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Taxonomy and Terms for Stakeholders in Senior Mobility

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Foreword

The taxonomy, terms, and definitions advanced in this publication of the Transportation Research Board constitute suggestions that, in the view of its sponsoring committee, will facilitate communication and promote best practice among a host of disciplines and professional organizations committed to safe, independent, and dignified options for seniors to remain mobile within their communities. It is anticipated that this resource will be revised and updated as needed to reflect the dynamic and evolving set of issues that confront practitioners in this area.

Important words must convey a consistent message within and among groups invested in the safe mobility of seniors, including but not limited to researchers, gerontologists, geriatricians, occupational therapists, licensing authorities, social workers, and seniors themselves, all of whom must communicate effectively by written and oral means. Practitioners and seniors must have a shared understanding of the complexities of the services provided to determine which mobility options are most appropriate for each individual's situation. It is particularly critical to use terms based on a common vocabulary to translate research into tools that support evidence-based interventions. While it is hoped and expected that this document can promote evidence-based practice, the circular does not establish a standard of practice, however.

Many international readers of this circular may appreciate it as an attempt to harmonize terms within the emerging field of traffic medicine. Broadly speaking, this encompasses all the various activities that are conducted in order to diminish harm from crashes. It includes the development of medical standards for driving, functional driving screens and assessments, the determination of fitness to drive-by clinicians, and research into how effects of cognitive and physical limitations on driving fitness are measured. However, it also includes the automotive engineer researching injury mitigation and prevention through improved crashworthiness of vehicles, the civil engineer designing safer roads, and the traffic engineer working on traffic control systems. The licensing agency's driver examiner is another vital part of the panoply of activities that comprise traffic medicine. So, too, are researchers working on the epidemiology of traffic crashes, retention systems, and the biomechanics of crash injuries. The educational activities centered on road safety are an important element in the traffic medicine spectrum, as is the training of drivers and the counseling of individuals who need or choose to transition from driving to alternative transportation.

Thus, while the use of the word "medicine" may lead some to assume a purely clinical orientation, the range of activities undertaken to support personal mobility and public safety are much more expansive, as carried out by practitioners throughout the world today. With such a wide variety of participants and activities it is essential that everyone involved in traffic medicine, although they may not speak the same language, strive to operationalize the terms they use by applying the same words to refer to a specific concept or practice.

Contents

Introduction

The community of stakeholders in safe mobility for seniors employs a language containing numerous technical terms or expressions having very specific meanings that differ across disciplines. Some of these terms are not well understood, and their use is subject to a variety of different interpretations. Moreover, this language continually changes to keep pace with advances in measurement tools and methods, vehicle technology, and alternative transportation options. With these advances, the terminology has grown and evolved; as new terms come into general use, older terms often must be perceived in a new light.

This document contains terms of common usage and best practice as identified in the technical literature and, where terminology is lacking, as elaborated through peer review in work undertaken by the Transportation Research Board's (TRB's) Committee on Safe Mobility of Older Persons and its subcommittee on Driver Medical Review and Driver Licensing. This e-circular was generated by members of these groups.

PURPOSE

The purpose of this e-circular is to provide a reference document for usage of terminology by stakeholders in senior mobility. This includes professionals and groups engaged in driver evaluation and rehabilitation services; research and program development; education and training; alternative transportation; and others (e.g., psychologists, social workers) who may encounter older adults with limited mobility and be asked to help identify potential solutions. It is hoped that this publication will foster improved communication among those who are involved in preserving and extending safe, independent transportation for older persons.

BACKGROUND

The genesis of this e-circular can be traced to discussions at the 2012 meeting of the TRB subcommittee on Driver Medical Review and Driver Licensing. Meeting attendees included occupational therapy authors writing a textbook on driving and community mobility. As the authors attempted to differentiate programs and wording, it became obvious that specific terms were used to describe programs and program components that differed in scope and content, yet were labeled using the same words. "Driver evaluation" was one such term. In different articles, descriptions of research methods used "driver evaluation" to refer to a paper-and-pencil test, a 15-min department of motor vehicles-administered road test, and a comprehensive, 2-h evaluation by a trained driver rehabilitation specialist.

