



C.A.R. Consulting Group

Global Marine and Automotive Consultants and Surveyors

STATUS OF DIGITAL VEHICLE HANDOVER INSPECTIONS

DIGITAL CONDITION CAPTURE AND DAMAGE RECOGNITION

MANAGING EXPECTATIONS

BY
TIMO DAVID PASILA

ECG CONFERENCE 2022
VIENNA, 14 OCTOBER 2022

carpodTM
by C.A.R. Consulting Group



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

INTRODUCTION

Speakers: Timo D. Pasila and Mark Morgan

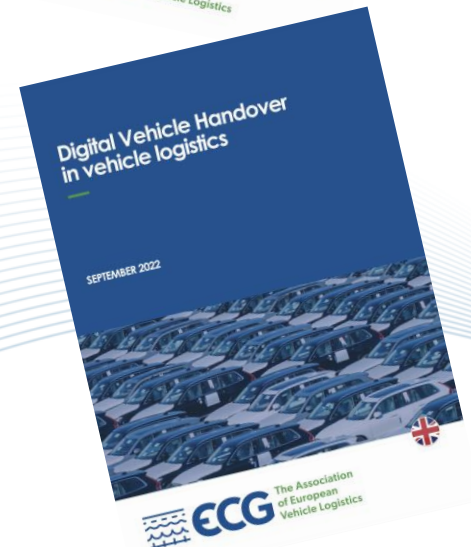
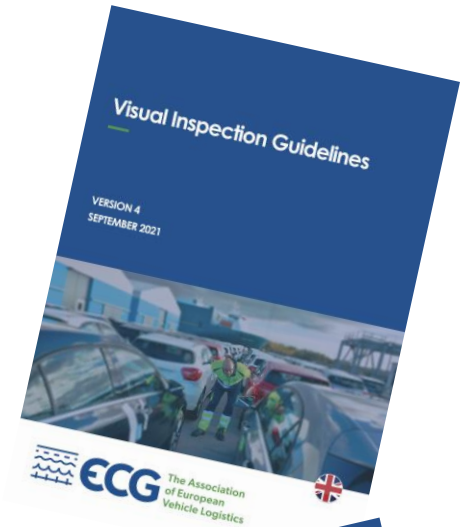
Both working in the Finished Vehicle Logistics (FVL) since 1998 (24 years).

Both involved in the re-writing of the Visual Vehicle Inspection Guidelines (version 4), by combining most of the existing OEM inspection standards and manuals into one unique ECG guideline.

The **Visual Vehicle Inspection** Guidelines (v. 4) were published by ECG in September 2021

Both participated in ECG Digital Vehicle Handover (DVH) Working Group.

ECG has published its first **Digital Vehicle Handover** Recommendation in September 2022.





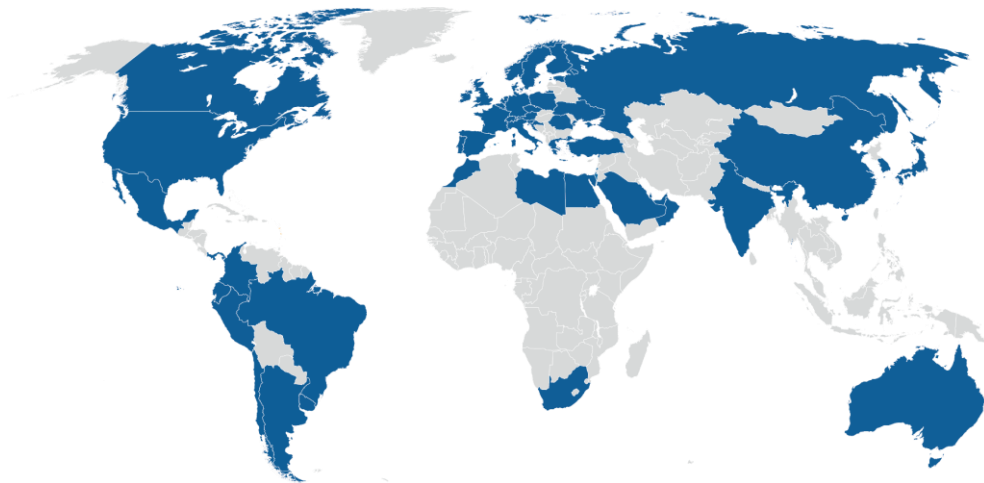
C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

EXPERIENCE

Work in C.A.R. Consulting Group since its establishment in 2004.

Over the last 18 years, C.A.R. Consulting Group has built a global inspection network, and currently provide vehicle hand-over inspections at over 160 locations, controlling over 12 million new vehicles per year.



