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Design for machines

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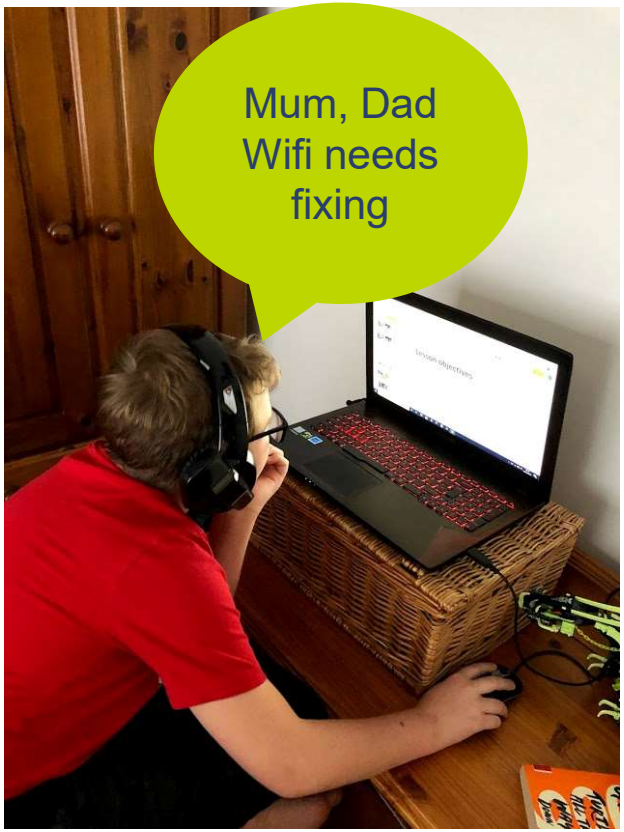
We are stuck on zoom / teams

- Throughout covid there was massive shift to remote working
- The worker was remote from the office in many disciplines be accountants, customer services, and enabling functions
- Good reliable communications enabled this to happen
- A culture shift was noticed

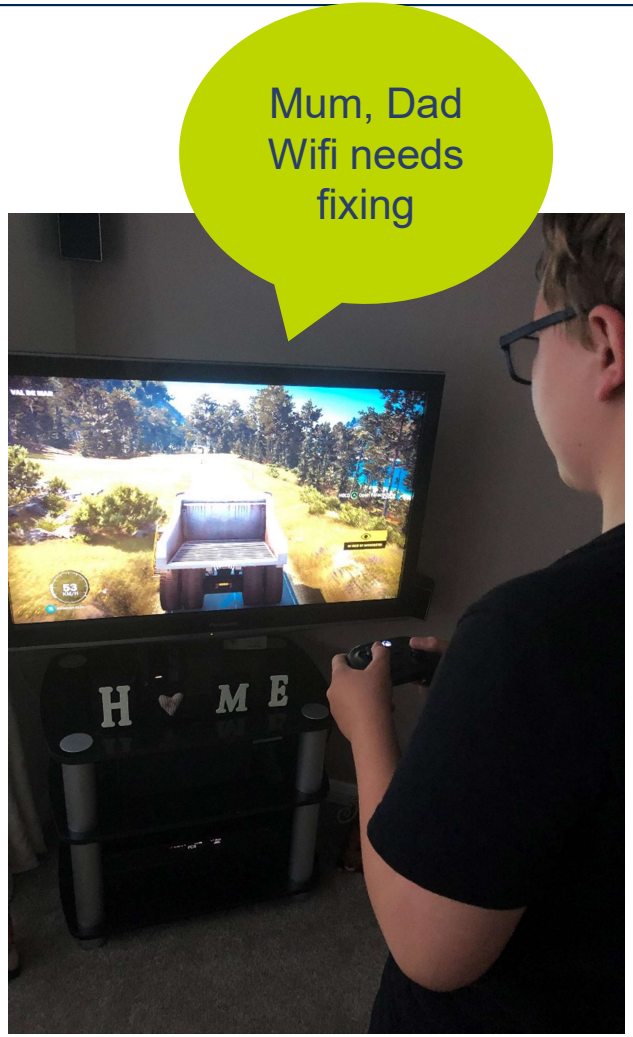
Digital culture

- The young went to school in a different way
- Hardware was required
- Good connectivity is expected
- They learn differently using VR, Mobile devices and high powered laptops



Piloting virtual machines is child play

- The young played in a different way
- Hardware was required
- Good connectivity is expected
- They play differently using VR, Mobile devices and high powered consoles
- The workforce will expect this in the future



