

LIDAR - THE ULTIMATE GENERAL PURPOSE TOOL FOR TRACK INSPECTION.



T. Lee & A. Eriksen
Zetica Rail, Oxford, UK

IHHA 2025

13TH INTERNATIONAL HEAVY HAUL
ASSOCIATION CONFERENCE 2025

November 17-21, 2025 | The Broadmoor, Colorado Springs, CO, USA

Introduction

This poster shows how Light Detection and Ranging (LiDAR), much like a Swiss Army knife, serves as a versatile tool for a wide range of mapping and inspection tasks across railroad departments. Its applications include mapping right-of-way (ROW) assets with near-survey-grade accuracy, assessing structure and vehicle clearances, measuring ballast volumes and track geometry, and providing local data for climate studies. Other uses include vegetation mapping, analysing drainage and the topography of cuttings and embankments, and run-on-run comparisons to detect subtle changes such as slope creep or maintenance activity. Selected examples are presented here.

Ballast volume assessment

Point cloud data is analysed to evaluate ballast volume levels in relation to the design template. Figure 1 presents an example where computed ballast levels are overlaid onto the point cloud. Warmer colours indicate areas with excess ballast, while cooler colours highlight areas of deficiency. The inset provides a cross-sectional view with the design profile template superimposed. This analysis helps identify structural or safety issues and supports efficient ballast resource management.