C.A.R. Consulting Group's Global Inspection Network

The main focus of our Group is to provide **Automotive Quality and Risk Management** services, in particular to the LSPs in the Finished Vehicle Logistics (FVL) industry, but also to the OEMs and insurance companies.

In 2018, we decided to actively proceed with adding digital vehicle inspection solutions to our visual inspection services, in order to improve the quality level of our services.



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

NEW TECHNOLOGY

During the course of 2019, we designed, developed and built our first digital inspection system, **carpodX** and introduced it to the market during our 2019 Annual Conference in Barcelona. Since, we have placed additional systems in Germany and Turkey.



When introducing and promoting our newly developed digital inspection technology on the market and talking with our LSP and OEM customers, almost immediately we received the same question:

“When can we replace our team of inspectors (Visual Inspection) with this new digital inspection system (Digital Damage Recognition)?”



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

MARKET EXPECTATIONS

The initial “expectation” of the LSPs, OEMs and FVL industry in general was that we could jump almost instantly from a **Visual Handover Inspection** to a fully automated Digital **Damage Recognition** system.

Today

Visual Vehicle
Handover
Inspection

Stage 0



Tomorrow

Fully Automated
**Digital Damage
Recognition**
Systems

Stage 1



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

MANAGING MARKET EXPECTATIONS

In March 2021, ECG initiated a project called the **Digital Vehicle Handover** (DVH), with the objective of making sure that the available digital vehicle handover solutions on the market are interoperable and integrate the results of visual inspections.

Early on, a clear distinction was made between 2 levels of digital handover inspections, namely:

- 1) Digital **Condition Capture**: whereby digital images of a vehicle would be taken at a handover inspection location, and then stored in order to retrospectively verify claimed damages to establish the root cause (pre-existing or not) and eventually allocate liability.
- 2) Digital **Damage Recognition**: whereby integrated Artificial Intelligence would automatically recognize and immediately report on any vehicle exceptions during that handover inspection.

The ECG DVH working group has also looked at the legal challenges.



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

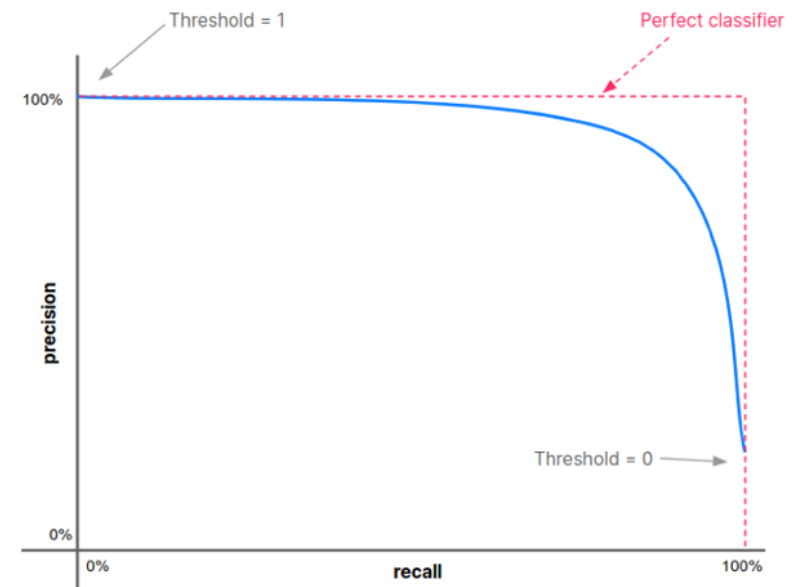
ARTIFICIAL INTELLIGENCE



Artificial Intelligence (AI) is just like a newborn baby: it's a beautiful and intelligent "subject", but it doesn't know anything yet. We need to teach this beautiful and intelligent "subject" to identify, understand and learn "to label" what it sees (vehicle image data sets).

That's exactly how machine learning AI algorithms work; by continuously and accurately "labelling" exceptions in vehicle image data sets, the damage detection will be ever more accurate.

AI is often measured in a "confidence score" out of a 100. AI in this situation needs to be a balance between "false negatives" and "false positives" in order to meet the OEMs or FVL expectations.





