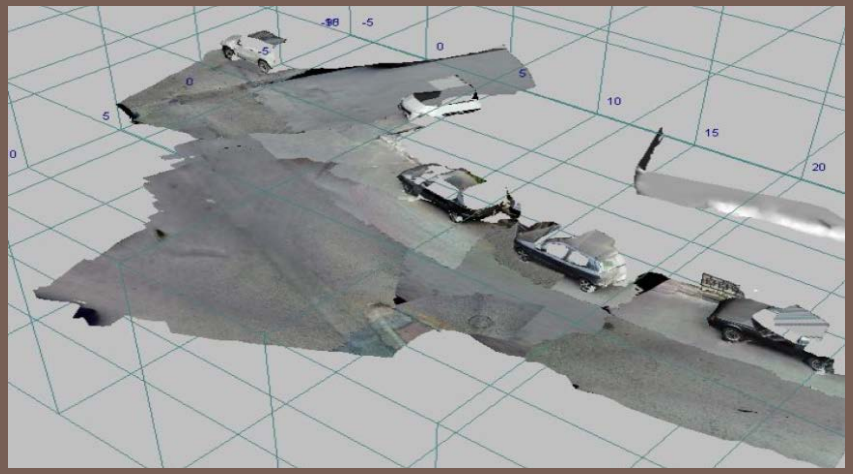

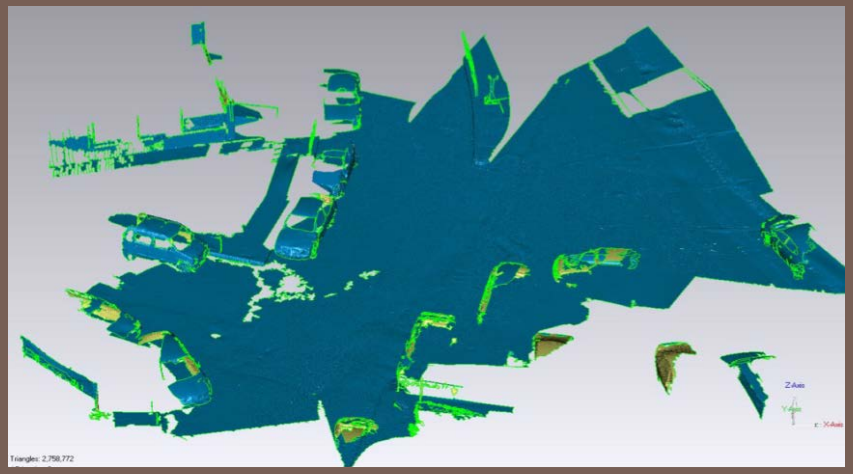

ROAD SAFETY IMPROVEMENTS IN JUNCTIONS USING 3D LASER SCANNING

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5th Panhellenic Road Safety Conference
Volos, October 2012

Outline

- Background
- Motivation / Objective
- Methodology
- Application setup
- Results
- Conclusions/discussion

