of PerceivAll ON" generally gives better performance in most cases.</li> </ul>

France (CEA LIST) In-lab	23 participants 9 were over 50 years old, and 14 were young participants (less than 35 years old).	Comparison between classical loudspeakers and car-glass loudspeakers	Ecological tests on pre-compensation sound localization.	In view with the results of the study, we can suggest that the acoustic glass could be used for the emission of lateral sounds (Left and Right). The acoustic glass provides good results for those lateral directions and is technically more feasible than using loudspeaker at- ear level.
Italy (CRF) In Lab	44 participants	PerceivAll applied to congruent alarm	To measure reaction time and to assess alarm localization.  It is based on output AlarmSniffer simulation.	<ul style="list-style-type: none"> <li>- Responses to the 4 “virtual hearing capability” levels are similar enough to show that the HMI system works well in helping (“virtually”) hearing impaired subjects to react like normal-hearing subjects.</li> <li>- In general, taking into account all results “as a whole”, a trend in improving correct DOA detections (up to 42%), in reducing reaction time (1 second) and in estimating the correct distance can be seen when the HMI system is activated:</li> <li>- Enhancement in sound localization and reaction time i.e. using a subset of the tests acoustic displays within specific directions</li> <li>- Adding visual display improves sound localization</li> </ul>
France (CENTICH) In vivo	<p>Session 1: 3 normal hearing, 4 presbycusic without hearing aid, 7 presbycusic with hearing aids</p> <p>Session2: 2 normal hearing, 4 presbycusic without hearing aid, 5 presbycusic with hearing aids.</p> <p>Total =25 Average age 57 y.o</p>	PerceivAll	To assess the product In the city, for in-car alarm detection and localization.	<p>Session 1</p> <ul style="list-style-type: none"> <li>- Enhancement in localizing pre-compensated sound diffused by loudspeakers inside the car for presbycusic drivers without hearing aids.</li> </ul> <p>Session 2</p> <ul style="list-style-type: none"> <li>- Enhancement of in car alarm detection for presbycusic driver</li> <li>- Enhancement of sound localization for persbycusis driver without hearing aids and normal hearing drive</li> </ul>
Italy (CERCAT) In-vivo	<p>5 normal hearing people, 4 presbycusis people with hearing aids 8 presbycusis people without hearing aids</p> <p>Total 17 Average age: 63 y.o</p>	<p>Complete solution with microphone arrays systems and detection/localization/identification algorithms</p> <p>(AlarmSniffer and PerceivAll )</p>	Assessment on track of external alarms localization.	<ul style="list-style-type: none"> <li>- Evaluation using PerceivAll with 2 different auditory displays: Results show a trend in improving reaction time: comparing the tested auditory displays, one is proved to be more effective than the other, in helping the users to correctly localize the external alarm and in reducing the reaction time.</li> </ul>

Table 1 : I'CityForAll products assessment

### 3. I'CityForAll Recommendations

The growth of age-related hearing loss for normal persons has been codified in ISO 7029 International Standards—ISO 7029-2000 (2000) Acoustics— statistical distribution of hearing thresholds as a function of age. ISO, Geneva. This standard quantifies how hearing acuity declines with age—physiologically beginning by the third decade, predominately in the high frequencies.

Below are listed the I'CityForAll recommendations. Short-term recommendations are directly related to the 4 products of I'CityForAll project while long term recommendations deals with certification, standardization and associations.

#### 3.1 Short-term recommendations :

We recommend the use of the 3 products of the project I'CityForAll:

- SIM<sup>ForAll</sup> for assessing the accessibility in terms of “intelligibility for all” in public spaces.- ----
- SpeechConformer for timbre voice homogenization.
- PerceivAll for better intelligibility and audio signal localization

#### 3.2 Long-term recommendations

##### ➤ Importance of increasing the number of specialized centers

To date, there are three national centers in France with an expertise in issues related to solutions that address the loss of autonomy and handicap. These centers are namely CENTICH (ICT for autonomy and health)<sup>12</sup>, le CEREMH (Elderlies and handicapped mobility)<sup>13</sup>, and the CEN STIMCO (cognitive simulation)<sup>14</sup>.

