Prevention of machinery-pedestrian collisions – Responsibilities of the different actors V2

Machine-pedestrian collisions are a significant risk on construction sites.

Proper work preparation, as well as awareness and training of all stakeholders, help to prevent this risk.

In addition to organisational measures and taking into account the human factor, the possibilities of equipping machines with warning devices have multiplied. Devices that also aim to stop machines before collisions and thus avoid collisions are emerging on the market.

Automatic emergency braking has an obvious interest in terms of prevention. However, some questions remain, in particular that of the responsibility of the various actors in the event of the failure of these systems.

In this context, it appeared necessary to clarify the responsibility of the various actors, *via*:

- A reminder of the obligations and responsibilities of each actor as defined in French law,
- Analysis of the potential impact of collision avoidance systems on these responsabilities.

To this end, representatives of users, rental companies and prevention companies met to analyse the applicable regulations and case law.

This document presents the main conclusions of this analysis, without the aim of exhaustive all the regulations in force that may intervene in the context of machine-pedestrian collisions.

This analysis takes into account feedback from manufacturers and importers representatives in France.

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1. Placing a machine on the market: obligations of the manufacturer

The rules for placing machines on the market are set out in the Machinery Directive 2006/42/EC, transposed in France into the Labour Code by the *Décret n° 2008-1156 du 7 novembre 2008 relatif aux équipements de travail et aux équipements de protection individuelle* codified in Articles R4311-4 to R4314-6 of the French Labor Code.

1.1. Placing the machines on the market

When placing a new machine on the market, the manufacturer:

- ensures that the machine complies with the essential, health and safety requirements set out in Annex I of Article R4312-1 of the Labour Code (CT-Article R4312-1),
- compiles a technical file relating to the means implemented to ensure compliance and makes it available to the competent authorities (CT-Article R4313-6 ; CT-Article R4313-22),
- provides the information necessary for the use of the machine, such as the instruction manual (CT-Annexe I de l'article R4312-1 1.7.4),
- draws up a CE declaration of conformity (CT-Article R4313-1),
- affixes the CE marking to the machine (CT-Article R4313-5),
- applies a relevant conformity assessment procedure.

Safety Components

Protective devices intended to detect the presence of people are safety components, listed in Annex V of the Machinery Directive 2006/42/EC.

At present, there are no harmonised standards (see section 1.2) for these devices.

The manufacturer must therefore apply an EC type-examination procedure (CT-Article R4313-23) with internal control of machine production (CT-Article R4313-20), or a complete quality assurance procedure (CT-Article R4313-43) to ensure that these protective devices are compliant.

The *guide pour l'application de la Directive Machines 2006/42/CE* specifies that this type of safety component detects the presence of persons or parts of persons and sends an adequate signal to the control system, in order to reduce the risks to the detected persons.

The signal can be generated when a person or part of a person exceeds a predetermined limit or when a person is detected in a predetermined area, or both.

The certification of compliance with the provisions of the Machinery Directive is left entirely under the responsibility of the manufacturer, who will choose a more restrictive certification procedure according to the risk potential of the equipment.

Integration of safety into machine design

When designing a machine, the manufacturer or his authorised representative ensures that a risk assessment is carried out in order to determine the technical rules to be complied with.

Compliance with the technical regulations is mandatory, but if the objectives set by the technical regulations cannot be achieved in view of the state of the art, then the machine must be designed and built to achieve these objectives.

The risk assessment also makes it possible to assess the limits of the machine during its normal use or during reasonably foreseeable misuse and to determine the risks and hazards with a view to eliminating or reducing them.

Priority is given to intrinsic prevention measures, the second priority is to use technical protection measures, the third priority is information for users.

1.2. Harmonised standards

In its design and risk assessment/elimination process, the manufacturer may choose to apply harmonised standards specific to the machine concerned.

The machine built in accordance with a harmonised standard, listée au Journal Officielle de l'Union européenne, is **presumed to comply** with the essential health and safety requirements covered by this standard (point 2 of the article 7 of the Machinery Directive 2006/42/CE).

If there is no harmonised standard for a type of equipment or a type of risk, the manufacturer can also turn to national or international standards or draft standards. Nevertheless, these "non-harmonized" standards will not give a presumption of conformity to the machine concerned.