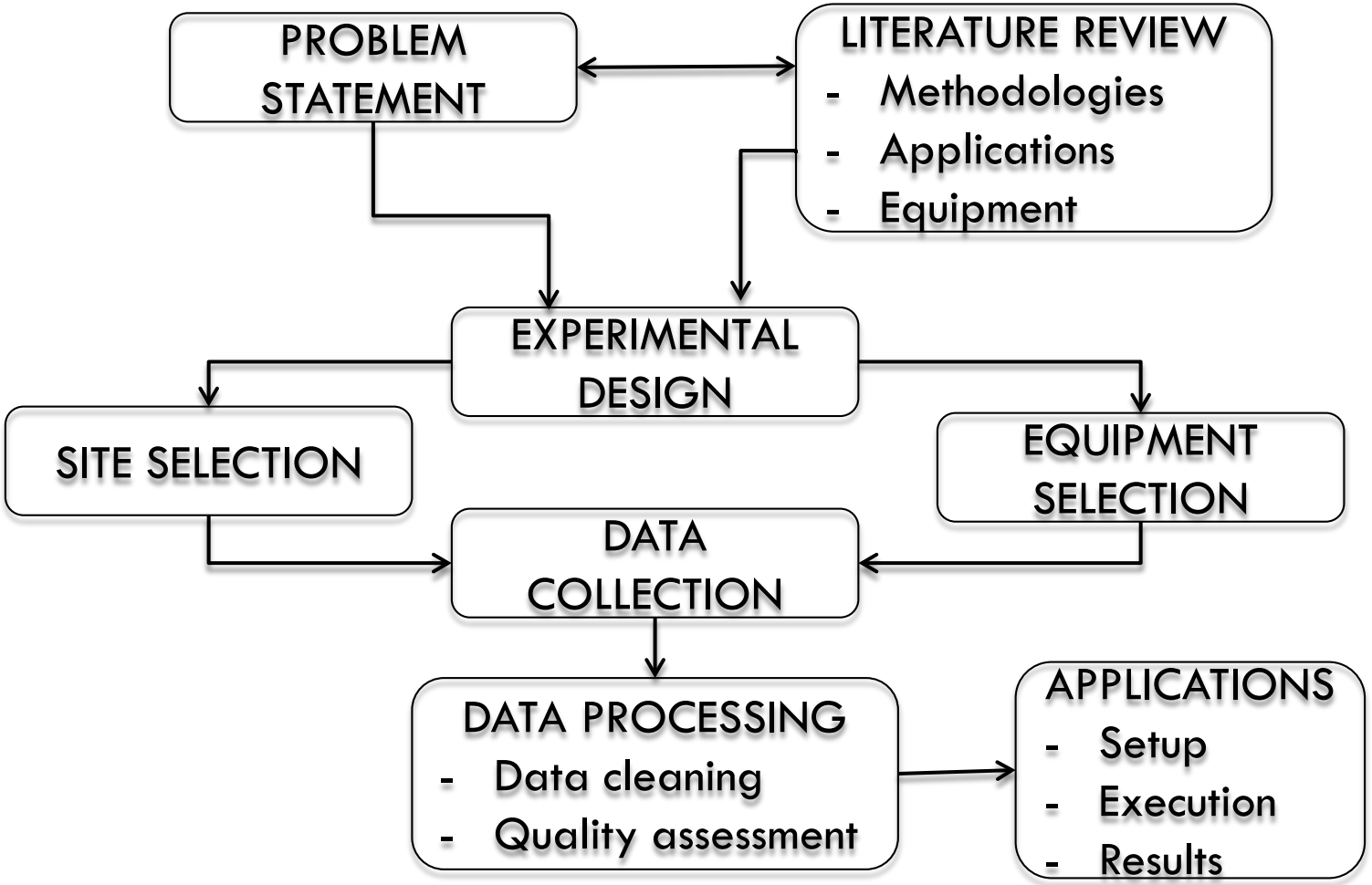
Background

- Human factors play an increasingly more central role in highway design
- Increase in the fidelity with which the road environment needs to be known
- The importance of true and precise 3D road geometry becomes very relevant in this context
- Information extracted by 3D laser scanning technology → departure from traditional 2D plans into fully 3D road design and construction

Motivation / Objective

- 3D laser scanning is proposed as a tool to support the evaluation of the effectiveness of road safety measures at intersections
  - obtaining more detailed representations
  - ability to evaluate combinations of measures in conjunction
  - 3D laser scanning results in a full 3D model
- Demonstrate a practical example of implementing terrestrial laser scanning and imaging total station for road safety analysis

