

Pilot 5. Flexible and Reflexive Standards: Constructing Resilient Infrastructure in Uncertainty Report for CRUISSE

Dr Ben Bowles and Professor Laura Bear

LSE

Executive Summary

Since the 2011 publication by the Cabinet Office (CO) of *Keeping the Country Running: Natural Hazards and Infrastructure* there has been an emphasis in maintaining and developing infrastructure that is resilient or:

- resistant to hazards
- designed for reliability
- contains redundancy in the capacity of systems
- contains planning for a response and recovery element

However it was unclear to the CO how and, to what extent, infrastructure is currently being built with these concerns at the forefront. This project responded to their call with CRUISSE to examine whether such goals are currently part of decision making in the public and private sector (see **Background** p. 2). In addition it examined if there are other incentives within institutions (such as those of cost-benefit analysis or project deliverability in the Treasury Green Book) that prevent these goals from being considered or realised. It also looked for best practice and broader concepts of resilience already applied by private sector companies, engineers and/or academics to infrastructure.

After consultation with the CO we used anthropological methods of participant observation and conceptual analysis of interviews and literature to reveal a complex infrastructure 'pipeline' and the processes of decision making within it (See **Background** p. 2). To achieve this we drew on Tuckett and Nikolic's analysis of decision making in uncertainty (See **Main Points from Report** p. 3 & **Outcomes** p. 5), actor network theory, discourse analysis and previous work on financial and social resilience in infrastructure (See **Outcomes** p. 5-6). To make our analysis concrete we focused on three key case studies, The Thames Tideway Tunnel, Anglia Water and HS2.

On the basis of this research we identified key findings and new policy recommendations (See **Main Points from Report** p. 3-5) . The key recommendations were:

There are barriers to creating resilience standards for infrastructure across public and private sectors (silos, illegibility, dispersed strategy, univocality, loss of civil service expertise) but these could be overcome by focus on:

- Resilience in the round or multiple forms of resilience including physical resilience, environmental resilience, financial resilience, political resilience and social resilience.
- A system of systems approach—or a focus on the interaction of various infrastructures (existing and planned) as they interact together
- A costing process that considers the complete Infrastructure life-cycle (rather than just the cost of building) & long-term resilience over decades
- Flexible and reflexive standards created and updated regularly using expert panels with a wide diversity of expertise & citizens juries

We also advised on **key sites of intervention for implementing resilience standards** (See **Main Points from Report** p. 5). These would be within departments or ministries as they make their

strategic business cases for the Treasury and inside Treasury Spending Review Teams, who could insist on resilience standards being applied.

Our report and its recommendations were very well received by the CO, the National Infrastructure Commission and key private sector players (See **Outcomes** p. 7 & **Further Work** 8). In addition we have shown the great practical and theoretical significance of a CRUISSE decision making under uncertainty approach (See **Outcomes** p. 5 & **Further Work** 8). We have also furthered the anthropology of infrastructure in a new, more ambitious direction of analyzing high level decision making processes and their unintended consequences (See **Outcomes** p. 7 and **Further Work** p. 8). We plan the publication of academic article(s) and presentation(s) on the basis of the research, along with further liaison with resilience discussions in the CO, private sector and National Infrastructure Commission.

1. Background

We responded to a call co-created by the Cabinet Office (CO) and the CRUISSE leadership. This was designed to help the CO make decisions about how major infrastructure projects can be made “secure and resilient by design” to protect major investments against future threats and habits. This call asked the researchers to explore the following questions: What does secure and resilient by design look like/mean? Can government be confident at the design stage that CNI is protected against future threats and hazards? How can government assess and/or account for radical uncertainties around infrastructure? Do government departments currently consider security and resilience in the design of major infrastructure projects? Does security and resilience by design look different across different sectors?