Meaningful translation of research to practice requires an accurate understanding of research methods to draw conclusions and generate recommendations. This is particularly important in a field where practice must rapidly evolve to meet increasing demand, as is the case for those providing services that support safe mobility for older adults. The implications of mixed meanings for terms were further examined in March 2012, at a meeting of experts funded through a cooperative agreement between the American Occupational Therapy Association (AOTA) and the National Highway Traffic Safety Administration (NHTSA). At this meeting, a

growing awareness of the variability in descriptors and practice-specific terms used to communicate between stakeholders was identified as a critical concern.

This concern was brought to the attention of the full TRB Committee on Safe Mobility of Older Persons at its annual meeting in January 2013. The members of the committee endorsed the recommendation to gather experts for a midyear meeting at the National Academies of Sciences, Engineering, and Medicine facility in Woods Hole, Massachusetts, to (1) identify terms needing clarification; (2) develop a taxonomy of senior mobility terminology; and (3) devise a method of communication and continued collaboration.

Outcomes of the 2013 midyear meeting included the generation of a draft list of terms to be elaborated through expert opinion—drawing upon existing technical literature to the greatest extent possible—by meeting participants, who organized into work groups before the meeting adjourned. A plan to facilitate communications within and between work groups via an online "wiki" was also developed. This wiki was subsequently implemented, with the support of East Carolina University, in time for the TRB 2014 Annual Meeting. At this Annual Meeting, a podium session provided information to a wider audience about the effort to develop a taxonomy and a common terminology with multidisciplinary application. During the 2014 committee meeting, a second midyear meeting was planned to advance this initiative.

Throughout the spring of 2014, the work groups contributed to the wiki, revising the draft definitions developed the previous summer and adding new terms; a lively online debate highlighted differing definitions used by specific professions or associations. In July, 2014, attendees at the midyear meeting refined terms compiled through the wiki, and developed a template and timeline for the development of this e-circular.

ORGANIZATION

This publication is divided into four parts: an index, a taxonomy and definitions of terms used by stakeholders in senior mobility; a list of abbreviations and symbols; and a list of references. The major part is the taxonomy and definitions of terms. The terms selected for definition include many terms that frequently are misinterpreted, misunderstood, or generally confusing because the same language can evoke strikingly different meanings within or across different areas of practice.

The definitions provided are sometimes more than basic definitions; they may also attempt to clarify the sources of confusion. This is facilitated by examining specific domains and, within each domain, focusing on groups of related terms in order to develop a better appreciation and understanding of the uniqueness of each individual term. Thus, the definitions do not appear alphabetically but are organized by domain. Within each domain, identified topics serve as headings for lists of terms that need to be compared to point out their distinctions; definitions for these terms are located next to one another. For some definitions, footnotes provide editorial comments, which may be helpful in establishing a better understanding of the term as it is applied in a particular context.

The domains of knowledge and practice on which the present taxonomy rests are: Driver Evaluation and Rehabilitation, Alternative Transportation Options, and Assistive Technologies in Driving and Community Mobility. It may seem an ambitious goal, to seek definitions of terms that can adequately serve all three domains; yet despite their disparate nature the relationship of

each of these domains with senior mobility revolves around a few common, core concepts: *capacity*, *performance*, and *accommodation*.

Because definitions of terms are not alphabetical, the user may want to refer to the index to more quickly locate a term's definition. The index shows the topic under which the term is grouped as well as the page number where the definition may be found. It also identifies the reference(s) that were used to develop a definition. What were believed by the contributing committee and subcommittee members to be the best thoughts and wording and most necessary features in existing terminology—taking into account the context of their use —were adopted in forming the definitions in this document.

NEED FOR UPDATES AND COMMENTS

This publication represents the initial attempt to harmonize terminology used by stakeholders in senior mobility. The TRB Committee on Safe Mobility for Older Persons plans to provide updates as needed. One aspect of the updating will be simply to improve the quality of the definitions. Such improvements certainly are anticipated once the definitions are put to use and specific problems, shortcomings, or inconsistencies are identified by users.

Another aspect of updating includes the addition of new terms that may come into use, along with the review and possible modification of existing definitions. This latter aspect recognizes the dynamic nature of technological innovation to assist persons with age-related diminished capabilities to remain safely mobile in their own vehicles, as well as the range of alternative transportation options coming online to meet the full range of mobility needs of those who cannot or choose not to continue driving. Such updates could be indispensable to effective and appropriate decision making by professionals who are called upon to screen, assess, evaluate, and advise or regulate the driving behavior of older adults, and those who provide education, training, and rehabilitation services to these consumers.