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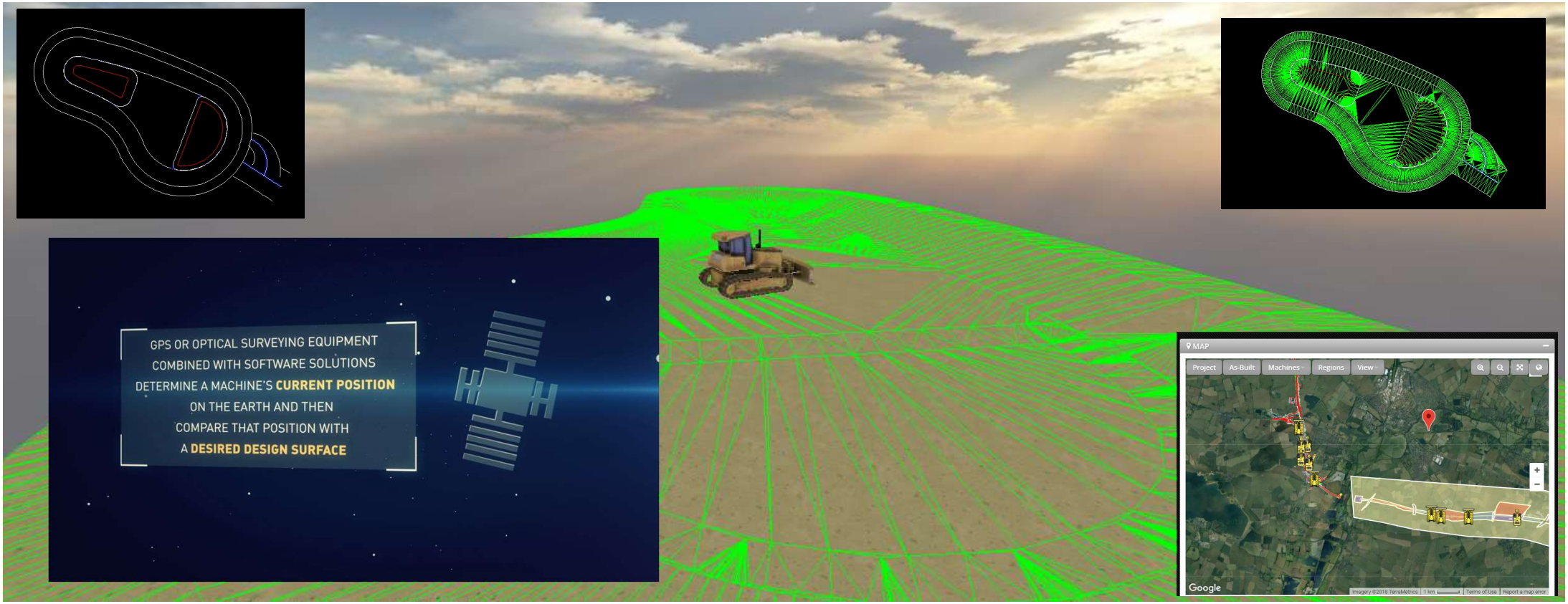
Design for machines not engineers



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Remote connection into 3D Machine Control