After winning the bid in June 2018 we carried out several consultations with the CO on how best to link our investigation to their concerns. After these we advised them that we would on the basis of our interviews and participant observation: outline the current barriers to the application of resilience standards; recommend ways to intervene in decision making around infrastructure so as to overcome some of these barriers; propose a way to construct standards frameworks that would support long-term decision making about resilience goals; advise on how to regularly review this framework to keep it reflexive (or in line with emerging hazards, new scientific evidence and monitoring of the challenges facing particular kinds of infrastructure; and recommend where and how it would be most effective to apply resilience standards in the pipeline of the conception, construction and delivery of infrastructure. We agreed to write a final report to the CO that would be presented to the cross-department Security and Resilience by Design working group (on which sit representatives from the MOD, National Infrastructure Commission, Her Majesty’s Treasury, Home Office, CPNI, Infrastructure Projects Authority, DEFRA, Cabinet Office) and circulated to relevant departments and ministers.

From July-December 2018 research included 24 semi-structured interviews with members of DEFRA, Thames Tideway, the Cabinet Office, HM Treasury, the IPA, IPPR, Arup and academics (among others). Participant observation was also carried out at a Thames Tideway DEFRA liaison meeting and in Policy Connect meetings in parliament. Along with this two detailed case studies were carried out on Thames Tideway Tunnel and Anglian Water, with supplementary work conducted on the High Speed 2 project. In addition we did a deep literature review into resilience, decision-making under uncertainty, the assurance process for infrastructure, and thought-leading resilience measures across sectors.

Before finalizing our report we held a workshop at LSE to review it with relevant experts on resilience from DEFRA, Leeds University, Arup and Policy Connect. We then presented our report to the cross-department Security and Resilience by Design working group on 19th December 2018. The feedback on this was excellent with requests from the National Infrastructure Commission for our longer report and for further conversations with us as they develop their resilience by design policies. Our CO office contacts also asked us to continue to contribute to the working group in future as needed because our input was very helpful indeed.

3. Main Points from the Report

Our report made the following three “take home” recommendations to the Cabinet Office in order to frame our further more detailed recommendations:

1. Resilience is about more than just the physical asset or even just physical systems; there are economic, physical and social systems of which it is part and to which it is vulnerable.
2. Most infrastructure is extant in systems and is being asset managed rather than designed and built. Currently the focus is too heavily on new infrastructure. All infrastructure should be properly through-life costed to unlock hidden costs and benefits.
3. All standards for infrastructure should be reflexive (able to look back at their decisions and improve them) and adaptive (able to change in the presence of new threats and challenges). The easiest way to do this is to make the standards about improving the quality of systems and decision-making rather than about providing set parameters or metrics“ (Bowles & Bear, N.d: introduction).

This was then followed by a series of evidence led sections, each of which had a key finding attached. These were summarised together to give the following conclusions:

1. It is vital to see resilience in the round (Ofwat, 2018). Seeing infrastructure only as physical assets is antithetical to true systems thinking and asset security. We have identified 5 types of resilience that all projects should consider: Physical, Environmental, Financial, Political and Social.
2. There is no simple route to infrastructure being built. The design, capital spend and build stages of infrastructure do not represent either the beginning of infrastructure projects, as they have multiple drivers, nor the end, as most of an asset’s life (and most of the spend and management on that asset) is after build. Many of the drivers for build and for particular *kinds* of build rest in individuals’ socially mediated conviction narratives (Tuckett & Nikolic, 2017)
3. Infrastructures experience barriers to resilience throughout their lifecycle. Some of these are built into the fabric of processes in the sector, but others are potential sites for intervention that will allow changes to cascade through the sector. The 8 barriers are: the legibility of private infrastructure, a lack of strategic process, infrastructure produced in silos, the weaknesses of CBA, the disciplining of business cases, the occlusion of assurance processes, a univocality of experts, and a lack of systematic learning and evaluating.
4. There are many examples of excellent resilience thinking across sectors, but few consider all the types of resilience that we have identified. Therefore, it is important to use a number of experts with different experience and specialisms when building expert panels.
5. There are a number of tools that exist that could be and are used to increase the resilience (as we define it) or infrastructure, but they are often either dealing with one type of resilience and/or are focussed on one sector and/or are under-utilised or entirely unused. A standards regime could begin by making use of these powers.
6. Tools for valuing resilience are being developed and are in their early stage. None is currently an industry standard. What they have in common is that they look at processes, they do not try to calculate resilience as a single integer, and they advise a project by project *adaptive* approach.

