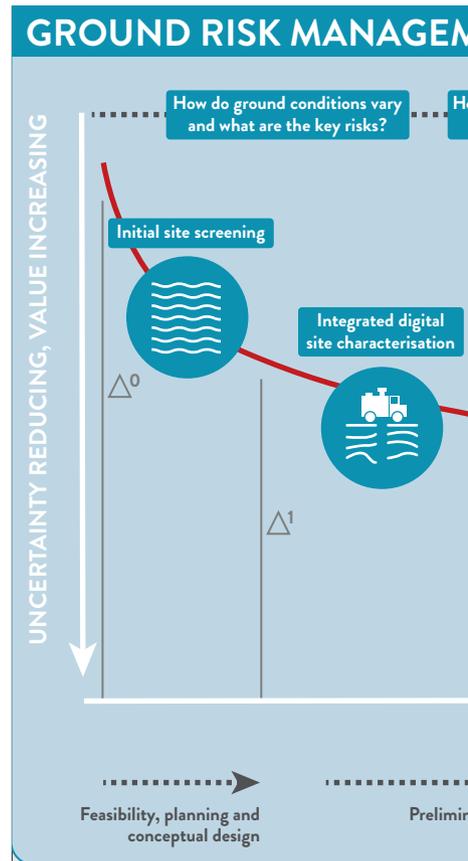


GROUND INVESTIGATION

ALL IN THE FRAME

FUGRO'S NEW FRAMEWORK APPROACH TO SITE CHARACTERISATION. CLAIRE SMITH REPORTS.



Delivering site characterisation and geotechnical engineering solutions to better manage and understand ground-related risk is the main aim of the Ground Risk Management Framework (GRMF) developed by Fugro.

According to Fugro director of land site characterisation USA Ray Wood (RW) and solutions director for land site characterisation Rod Eddies (RE), the framework has also helped the firm to identify gaps in its technology to improve its offer to clients.

WHAT'S YOUR 'ELEVATOR PITCH' TO DEFINE THE GRMF?

RE: The framework describes the subsurface risk environment that we share with our clients and is partly based on leveraging Fugro's consultancy mindset to add value all the way through the asset cycle by reducing uncertainty, the source of ground-related risk. That value comes from minimising our client's exposure to ground-related risk.

RW: To me, it is a process whereby you can best identify the sources of uncertainty for a particular project and then target appropriate industry skills to reduce those. The GRMF is very much an internal tool to develop the appropriate solution for our clients.

RE: The framework is not a blueprint for the approach to every ground risk problem, it needs to be tailored for context on the specific project.

KEY FACT

20%
Potential reduction in geotechnical construction costs from spending another 0.5% of the total capital cost on ground investigation

HOW LONG HAS IT TAKEN TO DEVELOP THE FRAMEWORK?

RW: It is the crystallisation of the understanding of the role of geotechnics in civil engineering that we've gained over a 25 year period. However, it has taken until now to develop all the component parts that make up the framework. In the last four or five years we have linked these components together through significant investment and acquisition of specialist firms to create the portfolio of competence and technology that is now offered through the framework.

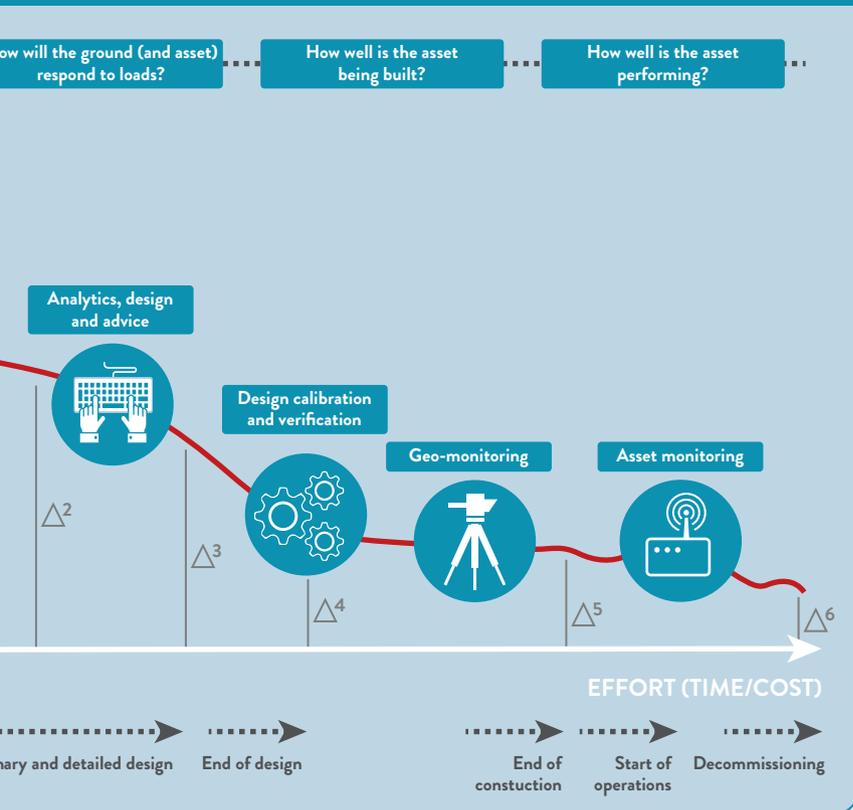
RE: The trend towards digitalisation also forced the crystallisation of the framework as well. It was clear to us that some of the challenges of geo-data flowing through the asset cycle could be met by understanding, not only the end game (designing, building and operating assets), but also the best means to get to that end game.