Connection over Tablet or PC is a normal way of working

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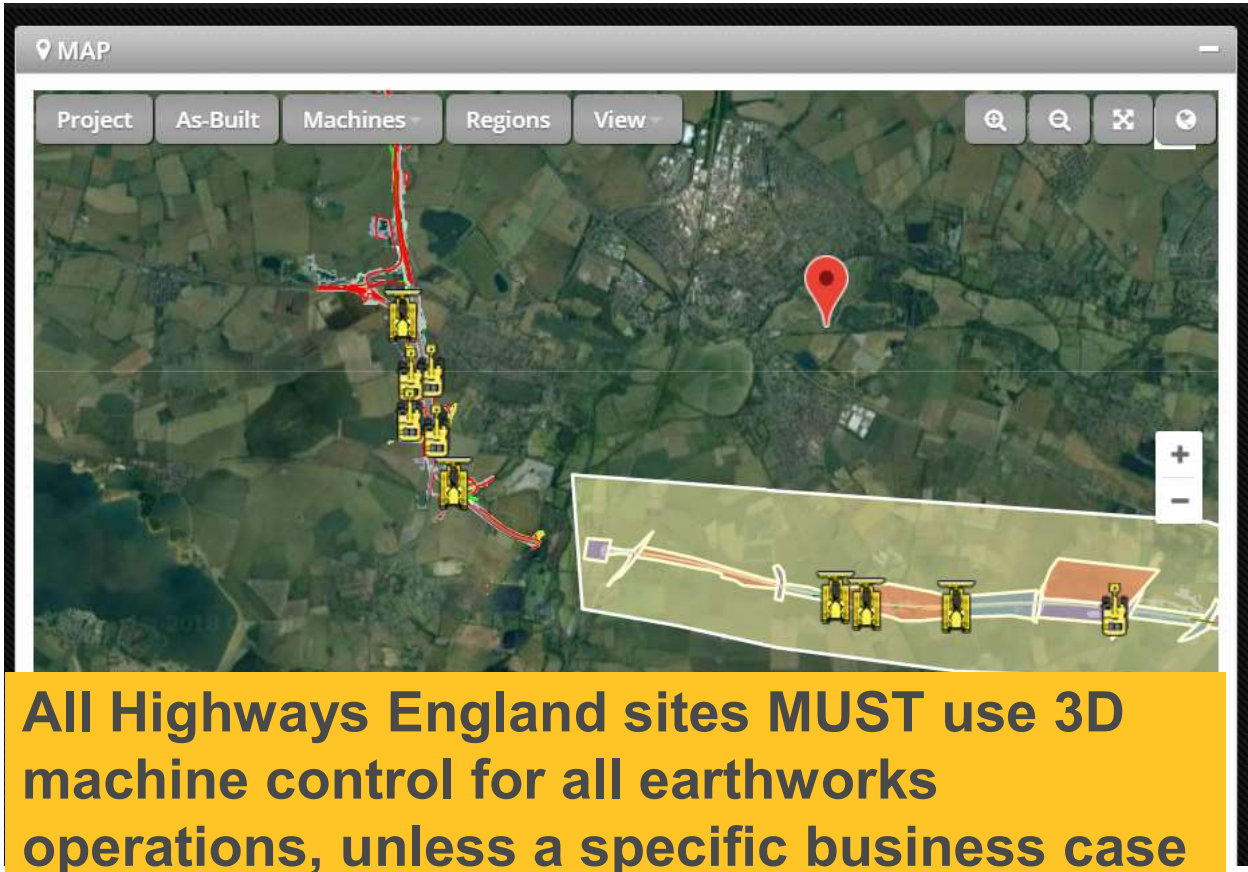
3DMC Design For Machines will

- Reducing people plant interface
- Increasing response times for technical queries between the operator and engineer
- Building on existing 3DMC efficiencies
- Enable Remote pilot machines- Demo in November 1st- 12th at CAT-finning



All Highways England sites MUST use 3D machine control for all earthworks operations, unless a specific business case is provided.

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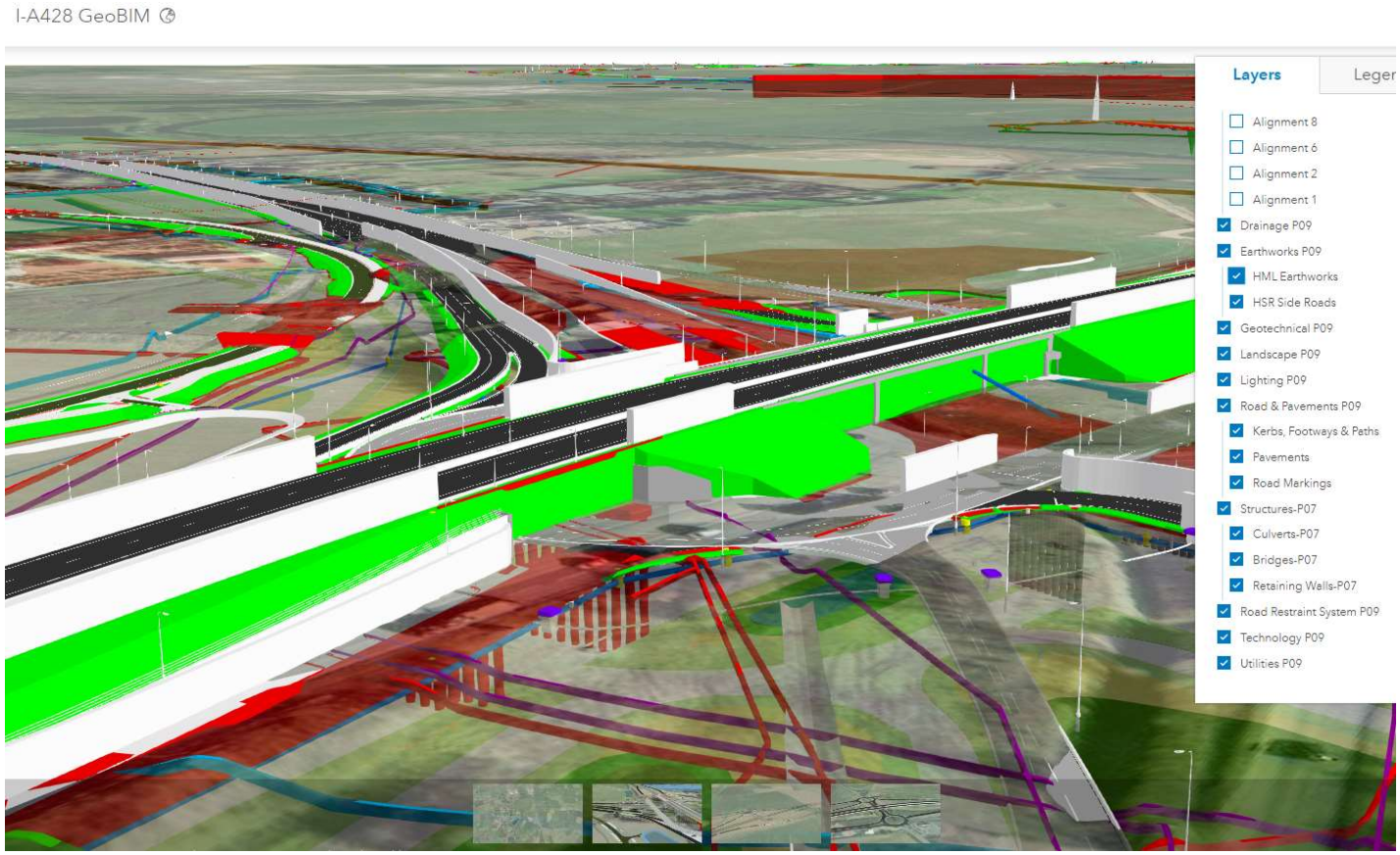
Humans require lots of data

