IMS
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White Paper

Seeing the Full Picture:

How Lidar and 360° Imagery Unlock Smarter Asset Management

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Executive Summary

Every mile of roadway tells a story — about the condition of infrastructure, safety of the traveling public, and the investments needed to sustain growth. Modern data collection tools now make it possible to read that story in greater detail than ever before.

Using advanced technologies such as lidar and 360° imaging, agencies can capture comprehensive, high-accuracy information about their assets, without the expense and disruption of traditional manual surveys. These tools provide a clear, measurable view of pavement conditions, roadside features, and the built environment.

Yet technology alone doesn't ensure success. The real impact comes from understanding how and when to use each method and how to balance precision, cost, and efficiency. This white paper explores how data collection and analysis technologies can work together to deliver the right level of accuracy for every project and every budget.


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Introduction

The Challenge: Seeing Beyond the Pavement

Municipalities and transportation agencies face growing pressure to do more with less, maintaining aging assets, ensuring ADA compliance, and planning for future improvements amid shrinking budgets and rising expectations. Beyond the surface of the roadway lies an interconnected system of infrastructure elements: signs, signals, striping, sidewalks, drainage features, and accessibility components — each with its own lifecycle and regulatory requirements.

To manage these assets effectively, agencies need more than just a snapshot of pavement conditions. They require a complete, reliable picture of their entire right-of-way, from curb to curb and beyond. That means knowing not only what exists, but also where it is, what condition it's in, and how those conditions are changing over time.

Accurate, up-to-date data is at the heart of every sound infrastructure decision, guiding maintenance priorities, budget allocation, and long-term planning. The challenge is not simply identifying which data to collect, but determining how to collect it efficiently, consistently, and meaningfully across diverse environments.

360° Imagery

Visual Insight at Street Level

High-resolution 360° roadway imagery provides a detailed, street-level perspective that captures the right-of-way at regular intervals, creating a consistent visual record of the transportation network. This imagery allows agencies to identify, document, and evaluate roadway assets quickly and accurately, all from a desktop environment.

At ICC-IMS, we capture roadway imagery at approximately 20-foot intervals using six synchronized cameras. Each image is georeferenced for spatial accuracy and easily integrated into mapping and asset management systems. The result is a clear, navigable dataset that combines panoramic coverage with fine-grained detail, ideal for inventorying signs, signals, pavement markings, and roadside features.

In our experience, we recommend using 360° imagery as a foundational layer for network-wide understanding. It delivers exceptional value when:

- **Conducting routine asset inventories** or condition assessments.
- **Supporting public engagement** and visualization initiatives.
- **Reducing field verification**, saving both time and travel costs.
- **Establishing a baseline** for ongoing monitoring and maintenance planning.

For most agencies, imagery offers the best first step toward data-driven asset management, providing immediate visual insight that makes complex networks visible, understandable, and ready for informed decision-making.

Example ROW image with observable assets

Lidar

Precision in Three Dimensions

While imagery provides valuable visual context, lidar scanning adds a layer of precision that transforms roadway data into measurable, three-dimensional intelligence. By emitting millions of laser pulses per second, lidar systems capture the exact shape and elevation of roadway surfaces, curbs, and surrounding features. The result is a dense point cloud — a digital twin of the physical environment that supports detailed analysis and engineering-level accuracy.

Lidar is particularly effective for applications that require high precision and quantitative assessment, such as:

- Pavement and surface modeling.
- ADA curb ramp and cross-slope evaluations.
- Drainage and grade analysis.
- Right-of-way and corridor design support.

In practice, we often recommend integrating lidar data with 360° imagery for a balanced approach. Imagery provides visual clarity, while lidar delivers the measurement accuracy needed for certain applications. Together, they create a comprehensive dataset that can be tailored to different project goals to enable confident decision-making, whether conducting a citywide inventory, supporting a design study, or validating field conditions.

Best Practice Recommendations

Based on years of experience with both types of surveys, we recommend:

- Use of imagery-first collection for network-level asset inventories and visual documentation.
- Adding lidar collection when vertical accuracy and surface geometry are critical.
- Combining both datasets in a centralized asset management platform for easy access, measurement, and collaboration.

