Colorado's System for Inspection and Management of Structural Assets:

Modernizing the Future of Structural Asset Management

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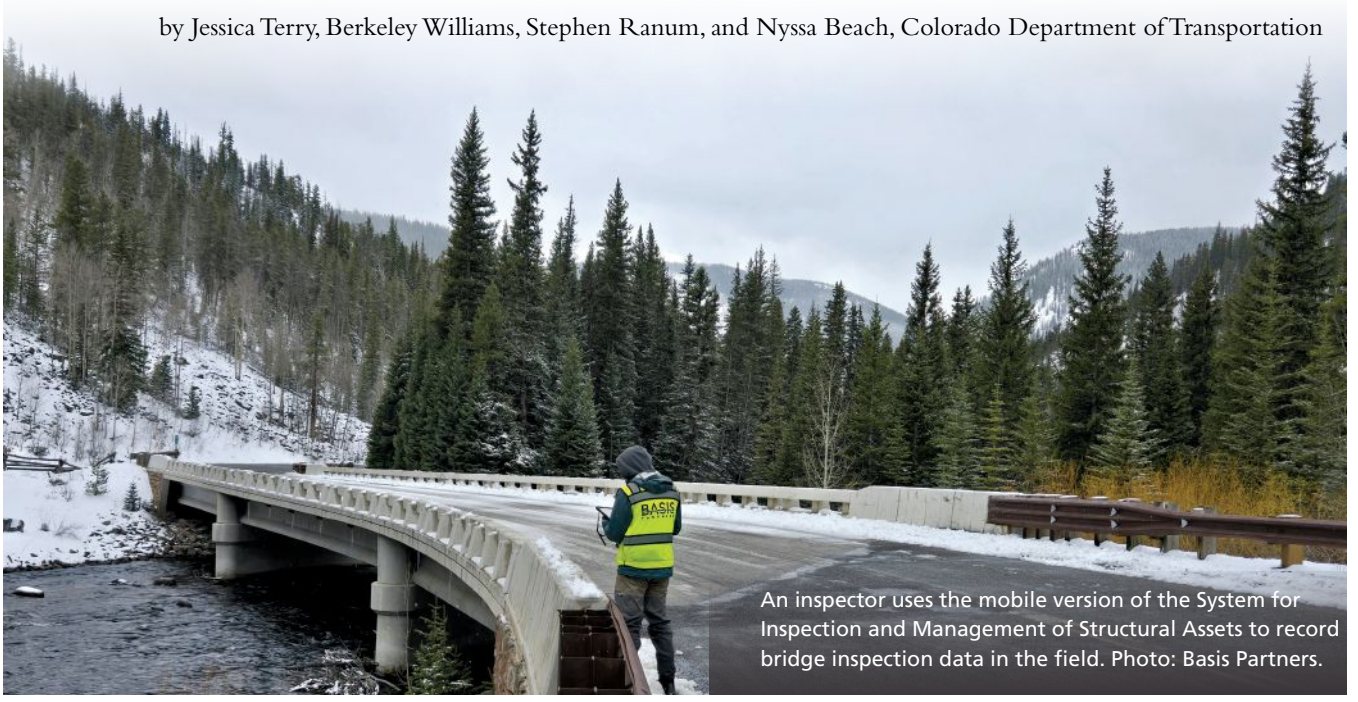


An inspector uses the mobile version of the System for Inspection and Management of Structural Assets to record bridge inspection data in the field. Photo: Basis Partners.

In the past, the life story of a Colorado bridge was documented in many places and in many ways. An inspector or designer looking for the history of a single structure might have to hunt through dusty boxes of hard-copy as-builts, search for a specific CD-ROM burned in 2005, or track down a thumb drive sitting in a desk drawer of a regional office. With 27,400 structural assets to maintain in Colorado, this mix of disconnected digital and physical data created a significant barrier to efficient and effective asset management.

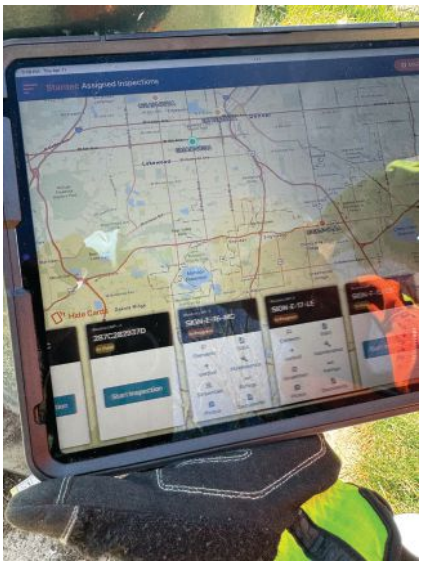
The Colorado Department of Transportation (CDOT) recognized the need for a modern solution that could handle the massive volume of data while remaining focused on the end user. The agency envisioned a one-stop-shop platform designed with field condition data and user experience at its foundation. Such a system would organize data into a clear, actionable narrative and provide the same level of transparency and intuition provided by an electronic health record, which allows a doctor to see a patient's entire history at a glance, from birth (construction as-builts) through every check-up (inspection) and intervention (maintenance and rehabilitation).