Examples of harmonized standards for certain equipement:

- NF EN 474-1:2022 Earth-moving machinery - Safety
  Partie 1 : General requirements

- NF EN 474-3:2022 Earth-moving machinery - Safety
  Partie 3 : Requirements for loaders

- NF EN 474-6:2022 Earth-moving machinery - Safety
  Partie 6 : Dumper requirements

- NF EN 1459-1:2017 Off-road forklifts - Safety requirements and verification
  Partie 1 : Variable reach forklifts

Examples of **non-harmonized** standards for earth-moving machinery:

- ISO 16001:2017 : Object detection and visual aids
  Performance Requirements and Testing

- ISO 21815-1:2022 : Collision Warning and Avoidance - Earthmoving Machinery
  Part 1: General Requirements

  This standard is intended to foster innovation and accelerate the pace of improvements in new collision warning and avoidance technologies. The performance requirements in this document are technology-neutral and do not specify the technologies to meet the requirements.

  This standard specifies that collision warning and avoidance systems are intended to assist the machine operator, and that the responsibility for the safe operation of the machine remains with the machine operator.

Arrival of the Machinery Regulations

The new regulation UE 2023/1230 of 14 June 2023 on machinery was published in the European Official Journal on 29 June 2023.

It will have to be applied in countries 42 months after its publication, i.e. on 14 January 2027. It will definitively replace the Machinery Directive 2006/42/EC.

The manufacturer retains the same responsibilities regarding the placing of the machines on the market: certificate of conformity, documentation, risk assessment, compliance with essential health and safety requirements.

It should be noted that :

- The introduction of the concept of **substantial modification** of machinery, defined as "*the modification of a machine or related product, by physical or digital means, after the placing on the market or commissioning of such machine or related product, which is not foreseen or planned by the manufacturer and which affects the safety of the machine or related product by creating a new hazard or increasing the existing risk* [...] (Article 3).
- The following clarification: *"A natural or legal person who makes a substantial modification to a machine or related product shall be considered a manufacturer for the purposes of this Regulation and shall be subject to the obligations incumbent on the manufacturer ... »* (article 18)

In terms of essential security requirements, the **risks related to AI** (ergonomics, reliability of control and command systems), the risks related to the evolution of software, and the tracing and archiving of interventions and software developments, the risk of computer corruption, are now taken into account.

In addition, software that behaves fully or partially self-scaling, and uses **machine learning** approaches that provide security features, is now included in the list of security components.

2. Maintaining compliance

Reminder

The Labour Code requires that work equipment be used and maintained in such a way as to preserve the health and safety of workers (art. L4311-1).

It is also **forbidden** to use work equipment that does not comply with the technical rules applicable to it (art. L4321-2).

It is therefore essential to keep this equipment in compliance by referring to the manufacturer's instructions, recorded in the equipment instruction manual (art. R4322-1 à R4322-3).

The maintenance of the state of compliance is verified in France on the occasion of:

- the acquisition of new or used equipment,
- the modification of machines in service,
- the regulatory checks (commissioning, recommissioning, periodic general checks) for the equipment subject to them.

In addition, verification of the good state of conservation is carried out during periodic general audits (VGP). The periodicity of these VGPs depends on the nature of the equipment (between 3 and 12 months).

Two main texts govern the performance of the various regulatory audits:

- l'arrêté du 1er mars 2004 for lifting devices and accessories,
- l'arrêté du 5 mars 1993 amended by the Decree of 4 June 1993 for certain construction machinery.

Interprofessional and professional guides have been developed to support manufacturers and users in the operational implementation of regulatory audits. The list of these guides is provided in the appendix to this document.

It is the "employer" who assumes responsibility for the conformity of the work equipment that he makes available to his employees: when acquiring this equipment, using it and *maintaining* it in a state of compliance (article R4322-1).

When equipment is made available via a rental contract, the rental company undertakes to deliver a machine that complies with the applicable technical rules.

Note: The distribution of maintenance tasks between the rental company and the tenant may be governed by the general interprofessional terms and conditions for the rental of company equipment with operator or without operator, developed by the DLR, the FFB and the FNTP.

When equipment is sold or rented second-hand, the seller is responsible for the conformity of the equipment via the second-hand certificate of conformity (article R4313-14). The model of this certificate is fixed by the arrêté du 22 octobre 2009.

Point of vigilance

Modifications to machines in service are common, and it is important to remember that these operations must be carried out rigorously.

