MARKET DEVELOPMENT

Key Activities and Achievements in 2024/2025

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Wind farm installation vessel, Scottland, UK © shutterstock.com/iweta0077

Educating stakeholders is the cornerstone of our market development strategy. The Market Development team builds lasting relationships with researchers, architects, engineers, steel makers, and industry leaders by demonstrating how molybdenum improves steel performance and supports more efficient production. We share knowledge to drive impact through presentations, webinars, technical publications and expert technical support. Since June 2024, over 5,800 people have attended our market development events, including 20 webinars and 25 conferences or other in-person presentations.

Carbon steel development

In carbon steels, we focus on developing and supporting the adoption of new molybdenum alloying concepts.

One of the future target applications is battery cases for Battery Electric Vehicles (BEVs), as an alternative to extruded aluminum profiles.

Hot-rolled direct-quenched steels

Thin-gauge, ultra-high strength, hot-rolled steel sheet use continues to grow in automotive chassis applications. Molybdenum alloying expertise, developed for direct quenching, has been adapted for use in North American mini mills to produce 800 MPa hot strip. Because mini mills lack the cooling capacity of direct quenching lines, combining molybdenum with niobium or titanium is essential to achieve the required strength. We supported steel makers with alloy and process design in iterative loops until the desired properties were achieved.

“Our collaborative steel research is advancing high-performance steels.”

Led by Professor Hardy Mohrbacher, these efforts combine research, industry collaboration, and technical communication to encourage broader use.

Super HSLA (High-Strength Low-Alloy) steels

Super HSLA steels, recently developed with 700–800 MPa strength and 0.15% molybdenum, are gaining rapid acceptance in Europe. The concept is also spreading to North America, China, and Turkey, with regional variations under development.

With availability increasing, additional research has helped to characterize Super HSLA steels’ formability in more detail. The data indicate these steels offer an unprecedented combination of global formability – typical of dual-phase steels – and local formability – characteristic of complex-phase steels. We have actively promoted this new class of steels through two papers in peer-reviewed publications, four conference presentations, and a series of in-house seminars over the last year. Several steel makers started development activities, while first end users are applying Super HSLA in components such as automotive seat rails.

Extra-heavy gauged plate steels

We are also developing extra-heavy gauged plate products for offshore and tooling applications. The main challenge is to generally reach the desired strength and hardness level, while particularly achieving acceptable properties in the plate center due to limited deformation during austenite conditioning and slow cooling after finish rolling. The molybdenum addition in such products ranges from 0.5 to 2% and is to be optimized in terms of properties and cost, taking advantage of synergies with other alloying elements such as nickel, chromium, or microalloys.

Presentations, conferences, and publications

Hardy presented at major conferences in Europe and North America. His new insights into molybdenum alloying in automotive and heavy plate steels prompted further engagement with steel makers and end users. On behalf of IMOA, he also co-organized a new event – Mo4Steel – with the Austrian Society for Metallurgy and Materials (ASMET), to share the latest research on molybdenum in

Cross Bay Link, Hong Kong, China
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a wide range of steel products and applications. The conference, held in Vienna, November 2024, featured 33 presentations covering the full life cycle of molybdenum in high-performance steels, from mining and fabrication to recycling. The feedback from the audience was very positive and the respective presentations are available in the member area of the IMOA website.

Hardy also authored five papers on the functionality of molybdenum in automotive and plate steels, three of which will be published in peer-reviewed journals in the coming months.

Nancy Baddoo and Francisco Meza of the Steel Construction Institute (SCI) authored a series of six concise technical briefs, designed to promote the benefits of higher-strength steels in construction. SCI consultants also participate in the technical committee responsible for the structural Eurocode on steels with strength from 700 to 960 MPa, thereby ensuring standards that enable the successful use of high-strength steel in construction are available.

Research projects

IMOA is working with CEIT, Dillinger, and the Nickel Institute to develop S690 extra-heavy gauge plate. The project has demonstrated molybdenum's unique role in improving steel hardenability and the supporting effects of nickel and boron. Dillinger piloted three full-scale trial heats, achieving 960 MPa strength in 100–160 mm plates. The current phase focuses on detailed mechanical and microstructural characterization and refining processing parameters for industrial implementation.

A collaboration with ArcelorMittal Industeel to produce plates up to 250 mm thick for plastic injection molding steels as an alternative to forging blocks has already generated substantial data. The data showed how different molybdenum levels influence steel hardness and strength through the formation of nano-sized carbides, so-called precipitation hardening. A deeper understanding of particle number, density and size distribution will require advanced analytical techniques using large-scale synchrotron and neutron beamlines at experimental research facilities, DESY and ILL, with testing scheduled for Summer 2025.