Also, there are a number of centers that provide information and advising on technical solutions for persons with a decreasing autonomy and handicap. We recommend increasing the number of these centers in departments/regions to allow for a better information dissemination on issues related to functional limitations precisely, auditory limitation far from any commercial interest. Indeed, in France “*les maisons départementales pour les personnes handicapées ou âgées*” play this role of providing information to this specific target group.

##### ➤ On the national and international level: the concept HQE and the concept of "audio for all"

High environmental quality (i.e La Haute Qualité environnementale - HQE) is a French environmental concept dating from the beginning of the 90's which gave rise to a trademark and a certification « NF Ouvrage Démarche HQE® » by AFNOR inspired by the “high energetic performance” certification by adding a sanitarian, hydrological vegetal dimension. The

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<sup>12</sup> <http://www.centich.fr/presentation>

<sup>13</sup> <http://ceremh.org/>

<sup>14</sup> <http://censtimco.org/>

procedure to obtain the certification is done through the association HQE, a French association recognized at the state level to be of public interest in 2004. This certification is passed on by the ADEME (*Agence de l'Environnement et de la Maitrise de l'énergie*) which is the French agency for environment and energy management. Also, the HQE is spreading internationally-wise and with an acoustic component.

The successive acoustic regulations have contributed to a meaningful improvement of the acoustic quality of buildings. According to the type of the building, these regulations specify a set of requirements relative to acoustic isolation between the different rooms with regard to the external environment and the commons areas in the particular case of impact and equipment noise whether individual or collective. However, these regulations deal exclusively with acoustic performances of the building without taking into consideration the type of activities performed within these buildings.

The HQE association is currently conducting a campaign aiming to develop a set of evaluation methods and acoustic display in order to allow the user to visualize the acoustic performance of the building. The HQE association plays the role of a catalyst of a collective movement of man and woman engaged in the sustainable development of buildings, infrastructure and territories that benefit individuals, communities and companies. Through voluntary approaches in France and international wise, the HQE association is acting for the general interest in order to anticipate, innovate, improve the knowledge and disseminate good practices. Created in 1996 and recognized to be of public utility since 2004, HQE association is attentive to all stakeholders and emphasizes collaborative work to extend its action and favor close exchanges with stakeholders.

➤ **Encouraging ENT<sup>15</sup> physicians and hearing care specialists to include ecological audiometric-based test that are in-vivo like (public announcements hearing, alarm localization etc...)**

Although in-vivo like tests are not a common practice for ENT' community, it is basically similar to the idea of setting hearing aids at home rather than at ENT physicians' practices. CENTICH is communicating about this practice via articles and journal paper via partners through its partner CERTA which has satellites in Angers, Poitiers and Metz. Hearing care specialist is government-regulated occupation and thus doesn't allow setting up this kind of device at home but only in specialist practice. Despite of this barrier, CENTICH is conducting a confidential study consisting on testing an approach based on a remote setting on a sample of 16 elderly persons. Based on that, we recommend including the remote setting technique to the in-practice setting and generalize it to ecological context that sounds more realistic. Even though the hearing aid profession seems reluctant to these changes, we should notice the creation of new academic curriculum in Angers consisting in a degree of rehabilitation and re-education of adult-auditory functions at the university of Angers aiming to make the profession aware of the importance of auditory rehabilitation and its evaluation in a more realistic-every day context.

## CONCLUSION

Even though some efforts are being done towards the promotion of intelligibility in public spaces, scarce recommendations are being formulated explicitly for mobility in cars despite its undeniable impact on security.

This deliverable dedicated to *Intelligible City For All* project shows that elderly audio profil is still insufficiently taken into account and is not dealt with specifically nor within a 'for all' integration approach despite the challenges that it represents.

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<sup>15</sup> Ear, nose and throat

Short-term recommendations of the project concern the 4 I'City for all products SimFor All, Speech conformer, PerceivAll, AlarmSniffer which lies in bringing -for a presbycusic- the intelligibility in public places as well as the perception of internal car alarms, to those of a normo-hearing person and improve the localization of external alarms and the reaction time of a presbycusic driver.

Long-term recommendations are also proposed; they concern the importance of increasing the number of specialized center, the importance of enhancing the HQE concept and the "for All" concept and encouraging ENT physicians and hearing care specialist to include audiometric based test that are in-vivo like (public announcements hearing, alarm localization etc...).