Closely related to the update of the included taxonomy and definitions is improvement of the overall publication. For example, for some terms one or more references that deserve citation may have been omitted. Comments or suggestions are encouraged on how either the definitions or other parts of this publication can be improved to meet users' needs while harmonizing practice among stakeholders in safe mobility for seniors. Comments or suggestions, with supporting documentation as appropriate, should be directed to Bernardo Kleiner at bkleiner@nas.edu.

Alphabetical Index of Terms

Taxonomy and Definition of Terms

DRIVER EVALUATION AND REHABILITATION

It is understood that professional organizations (e.g., AOTA, Association for Driver Rehabilitation Specialists) have their own terms of use. In the following pages, there will be an acknowledgment when a term has a specific definition from such a professional organization that may differ from the definition provided here.

Driving skill(s): The demonstration of appropriate vehicle control decisions at operational and tactical levels in a range of traffic and environmental conditions to which the driver may be exposed as well as a knowledge of rules of the road that meets jurisdiction requirements.

Driving abilities: The sensory–perceptual, cognitive, and psychomotor functions needed to control a motor vehicle in a range of traffic and environmental conditions.

Driving impairment: A loss or decrement of any body part, organ system, or mental function that prevents the driver from performing the actions normally required for safe driving.

Transient driving impairment: A limitation that is present for a finite time (e.g., hours, days, weeks, months), with an expectation of a return to normal driving functioning.

Physical driving limitation: A limitation caused by the loss, abnormality, or decreased functioning (e.g., strength, range of motion, coordination) of a joint or limb involved in the actions required for driving.

Cognitive driving impairment: A deficit in the executive functions (e.g., judgment, reasoning, insight) or mental capacities that govern behavior that are needed for fitness to drive. [Note: Cognitive processes collectively include all mental capacities needed for fitness including (but not limited to) memory, attention, divided attention, concentration, speed of processing information, praxis, somatognosia body perception, visual perception, sustained mental effort, and the ability to follow instructions. It is a general rather than a specific definition.]

Driving simulator assessment: Use of a simulator to measure and characterize driving skills and abilities; not equivalent to an on-road assessment.

Cut point: A level or threshold of performance obtained with a reliable and valid measurement procedure; one that is used to classify a driver into a risk group as the basis for a decision or recommendation regarding the need for additional evaluation or intervention.

Driving competency: The demonstration of fitness to drive that meets criteria recognized by a body responsible for driver licensing. [Note: May be with or without restrictions or assistive technology or adaptive equipment.]

Warning signs of impaired driving: Observable or quantifiable indicators of impaired driving that may include (but are not limited to) an apparent decline in function or skill level; reported lapses of control or erratic control of a vehicle; a crash; or indirect evidence (e.g., dents, scratches).

Critical driving error: A control action by a driver that results in a crash, a near crash, or a high-risk encounter (without an adverse outcome).

Driving simulation: A controlled environment used for driver assessment or training that is considered to be representational, such that drivers may not respond the same as during real-world driving. [See Notes under "interactive driving simulation."]

Driving simulator: A computer-controlled environment that presents selected aspects of the driving experience considered representational of real-world driving and that allows objective measurements of users' responses to designated driving tasks. [See Notes under "interactive driving simulation."]

Interactive driving simulation: A computer-controlled environment that presents selected aspects of the driving experience considered representational of real-world driving and that allows objective measurements of users' responses to designated driving tasks, where users' accelerator, brake, or steering responses influence subsequent events within the limits of the parameters of the simulation program. [Notes:

- Driving simulators can be extremely variable in the amount and fidelity of information (visual, auditory, tactile–haptic, etc.) they present and the amount and fidelity of feedback available to the driver for his or her vehicle control inputs.
- Simulation biases include, but are not limited to, cognitive bias (e.g., responding to simulated driving scenarios as a game, where vehicle control decisions and actions do not have the same consequences as when actually driving); perceptual bias (e.g., display characteristics that do not offer the resolution drivers need to make gap judgments or read signs, or the dynamic range to detect low contrast targets, etc.); and psychomotor or proprioceptive bias (e.g., distortions in relation to one's own car in how pressing on a pedal translates into speed change, or how movements of the wheel translate into a lateral position change).
- While performance in a simulator can reliably signify gross sensory deficits (e.g., hemianopia) or cognitive impairment (e.g., ignoring traffic control information, or an absence of hazard avoidance behaviors), evaluators must be cautious in applying simulator data to measure a driver's competence to respond appropriately under real-world driving conditions.]