Many changes occur for many reasons (increased productivity, addition of an accessory or function, addition of a driver assistance system, etc.) but they sometimes lead to dangerous situations, or even serious or fatal accidents, if the risk assessment has not been carried out correctly.

For example, adding a camera-monitor system to a machine that is already in service is a machine modification that should be treated as such. This is not insignificant. Since the monitor in the cab was not provided for at the design stage, its position in the cab must be evaluated with the greatest care, in particular so as to avoid creating new risks linked to a blurring of the field of vision on dashboard controls or on areas in the environment close to the machine, and must limit the impact on ergonomics at the driver's seat as much as possible.

Reference may be made to the digest « *modifications de machines en service* », developed by EVOLIS, to know the essential rules to follow in this field. An EVOLIS practical guide also deciphers the interministerial recommendations on the subject.

3. Obligations and responsibilities for the use of construction machinery

This chapter recalls the main rules applicable to liability in the event of damage caused by machinery. It does not present all the rules relating to the liability of the employer and its employees.

3.1. Employer's responsibilities towards its employees

When the employee is the victim of an accident in the course of his or her duties, the employer may be held liable.

Employer's safety obligation

The employer's general obligation of safety towards its employees is defined in the article L4121-1 of the Labour Code : the employer must take the necessary measures to ensure the safety and protect the physical and mental health of its employees. Otherwise, the employer incurs civil liability.

The employer is presumed liable if an accident at work affects one of its employees. He may be exonerated from liability if he can prove that he has taken all the necessary preventive measures to preserve the health and safety of his employees. It is up to the judges to rule on these measures.

Obligation to train employees

The employer must only assign employees trained for this purpose to operate construction machinery (CT-Article R4323-55).

He must therefore ensure that his employees are trained in the use of construction machinery and issue them with a driving licence (CT-article R4323-56) :

> *« The operation of self-propelled mobile work equipment and lifting work equipment is reserved for workers who have received adequate training. This training is completed and updated whenever necessary. »* (CT-Article R4323-55)

Possible exemption from employer liability

The employer may also exonerate itself from liability by establishing that the damage stems from one of the following causes:

- Force majeure :

  In this case, the employer can completely exonerate himself from liability by demonstrating that the accident is due to an unforeseeable, irresistible external cause.

- The fault of the employee who was the victim of the accident:

  Either the victim's fault has the characteristics of force majeure, and the employer is **totally** exonerated.

  Either the victim's fault does not have the characteristics of force majeure, and the employer is **partially** exonerated.

- The act of a third party, such as the manufacturer:

  Either the act of a third party presents the characteristics of force majeure (unforeseeable, irresistible, and external). In this case, the employer is **completely** exempt. The victim will have to sue this third party to be compensated.

  Either the act of a third party does not have the characteristics of force majeure. In this case, case law refuses to allow the employer to exonerate itself, even partially, from its liability by invoking the act of the third party. We are dealing with co-perpetrators who are required to make reparation for the damage *in solidum*.

- The employee's liability, if he or she has committed an inexcusable fault (difficult to prove)

  This fault is defined by the Court of Cassation as "a voluntary act, of exceptional gravity, by which he exposes himself without valid reason to a danger of which he should have been aware" (Cass. ass. plén., 24 juin 2005, n° 03-30.038).

  It may be certain serious imprudence, his disobedience to a formal order or his state of drunkenness...

3.2. Responsibilities of the employee

Employees – whether drivers or pedestrians – have a duty of care and diligence (Article L4122-1 du CT), that is, they have an obligation not to harm their health and safety as well as that of other workers.

Ils sont tenus également de respecter les consignes et instructions données par l'employeur qui précisent notamment les conditions d'utilisation des équipements de travail et des moyens de protection (Article L4122-1 du CT).

Finally, they are required to alert of any situation that they believe may present a serious and imminent danger (Article L4131-1 du CT).

What is the risk for an employee who does not comply with his or her duty of care or safety instructions?

Failure to comply with the duty of care and diligence may result in disciplinary sanctions for the employee, up to and including dismissal. Like what:

- An employee loses control of his truck. The judges confirmed that the failure to wear a seat belt and the lack of control of the vehicle, even 4 km/h above the speed limit, constitute a serious breach of his obligations and justify dismissal for serious misconduct (Cass. Soc. 15 Déc 2016 – N°15-21749).

- A forklift driver continues to work knowing that he is not in a condition to continue his activity because of his medical treatment, and that he is therefore putting his colleagues at risk. The Court confirms that his dismissal is justified (Cass. Soc. 12 Oct. 2017 – N°16-18836).