Mass data in BIM and Geobim

DEMO

Mass data is suitable for the humans however currently machines cannot handle complex data



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Reduce People Plant Interface further by design

Appealing to the eye for a human but fragmented to a machine.

Fragmented models mean that site staff start to look at the problem in the cab of the machine or on site. Increasing People Plant Interface

Linework for machines should be continuous.

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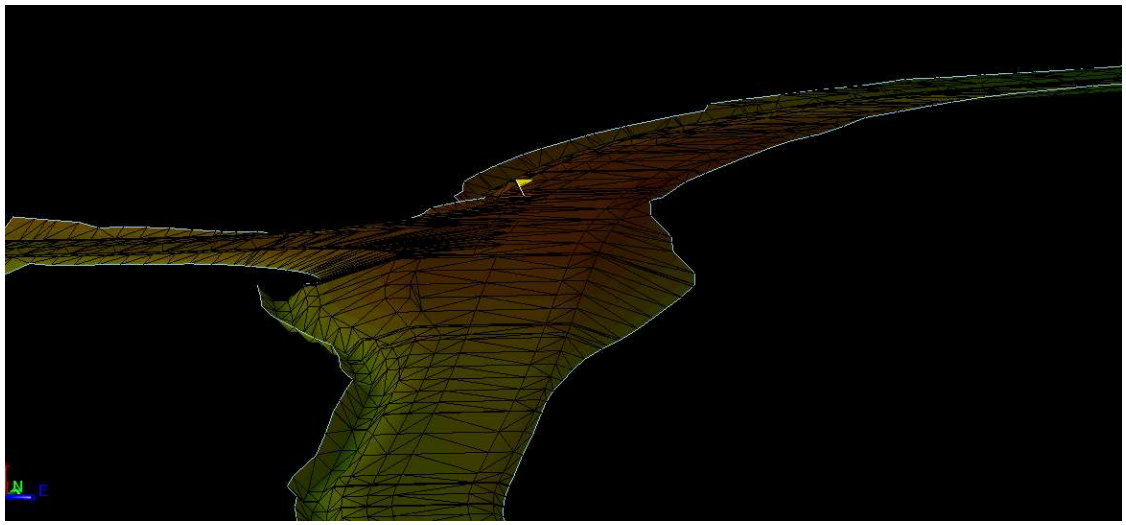
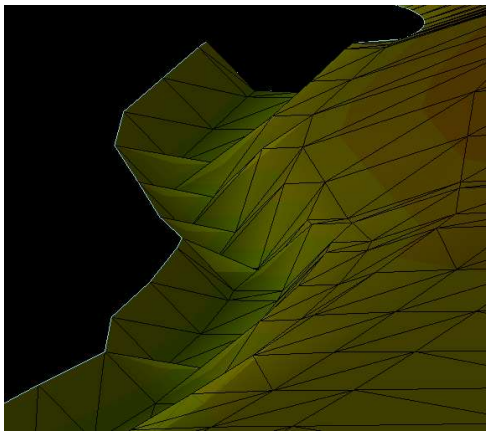
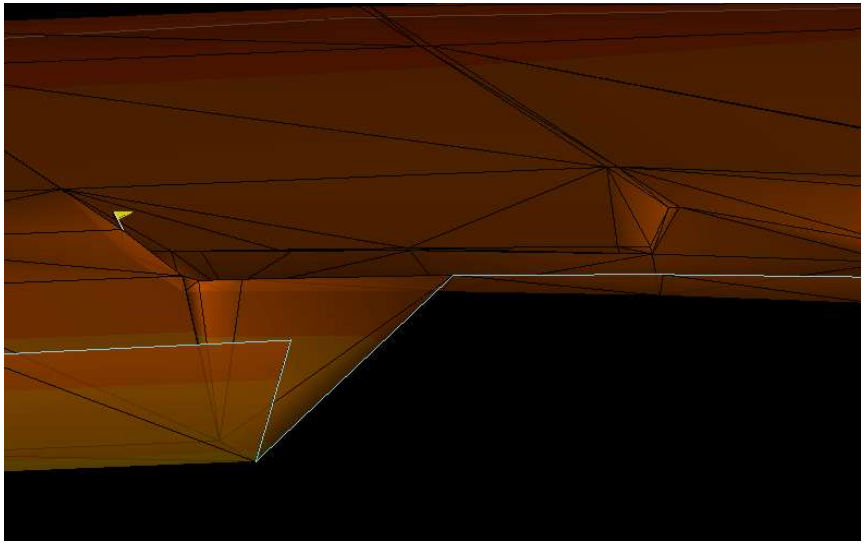
Surfaces are essential for 3DMC