Methodology overview



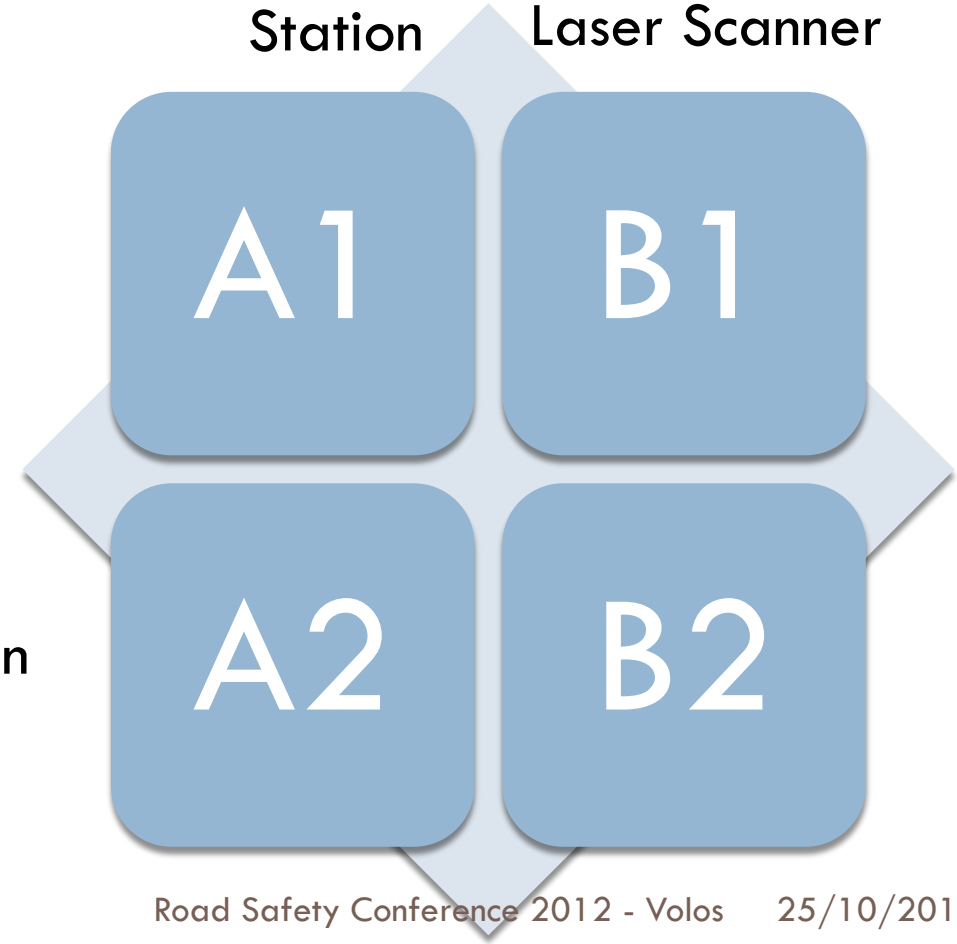
Experimental design

A. Total Station

B. Terrestrial Laser Scanner

1. Urban setting

2. Suburban setting



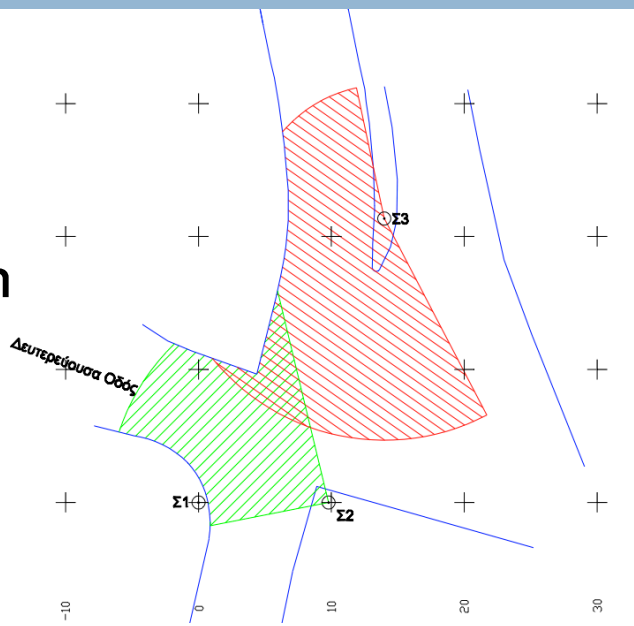
Equipment selection

- Terrestrial laser scanner: Leica Scanstation 2
  - measurement range of 5-350m and point accuracy of 6mm
  - 50,000 points/sec

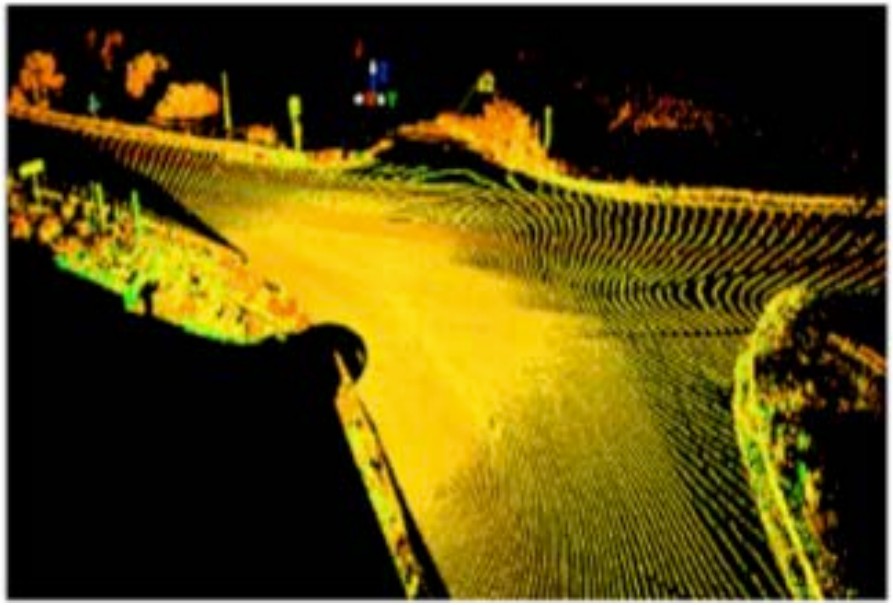
- Imaging total station: Topcon IS-203
  - Range up to 2000m
  - ±(2 mm + 2 ppm x D)
  - Scanning 20 points/sec
  - 2 digital cameras