What is the risk of an employee who does not comply with his obligation to alert in the event of serious and imminent danger?

The employee is subject to an obligation of vigilance and a duty to alert. Failure to comply with this obligation, which would be the cause of a fatal accident at work, can legitimise a **dismissal for serious misconduct.**

3.3. Employer's responsibilities with regard to its employees towards third parties

The employer may be held civilly liable as soon as damage has been caused to another person by his fault or by the fault of the persons for whom he is responsible:

> « *A man is responsible not only for the damage he causes by his own act, but also for that which is caused by the act of the persons for whom he is responsible, or of the things he has in his care.* » (article 1242 of the Civil Code)

The employer is civilly liable to third parties for damage caused by one of its employees in the performance of his duties.

The employer is liable for any damage that may be caused by things handled by the employee in the performance of his or her duties: vehicles or any machine entrusted to the employee for the performance of his or her duties.

The employer may exonerate himself from liability by invoking the act of vicarious, force majeure, the fault of the victim but also the abuse of office (if the employee has acted without authorization and outside of his duties).

The company's civil liability insurance covers damage committed by employees to third parties.

4. Insurance coverage for companies

Damage caused to third parties by construction equipment or machinery is covered either by the motor insurance contract (Land Motor Vehicle insurance) or by the company's Civil Liability insurance.

4.1. Land Motor Vehicle Insurance

This insurance is compulsory for vehicles considered to be **Land Motor Vehicles** (LMVs) within the meaning of Article L. 110-1 of the Highway Code. The guarantees of this coverage will apply in the event of a **traffic accident.**

In the event of rental, this insurance is the responsibility of the landlord (art. L.211-1 Insurance Code).

> Self-propelled construction machinery is considered to be a VTM and is therefore subject to this insurance obligation, whether it is a crawler tractor, a hydraulic excavator, an agricultural tractor, a backhoe loader or an aerial work platform.
>
> Similarly, the nature of the energy used (petrol, diesel, electricity, etc.), the power and the absence of the obligation to register the vehicle have no influence on its qualification.
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> Note: a tipper without wheels, even when it is on the public road, is not affected by the insurance obligation.

For construction machinery, it is the **notion of movement** that decides whether it is necessary to be insured, regardless of the vehicle and the event causing the damage. The traffic function is only incidental to their use as machines.

4.2. Commercial General Liability Insurance

This insurance covers the company when the machine is in operation in **its "tool" function** or in the course of work, i.e. out of traffic or parking (some "Fleet" contracts may also cover civil liability according to "tool").

An accident that is exclusively related to the function of a forklift truck as a lifting tool and not to its traffic function can be classified as a traffic accident (Court of Cassation, Civil, Civil Chamber 2, 18 May 2017, 16-18.421).

The company must take out Land Motor Vehicle ("Traffic Liability") insurance and Commercial Civil Liability insurance.

5. Impact of collision avoidance systems on the responsibilities of actors

An analysis of the regulations and case law was carried out concerning the **installation** of collision avoidance systems **on new machines**.

This analysis did not cover the installation of a collision avoidance system on an existing machine ("*retrofit*"), which is a modification of the machine in service.

> At the date of publication of this note, there is no stabilised interpretation of the concept of substantial change, as defined in the new machinery regulation. It is not possible for us today to attest that such an amendment would be systematically considered substantial.
>
> It is imperative to contact the original manufacturer before considering such a modification of the machine in service.

A collision avoidance system (as defined in ISO 21915-1) is similar to a safety system **that blocks aggravating movement**, similar to what exists:

- in the field of lifting loads with load state controllers (CECs) that block the movement of a crane's boom, to prevent the crane from tipping over.
- in the field of lifting people, with the slope limiters that equip some Mobile Lifting Platforms (MEWPs), to prevent the basket from tipping over.

A collision avoidance system is also similar to a **neutralization of the movements of a machine** when a light curtain is crossed, a safety component mentioned in Annex 5 of the Machinery Directive 2006/42/EC, which can be found in particular in industry, such as on hydraulic presses.

According to our analysis, there is an important case law on accidents related to the shunting of such safety components on a machine.

On the other hand, **we have not identified any case in which the origin of the accident is linked to the malfunction of a safety component**.