Rehabilitation (as an outcome): A successful implementation of an intervention or course of action that facilitates safe mobility and transportation.

Rehabilitation (as a process): An intervention intended to ameliorate impairments or deficits related to the driving task or alternative methods of mobility.

Behind the wheel: Performing driving maneuvers using typical equipment in a motor vehicle (not a driving simulator), for purposes of evaluation or instruction–training on public roads, off-road settings, or closed course.

Copilot: A passenger that assists with driving tasks primarily at the tactical level.

Operational level (of driving): Controlling the motor vehicle through the physical actions of steering the wheel, moving or shifting gears, pressing the accelerator or brake, or using the turn signals; draws upon skills that are overlearned and habitual so that performance of such actions is largely automatic.

Tactical level (of driving): Executing maneuver control over the vehicle to complete a goal directed trip in response to prevailing conditions; including behaviors that are typically learned and practiced such as maintaining lane position or speed, obstacle avoidance, gap acceptance, obeying traffic signals, turning, and passing other vehicles.

Strategic level (of driving): The general planning of a trip, including trip goals, route, and modal choice with the associated costs and risks involved; also including the ability to adapt plans when necessary such as changing a route due to a crash or construction, needing to make an unexpected stop (e.g., to use a bathroom), a change in a trip's goals, or seeking help if lost.

*In the area of **Driver Rehabilitation**, health professional roles are often blurred. Below are distinctions between specific roles, not complete definitions of a particular profession; these may be different from terms used by the professional associations.*

Occupational therapist, generalists: Provides clinical driving evaluations or applies specific assessment tools in order to assess fitness to drive as an instrumental activity of daily living and intervention to develop or restore driving abilities.

Occupational therapist, specialist in driving rehabilitation: Provides comprehensive driving evaluations, clinical driving evaluations, driving mobility equipment evaluations, and intervention to develop or restore driving skills and abilities.

Driver rehabilitation specialist (DRS): Provides clinical driving evaluations and driving mobility equipment evaluations and intervention to develop or restore driving skills and abilities. [Note: A DRS may or may not have a health professional background. With a health professional background, a DRS can provide the comprehensive driving evaluation.]

Physician: Provides a recommendation regarding fitness to drive based on an assessment or review of the individual's medical condition(s) and functional status with respect to sensory–perceptual, cognitive, or psychomotor abilities identified as significant predictors of crash risk.

Driver instructor: Provides driving assessment for individuals without medical conditions and training for individuals with or without medical conditions.

Immediately following are general terms and are defined as such. When combined with driving, in the next set of terms, definitions are more specific.

Evaluation: Obtaining and interpreting data to document results and inform an individualized mobility plan.

Assessment: Use of specific measurements, tools, or instruments during the evaluation process.

Screening: Obtaining and reviewing data to determine the need for evaluation.

Self-screening: An individual obtains and reviews his or her own data to determine the need for evaluation.

Proxy screening: An individual obtains and reviews data to determine the need for evaluation for another person.

Evaluator screening: A professional skilled in a specific screening tool obtains and reviews data to determine the need for evaluation for a specific individual.

Driving assessment: Use of an on-road test to measure and qualify driving skills and abilities, which may be triggered by a screening outcome indicating increased risk for driving impairment or crash involvement.

Driving evaluation: Obtaining and interpreting data and documenting results to inform an individualized mobility plan based on an individual's driving abilities or potential to be an independent driver, or inform a determination of fitness to drive.

Clinical driving evaluation: A healthcare professional obtains and interprets data and documents results to determine fitness to drive through assessment of sensory–perceptual, cognitive, or psychomotor functional abilities using specific tools or instruments.