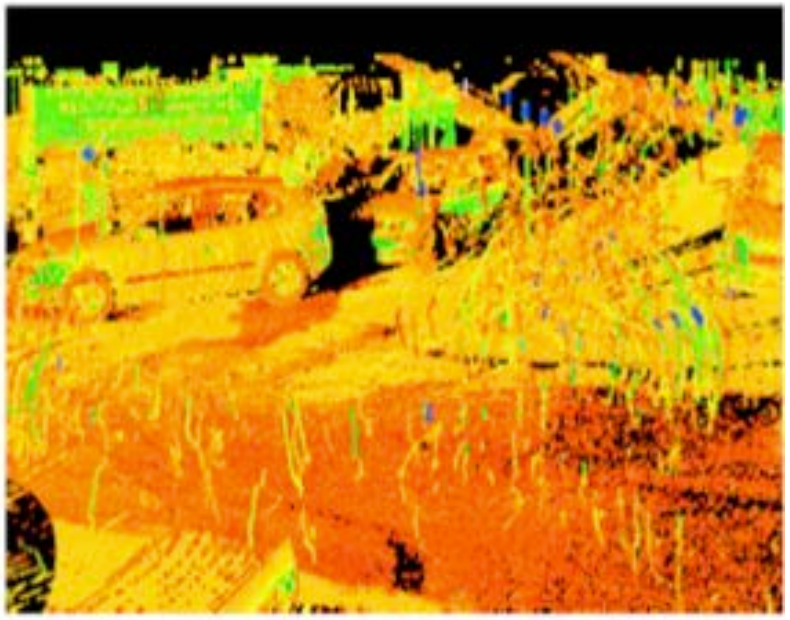
Main processing steps

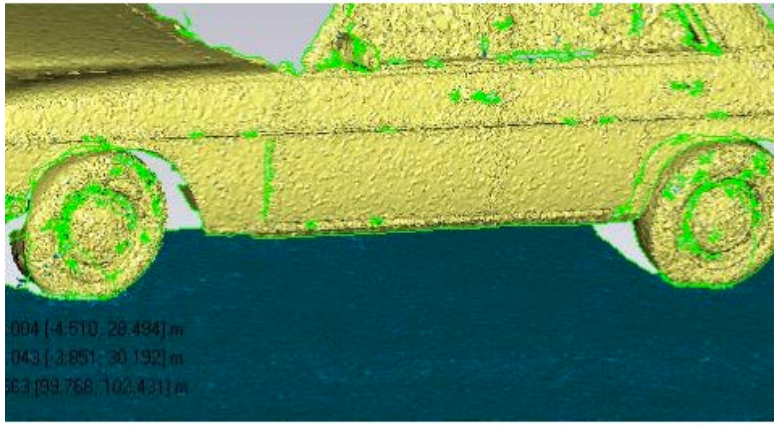
- Field data collection
  - Surveying measurements
  - Scanner/point cloud data acquisition
  - Image data acquisition
- Data registration
- Data processing and analysis
  - Geometric alignment and georeferencing
  - Noise reduction
  - Creation of ortho-images
  - Creation of 3D models



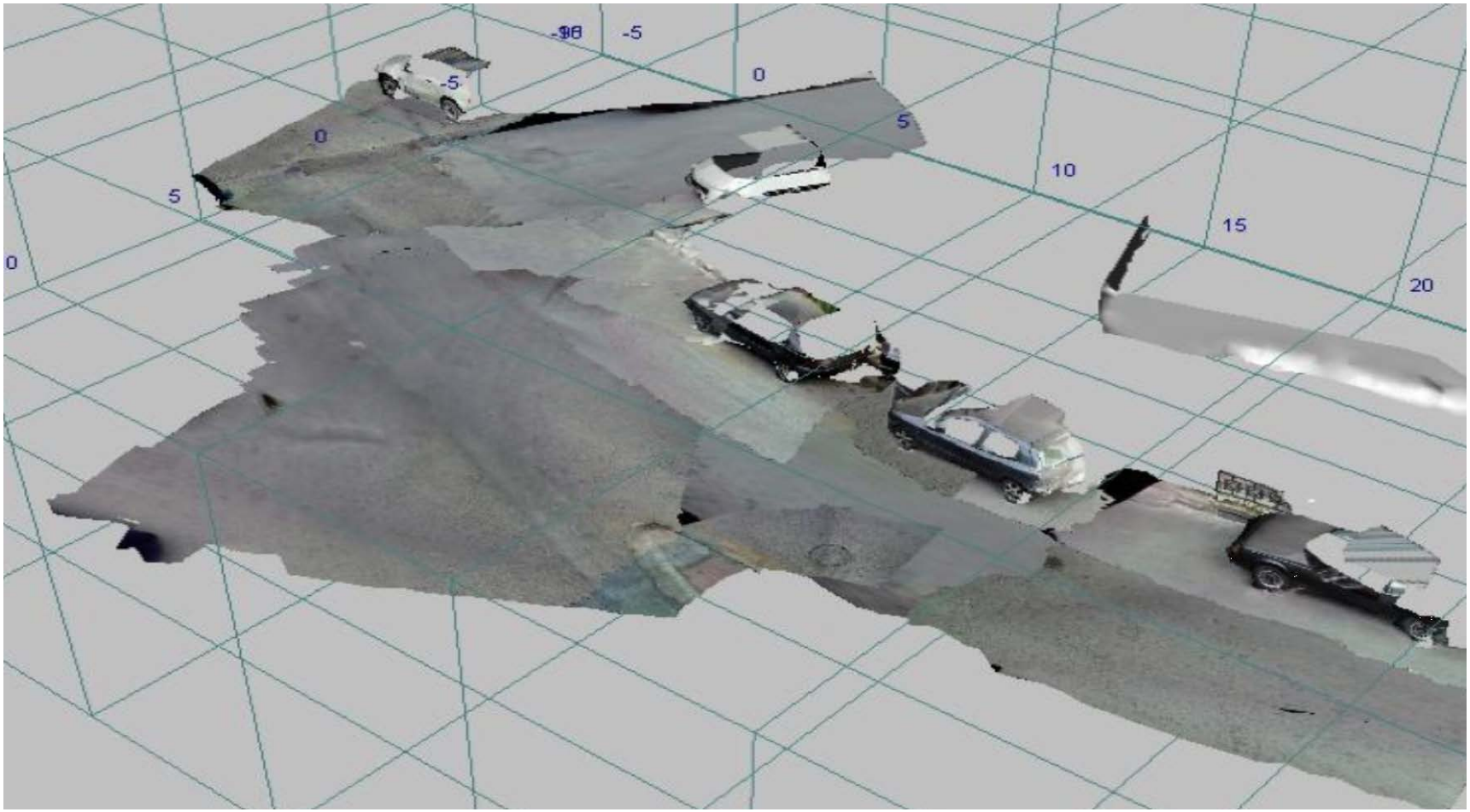
Data processing and analysis
Scanner data