In addition, vehicles equipped with collision avoidance systems are not subject to the regulations on autonomous vehicles, the salient points of which are specified in Annex A of this document; Indeed, the machine remains driven by an operator, who remains responsible for driving his machine, whether or not this machine is equipped with automatic emergency braking.

Reminder: Machine operators must hold a **driving licence**. It ensures that they have the skills and knowledge necessary for safe driving. The driving permit is issued by the employer on the basis of:

- a fitness notice issued by the occupational health practitioner,
- a check of drivers' knowledge,
- a knowledge of the premises and instructions to be followed at the site(s) of use.

Finally, it should be noted that the acquisition or rental of a vehicle with a collision avoidance system does not remove the employer's **obligation to ensure the safety** of its employees (see 3.1).

Appendix A - Liability Regime for Autonomous Vehicles

This annex specifies for information the regime applicable to autonomous vehicles. A vehicle equipped with a collision avoidance system is not subject to this regime.

This regime is specified in the Highway Code:

- The conditions for the use of an automated driving system are defined by the vehicle manufacturer or its authorised representative (art. L319-1).
- Certain **operating conditions for** an autonomous vehicle, called "delegated driving vehicles", are specified:
  - The automated driving system must perform self-diagnosis to verify that it is able to exercise dynamic control of the vehicle, and must inform the driver of its operational capability;
  - The activation of the automated driving system is the result of a **voluntary action by the driver.**
- If the automated driving system detects that it is no longer able to exercise dynamic control of the vehicle, or that the conditions of use may no longer be met, it must:
  - inform the driver,
  - ask the driver to take control of the vehicle,
  - in the event of a serious failure, or if the driver does not take control of the vehicle, the automated driving system must initiate and execute a "minimal risk manoeuvre", as defined in Article R311-1-1 of the Highway Code (art. L319-3).
- The **criminal liability** applicable in the event of the use of an autonomous vehicle is specified:
  - The driver is not liable for criminal offences when it is the automated system that exercises dynamic control of the vehicle at the time of the incident (art. L123-1). In this case, criminal liability could be transferred to the vehicle manufacturer.
  - The criminal liability of the builder for injury or manslaughter can only be incurred in the event of fault on his part (art. L123-2).

In the event of an accident, the insurer of a land motor vehicle (LMV) must compensate the victim **civilly**.

This insurer is subrogated to the rights of its insured and can therefore take action against the manufacturer of a vehicle if a defective part is the cause of the accident.

The defect in driving software, which is also a component of a land motor vehicle, should not be treated differently.

If the accident is caused, in whole or in part, by a failure of the automated driving system, an action could be considered against the manufacturer of the autonomous vehicle on the basis of product liability (art. 1245 et seq. of the Civil Code).

La preuve de la défaillance du système de conduite automatisé sera facilitée pour les véhicules équipés d'une « boite noire » enregistrant les données de conduite.

Black boxes

EU Regulation 2019/2144 provides that vehicles approved in Europe since July 6, 2022 must be equipped with automotive data recorders, commonly known as "black boxes".

These devices record data relating to speed, acceleration, braking, seatbelt wearing, etc. or the force of the collision.

The recorded data is kept only in the event of an accident and covers a period from 30 seconds before the accident to 10 seconds after the accident.

This data is only accessible in the event of an accident to investigators, judicial authorities or *research institutes*.

Appendix B - For more information

- *Zoom sur le risque de collisions sur chantier*, published by the OPPBTP
- Guide « *Travailler plus en sécurité avec les machines de construction* », published by CECE, EFBWW and FIEC

1. Guide « *Prévenir les collisions engins-piétons* » (ED 6083), published by INRS

- Professional guide for companies « *Réalisation des vérifications générales périodiques des engins de chantier* », co-published by the DLR, EVOLIS, the FNTP, and SEIMAT (2014)
- *Recommandations interprofessionnelles relatives au contrôle de maintien en bon état de conservation des matériels utilisés en travaux publics, non soumis à des vérifications générales périodiques*, co-published by the DLR, EVOLIS, the FNTP, and SEIMAT (2016)
- Technical Guide « *Modifications de machines et d'ensemble de machines en service - Guide d'interprétation et d'application de la réglementation et des recommandations ministérielles* », published by EVOLIS (2020)
- Fiche de synthèse « *Modification de machines en service* », published by EVOLIS (2020)
- Focus on Prevention « *Autorisation de conduite et habilitation* », published by the OPPBTP