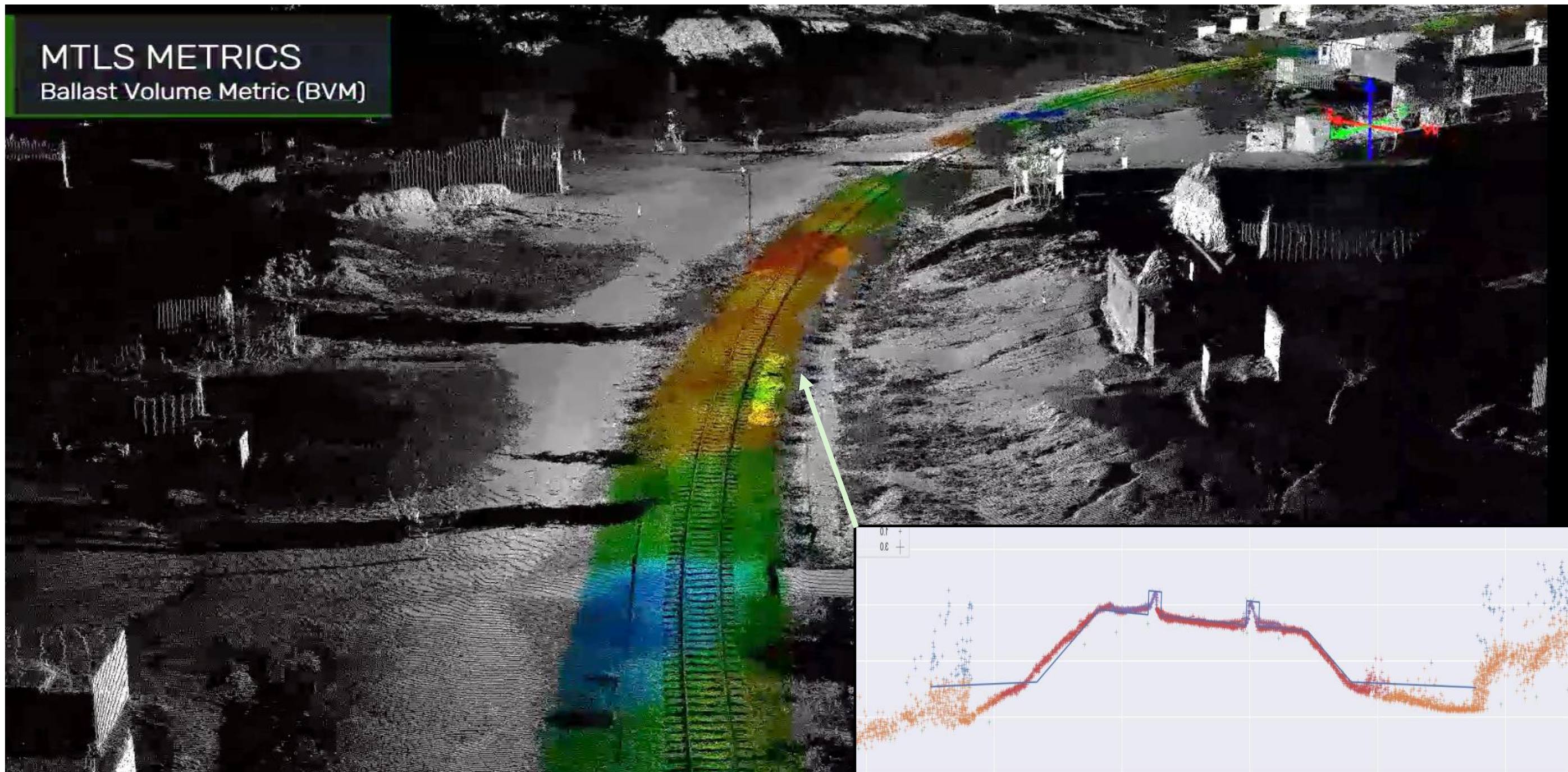


Figure 1. Determining ballast volume excess or deficit from a point cloud.

Right of way analysis

Classified point clouds are automatically analysed to assess the condition and characteristics of the right-of-way. Figure 2 illustrates a passing clearance analysis conducted within a tunnel. With range accuracy better than 1 mm, LiDAR is well-suited for safety-critical assessments of this nature. The figure also demonstrates the automated extraction of an embankment's shoulder and toe, along with associated vegetation encroachment analysis. This information supports data-driven vegetation management planning and risk mitigation.