Advancing structural stainless steel

We are an active member of Team Stainless (TS), which funds most structural stainless steel initiatives. Together, we promote molybdenum-containing stainless steel in applications where carbon steel has traditionally dominated.

Standards development

Team Stainless consultants Nancy and Francisco of the SCI, along with Catherine Houska of Catherine Houska Consulting LLC (CHC), are continuing work to update the American Institute of Steel Construction's structural stainless steel design standard, ANSI/AISC 370-21. These standards cover all commonly used structural grades, including molybdenum-containing stainless steels.

The team also responds to technical inquiries from users. Catherine is revising AISC 313-21 and has coordinated the alignment of the two documents. SCI and CHC contributed to the revision of ASCE/SEI 8 and serve on its committee, therefore ensuring that the latest information is reflected in the standard.

SCI is developing proposals for seismic design rules for stainless steel structures. Without such rules, specifying stainless steel in seismic areas is difficult. A summary will be published as a Part 3 Resource Paper for the National Earthquake Hazards Reduction Program (NEHRP), supported by a more detailed paper in AISC's peer-reviewed Engineering Journal. This will pave the way for greater adoption of stainless steels, including molybdenum-containing grades, in seismic areas.

SCI also began writing an Appendix on structural stainless steel for the AISC N690 standard, *Specification for Safety-Related Steel Structures for Nuclear Facilities*.

Multi-year efforts continue on six specifications for duplex stainless steel bridges: material, design, fasteners, welding, fabrication, and construction. This is an initiative with the American Association of State Highway and Transportation Officials (AASHTO) and AISC's National Steel Bridge Alliance. The specifications apply to highway, pedestrian, and rail bridges. Duplex stainless steel's high strength saves weight and its excellent corrosion resistance reduces maintenance – important advantages for bridges over railways, waterways, and in coastal environments where upkeep can be particularly costly.

Although developed for the US market, the specifications are broadly applicable in other regions. AISC 370, AISC 313, and ASCE/SEI 8 are required for stainless steel structural design in the International Code Council's (ICC) International Building Code (IBC), used in over fifty countries. Many jurisdictions also reference AISC standards in their building regulations.

Promotion and education

Team Stainless is partially funding a new AISC Design Guide, *Structural Joints Using Stainless Steel Bolts*, which will cover the design, fabrication, and installation of bolted connections for both buildings and bridges. It includes guidance for connections between stainless steel sections and for joints between stainless and carbon steel. The guide is being authored by SCI.

In June 2024, SCI and CHC delivered a three-part webinar series with AISC on structural stainless steel, attended by hundreds of designers. The recordings are available as continuing education programs. Additional webinars followed, targeting US transportation officials and engineering audiences in Indonesia and Australia.

In February 2025, AISC and TS sponsored a presentation by CHC on structural stainless steel fabrication and selection at the Inspection Expo & Conference, which attracted over 150 attendees. The following month, CHC gave the opening keynote at an IMOA-supported conference in India on sustainable architecture and the circular economy, SACE, attended by around 250 participants. The presentations received positive feedback and led to further engagement with attendees and requests for presentations at future events, including in India and Singapore and at an AISC event later this year.

SCI also developed three case studies showcasing structural stainless steel in the water industry (sluice gates), infrastructure (road bridges), and architecture (canopies over subway entrances). Together, they highlight the wide range of structural applications where molybdenum-containing stainless steel offers an effective solution.

Huntington station, Washington, D.C., US
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Harvard University, Cambridge, MA, US

Stainless steel in architecture

Australia represents strong potential for broader stainless steel use in architecture. IMOA consultant Veronika Matheson is developing a national network of architects, engineers, and fabricators to promote stainless steel through education, collaboration, and technical guidance. This effort builds on a solid foundation of local expertise and industry partnerships. Australia's challenging climates, particularly in coastal regions, make durable, low-maintenance materials essential, highlighting the value of molybdenum-bearing grades.

A new education initiative in Australia is a *Lunch & Learn* program, an informal, architect-to-architect conversation focused on specification challenges and the aesthetic and performance benefits of stainless steel in design.

Veronika is also developing case studies across Australia that demonstrate molybdenum-containing stainless steel's durability, sustainability, and design flexibility. These will cover public infrastructure, coastal structures, and civic and commercial buildings. The case studies will include analysis of cost, corrosion performance, material and finish selection, detailing, and maintenance.

In parallel, we co-sponsored an Architectural Record webinar with the Ornamental Metal Institute of New York (OMINY), presented by CHC in May 2025, on lifecycle and resilience assessment in a changing world. The webinar attracted 551 attendees and remains available for continuing education credit for one year. During this period, 180 people accessed last year's Architectural Record webinar on structural stainless steel. CHC also leads monthly training sessions for our global team and invited guests, introducing design and specification topics and providing technical guidance enriched by regional case studies from our team.