This multi-layered approach ensures agencies get the right data at the right cost — aligning precision with purpose and maximizing the return on each data collection effort.

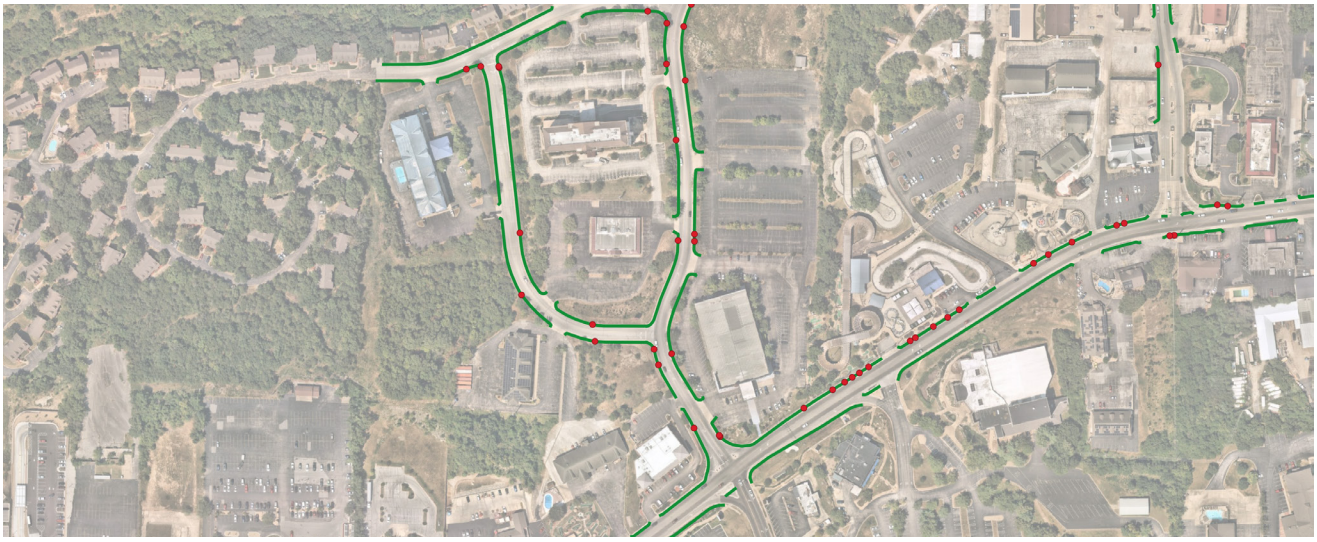
Why Accuracy is More Than Numbers

Accuracy is often viewed as a purely technical metric — a question of inches or centimeters. But in practice, accuracy is as much about perception as it is about precision. When agencies view roadway assets in a GIS environment, they're typically comparing new data against basemaps like Esri or Google imagery. These basemaps, while visually familiar, can be misaligned by several feet depending on the source and projection.