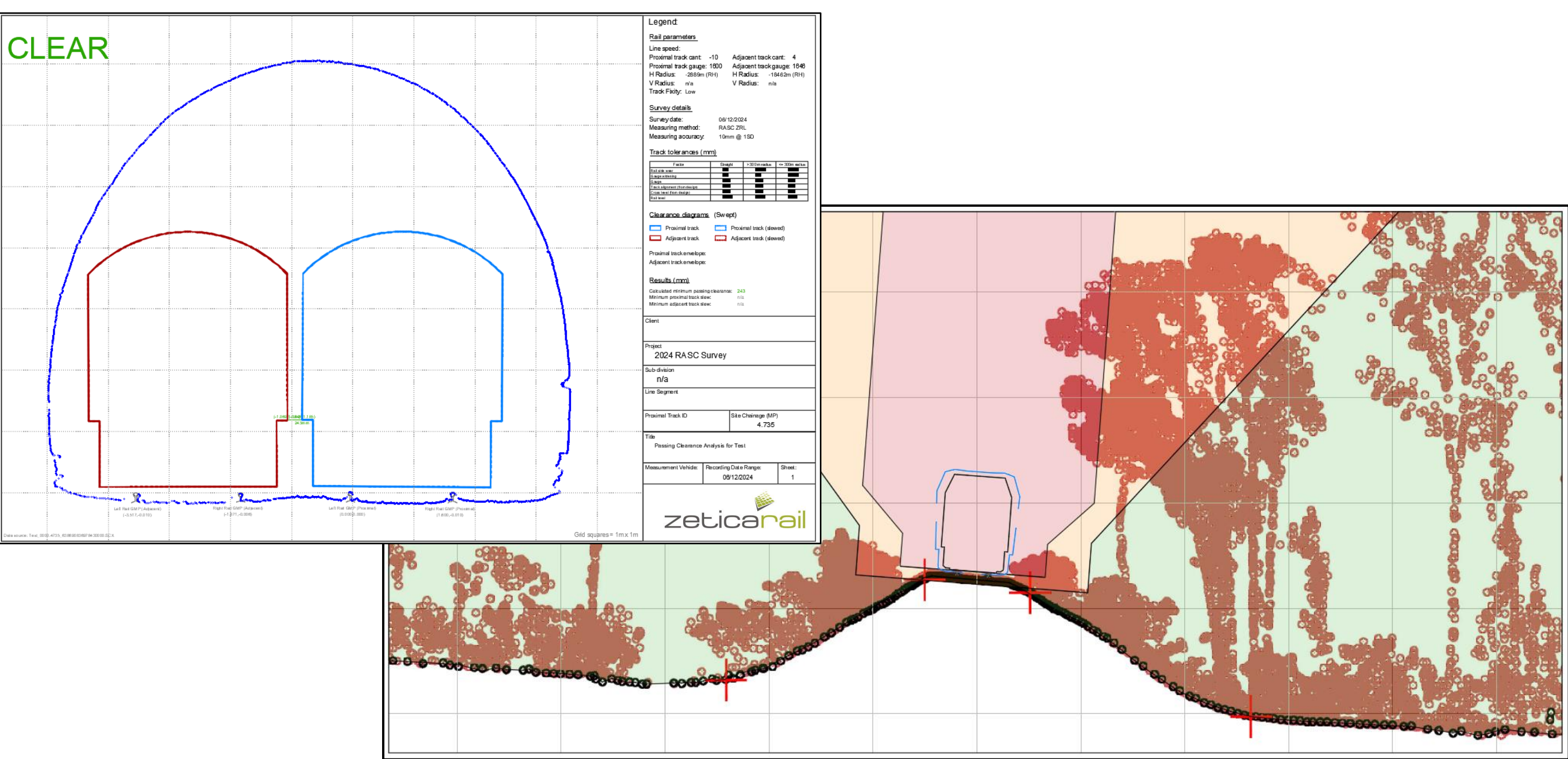


Figure 2. Point cloud cross section with clearance assessment (top left) and vegetation and embankment assessment (bottom right).