Unfinished surfaces mean that site staff start to look at the problem in the cab of the machine or on site.
Increasing People Plant Interface



Appealing to the eye for a human but not smooth to a machine.



Surfaces for machines should be continuous.

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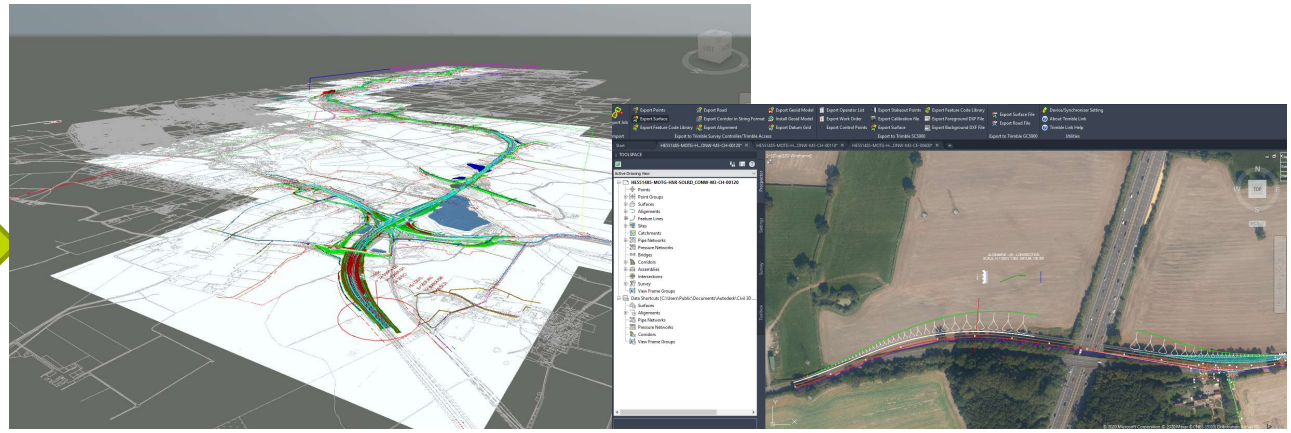
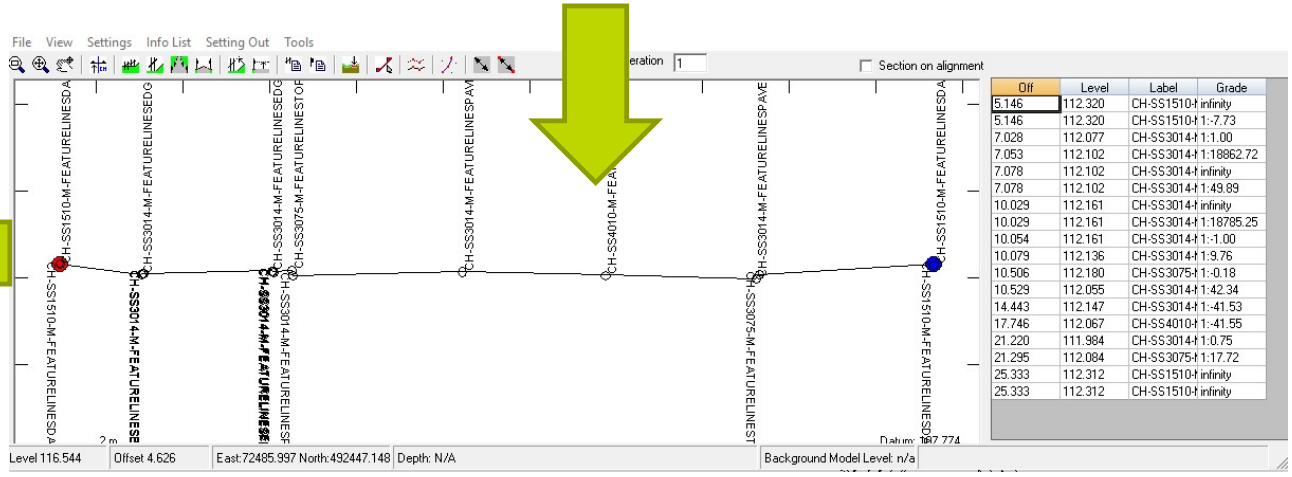
Office v site computing power





