“We at SWS continue to invest in research and development to gradually and positively evolve how we deliver infrastructure needed by the communities we work in. SWS recognises the need to bring together the best of what is currently available to guarantee safety, suitable integration and rational use of resources.”

Paolo Cucino SWS engineering R&D Chief

Executive Summary

This booklet has been developed to describe the main features of SSS.infra, an innovative Guideline developed for the sustainable design of new infrastructures and for the retrofitting of the existing transportation network.

The three “S” stand for Safe performance, Suitable integration and Source control, representing an evolution of the three traditional pillars of sustainability.
We need a change ...

Infrastructure - roads, bridges, tunnels, railways - drive economic growth in many countries by facilitating manufacturing, services and trade.

Yet many problems may arise due to bad design, wrong track selection, poor stakeholder involvement, low intrinsic resilience ...

It’s not just a matter of building more, we need to build better.
Critical issues of Existing Infrastructure

It’s no secret that today’s infrastructure network is under continuous and rising pressure:

• Poor durability, lack of maintenance and/or bad design have been the cause of dramatic failures;

• Authoritative decision-making, characterised by low stakeholder engagement, has produced widespread public resistance to strategic connection projects, generating significant construction delays;

• Superficial planning and inattentive materials selection have compromised infrastructure integration with the surrounding natural, human and cultural environment;

• Underestimation of climate change consequences has led to network breakdowns, due to an intrinsic lack of resilience.

That’s why we need to change our approach to infrastructure design and maintenance ... moving towards something more responsible and sustainable.
towards Sustainability ... 

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." 

SWS subscribes to this definition and has gone beyond current industry best practice to develop a design framework that takes sustainable development to new levels.

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1 World Commission on Environment and Development, Our Common Future (1987)
In organised society the function of infrastructure, especially civil infrastructure, is to provide for personal security, establish a basis for public health and institutionalise a quality of life that meets the expectations of those it serves.

Population growth, climate change, ineffectual decision making, the need to protect the environment that sustains all life, depletion of scarce resources and geopolitical considerations challenge our ability to continue to live and develop unless we recognise the trade-off associated with our decisions about resources and their use. Our infrastructure, which characterises our collective footprint on this planet, must reflect this.

We have to recognise that many of our resources are finite and that development has environmental, social and economic consequences. It is not enough to create infrastructures that are intelligently designed, well engineered and competently constructed. They must also be sustainable. The new public mandate is to not only to do the job right, but to do the right job in the first place.

Today sustainability is an imperative and a responsibility not only for current needs, but also for the wellbeing of future generations.
SWS is a company built to provide rigorous engineering services. It endorses a quantitative approach to sustainability, and promotes a holistic and design oriented technical approach.

For this reason SSS.infra has been conceived as a rational Guideline for everyday design practice, an effective tool for guiding technical decisions through different design scenarios.

SSS.infra, in summary, can be seen as an evolution - not a revolution - of the three traditional pillars of sustainability (economic, environmental and social).
SFT - Safe Performance
A modern infrastructure should be able to generate a safe environment for users, workers and local residents, during normal operation and in any extreme scenario. Both natural and anthropic hazards have been considered in SSS.infra, assuming that improved knowledge of boundary conditions always represent an advantage for the final performance of the system.

STB - Suitable Integration
A responsible infrastructure design should carefully consider the relationship with the surrounding environment, including landscape, anthropic components, flora, fauna and local communities. Furthermore it should promote advantages of effective integration of technical specialities involved, by fostering a holistic and innovative approach.

SCC - Source Control
Sustainable management is an essential requirement when the environmental resource base needs to be sustained and expanded. For this reason, SSS.infra focuses on the responsible use of priceless natural resources, promoting potable water conservation, low energy consumption, waste reduction and intelligent selection of materials.
based on a Rigorous Framework of credits ...

SSS.infra Guideline has been developed with reference to three sustainability parameters: Safe Performance, Suitable Integration and Source Control.