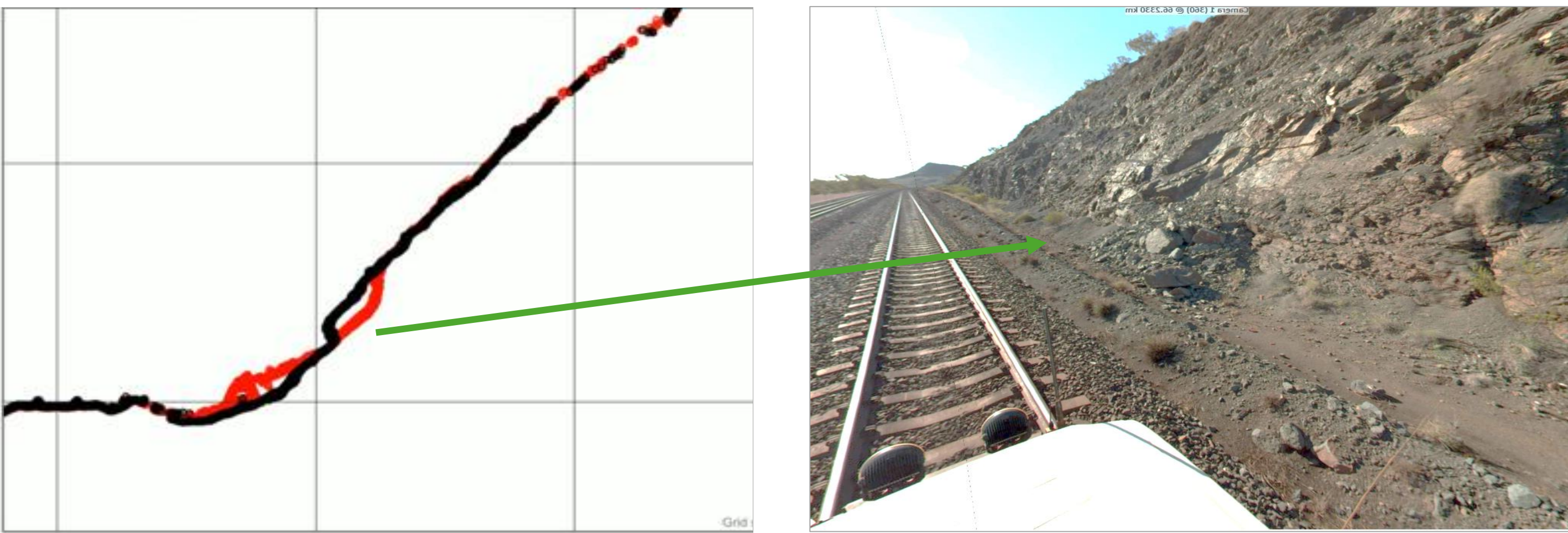


Figure 3. Comparison of LiDAR cross sections between two surveys (red and black cross sections - left) with accompanying photo (right).

When repeat surveys are available, LiDAR datasets can be precisely aligned to detect changes over time. Figure 3 shows a rockfall identified through the comparison of two survey passes. Such changes are automatically detected and classified to determine their nature—for example, distinguishing between vegetation growth and a rockfall. This capability enables timely identification of potential hazards and supports proactive maintenance planning.

Track drainage assessment

Point clouds are also analysed to determine surface drainage potential. Figure 4 shows an example where drainage ditches are located from point clouds. The depth, location and gradients of ditches are assessed and potential blockages identified. Details are presented in Lee, Griffiths and Eriksen (2023).