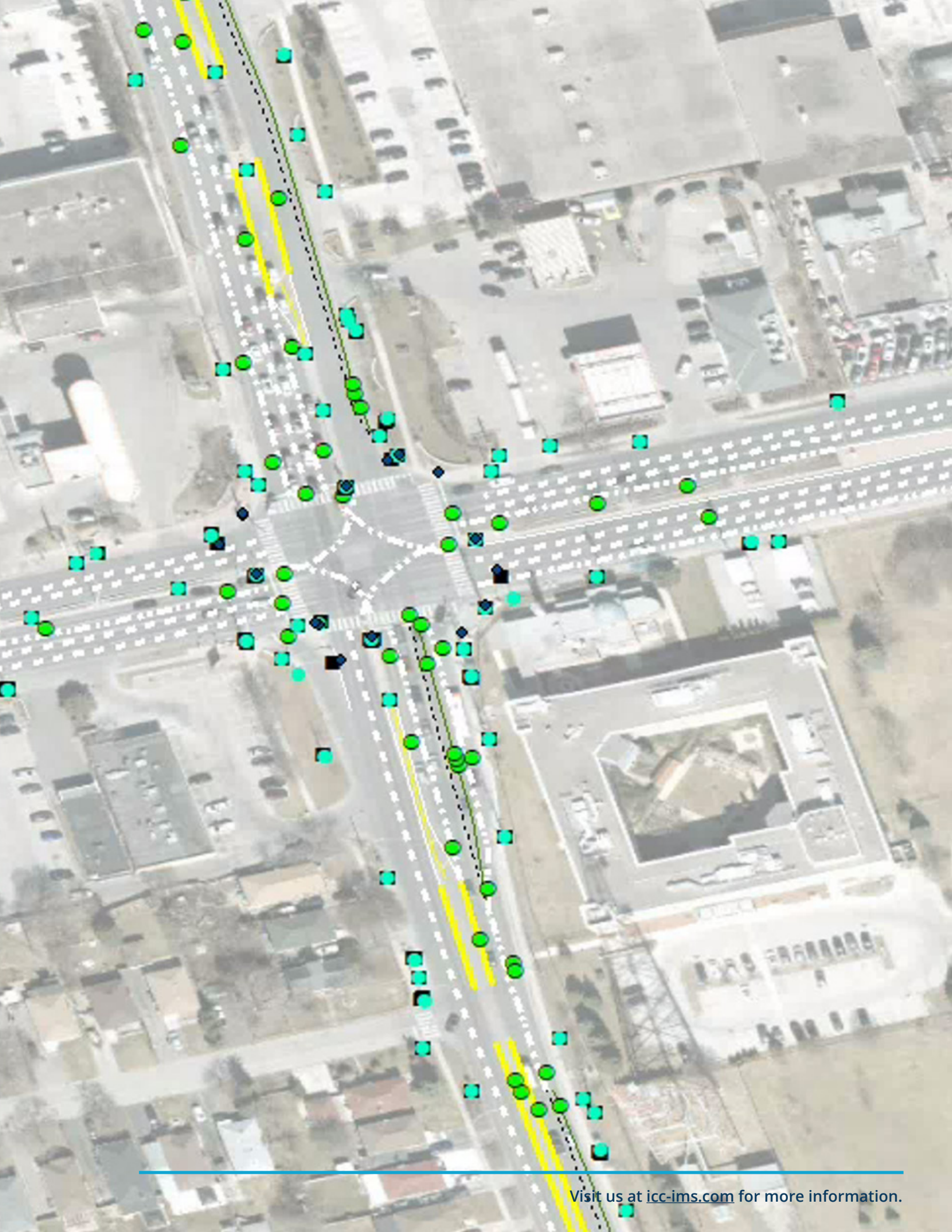
This means that even the most technically precise data can appear "off" when overlaid on a base layer that isn't perfectly georeferenced. The result? Users may question the accuracy of the data, even when it meets or exceeds survey standards.

In our experience, this disconnect between geometric accuracy and visual alignment is one of the most common challenges agencies face. Perceived alignment - how well the data visually "fits" the basemap - often matters more for day-to-day usability than sub-inch precision. After all, the primary goal is confidence: decision-makers need to trust what they see.

That's why we recommend starting each project with a clear understanding of how the data will be used. For planning, asset management, or public engagement, visual alignment may take priority. For engineering design or construction, geometric accuracy becomes paramount. By tailoring data collection methods to the intended application, agencies can achieve the right balance between precision, practicality, and trust — ensuring the data not only meets technical standards but also feels right to the people who depend on it.



Positive asset alignment with respect to the basemap



Lidar and Imagery: Better Together

Lidar and 360° imagery are often discussed as separate technologies, but in practice, they're most powerful when used in tandem. Each captures a different dimension of the built environment — and together, they create a dataset that is both measurable and meaningful.