Examples of the data products



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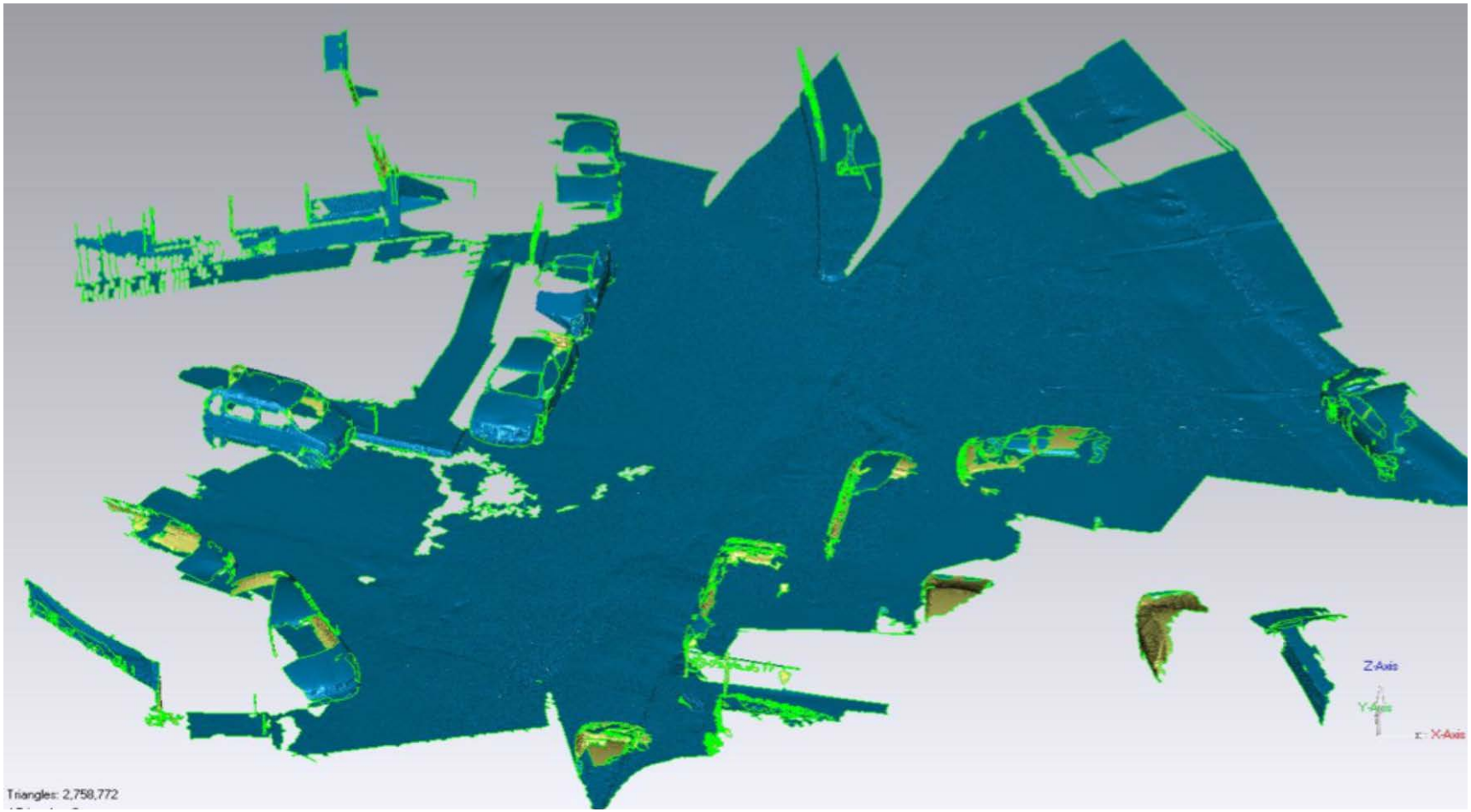