Starting from this backbone structure, a rigorous framework of credits has been defined on the basis of a quantitative and design-oriented set of performance indicators.
conceived to take advantage of Powerful Digital Tools ...

Effective integration with state-of-art digital tools has been considered as one of the key targets for SSS.infra Guideline.

BIM models, GIS software and flexible DATA BASE technologies have been studied and customised to provide an efficient management of the massive data volume that is typically required to optimise complex infrastructural projects.
**PROJECT DIGITALISATION**
Digital model of alignment, soil properties, stratigraphy, civil works ...

![Autocad](#)  ![Civil 3D](#)  ![Revit](#)

**GIS-BASED TOOLS**
Processing geographic datasets and georeferenced infrastructure models with GIS based software ...

![QGIS](#)  ![USGS EarthExplorer Website](#)

**CALCULATION**
Advanced data processing implemented using SWS Digital Project Tools specifically conceived to support iterative calculation of design parameters ...

![mongoDB Software](#)

**Calculation Process Management**

**Digital model of alignment, soil properties, stratigraphy, civil works ...**

3D Model useful for quantity takeoff - Revit

2D Support Model - Autocad

Road alignment and land use / land cover - QGIS

Diffital Surface Model DSM file - QGIS

Subsidence thresholds map - QGIS

Cut & Fill Optimisation - Civil 3D
SSS.infra Guideline has been developed keeping in mind the existing network of certification protocols and the widespread need to associate sustainability tasks with industry-standard design stages.

The objective was to create a fully integrated tool rather than a independent new protocol, and thereby reduce the extreme fragmentation that characterises the existing technical literature.
Design Stages and existing Protocols

SWS decided to develop SSS.infra Guideline with the purpose of providing a useful tool that could be effectively integrated in the design process.

The first step was to establish a strong connection between credits and widespread design standards. RIBA Plan of Work 2013 was used because of its recognised reliability, but the implementation approach has been conceived to provide sufficient flexibility to support many different references.

The second step was to identify a reliable framework of accredited protocols, with the purpose of showing how SWS’ work on the Guideline could lead to an appreciable improvement in the existing approach to sustainability. Envision was selected as the best tool for the general planning of a new infrastructure, providing specific guidance for the strategic allocation of resources.

Meanwhile SSS.infra was developed for the practical design of all the meaningful infrastructural components, including roads, bridges, tunnels, culverts ...

Finally, LEED NC was chosen for the quantitative assessment of all the support buildings required by the infrastructure, including resting areas and service buildings.

The schematic on the left shows how SSS.infra has been integrated with design stages and existing certification tools.
... and offering Meaningful Advantages

We believe that accurate implementation of SSS.infra Guidelines can guarantee an appreciable improvement in the quality of design, by providing a quantitative and objective estimation of performance.

The Guideline uses a rigorous and reliable mathematical formula for the definition of weights, enabling the scoring system to be customised to suit client requirements or stakeholders views.
Analytical Performance

One of the most important characteristics of SSS.infra is its analytical approach for reliable and objective evaluation of infrastructure performance. Overcoming subjectivity was one of the mandatory requirements in development of the Guideline.

Association with Design Stages

Clear and effective association with widely used Design Stages was important in order to define roles and responsibilities. The RIBA Plan of Work 2013 has been selected considering: Concept Design Stage (2), Developed Design Stage (3) and Technical Design Stage (4).

Promotion of Integrated Design

The rich network of connections established between different credits has the specific purpose of promoting advantages of integrated design implementation. Thanks to this structure, contributions from different technical specialties can be coordinated to improve the final quality of the project.
SSS.infra Commercial Advantages

- Advanced Multicriteria Analysis
- Quantitative Performance Indicators
- Integration with RIBA Plan Work 2013
- Effective Stakeholder Engagement
- Reliable and Objective Evaluation
- Promoting Design Synergies

Notes