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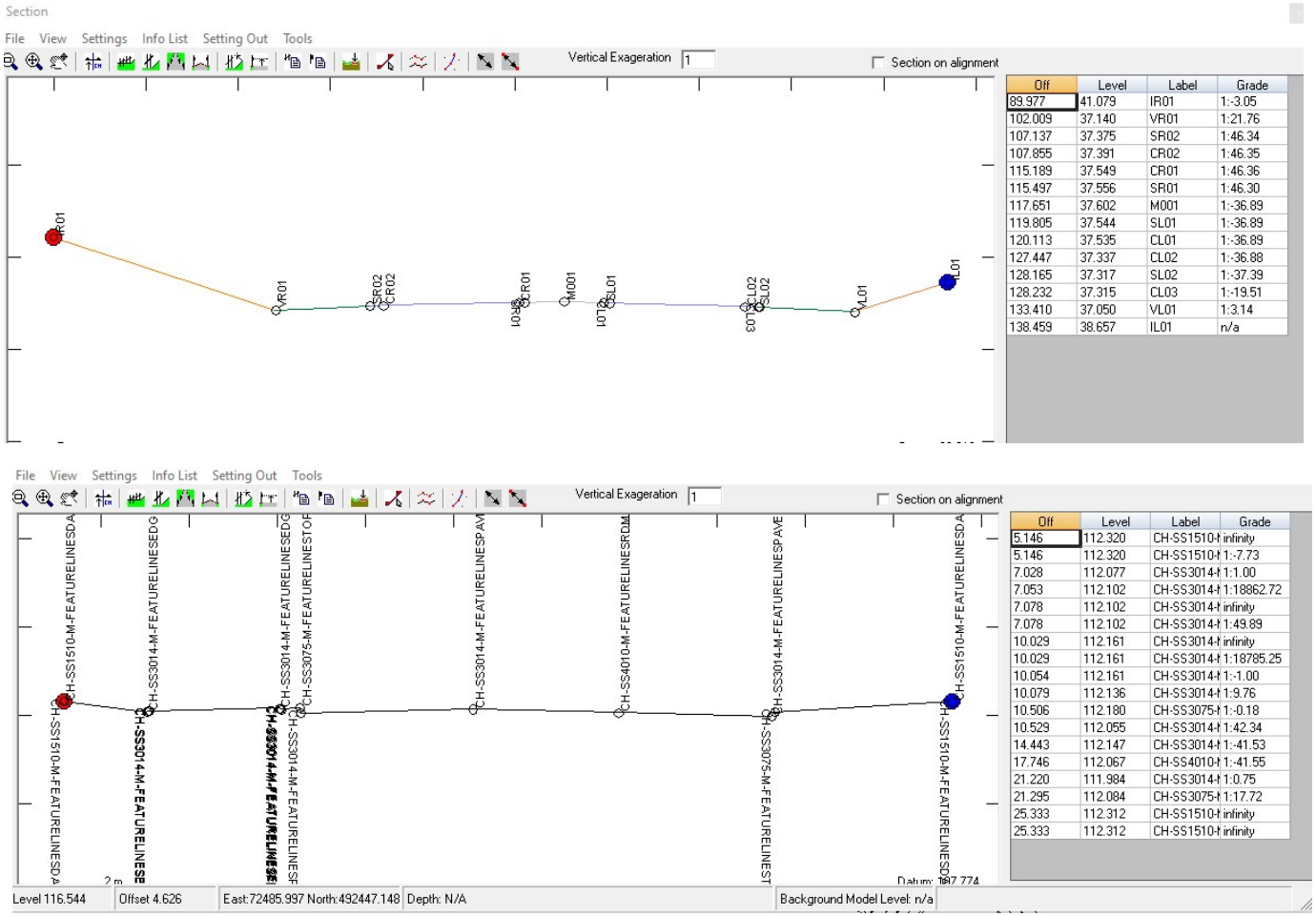
Simple data v complex data