Comprehensive driving evaluation: A complete evaluation of an individual's driving knowledge, skills, and abilities by a healthcare professional that includes

1. Medical and driving history;
2. Clinical assessment of sensory–perceptual, cognitive, or psychomotor functional abilities;
3. On-road assessment, as appropriate;
4. An outcome summary; and
5. Recommendations for an inclusive mobility plan including transportation options.

Driving mobility equipment evaluation: Obtaining and interpreting data and documenting results to inform an individualized mobility plan based on an individual's abilities or potential to be an independent driver using mobility equipment, including wheelchair seating, that may include

1. Screening or assessment of sensory–perceptual, cognitive, and psychomotor functioning;
2. Wheelchair seating or mobility equipment as they pertain to the functional skills necessary to safely operate a motor vehicle; and
3. On-road assessment of the individual using equipment similar to that which will be recommended.

Fitness to drive: A driver characteristic or a description of a driver, defined by the absence of any functional (sensory–perceptual, cognitive, or psychomotor) deficit or medical condition that significantly impairs an individual's ability to fully control the vehicle while conforming to the rules of the road and obeying traffic laws, or that significantly increases crash risk.

Episodic impairment: An impairment that occurs in an otherwise unimpaired driver, such as a seizure or a loss of consciousness, where prediction of the degree of risk is based upon the clinical situation and history of the individual driver.

Permanent driving impairment: An impairment that will not improve in the foreseeable future.

Standardized road test: A road test with specific components (e.g., right turns, highway, intersections) that are always performed, to establish a score that is comparable across individuals. [Note: Standardized road tests may only be standardized for a specific, city, evaluator, or research study.]

Road test: An examination of driving maneuvers and knowledge of rules of the road performed in a motor vehicle on a public highway or street.

Driving test: An exam including specified driving maneuvers performed in a motor vehicle.

Off road: Driving on roadways or areas that are not usually paved, including private roads or public roadways.

On road: Driving on roadways, usually public streets or highways.

Predriving exam: Tests completed prior to a driving test that may include vision or knowledge of rules of the road, which may be completed by nonmedical personnel.

Closed course: A driving venue separate from publicly-traveled roadways, with known and controlled driving parameters, that is used for evaluation of skills or abilities, or practice of driving maneuvers.

Naturalistic driving (study or assessment): A methodology to monitor or evaluate driving behavior, using instruments installed in a driver's own car, that 1) provide an objective driver ID and driving data for each trip, and 2) operate in a passive manner, requiring no interaction from the driver.

ALTERNATIVE TRANSPORTATION OPTIONS

Alternative transportation: Mode of transportation other than driving one's self in a private vehicle.

Individualized transportation options: Mobility choices tailored to a person's needs.

Transportation options: Range of ground conveyance that includes private motor vehicle, taxi or ride service, walking, bus, train, bicycle, or streetcar.

Informal transportation support: Rides from family, friends, or one's social network that are outside traditional taxi or other for-hire providers.

Formal transportation support: Public or private transportation service.

Supportive, assistive, or escorted transportation: Levels of individualized passenger assistance, often from curb to curb to stay at the destination.

Driving retirement: Prior to cessation, the transition from operating an automobile to becoming a passenger or using alternative transportation; this occurs at different rates for different people.

Transition to nondriving: The process of shifting from the driver's seat to the passenger seat, or to forms of alternative transportation.

Driving cessation: When an individual chooses or is forced to permanently stop driving.

Transportation plan: An individual approach to future mobility options, usually in addition to driving, that may include learning to navigate and use alternative transportation options, as well as setting aside resources in cash, credit or insurance to fund such choices.

Mobility management: A strategic approach, generally by a professional, to optimize mobility to meet daily transportation needs.

Self-regulation of driving behavior: Change in the amount, time, location and kind of driving an older person undertakes in an effort to avoid risk and preserve safety. [Note: May include not driving at night, avoiding rush hour, highways, or left turns, driving slower, no passengers, etc.]

Private transportation capacity: The vacant seats in private automobiles available for sharing rides.

Ride sharing: When more than one person going in a similar direction travel in a private automobile.

Volunteer driver program: A program designed to assist members with their transportation needs using volunteer drivers and vehicles.

Volunteer driver: When a driver transports another person without direct compensation.

Volunteer vehicle: When a vehicle is donated for use in providing personal transportation for others.