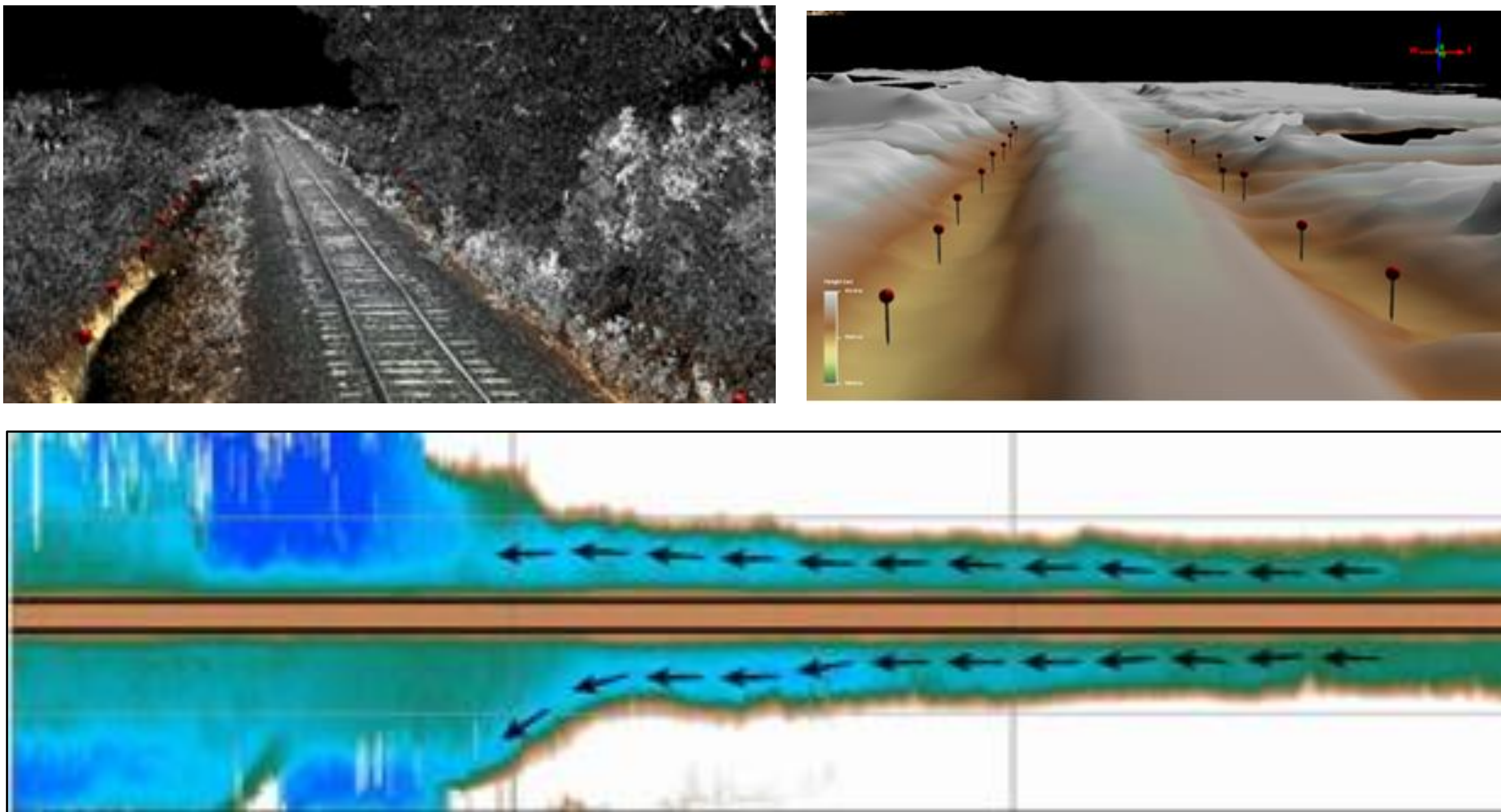


Figure 4. Identification of drainage ditches and their longitudinal flow gradient.

Conclusion

This poster offers a snapshot of the diverse ways LiDAR is currently being leveraged by railroads to enhance asset management, support maintenance planning, validate construction quality, and improve safety. As LiDAR technology continues to advance, so too does its potential. With accurately classified point clouds, rail-specific algorithms can be developed and scaled to address an expanding range of operational and engineering challenges.

References

Lee, T., Griffiths, C. & Eriksen, A., 2023. Automated assessment of trackbed drainage utilising mobile terrestrial laser scanning and ground penetrating radar. Proceedings of the 13th International Heavy Haul Association (IHHA) Conference, Rio de Janeiro, Brazil.

Acknowledgments

The authors would like to thank our customers for the opportunity to apply LiDAR across their networks and engage in detailed discussions on outcomes.

For further information please contact:
Thomas Lee, Zetica Ltd, thomas.lee@zetica.com
Asger Eriksen, Zetica Ltd, asger@zetica.com



This is the title of the poster and it can be 1 or 2 lines [Arial , bold, 80pt , white, small caps]



A.B. Author & C. Author [Arial, bold, 32pt, black]
Affiliation1, City1, Country1 [Arial, italics, 32pt, black]
D.E. Author
Affiliation2, City2, Country2

IHHA 2025
13TH INTERNATIONAL HEAVY HAUL
ASSOCIATION CONFERENCE 2025

November 17-21, 2025 | The Broadmoor, Colorado Springs, CO, USA

Introduction [Arial, bold, small caps, 44pt, black]

This template provides two possible layouts with text and graphs separate and another layout on the second page. The third page contains an evaluation sheet with useful recommendations for creating an effective poster. Please evaluate your poster before submission. [Normal text, Arial, 30pt]

In the Introduction part, get your viewer interested in the issue or question while using the absolute minimum of background information and definitions; quickly place your issue in the context of published, primary literature; then pitch an interesting, novel hypothesis ... then you can describe (briefly) the experimental approach that tested your hypothesis. Unlike a manuscript, the introduction of a poster is a wonderful place to put a photograph or illustration that communicates some aspect of your research question.

[100 - 200 words]

You are welcome to use any layout for your text and figures, as long as you stay within the white allocated space

Experimental work

Briefly describe experimental equipment and procedure, but not with the detail used for a manuscript; use figures and flow charts to illustrate experimental design if possible; include photograph or labeled drawing of organism or setup; mention statistical analyses that were used and how they allowed you to address hypothesis.