Flinders Street station, Melbourne, Australia
© Veronika Matheson

Stainless steel promotion in China

China is the world's largest steel producer and a global leader in materials research. Current policies support the development of domestic supply chains for high-performance materials serving strategic sectors such as aerospace, defense, energy, and construction. While molybdenum use per tonne of steel remains below the global average, it is steadily increasing thanks to numerous R&D initiatives focused on material performance improvements.

We support market development in China through technical engagement and knowledge-sharing, led by Dr Gaetano Ronchi and a team of experienced consultants: Fabio Ries, Chen Chao, Chen Wenlei, and Wu Yongkang (John). Their collaborative efforts, through conference presentations and ongoing dialogue with designers and engineers, have supported the ten-fold growth in molybdenum-containing stainless steel use over the past 15 years.

Architecture, building, and construction

IMOA's market development consultants work closely with public and private stakeholders to track new projects in China using molybdenum-containing stainless steel, assess the long-term performance of existing installations, and exchange technical information and data to inform future guidance.

Notable examples using Type 316L stainless steel include the Museum of Contemporary Art and Urban Planning (MOCAUP); the new Science and Technology Museum; and the China Merchants Bank Global Headquarters – all in Shenzhen, as well as other landmark buildings in Guangzhou and Shanghai.

Nanhuizui Guanhai Park, Shanghai, China © Nicole Kinsman

Engineering and corrosion

In the fall and winter of 2024, Fabio presented at several major engineering conferences on fabrication, alloy selection, and the use of stainless steel in service lines and secondary water systems, essential elements in high-rise water distribution. Stainless steel is now the preferred material for these systems, with Type 316L mandated in major coastal cities such as Shenzhen.

IMOA is working with Shanghai University of Electric Power on a lab-based testing program to promote molybdenum-containing stainless steels in flue gas desulfurization (FGD), as used in coal-fired power plants. Various grades of molybdenum-containing stainless steels will be exposed to simulated service conditions to evaluate their performance across a range of environments. Results will be shared through publications and industry events in 2027.

Communication and media

Wenlei adapts IMOA's English-language content for the Chinese website and WeChat channel, both of which continue to receive strong engagement.

Team Stainless collaboration

IMOA is part of Team Stainless (TS), an informal alliance of trade associations that pool resources and expertise to promote stainless steel. Activities related to TS's structural program are described above.

Driving sustainability standards at ASTM E60

Catherine Houska represents TS and the Specialty Steel Industry of North America (SSINA) on the ASTM International Committee E60 on Sustainability, where she is currently Vice Chair. She leads the development of two new life cycle assessment (LCA) standards that incorporate resilience assessment. These standards address a critical gap in existing guidance. They originated from the Joint ASTM E60/NIST *Workshop on Decarbonization: A Gap Analysis of LCA Standards for Industry*, which Catherine co-chaired. She also co-authored the resulting report, published in October 2024. In addition, Catherine contributed to the first international circular economy standard, recently published by ASTM E60, following recommendations from a 2023 ASTM E60/NIST workshop report.

As part of this broader effort, Catherine regularly engages with US government agencies, including NIST, EPA, DOT, and DOE, providing technical input on sustainability and resilience. She also serves on the US Technical Advisory Group (TAG) to ISO/TC 59/SC 17 and contributes to related work in ASTM committees on homeland security, building performance, and environmental risk.

Stainless Steel Service Lines

Water loss through underground leaks is a global issue. According to Global Water Intelligence, more than 30% of all treated water worldwide is lost to distribution system leaks. Team Stainless promotes the use of Type 316L stainless steel service lines to reduce leakage, drawing on the experience of utilities in Japan, Taiwan, and South Korea that pioneered this approach. Their data show that service lines are the weakest part of water distribution systems, responsible for up to 95% of all leaks. Stainless steel partially corrugated tubing (SPCT) has proven highly effective, with burst rates close to zero.

Italy

SPCT has attracted interest from 20% of Italy's largest utilities, which together serve about two-thirds of the country's population. By Q1 2025, 10 different utilities have conducted trial installations across Italy and in Malta. Eight of these trials have progressed or are expected to progress to larger proof-of-value (PoV) trials with several hundred connections. IMOA consultant Gaetano Ronchi, supported by Nicole, is working with several additional utilities that have shown interest in PoVs or smaller trials.

A local supply chain has been active since early 2024, anchored by Italian manufacturer CPC Inox and Grifone, a consortium of distributors serving water utilities. Their presence helps maintain a strong profile at major Italian water sector events, actively promote SPCT, and respond quicker to utilities.