Car trade: When someone exchanges an automobile for transportation service.

Fixed-route transit: High-occupancy vehicles, generally publicly funded, that travel an established route and stop at predetermined locations (e.g., rail and bus stops).

Demand-responsive transit: A form of public transportation characterized by flexible routing and scheduling of small or medium vehicles operating in shared-ride mode between pick-up and drop-off locations according to passengers' needs.

Deviated route transit: Transportation service provided by a high-occupancy vehicle that typically follows a predictable route that may vary based on rides scheduled for individuals who request a stop at a specific house or building.

Paratransit: Special transportation services for people with disabilities, often provided as a supplement to fixed-route bus and rail systems by public transit agencies.

Transportation credit: Equity in a transportation system in lieu of cash reimbursement for driving or trading an automobile.

ASSISTIVE TECHNOLOGIES IN DRIVING AND COMMUNITY MOBILITY

Assistive technology: Any item, piece of equipment (or product system) available commercially as original equipment, as modified equipment, or as customized equipment that is used to increase, maintain or improve functional driving capabilities.

- Assistive technologies being developed are no longer exclusively used for individuals with disabilities. Assistive technologies include mainstream devices useful to individuals with a wide range of abilities off the shelf or after market (e.g., GPS units, backup cameras).
- Includes hard and soft technology:
  - Hard technology is the actual device or piece of equipment (e.g., vehicle hand controls, left-foot accelerator) and
  - Soft technology is the human supports of training or assessment strategies in order to use the hard technologies.

Adaptive equipment: Any product or device designed to enable the performance of daily activities by an individual.

- Adaptive equipment is considered a subset of assistive technology.

- Adaptive equipment is typically used to assist with daily activities such as eating, dressing, and personal hygiene. Frequently these items can be commercially available and do not require a clinician for procurement.
- Adaptive equipment for vehicles, although commercially available, should not be installed or used by the consumer without professional input, especially for products that interact with the action of driving (e.g., hand controls, left-foot accelerator, spinner knob). Professional expertise would include recommendations for installation, types and styles of equipment, position of equipment, as well as evaluation and training in the use of the adaptive equipment. These include mechanical adaptations.
- Adaptive equipment that is beyond a mechanical adaptation or requires its own motor to operate is considered high-tech adaptive equipment and requires the expertise of a skilled clinician for evaluation or training and an engineer or mechanic for installation.

Rehabilitation technologies: Devices that are used as part of remediation or rehabilitation and not used as part of daily life (e.g., parallel bars, driving simulation). [Note: These devices are used as one component in an overall rehabilitation plan.]

Vehicle automation: Technologies that allow a motor vehicle to perform some or all of the control functions traditionally performed by drivers; specific levels of automation are defined in U.S. government publications. [Note:

- **Full self-driving automation** (NHTSA Level 4). A vehicle designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip, such that the driver provides destination or navigation input but is not expected to be available for control at any time during the trip. This may include self-driving vehicle, robotic vehicles, and autonomous vehicle.
- **Limited self-driving automation** (NHTSA Level 3). The vehicle enables the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions, relying on the vehicle to monitor conditions and notify the driver with sufficient time for the driver to transition back to driver control.
- **Combined function automation** (NHTSA Level 2). The vehicle used automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions, although the driver is responsible for the safe operation of the vehicle at all times.
- **Function-specific automation** (NHTSA Level 1). Vehicle allows automation over specific and independent control factors to aid the driver in certain normal driving or crash-imminent situations (e.g., cruise control, electronic stability control), although the driver has overall control and is solely responsible for the safe operation of the vehicle.
- **No automation** (NHTSA Level 0). The driver is in complete and sole control of the primary vehicle controls (e.g., brake, steering, throttle) at all times, and is solely responsible for monitoring the roadway and for safe operation of all vehicle controls.]

Connected vehicle systems (CVS)**:** Vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) communication systems that allow vehicles to communicate location, speed, direction and other data to similarly equipped vehicles or to roadway infrastructure. [Note: Some vehicles currently have technologies that assist drivers with warnings that a collision is imminent or that provide

partial automation that can prevent or mitigate the severity of a crash. The following list includes the most common technologies available in U.S. vehicles at the time of publication.]