The result is CDOT's System for Inspection and Management of Structural Assets (SIMSA), a new national benchmark for transportation safety and asset management. This custom-built, nonproprietary platform has transformed how CDOT manages its vast inventory of structural assets, including more than 3500 CDOT-owned bridges, which are among the 9000 state-owned and off-system bridges in Colorado. Prior to developing SIMSA, CDOT researched and used some available asset-management software products before determining that they would not fully meet the needs of the agency. Developed in partnership with the consulting firm HDR Inc. but fully owned by CDOT, SIMSA was built for long-term operational flexibility, allowing CDOT to adapt quickly to evolving industry requirements, including collaboration with the Federal Highway Administration (FHWA).

SIMSA, which aligns with FHWA's *Specifications for the National Bridge Inventory* (SNBI),[1] has been operational since the summer of 2025. The platform delivers a single, unified database of CDOT's structural assets, which promises to facilitate structural safety and efficient maintenance of Colorado's infrastructure for years to come.

Field First: User-Centric Development

While SIMSA leverages cutting-edge technology, its success is rooted in a "field-first" philosophy. From the outset, the development team prioritized the



The System for Inspection and Management of Structural Assets' map view offers inspectors a helpful interface. Photo: Stantec.

Inspectors can use the System for Inspection and Management of Structural Assets mobile version to tag photos to specific inspections, which saves time by streamlining report generation. Photo: Basis Partners.

needs of the inspectors working on site at bridges, tunnels, and culverts.

To ensure that the platform reflected real-world conditions, software developers visited asset sites alongside bridge engineers, maintenance crews, and inspectors to understand firsthand which data points were most critical for field operations. The result is a system that offers immediate, tangible benefits, including the following:

- Automated workflows: SIMSA's mobile app is accessed by CDOT and consultant bridge inspectors in the field on tablets. It allows inspectors to automatically tag photos to specific inspections and structures so that data-informed reports can be instantaneously generated. This feature eliminates the need for manual photo renaming and cumbersome logs.
- Data integrity: A well-defined backend schema has significantly reduced data cleanup and rework.
- Comprehensive scope: The platform provides actionable condition data for a wide array of assets beyond bridges, including tunnels, culverts, traffic signals, and highway signs. A subset of a structure's documents is automatically included in the sync for inspector's use in the field.

From Reactive to Predictive Management

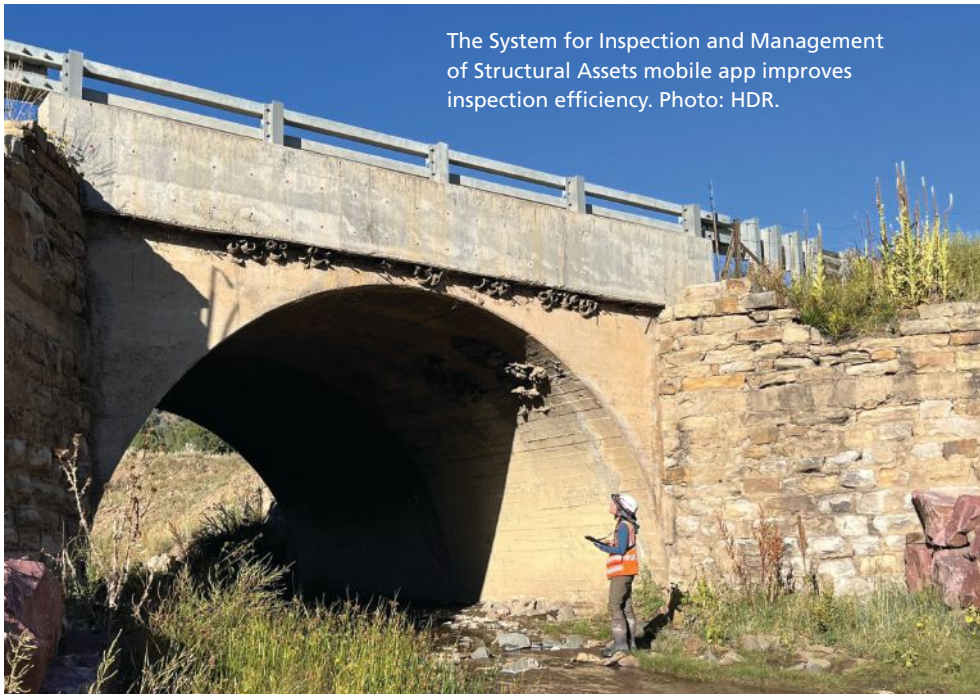
The shift to a centralized, comprehensive dataset has empowered CDOT to move away from a "worst first" maintenance mentality toward a proactive, life-cycle-based strategy. By leveraging precise analytics, CDOT can now implement the following:

- Preventive maintenance: Enhanced data scoring identifies concrete structures that are prime candidates for early intervention, such as deck seals or overlays, before costly rehabilitation is required.
- Strategic bundling: A unified database allows CDOT to bundle routine maintenance tasks within specific geographic project boundaries, maximizing resource efficiency.
- Deterioration modeling: SIMSA provides the bridge-element-level data necessary to predict future infrastructure health, allowing CDOT to optimize limited funding.

SIMSA's advanced filtering capabilities are an important benefit for stewardship. Users can instantly isolate specific categories—such as active, CDOT-owned, or federally-owned concrete bridges—and view them in both map and table formats. From there, managers can drill down into maintenance items, historical load ratings, streambed profiles, and vertical clearances.

Navigating the SNBI Transition

The resilience of the SIMSA platform was put to the test in 2022 when the FHWA published SNBI while SIMSA was being developed. This publication was not a minor update: SNBI represented a major shift for all nationwide state transportation agencies, as it requires an overhaul of bridge inspection data.



The System for Inspection and Management of Structural Assets mobile app improves inspection efficiency. Photo: HDR.

The System for Inspection and Management of Structural Assets dashboard. Photo: HDR.

FHWA's objective for SNBI is to transition from a rigid, "one-size-fits-all" time-based approach to a risk-based inspection model that prioritizes resources for bridges in the most critical condition. SNBI replaces outdated 1995 standards[2] with a modernized, bridge-element-level data structure that improves safety through better technology integration and more-precise condition reporting.

For CDOT, the timing of SNBI was particularly challenging. The agency was already in the midst of its own internal system transformation to SIMSA when the SNBI mandate required a nationwide revision of databases, update of procedures, and the comprehensive retraining of both inspection and bridge teams. Rather than pausing to rebuild the SIMSA system around the changing FHWA requirements, CDOT strategically completed the platform's original data schema first. This approach allowed the team to verify and clean legacy data in this single platform before initiating a comprehensive conversion to the new SNBI format.

The transition to SNBI introduced more than 50 new federally required data fields and complex many-to-one datasets for spans and substructures (see sidebar, "Implementing SNBI"). To prevent data bloat, the SIMSA team redesigned the user interface based on inspector feedback. Instead of flat, exhaustive lists, the system now uses organized, pull-down menus to keep data scannable and actionable.

To ensure compliance well ahead of the first federal submittal deadline for adopting the new SNBI schema (March 2026), CDOT employed a two-track collection strategy:

- Deskside collection: Starting in 2023, office teams coded new fields by reviewing historical plans and Geographic Information System imagery.
- Field collection: Beginning in early 2024, inspectors began capturing new SNBI measurements during regular inspection cycles.

Conclusion

SIMSA is a landmark achievement that redefines the relationship between a transportation agency and its data. By consolidating fragmented information into a single, transparent system, CDOT has pioneered a scalable path for structural asset management that extends beyond Colorado. Guided by an open-source philosophy, CDOT is actively working to share this robust tool with partnering agencies, elevating local excellence into a national best practice. As the industry looks toward a more resilient national bridge network, SIMSA stands as a testament to the power of user-focused, data-driven stewardship.

Implementing SNBI

Implementation of the *Specifications for the National Bridge Inventory* (SNBI)[1] has been proceeding as states begin to capture bridge inspection data in the revised format. This implementation will necessitate development of new database systems, updates to procedures, and training for inspectors and database managers, among other actions.

References

1. Federal Highway Administration (FHWA). 2022. *Specifications for the National Bridge Inventory*. FHWA-HIF-22-017. Washington, DC: FHWA. https://www.fhwa.dot.gov/bridge/snbi/snbi_march_2022_publication.pdf.
2. FHWA. 1995. *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*. FHWA-PD-96-001. Washington, DC: FHWA. https://www.fhwa.dot.gov/bridge/mtguide.pdf.

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User input for development of the System for Inspection and Management of Structural Assets. Figure: HDR.