C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

UNDERSTANDING INSPECTION & REPORTING REQUIREMENTS

For Digital **Damage Recognition** system with integrated Artificial Intelligence to replace a physical inspector (**Visual Vehicle Inspection**), we need to understand the **3 specific elements** to be “recognized” when performing a new vehicle inspection in the FVL Supply Chain:

- the **body part/area** of the vehicle and related codification (e.g. [left front door](#))
- The **type** of the vehicle exception (e.g. [scratch](#), dent or panel-edge chip)
- the **classification** of the vehicle exception (e.g. [transportation](#), PDI, warranty, other)



Considering that the classification of the vehicle exception is mostly related to a mix of the part/area, type, extent and sometimes the grid (location on body part)

The combination of these 3 elements define a “**Vehicle Exception**” that results in the final description of an inspection report. In case one of these 3 elements is missing, the inspection report will be incomplete.

This is valid for both a visual as well as a digital handover inspection!



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

DISTINCTION BETWEEN DIFFERENT INSPECTION LOCATIONS

OEMs - Manufacturing Plant

End-of-Line
Indoor Environment



1) OEM requirements: at the end-of-line at the plant, no need to provide OEM **classification** of vehicle exception

2) Inspection Conditions: favorable for AI to learn, as the vehicles are clean and dry, not yet covered by protection film

LSPs - Supply Chain

Finished Vehicle Logistics
Outdoor Environment



1) OEM requirements: in the FVL supply chain the LSPs need to report the OEM **classification** of vehicle exception

2) Inspection Conditions: unfavorable for AI to learn, as vehicles are wet, dirty covered mud, ice, snow, protection film



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

HOW WILL ARTIFICIAL INTELLIGENCE GROW?

Vehicle Specifications (Spec Checks)



Incorrect wheel center cap



Presence / Absence - valve cap on front right wheel



Missing Emblem / Badge



Missing Wiper Blade

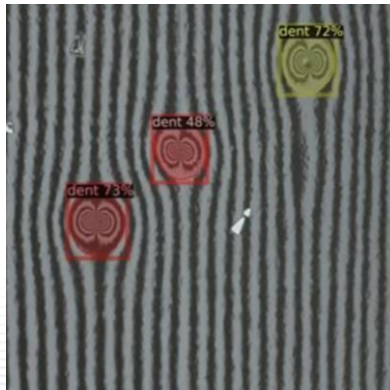
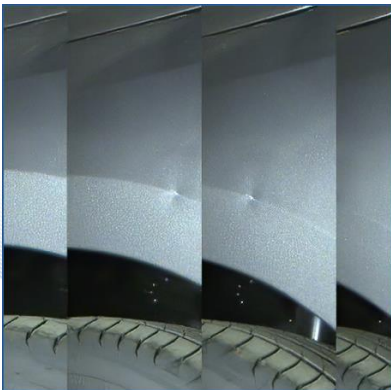


C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

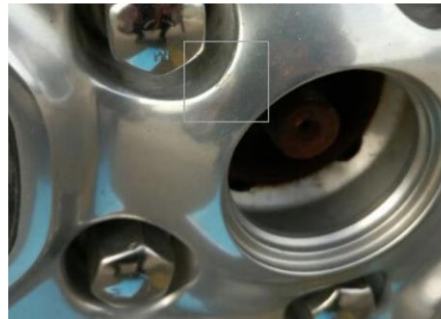
DIGITAL VEHICLE HANDOVER INSPECTIONS

HOW WILL ARTIFICIAL INTELLIGENCE GROW?

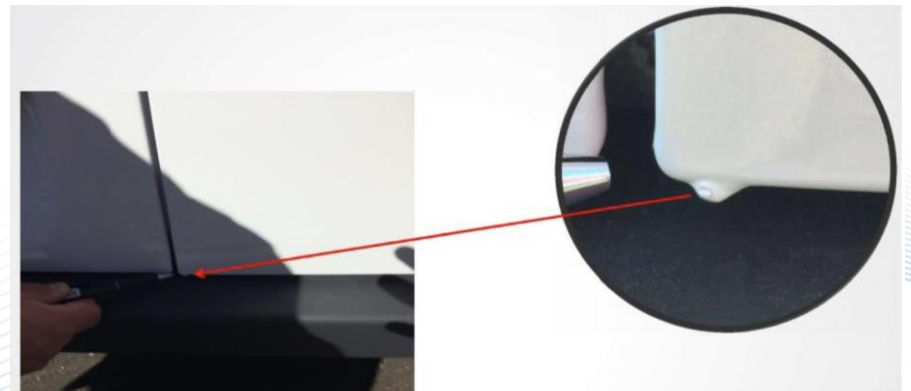
Dent Detection



Other Warranty Defects



Chips located on wheel rim, close to the wheel nuts



Technical paint issues, such as paint runs, overspray, sags, etc



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

HOW WILL ARTIFICIAL INTELLIGENCE GROW?