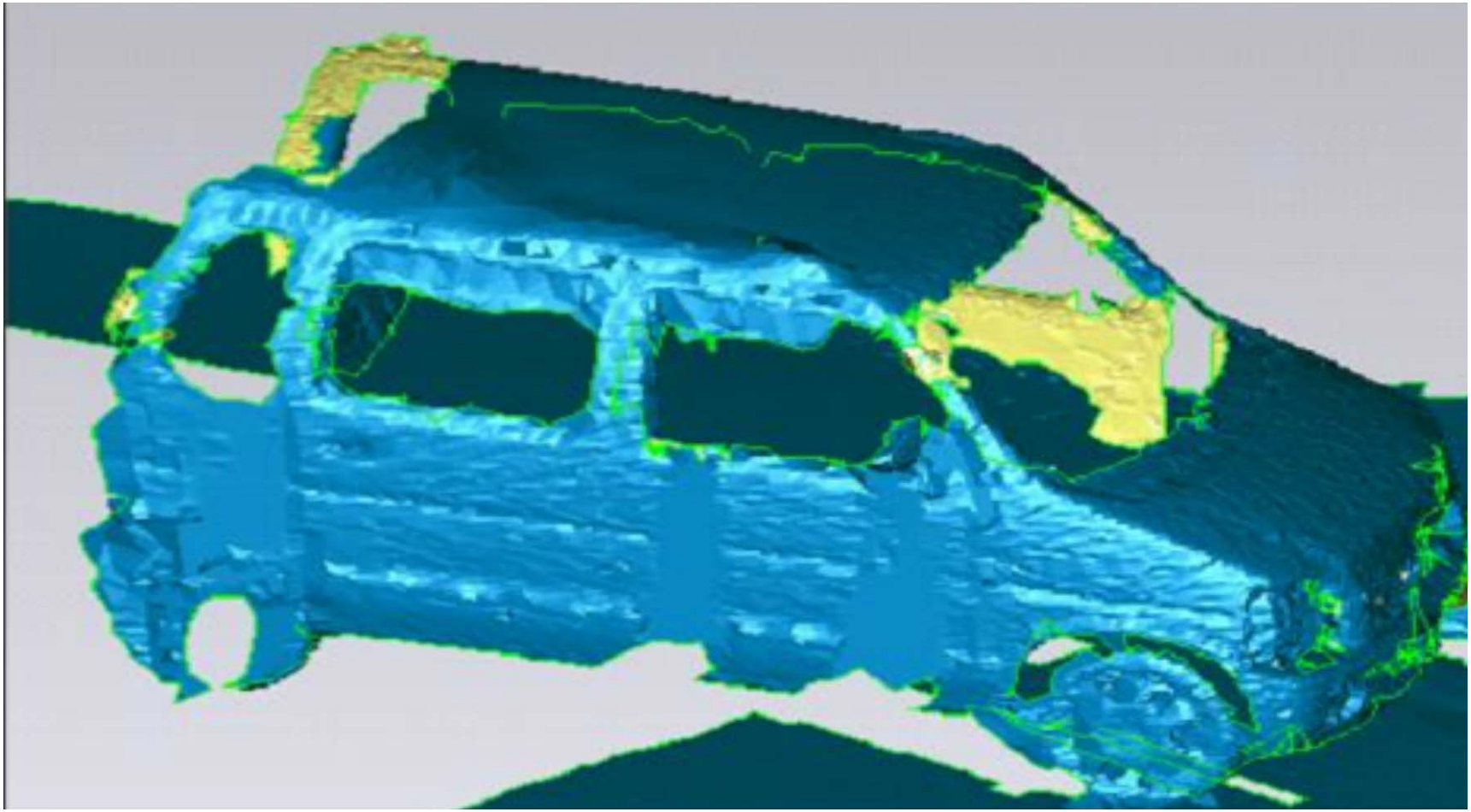
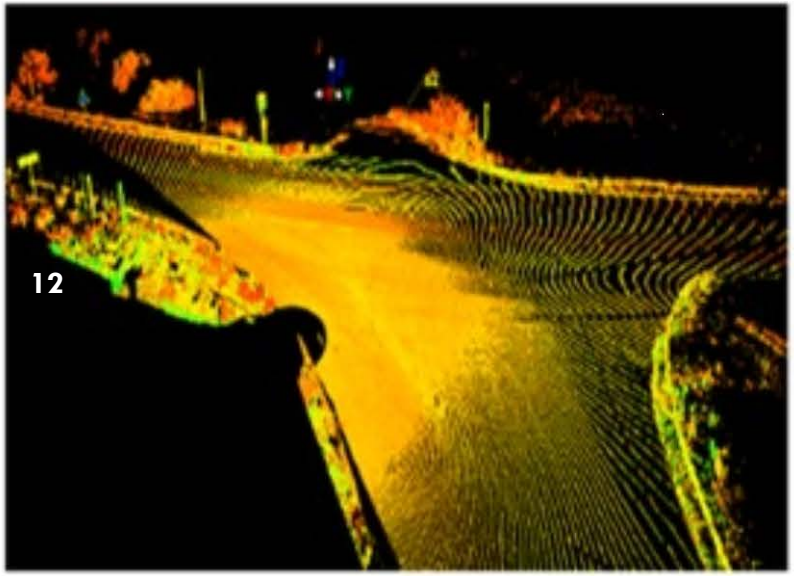
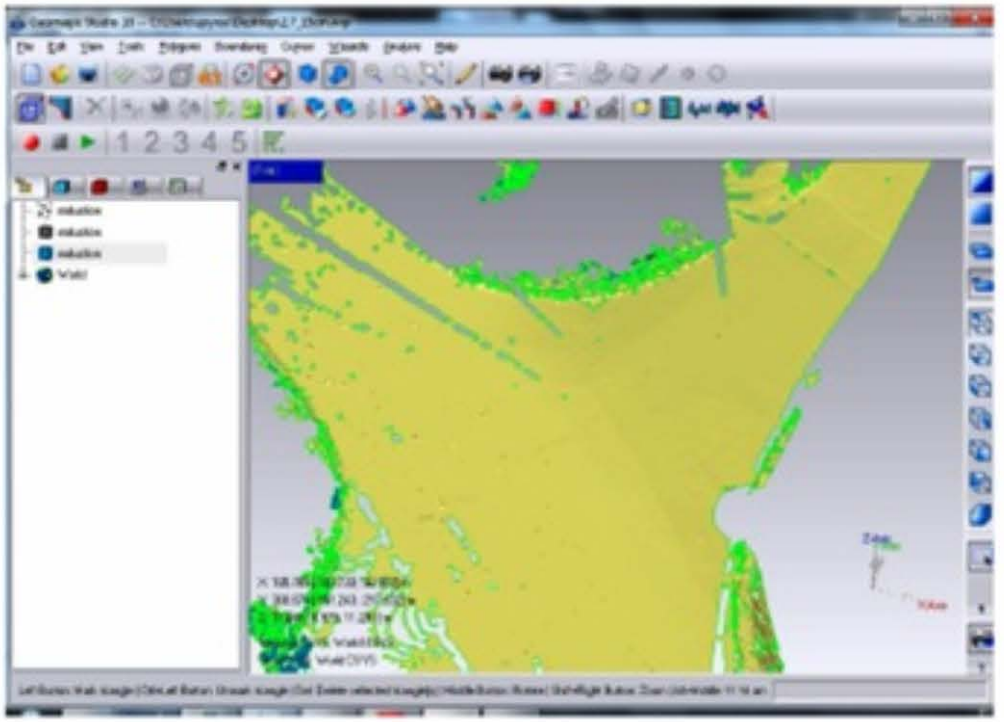