WHY WAS IT NEEDED?

RW: It is fairly well recognised in civil engineering that much of the project risk is actually below ground and it is important that geotechnical engineers see themselves primarily as risk managers. The development of the framework started from a realisation that risk arises from uncertainty and if you can reduce that uncertainty then improved risk management is an automatic consequence.

RE: We have also carried out some research into the economics of capital project performance over the last

MENT FRAMEWORK



60 to 70 years and, while it can't all be pinned on ground risk, the performance over that period is somewhat underwhelming in terms of both cost and schedule. There are aspects of the framework that could help address this.

DOES THE FRAMEWORK HELP THE CLIENT TO UNDERSTAND THE NEED TO INVEST IN GROUND INVESTIGATION?

RW: Geotechnics is one of the few sectors that breaks the commonly held understanding of the risk/reward trade off. The framework helps clients to see the improved value for money that comes from driving down uncertainty to the point where you minimise or even eliminate unforeseen consequences that often cause projects to overrun in terms of cost and time. The ground investigation budget is usually 1% to 1.5% of the total capital cost but I have seen examples where reducing the uncertainty by spending another 0.5% on ground investigation can reduce the geotechnical construction costs by 20%. The framework demonstrates that.

HOW ELSE DOES THE FRAMEWORK BENEFIT CLIENTS?

RW: If you have less uncertainty in the definition of the ground conditions and the way they will behave under the influence of the structure you're going to build, that leads to the design of cheaper construction. The results of the framework approach allow you to effectively manage the component of over engineering that is inherent in

Fugro's framework describes the subsurface risk environment and is based on delivering bespoke solutions to reduce uncertainty and meet client's engineering business objectives

“ The results of the framework approach allow you to effectively manage the component of over engineering that is inherent in many design methods

many design methods, resulting in leaner design. Also, it is largely in a client's interest to transfer the ground risk to the constructor and that's a trend we have seen increasingly over the last four or five decades. Typically, the constructor, who is arguably best able to manage the ground risk, builds a premium into their bid to manage that risk but with more certainty about the ground risk, the size of that premium reduces and results in lower costs for the client.

HOW DOES THE FRAMEWORK IMPROVE DELIVERY OF THE GROUND INVESTIGATION?

RE: The GRMF helped us identify some gaps in terms of investigative capabilities that could benefit more projects and clients. As an example, we refer to initial site screening as being an early evaluation that identifies the initial variations in subsurface conditions and initial ground risks that drive the design of subsequent intrusive investigation. However, we became aware that there are many sites where site screening – and even intrusive investigation – is challenging so we developed a passive seismic system that can be left on site for up to a week and, after some advanced processing, we can deliver a 3D model of ground stiffness to a reconnaissance level.

I would describe it as having an MRI scan ahead of going into hospital for surgery – the surgeon knows broadly what to expect.

CAN YOU GIVE AN EXAMPLE OF HOW THE FRAMEWORK BENEFITED A RECENT PROJECT?

RE: Ground investigation for Anglo American's polyhalite mine tunnel in North Yorkshire was developed using the framework approach. The challenge was to investigate the route of a 37km long tunnel running at more than 250m below ground level below a National Park with complex geology. However, through early geophysical screening, followed by follow-up targeted intrusive investigation and consultancy, in other words, delta-1 to delta-3 in the framework, we were able to pretty much identify the main risks that the tunnel boring machines would likely encounter.

HAS THE FRAMEWORK HELPED YOU IDENTIFY THE FOCUS FOR FUTURE R&D AT FUGRO?

RW: Each of the solutions within the framework is fed and underpinned by advances in engineering, technology and data management, so we will always be looking for improvement. The ground is a difficult problem and it will never be technologically satisfied but there will always be an improvement or enhancement we can make.