Backup camera: A camera that provides an image of what is immediately behind the vehicle.

Rear parking sensor: A technology to warn drivers when there are objects behind the vehicle when the vehicle is in reverse. Some systems automatically apply the brakes to keep the vehicle from backing into or over an object.

Rear cross-traffic alert systems: A technology to detect approaching vehicles that may cross the path of a backing vehicle, provide a warning to the driver, and (in some systems) automatically brake to prevent a collision.

Adaptive headlamps: An active safety system in which the headlamps rotate in the direction of travel based on steering wheel movement, and sometimes the vehicle's speed, to provide better visibility on dark curves.

Adaptive high-beam headlamps: Detects oncoming traffic and either adjusts high-beam distance or disables high beams altogether in the face of oncoming traffic.

Enhanced night vision display: A technology that affords visibility via an in-vehicle display of pedestrians, cyclists, animals, or objects which otherwise would be difficult or impossible for a driver to detect in the dark.

Adaptive cruise control: This technology, like regular cruise control, helps drivers maintain a set speed. Unlike regular cruise control, adaptive cruise control slows down or accelerates up to the set speed to maintain a specified following distance to the vehicle ahead. If the vehicle slows below a certain speed as it approaches another vehicle, some systems are designed to disengage and require the driver to resume control, while others can bring the vehicle to a complete stop.

Forward collision warning (FCW) and prevention system: A system that alerts the driver if the calculated time-to-collision (TTC) with a lead vehicle is below a specified threshold, such that a crash is imminent if the driver fails to take action. Most systems issue a warning and pre-charge the brakes to maximize their effect if the driver responds by braking. Many systems brake the vehicle automatically if the driver doesn't respond. In some cases, automatic braking is activated without a preliminary warning.

Lane departure warning system (LDW): A camera-based system that can alert the driver as the vehicle deviates in its lane, approaching or reaching a lane marking, with a visual, auditory, or vibrating alert, which is negated if the turn signal is on as the system assumes the driver is intentionally crossing over the lane.

Lane keeping assist system: A system that senses the vehicle deviating from its lane, and can apply a small amount of counter steering or braking force to help the vehicle stay near the center of the lane.

Blind spot monitor (also blind spot detection): A technology that senses vehicles approaching in the driver's blind spot behind or alongside and, if the turn signal is on, alerts the driver.

Active blind spot assist system: A technology that applies a small amount of counter steering or braking force when the vehicle deviates from its lane into an occupied area in the adjacent lane.

Drowsy-driver warning system: A system that detects driver drowsiness via driving patterns or facial recognition, and can provide warnings via visual, auditory, or haptic stimuli to awaken the driver.

Antilock braking system (ABS): A system providing automated, algorithm-based braking of each wheel to prevent locking up and skidding in order to maximize driver control during emergency braking.

Brake assist (BA or BAS): A system that applies power to the brakes earlier and faster than most drivers can (or will) in an emergency stop. [Also **emergency brake assist (EBA)**.]

Brake override system: Cuts any acceleration when the brake pedal is pushed, giving the brakes precedence if both pedals are simultaneously depressed or if the accelerator is already depressed when the brake is applied.

Automatic braking: A system that detects when a forward collision is imminent, delivers a warning, and automatically brakes the vehicle to a stop. The system is based on time-to-collision calculated via an onboard algorithm and works best at moderate speeds.

Electronic stability control (ESC): An automated algorithm that detects and prevents (or recovers from) skids when either the accelerator or brakes have been applied.

Traction control: A sensor system that continuously detects the speed of each wheel and if the system observes a wheel spinning faster than others, it automatically prompts the brakes of that wheel to slow it down; engine reduction may also be applied to take power away from the wheel.

Abbreviations

ABS	Antilock braking system
ADED	Association for Driver Rehabilitation Specialists
AOTA	American Occupational Therapy Association
BA	Brake assist
CDRS	Certified driver rehabilitation specialist
CVS	Connected vehicle systems
DRS	Driver rehabilitation specialist
EBA	Emergency brake assist
ESC	Electronic stability control
FCW	Forward collision warning
GPS	Global positioning system
LDW	Lane departure warning
NHTSA	National Highway Traffic Safety Administration
TRB	Transportation Research Board
TTC	Time-to-collision
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-vehicle

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