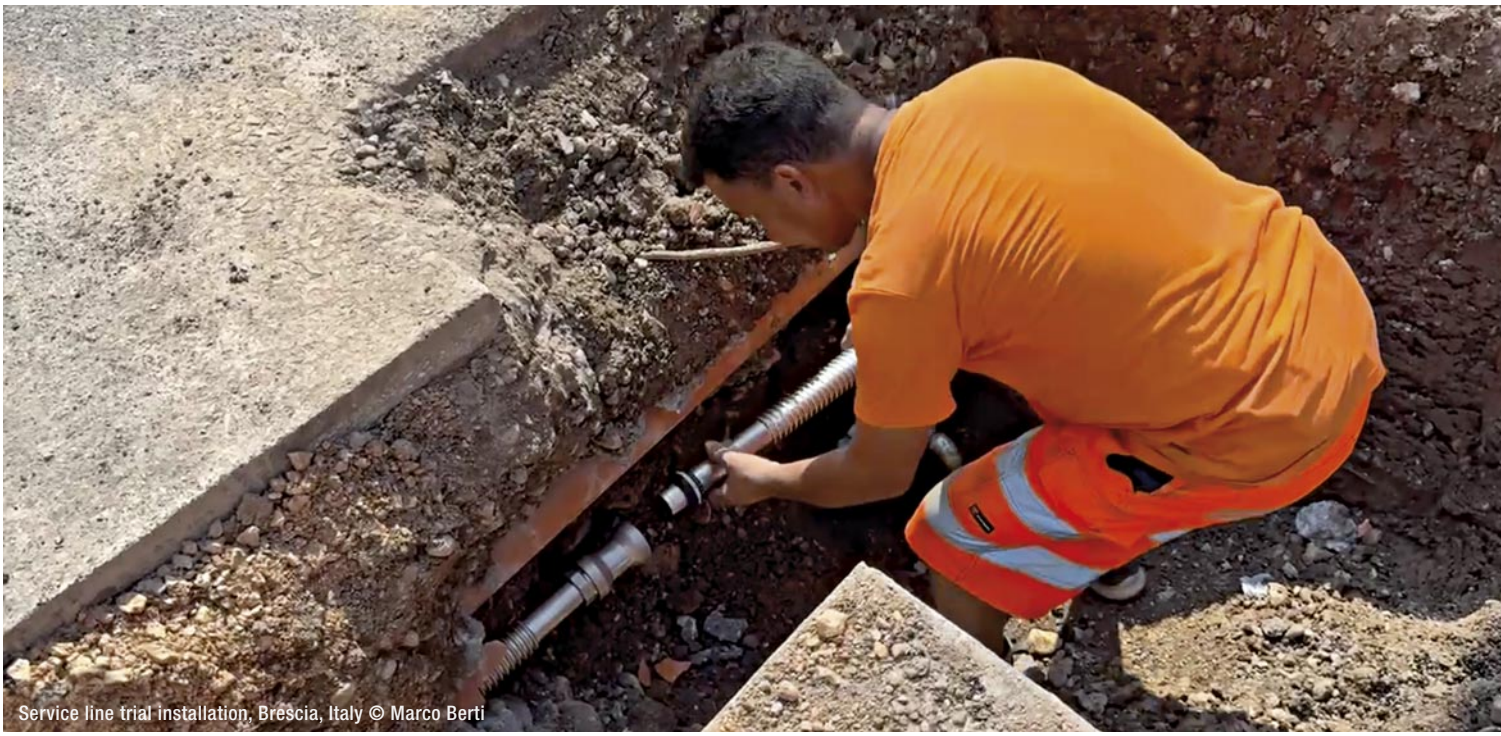
Italy faces some of the highest levels of water loss in Europe due to aging infrastructure, increasing droughts, and seismic activity. In 2021, over €2 billion was allocated under the National Recovery and Resilience Plan (PNRR) to upgrade water systems. By 2025, the funds will be fully distributed, enabling previously ineligible utilities to pursue pilot projects.

Other trials

A utility near Brisbane, Australia, is preparing to trial 60 lengths of SPCT. Singapore's national water authority has also selected a site for a trial. Efforts to promote SPCT are ongoing through conferences and industry forums in New Zealand, Indonesia, North America, Malaysia, China, Thailand, the UK, Italy and Australia.

Benefits of working together

The work we do on behalf of our members would not be possible without the support of our team of expert consultants. We are grateful for their expertise, passion and commitment. The guidance of our market development committee is also important in setting the direction of our work and we are grateful for their time and expertise.



Service line trial installation, Brescia, Italy © Marco Berti