Detail of the 3D model

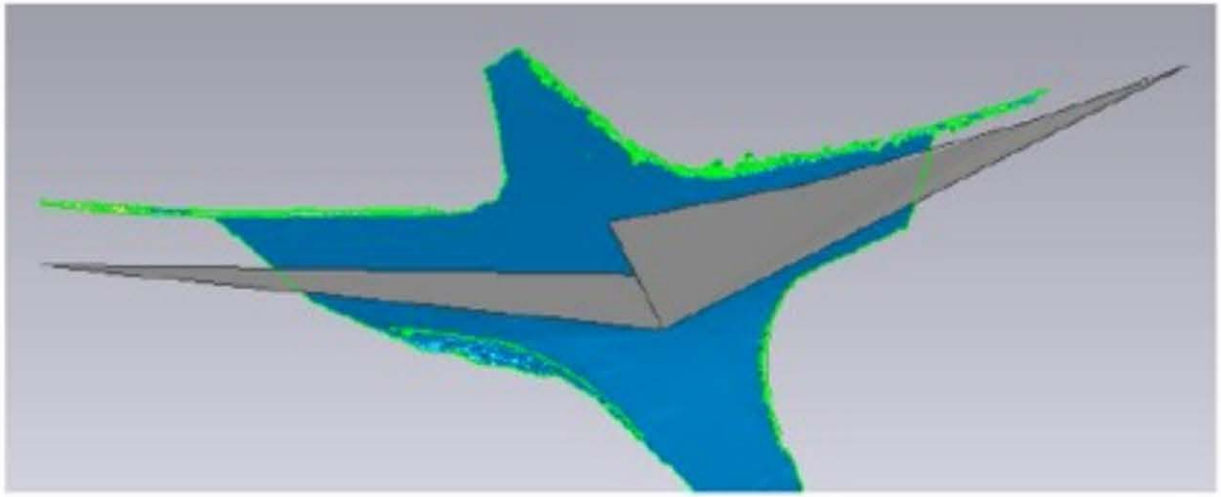




(a)



(b)