7. Resilience failures, where resilience in the round is not accounted for, can cause an asset to travel a distance from its original strategically intended position and can, therefore, make it a riskier asset. Looking at these travels can make for more productive case studies than looking at security failures or extreme failures of physical resilience.

8. There has been a concerted move towards capturing the value of resilience in systems so as to make resilient infrastructure more attractive from a Cost/Benefit Analysis point of view. We note the potential benefits of this, but note that any quantitative metric not reflexively used and sparingly applied will potentially cause the best decisions to be missed, and further that it is unclear how qualitative concerns are actually integrated into CBA. We suggest that decisions made *parallel* to CBA, but not through modelling, will be stronger as they will not be subsumed by the models. We recommend an *and* rather than an *or* approach to the transformation of CBA.

9. Intervening at one stage of the infrastructure lifecycle does not allow you to guarantee resilience and a good standards regime should be able to shape infrastructure at strategically important stages across its life-course. They should be called upon to make recommendations at all of the major stages of the lifecycle. If there is one excellent location for intervention, however, it is in the assessment of the Strategic Business Case by Treasury spending teams. Spending teams should be made to take SBC's resilience into account.

10. Due to the weakness of static and reductive standards when dealing with endemic uncertainty, standards must have the following five features built into their design: they must be reflexive, adaptive, non-reductive, evidence-led and democratic, and multi-vocal.

11. Resilience often involves a trade off of extra cost for a potentially small future benefit, in such cases, it is best that communities be involved in making decisions on what kinds of and what standard of resilience is in-built into the infrastructure they require. Communities need to be led to understand the difference between short and long term costs and outcomes with expert support. These kinds of democratic choices can have political benefits for providers" (ibid:XX).

Most crucially we made some concrete policy recommendations. These were designed to overcome the barriers to creating resilience standards for infrastructure across public and private sectors (silos, illegibility, dispersed strategy, univocality, loss of civil service expertise, see) by a government policy focus on:

- Resilience in the round or multiple forms of resilience including physical resilience, environmental resilience, financial resilience, political resilience and social resilience.
- A system of systems approach—or a focus on the interaction of various infrastructures (existing and planned) as they interact together
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We also advised on **key sites of intervention for implementing resilience standards**. These would be within departments or ministries as they make their strategic business cases for the Treasury and inside Treasury Spending Review Teams, who could insist on resilience standards being applied.

These findings, with their support from our primary and secondary data gathering, were put to the Cabinet Office as described below, proving to be directly useful to their decision-making processes as they plan interventions into the assurance processes around infrastructure.

4. Outcomes

Specific

CRUISSE, as a logic and frame of study, has a lot to add to the study of resilience. Resilience is fundamentally about the recognition of endemic uncertainties and an understanding that systems will always be challenged by unpredictable external threats. The excellent fit between CRUISSE and the Cabinet Office's project is demonstrated by the recognition that the Cabinet Office's challenge to make infrastructure resilient by design is about transforming processes and making decision making logics more robust, understanding that they will have to stand up in an uncertain future. Being part of a CRUISSE network gave us the confidence to describe to our partners how, under conditions of uncertainty, the knowledge of experts is important, and how having the right processes in place is more important than making the right decision (as they can be no "right" decision before the fact). Our final report to the CO was an attempt to introduce these CRUISSE influenced revelations into an infrastructure sector that often (through means such as Cost Benefit Analysis) seeks to take uncertain and incalculable outcomes and make them part of quantitative calculations/