[100 - 200 words]



Figure 1. [Caption title]



Figure 2. [Caption title]

Results

First, mention whether your experiment procedure actually; in same paragraph, briefly describe qualitative and descriptive results to give a more personal tone to your poster; in second paragraph, begin presentation of data analysis that more specifically addresses your hypothesis; refer to supporting charts or images; provide extremely engaging figure legends that could stand on their own (i.e., could convey some point to reader if viewer skipped all other sections, which they will do); place tables with legends, too, but opt for figures whenever possible. This is always the largest section (except if you have no data).

[approximately 200 words, not counting figure legends]

Conclusions

Remind the reader (without *sounding* like you are reminding the reader) of the major result and quickly state whether your hypothesis was supported; try to convince the visitor why the outcome is interesting; state the relevance of your findings to other published work; relevance to real organisms in the real world; future directions.

[100 - 200 words]



Figure 3: [Caption title]

References

List references cited in the text according to the Harvard method, alphabetically:
Last name, Initials. Year. Book title. City: Publisher.
Last name, Initials. Year. *Title of article*. Title of Journal (series number) volume number (issue number): page numbers.

[max. 5 citations]

Acknowledgments

Thank individuals for specific contributions (equipment donation, statistical advice, laboratory assistance, comments on earlier versions of the poster); mention who has provided funding; be sincere but do not lapse too much into informality in this section; do not list people's titles (e.g., write Colin Purrington not Dr Purrington). Also include in this section disclosures for any conflicts of interest and conflicts of commitment.

[approximately 40 words]