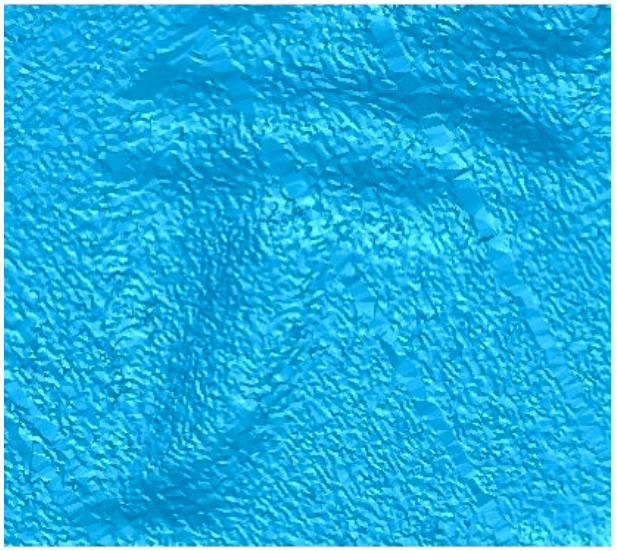
(c)

Conclusion

- 3D laser scanning is a powerful tool, which can have several applications in highway engineering and design
- The ability to construct a highly detailed model of the infrastructure at its actual current state is valuable as it can be used to monitor its condition
  - Particularly relevant in specialized structures, such as bridges and tunnels
  - Monitoring of the evolution of the physical structures (e.g. barriers) and plants
  - Pavement condition monitoring

Discussion

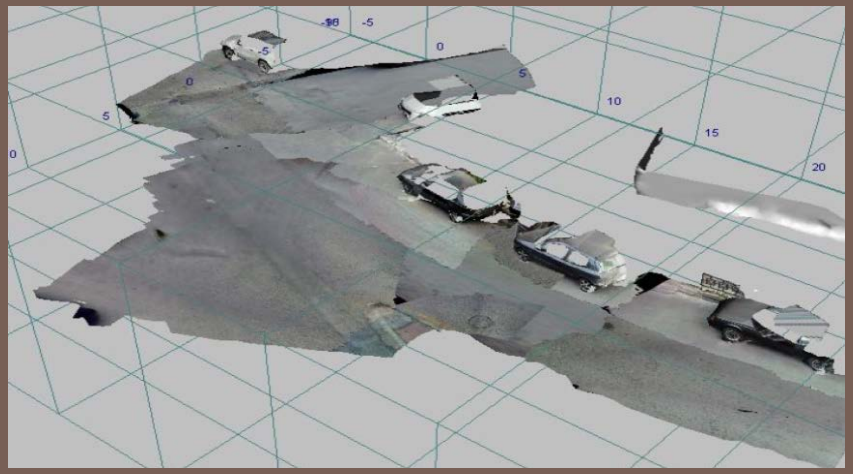
- 3D laser scanning can develop accurate 3D models with many possible applications, e.g.
  - Infrastructure condition monitoring
    - Specialized structures (bridges, tunnels, …)
    - Pavement condition
    - Safety equipment (e.g. barriers)
  - Asset management
  - Contract management
  - Assessment of road safety measures
  - Incident clearance and investigation

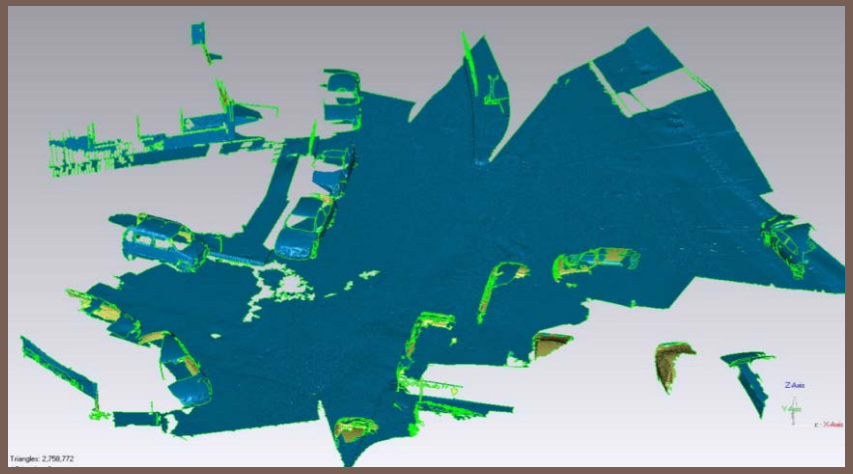


- Mobile scanning is quickly becoming accessible
  - Which are the use cases in which the static equipment is still relevant?

Discussion (cont'd)

- In-depth accident investigation, assisting not only the detailed identification of accident causes but also the design of the appropriate countermeasures
- Combined effect of geometric and traffic control treatments at junctions
  - Combination of two cost-effective treatments
- Drive through the new layout (using available 3D techniques)
  - Allowing human factor assessments of the new layout prior to its construction





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