From our "home" discipline of social anthropology we brought in frames from Actor Network Theory (see Latour, 2007) and left these implicit in the report. ANT allowed us to see the infrastructure network as a seat of human and non-human power, where some processes and technologies (for example the Green Book) have an emergent ability to "act" in the world and where humans are not the only "decision makers." We also borrowed from the Foucaultian concept of discourse, which allowed us to question what kind of an idea resilience is, to work out what it was influenced by and where it had come from. In the recognition of uncertainty and need to build robustness and capacity, resilience links all the way back to Hayek (1967) and to Lorenz's Chaos Theory, and is therefore implicated in the making of the neoliberal subject (Bowles in press). This is useful for understanding what the assumptions are behind it, as it allowed us space to suggest empowering individuals and communities, due to neoliberalism's interest in the power of the individual and in "capacity building."

Further, we could trace Resilience's development through the sciences to its current ill-defined or "empty box" nature, where "although we can broadly agree on what resilience is, the conclusion must be that it does not mean very much" and "a quick search of the literature shows that resilience lacks any deeper meaning in relation to either the functioning of systems or the psychology of the human condition" (Joseph, 2012). This recognition allowed us to recognise the problem of the Cabinet Office, where they understandably are unsure of how to tie down resilience, whilst knowing that it is important to system health (as resilience, if broadly defined as seeing an asset as part of a system, clearly is important in this sense). In this way, we were able to produce a useful multi-factoral synthesis definition and give them confidence that resilience is about processes rather than metrics, to encourage them against finding a single integer to represent the resilience of systems,

and to encourage them to attack the problem broadly and without reducing complexity. In addition our focus on financial and social resilience, alongside environmental resilience, extended Bear's earlier work in her monograph *Navigating Austerity: currents of debt along a South Asian River* (2015) into UK policy discussions.

In general, the training that we had undertaken as part of the CRUISSE network allowed us to look outside of reductive answers and to understand the complexity of the issue of how to value and ensure resilience. We understood current mechanisms of infrastructure assurance, although nominally "technocratic," to represent the action of subjective people acting within a specific and limited regime of knowledge. This recognition allowed us the opportunity to express the importance of adaptability, flexibility and the avoidance of epistemic monocultures. CRUISSE as a programme and anthropology, acting together, thereby shaped the nature of our enquiry, where we asked many experts with a broad range of perspectives and did not look for numbers. This, in turn, shaped our suggestions towards the solution of a difficult problem, where we came to suggest similarly open and process-led ways to intervene. This logic is now in the process of going one further step, transcending the theoretical, and become embedded in policy and practice.

To achieve this widening out of our output, we have begun to disseminate these findings broadly. We presented back via the CRUISSE conference in November, via an LSE expert workshop in December, presented directly to Cabinet Office partners, and then again to their SRBD working group in late December. When this working group conclude their work, we are hoping that our suggestions will become part of their presentation of a new standards regime to the National Security Council - NSC (THRC) - and in the preparation of a ministerial write-around in order to become policy in 2019. We will be tracking this impact and hope that this project will come to be a case study that demonstrates of the ability of uncertainty scholars to change policy and practice at the highest governmental levels.

General

Widening out from the specifics of this pilot project, what is demonstrated here is the value of the anthropological perspective in the development of government policy. Paul McCloghrie, Deputy Director of Civil Contingencies Secretariat (Cabinet Office) wrote concerning our practice that:

"Ensuring that security and resilience considerations are embedded in the design of UK national infrastructure is a key policy challenge and the report's findings have contributed greatly to the way that we will take forward this work.

We have particularly found the findings on how to build adaptive and reflexive standards helpful. These will be used as a basis to support the development of security and resilience standards over the next 12 months. We have shared the wider findings from the report with our cross-government stakeholders who have expressed an interest in the report's conclusions and how they might be used in other government projects. The section of the report detailing the critical points of intervention in an infrastructure assets' life cycle has also been useful in shaping thought on where government would be most effective in any planned interventions.