Repetitive Transportation Damages



Panel-edge chip left front driver's door



Scratches underneath the front bumper



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

ARTIFICIAL INTELLIGENCE

Large Impact Damage



All the Rest



Heavy scratches on front bumper – right and left side



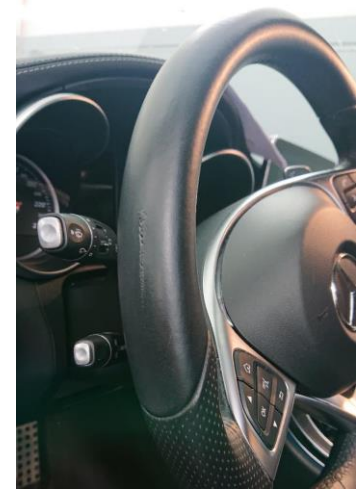
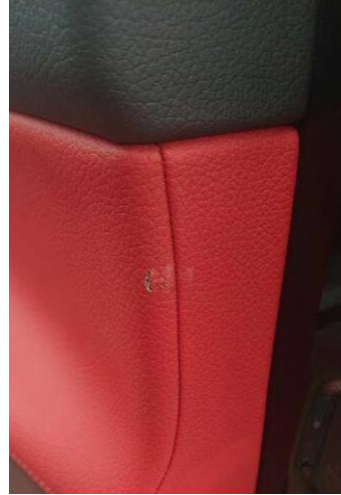


C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

MANAGING MARKET EXPECTATIONS

It would also be important to underline that not all the vehicle exceptions are visible with a digital vehicle handover inspection (*e.g. loose items in the boot, interior parts, driver's side inner sill area*), however a hybrid system of a digital inspection with either an additional or an “ad-hoc” visual inspection would be the right solution for successful and effective **Automotive Quality & Risk Management** as well as fair and transparent **Claims Management** process.



Interior damage – trim panel or dashboard in driver's side cockpit



Inner sill – left front driver's side



Missing loose items in boot



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

MANAGING MARKET EXPECTATIONS

Having well-understood the “limitations” and challenges of the digital vehicle handover inspections, several LSPs and OEMs have decided to go ahead and implement Digital **Damage Recognition** Systems as well as Digital **Condition Capture** Systems either at the manufacturing plant and/or within their FVL Supply Chain in combination with the visual inspection results.

Reaching an acceptable accuracy level of automated **Damage Recognition** is not the only reason why we should collectively embrace and adopt the Digital **Condition Capture** Systems.

Digital **Condition Capture** is also beneficial for both **Automotive Quality and Risk Management** as well as provide a basis for transparent and fair **Claims Management** process.

Knowing exactly where a damage has been caused, your organization will be able to effectively pinpoint and implement the right damage prevention measures to avoid reoccurrence of the same. Also, the claims handling process will be more transparent and fairer, as nobody would argue with a picture that proves whether a damage was pre-existing or not.



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

ARTIFICIAL INTELLIGENCE

OEMs - Manufacturing Plant

End-of-Line
Indoor Environment



Fully automated Digital **Damage Recognition** with integrated AI could replace a physical inspector (**Visual Vehicle Inspection**)

Digital **Damage Recognition** ✓

LSPs - Supply Chain

Finished Vehicle Logistics
Outdoor Environment



Fully automated Digital **Damage Recognition** **cannot** instantly replace a physical inspector (**Visual Vehicle Inspection**)

Digital **Condition Capture** ✓



C.A.R. Consulting Group
Global Marine and Automotive Consultants and Surveyors

DIGITAL VEHICLE HANDOVER INSPECTIONS

CONCLUSION

Digital **Damage Recognition** systems could replace physical inspectors at the manufacturing plant and may already have an equal or higher detection ratio than a visual inspection.

Digital **Condition Capture** solutions, even though they are not yet able to fully replace a physical inspector, would be very beneficial within the FVL Supply Chain in support of the visual inspections. The Digital **Condition Capture** systems could already replace the Visual Vehicle Inspection if both the OEMs and the LSPs jointly agree that a **date and time-stamped image** of the vehicle exception would be an acceptable basis for quality and risk management and for claims handling process.

As an industry, we need to collectively look at the **interoperability** of the digital vehicle inspection solutions and make sure that it integrates not only the different digital systems available on the market, but also the visual inspection results.

We would like to underline the importance that both the OEMs and the LSPs together embrace the Digital Vehicle Handover solutions in order to reach our common target of delivering damage-free vehicles.



C.A.R. Consulting Group

Global Marine and Automotive Consultants and Surveyors

Thank you

for your kind attention!

ECG Conference 2022
Vienna, 14 October 2022



carpodXTM