# Ensuring LNG Structural Integrity

*See into the heart of your LNG tanks to ensure the structural integrity of your investment. Extend operational asset life by ensuring quality assurance from initial construction through to long-term operation. Quickly detect structural damage or leaks and get rapid safety assessments after major events like earthquakes or fires.*

## The LNG Tank Integrity Challenge

LNG tanks consist of a concrete outer wall and an inner wall separated by an insulating gap called the annular space. This narrow space is permanently sealed, making it inaccessible for inspection. Yet it's within this unseen space that the most critical movements occur.

*Construction at the LNG storage tanks in Thailand at the Nong Fab LNG Receiving Terminal in Rayong.*

The inner wall, exposed to cryogenic temperatures of around -169°C, undergoes significant thermal contraction. As the tank cycles through loading and unloading, this contraction causes the inner wall to sink or move horizontally relative to the stable outer wall. Undetected, these movements risk catastrophic structural damage or leakage, making LNG infrastructure increasingly vulnerable to failure. Increasingly, Federal regulations worldwide are starting to mandate Linear and Rotational Tank Movement Indicators.

## Roctest: Your Source for LNG Structural Monitoring

As the recognized experts in cryogenic tank structural monitoring, Roctest delivers integrated solutions that combine multiple advanced sensing technologies into a comprehensive monitoring ecosystem. We provide robust structural monitoring systems and related support services, from initial design consultation through decades of operational support.

Our suite of structural monitoring solutions addresses every critical aspect of LNG tank safety and structural integrity.

## Tank Movement Monitoring System (TMMS)

Our revolutionary Tank Movement Monitoring System offers unparalleled insight into the inaccessible annular space. Specialized equipment is permanently installed during construction, continuously measuring movement between the two walls once operational. The system monitors critical movement in the inner wall due to cooling and any unexpected structural settlement or rotational shifts, providing operators with early warning of crucial data unmatched by any other system.

Our intrinsically safe fiber optic sensors are specifically designed to thrive in harsh cryogenic environments and can withstand temperatures of -169°C on a permanent basis. This unique solution isolates differential movement between the inner and outer walls from other structural movements, ensuring accurate detection of the most critical risks.

*Installed sensors prior to the placement of the resilient blanket and permanently filling the annular space with perlite.*

## Structural Health Monitoring: Concrete Slab and Walls

Our comprehensive structural sensors monitor your tank through every phase—construction, hydro-testing, and normal operation. Strain and temperature sensors embedded in the concrete slab and walls provide vital information on load and stress distribution throughout the structure.

*Strain guages and temperature sensors being installed during construction.*

Settlement monitoring is performed using inclinometer probes inserted into pre-installed horizontal inclinometer casings in the concrete slab, with automation options available. We also monitor the inclination of the concrete outer wall using precision tiltmeters and track axial and transverse movements of the outer wall using pendulum systems. This structural monitoring provides cost-effective quality assurance throughout construction and the entire operational period.

## Advanced Temperature Monitoring and Leak Detection System

Temperature within the tank is a critical parameter for both operational efficiency and safety. While traditional monitoring relies on multiple Resistance Temperature Detectors (RTD) to create a basic temperature profile, Roctest's Intrinsically Safe Fiber Optic Distributed Temperature Sensor (DTS) revolutionizes this capability.

With just a single fiber-optic cable installed at different levels along the perimeter of the tank, our DTS system provides an unparalleled amount of temperature information inside the tank and throughout the annular space. This comprehensive temperature mapping makes leakage detection dramatically more efficient and cost-effective, identifying thermal anomalies that indicate potential breaches before they become critical failures.

*Workers installing monitoring sensors within the tight annular space inside the LNG tank*

## Full-Lifecycle LNG Terminal Surveillance

Roctest offers comprehensive LNG Terminal surveillance that enables owners to standardize monitoring and make defensible long-term decisions. Our integrated sensing ecosystem combines highly stable Vibrating Wire (VW) sensors with advanced Fiber Optic (FO) sensing technology, creating a complete monitoring solution for:

- Structural integrity of LNG tanks
- Leak detection in tank annular space
- Underground LNG storage facility deformation monitoring
- Real-time safety assessment following major events

All measurement data from these multi-technology deployments is fed to a control room's PLC along with all the other daily operational information generated and managed during normal operation.

## Roctest: Your LNG Integrity Partner

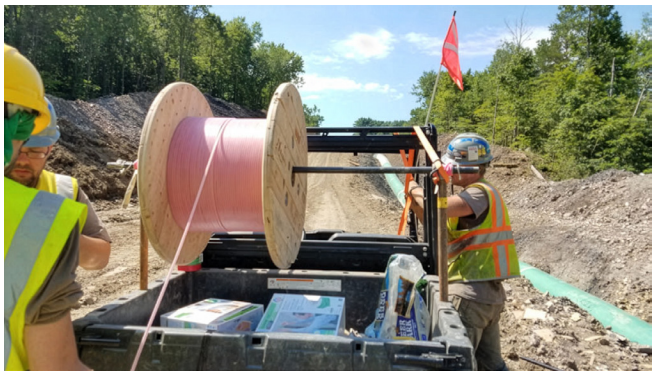
**Integrated Solutions** — We deliver complete, turnkey solutions using the optimal combination of sensing technologies for your specific requirements.

**Quality Assurance** — Verify that new and existing structure performance meets design specifications from day one through decades of operation.

**Immediate Safety Assessment** — Monitor conditions after earthquakes, leakages, or fires with real-time data from all monitoring systems.

**Optimized Security and Maintenance** — Comprehensive structural health monitoring data on the real condition of tanks reduces operational expenses through minimal maintenance.

**Remote Access to Inaccessible Locations** — Our systems provide critical information on temperature, movement, and deformation from locations that cannot be physically inspected.



*Strain sensing cable on spool before installation*

**Seamless Integration** — Our monitoring systems work with almost any protocol such as Modbus and can easily integrate with any PLC used with other monitoring systems.

**Intuitive Visualization** — Our HMI-like software can easily be used by technical staff, with critical data shown in fully graphical mode for quick identification of points of interest.

**Rugged, Proven Equipment** — Our sensors are designed for harsh environments including extreme cold temperatures, heavy construction, and rough manipulation.

## Proven Global Expertise

We have been implemented at some of the world's most vital energy hubs, including projects like Freeport LNG, Cameron LNG, and Gulf LNG in the US, Dunkirk LNG in France, PTT LNG in Thailand, SLNG 2 in Singapore, and many others across Canada, Spain, China, Vietnam, and Algeria.

## The True Value of Certainty

We provide our clients the certainty required for safe and optimal LNG operations from initial construction through to long-term operation. Critical data on the real condition of tanks and pipelines provide immediate safety assessments especially following a major event like an earthquake or fire. This optimized security, reduced operational expenses through minimal maintenance, and crucial regulatory compliance protects your investment for its entire 20–40 year operational life.

Our technologies provide real-time peace of mind and ensure your investments are secure and operating within design limits. As your single-source partner for advanced monitoring systems and related support services, Roctest delivers the complete solution you need to protect your critical LNG infrastructure.