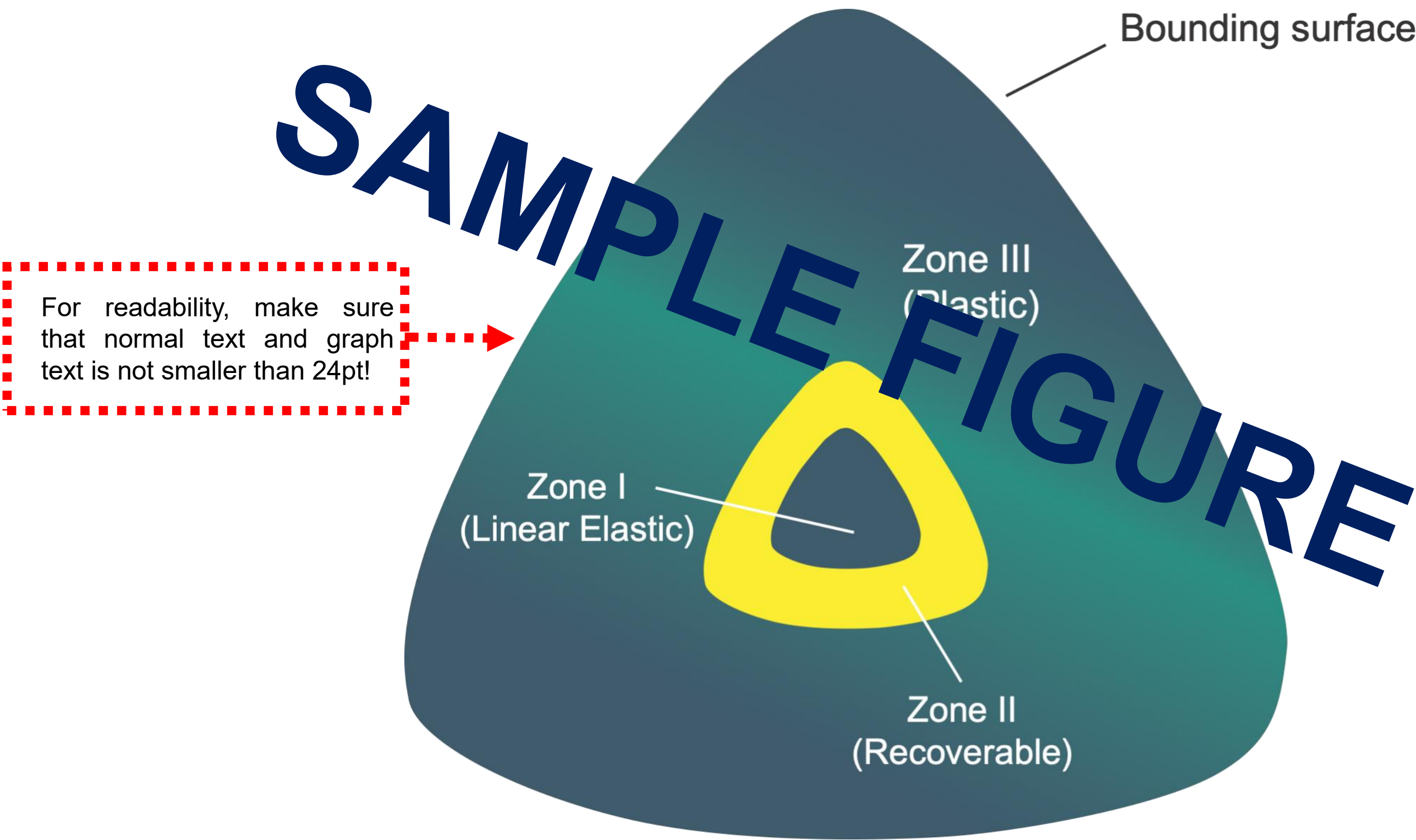


Figure 4: [Caption title]

For further information please contact:
[Name] , [Organisation], [Email address]
[Name] , [Organisation], [Email address]

Change this to your own organization's logo -
• Right-click on the 'MxV Rail logo'
• Choose "Change picture"
• "Insert Picture" from file
• Choose the correct picture from your computer



EVALUATE YOUR POSTER IN 60 SECONDS

This table provides a useful evaluation to judge the quality of your poster. Rate your poster with reference to the main aspects on the left and by using the 0 – 2 allocation of scores provided here. Do not submit if your score is below 10!

Overall Appearance	0	Cluttered or sloppy appearance. Gives the impression of a solid mass of text and graphics, or pieces are scattered and disconnected. Little white space.
	1	Pleasant to look at. Pleasing use of colors, text, and graphics
	2	Very pleasing to look at. Particularly nice colors and graphics.
White Space	0	Very little. Gives the impression of a solid mass of text and graphics.
	1	OK. Sections of the poster are separated from one another.
	2	Lots. Plenty of room to rest the eyes. Lots of separation
Text / Graphics Balance	0	Too much text. The poster gives an overwhelming impression of text only. OR Not enough text. Cannot understand what the graphics are supposed to relate.
	1	Balanced. Text and graphics are evenly dispersed in the poster; enough text to explain the graphics.
Text Size	0	Too small to view comfortably from a distance of 1-1.5 meters.
	0.5	Main text OK, but text in figures too small.
	1	Easy to read from 1-1.5 meters.
	2	Very easy to read.
Organization and Flow	0	Cannot figure out how to move through poster.
	1	Implicit. Headings (Introduction, Methods, etc.) or other device implies organization and flow.
	2	Explicit numbering, column bars, row bars, etc.
Author Identification	0	None.
	1	Partial. Not enough information to contact author without further research. This includes missing zip codes on addresses.
	2	Complete. Enough information to contact author by mail, phone, or e-mail without further research.
Research Objective	0	Can't find.
	1	Present, but not explicit. Buried at end of "Introduction", "Background", etc.
	2	Explicit. This includes headings of "Objectives", "Aims", "Goals", etc.
Main Points	0	Can't find.
	1	Present, but not obvious. May be imbedded in monolithic blocks of text.
	2	Explicitly labelled (e.g., "Main Points", "Conclusions", "Results").
Summary	0	Absent.
	1	"Summary", "Results", or "Conclusions" section present.
TOTAL SCORE:	15	