The machine only needs this for the task

A human wants more for multiple tasks



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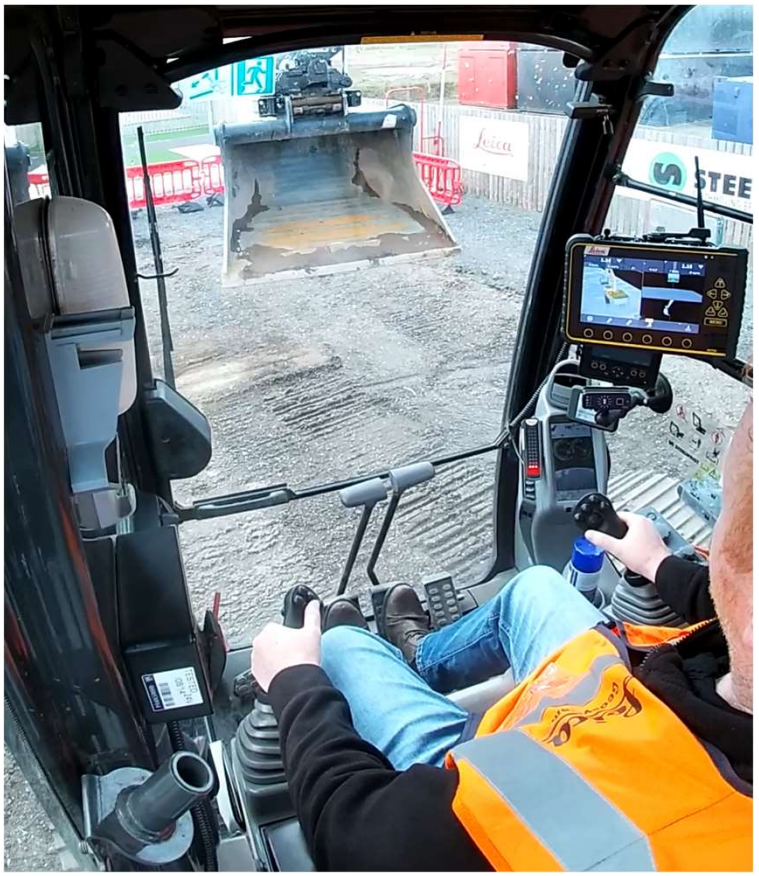
Avoidance zones

Digitally made avoidance zones **if not** in the correct language or file type will be ignored.

Design for machines need to be specified by the industry and then referenced in safety requirements, when using this type of equipment.