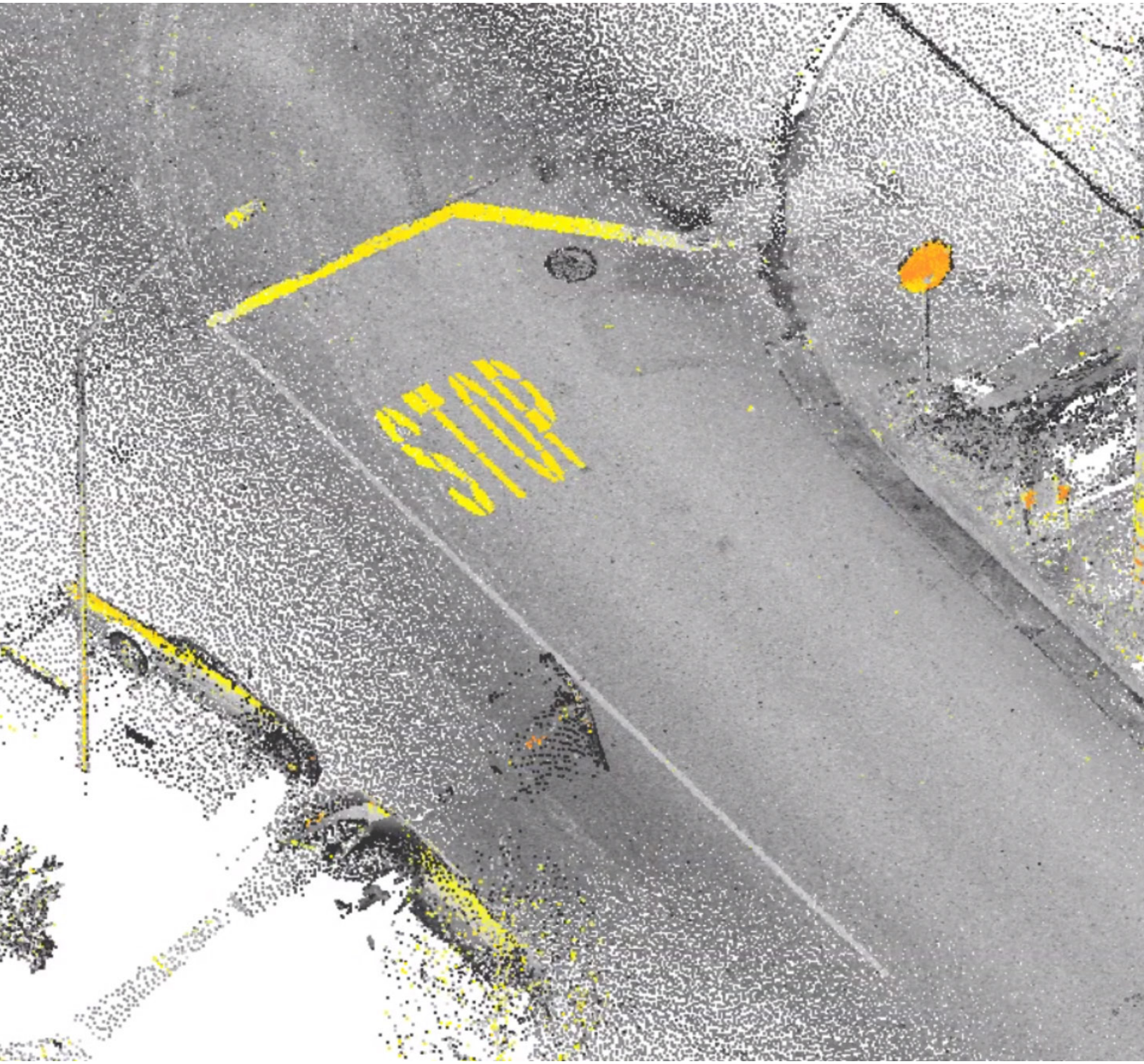
Lidar captures geometry — the precise shape, elevation, and spatial relationships of roadway and roadside features. It delivers the hard measurements needed for engineering-grade accuracy, surface modeling, and condition analysis. Imagery, on the other hand, captures context — color, material, text, and visual cues that help users recognize what they're seeing. A sign's position can be measured in lidar, but its legend, condition, and visibility are understood through imagery.