Throughout the last six months, I have been impressed with Laura and Benjamin's access to, and ability to navigate across both government and non-government stakeholders. Their case studies on projects such as the Thames Tideway Tunnel have provided some unique analysis and insight which Cabinet Office officials would not typically have access to."

This demonstrates clearly that anthropology's ability to gain access to the private sector and to synthesise the thick qualitative data provided by experts and policy makers is directly useful to decision makers. This could especially be the case when government departments are confronted by problems that cut across multiple types of institutions and bodies.

Further, anthropologists can further the aims of CRUISSE in adding towards a growing understanding, one that can only be reached through concerted work from a number of disciplines, on what radical uncertainty actually means, where it is recognised and where it is ignored, and how it impacts the decision making of policy-makers and other powerful brokers and actors.

Such an applied approach to decision making from the perspective of uncertainty has not yet been undertaken elsewhere in the anthropology of infrastructure and, as such, this innovative work will be written up into a paper to be submitted to *Economy and Society* and/or *American Ethnologist*. It will also be included in conference papers to be delivered at the UK and European Associations of Social Anthropologists. This will demonstrate the importance of this work to anthropology's infrastructural turn and the value of focusing on the role of large-scale policy and high-level decision making, against what can sometimes be a narrow focus on specific projects.

In summary, our focus on actual processes and interactions has helped the Cabinet Office to see the contested frameworks through which infrastructure is designed and implemented and to identify the best possible locations for and style of intervention to ensure the resilience of future and existing infrastructure. The Civil Contingencies Secretariat at the Cabinet Office have been able to, through our work, gain an understanding of stakeholder positions and perspectives in infrastructure to which they would not have otherwise had access. This has enriched their decision making and made it more robust, as will be demonstrated in the design of the standards regime that they will be putting into place. This standards regime will have been shaped by our reporting and frequent feedback and will have the real-world effect of improving the safety, security and equitability of our infrastructure assets and systems.

5. Further Work

In six months, we have achieved a great deal on behalf of our partners at the Cabinet Office and can clearly demonstrate how we have impacted on their decision making through our attention, in turn, on another layer of decision making: how decision making on asset resilience is made in the infrastructure sector. However, there is much that could still be done to scale up our work and provide utility to other partners. Some suggestions follow:

As social anthropologists, our methodology (including participant observation and the provision of "thick description") means that we can provide the best possible qualitative data on the actual motivations behind decision making, against rhetorics and rehearsed narratives. We do this through observing the gap between stated intentions and actions and demonstrating how occluded ideologies, concepts and preferences create social action. Therefore, more general theories of resilient decision making that are developed by the inter-disciplinary CRUISSE project should have the methodological work of social anthropology in its arsenal.

CRUISSE, with anthropologists within its operational structure, can and should be able to scale up from the pilot projects that have been described here in order to devise more general theories of robust decision making. The actual role of conviction narratives, of particular ideas of luck or

probability, and of the role of individuals' personality, social capital and charisma, should be examined in a number of real-world settings in order to ascertain the actual working nexus biases that decisions are made under. When these are understood, decisions (that are still based on uncertainty) can be rationalised; and in turn, when a focus on optimisation of outcome through probabilistic techniques such as Optimal Choice Frameworks is reduced, decision makers can then focus on making decisions through better and more robust processes.

Within the infrastructure sector, anthropologists and other CRUISSE trained practitioners should complete work to follow the effects of the kind of decisions being analysed in this pilot project and to chart how they come to effect the social, economic and physical health of infrastructure assets. Only by creating a virtuous circle between actual existing projects and decision making processes will the infrastructure sector become an example of the best decision making practices for the benefit of users.

There should be more interdisciplinary work completed on the infrastructure sector as a whole and specifically on the relationship between infrastructure strategy-setting processes, financing regimes, assurance bodies, regulators, and private providers. A joined-up picture of the sector does not exist and therefore, multiple perspectives need to be brought together in order to put nodes of decision making into context, for the health of the sector as a whole.

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