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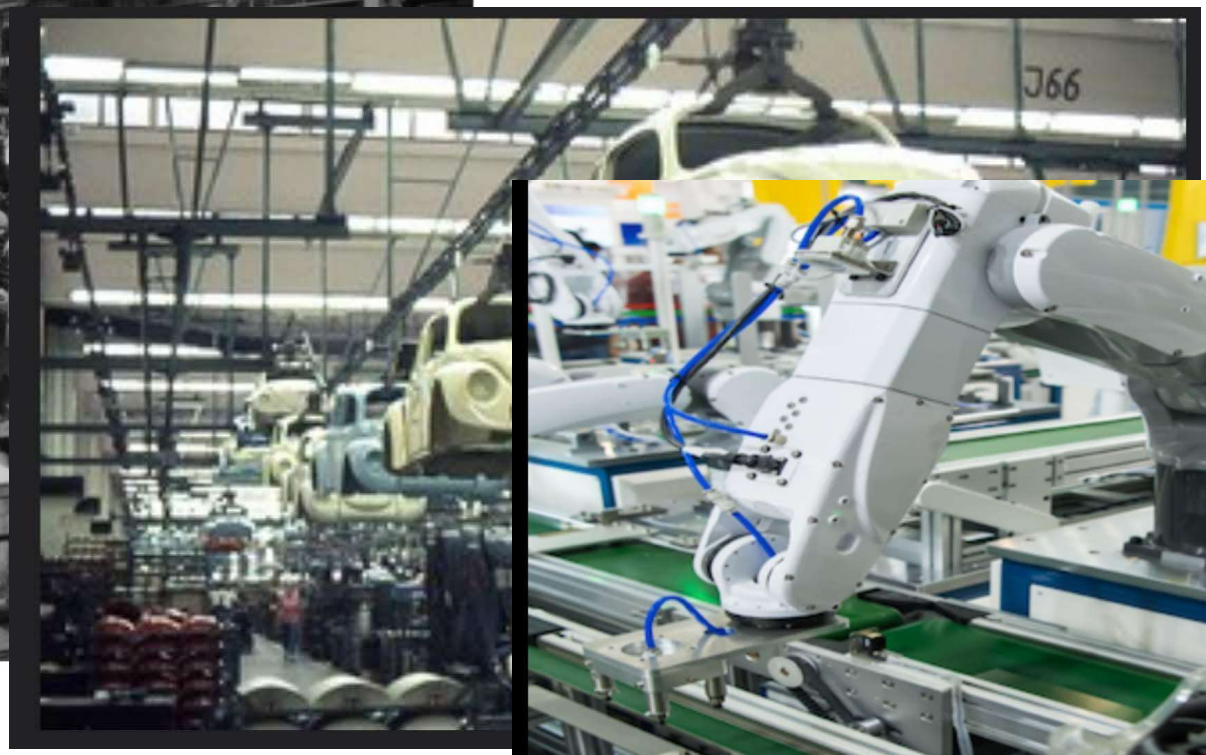
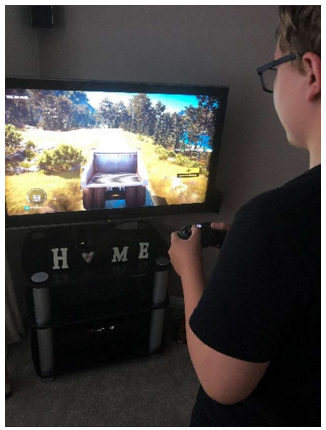
A changing workforce



Internet

Beyond child play



Encourage

Scout for talent and train

- Schools
- Armed forces
- Prisons
- Disabled communities
- Retired workers
- Operate Skills Hubs

Naturally inclusive

- Flexible working
- Short travel to the virtual site
- Easier access
- Shared drivers

- Productivity study on AccuGrade December 2006 at the Malaga Demonstration and Learning Centre Spain.

		Conventional Way	New Way	Productivity Gain
	Passes	Earthmoving 259 Sub Fine Grading 214 Base course 156 Total 632	Earthmoving 200 Sub Fine Grading 60 Base course 46 Total 306	+ 30 % + 257 % + 239 % + 107 %
		210 l	136 l	35% saved
		Earthmoving 234 Base course 74 Total 308 Earthmoving 31 Base course 9 Total 40	Earthmoving 176 Base course 69 Total 245 Earthmoving 23 Base course 8 Total 31	+ 32 % + 7 % + 26 % + 29 %
		231 l	123 l	47% saved
	Passes	Base course 62	Base course 17	+ 265 %
		22 l	7 l	68% saved

		Conventional Way	New Way AccuGrade	Productivity Gain
Staking		07:31	00:54	6:37 hours saved
Bulk Earthmoving	D6N 330D	04:40 02:23	04:18 01:53	+ 9 % + 27 %
Subgrade grading	D6N 330D	03:48 02:56	01:28 02:43	+ 159 % + 8 %
Base Course grading	D6N	02:24	00:53	+ 172 %
Base course fine grading	140H	01:49	00.32	+ 241%
Total		24:32	11:50	+ 101%

- 3DMC has been providing an efficient method of working for many years.
- Remote piloted machines will have this already built in.

Summary

- 3D Machine Control is here to stay
- Remote piloted machines are coming (Future robots)
- We must design for machines not just Engineers
- Machine avoidance zones need good data
- There is no design specification for this way of working (Design For Machines)
- We have removed People from around machines with 3DMC and now introducing a different set of people around the machines, because of a lack of design specification

Questions