When combined, the two datasets reinforce one another: lidar provides the numbers, imagery provides the narrative. The result is a single, high-fidelity view of the roadway network that supports both analysis and communication — equally useful for technical teams and public stakeholders.

Technology	What It Captures	Key Benefit
Lidar	Geometry, elevation, and 3D measurements	Precision and measurable accuracy
Imagery	Color, material, text, and visual attributes	Context, clarity, and visual verification

In our experience, we recommend integrating both datasets whenever projects require not only accurate measurements but also intuitive understanding. This blended approach ensures that assets are precisely located, clearly visible, and readily verifiable, giving agencies the confidence to plan, design, and maintain with greater certainty.

Lidar and Imagery: Better Together



Example of intensity differences

Making the Right Choice

Selecting the right data collection method isn't about choosing between lidar and 360° imagery, it's about aligning technology with purpose. Each tool excels in different scenarios, and the best results come from matching the method to the questions you need answered.

In our experience, clarity comes from first defining why you're collecting data. Are you documenting assets for visibility and communication, or measuring them for compliance and design? Understanding that distinction guides every technical decision that follows, from equipment selection to data processing and integration.

Use Case	Recommended Method	Why It Matters
Sign inventory, pavement markings, general asset mapping	360° Imagery	Captures a complete, street-level visual record quickly and cost-effectively. Ideal for identifying and classifying assets with clear visual context.
ADA/PROWAG compliance, curb slopes	Lidar (or combined approach)	Provides precision surface modeling and slope measurements to meet regulatory standards with confidence.
Clearance verification (bridges, tunnels)	Lidar	Generates highly accurate 3D measurements to verify vertical and lateral clearances for safety and compliance.
As-built verification	Lidar	Delivers engineering-grade absolute accuracy for validating construction work and design conformance.
Public communication or condition documentation	360° Imagery	Provides a visual medium that's easy to interpret and share, building transparency and public trust.

Ultimately, we recommend thinking of lidar and imagery not as separate choices but as tools on a continuum, each suited to a specific level of precision, scale, and purpose. The key is to match the method to the decision it supports.

For example, a citywide sign inventory might rely primarily on imagery for speed and visual clarity, while a targeted ADA assessment could pair that imagery with lidar data to capture precise surface slopes. By making intentional choices, agencies can optimize both accuracy and efficiency, ensuring that every dataset collected serves a clear operational or strategic goal.

Conclusion

Turning Information into Insight

Data is only as powerful as the decisions it enables. The true promise of technologies like lidar and 360° imagery lies not in the tools themselves, but in how they are applied — with strategy, context, and purpose. When agencies align precision with need and technology with intent, they unlock a clearer understanding of their infrastructure and a stronger foundation for planning the future.

For more than 50 years, ICC-IMS has been at the forefront of that mission. As innovators in data collection and asset management systems, we've helped cities, counties, and transportation agencies transform how they see, measure, and manage their networks. Our experience spans generations of technology - from early pavement surveys to today's advanced mobile mapping - and one thing has remained constant: our commitment to helping clients make the best decisions for their communities.

We understand that every agency faces unique challenges, and there is no one-size-fits-all solution. That's why ICC-IMS brings a full toolbox of technologies, methodologies, and expertise — guiding partners to choose the right tools for the right tasks, at the right scale. Whether improving safety, planning capital investments, or achieving compliance, we work alongside agencies to build smarter, data-driven infrastructure programs that stand the test of time.

Seeing the full picture means understanding not just the pavement, but everything that surrounds and supports it.

At IMS, we combine decades of experience with the latest lidar and 360° imagery technologies to help agencies assess and manage the complete right of way — pavement, markings, signs, signals, and more. By turning complex data into clear insights, we empower communities to plan smarter, allocate resources confidently, and build transportation networks that stand the test of time.

Ready to bring your right of way into focus?
Learn more at icc-ims.com.