



Network
Resilience

Road network resilience in the face of the changing climate

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5th National Traffic Managers' Conference
Northampton
Wed 5th Oct 2023



JESIP Joint Doctrine (Oct 2021)

JOINT DOCTRINE: The Interoperability Framework

Edition 3 (October 2021)



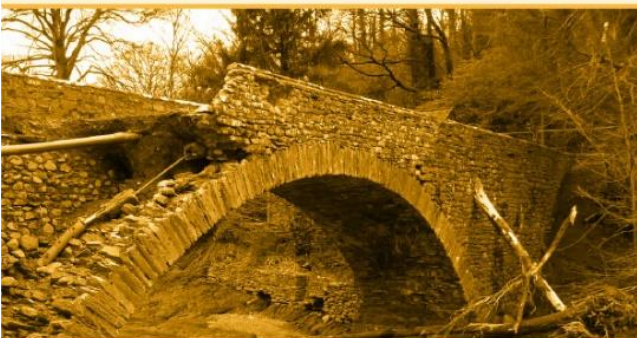
 **JESIP**
Working Together – Saving Lives

“Ultimately all incidents involve people; they might be the public we are serving, or responders who are providing that service.

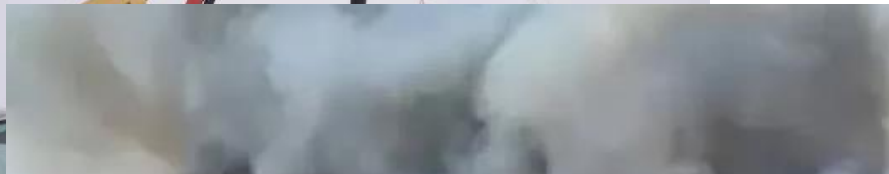
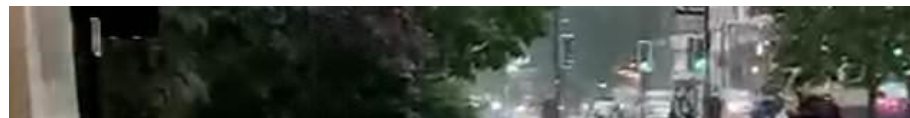
To achieve our overarching aim of *‘working together, saving lives, reducing harm’*, we need to put people at the centre of the incident, from planning, through to response and recovery.” (p.8)

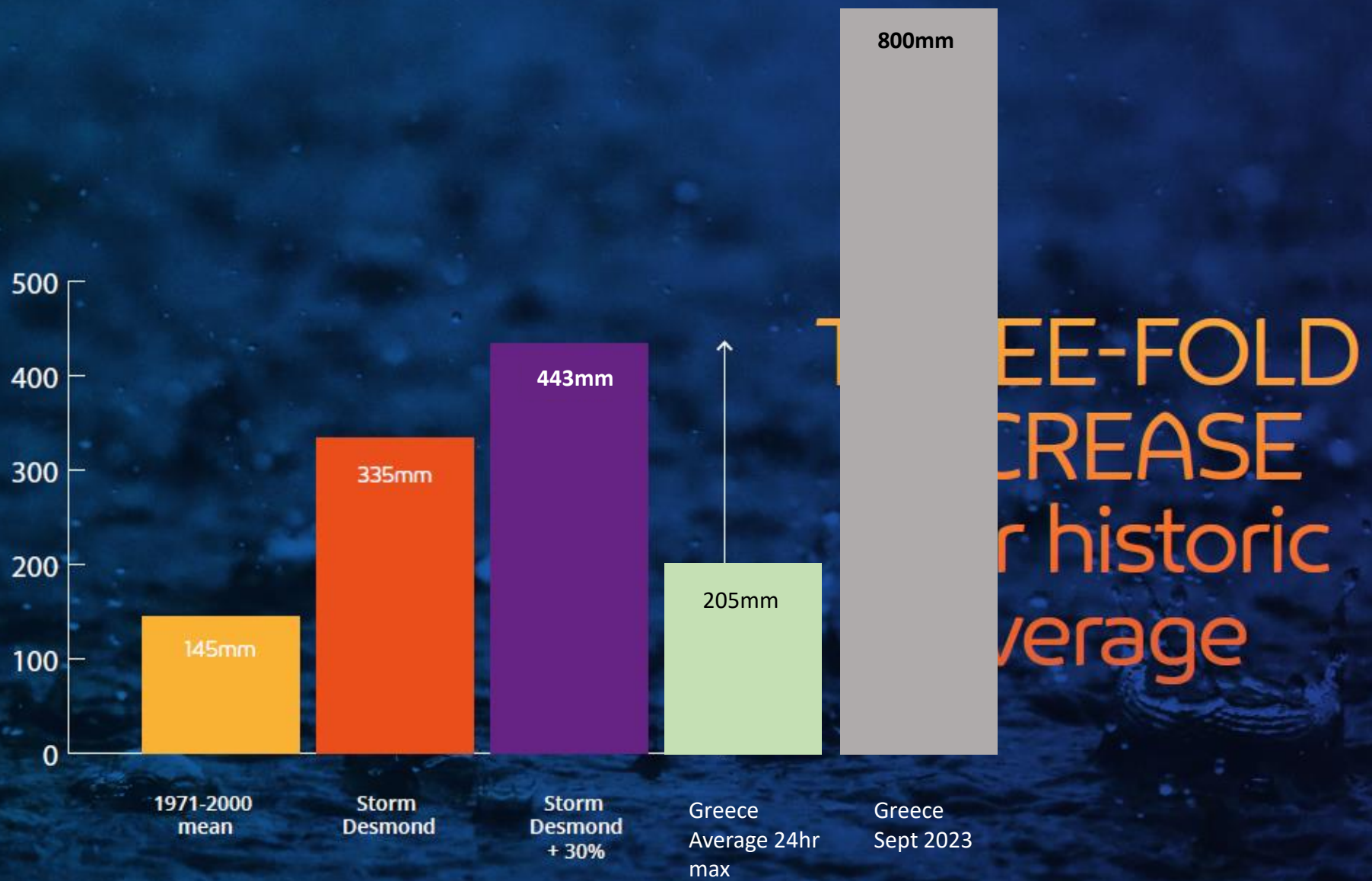
Emergency Preparedness, Response & Recovery:

**Identifying lessons learned by UK highway
sector from extreme-weather emergencies
(2015-2020)**



A report prepared for the Department for Transport and the Local Government
Technical Advisers Group by: HD Research, Bentham, N. Yorks, LA2 7DL

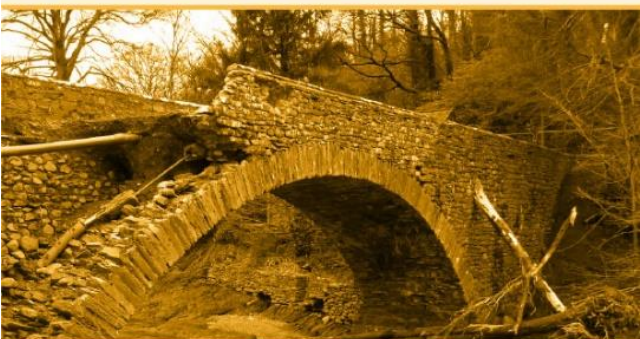




Data: Met Office (2022) and Marsh et al. (2016), HMG, Flood Resilience Review (2016)

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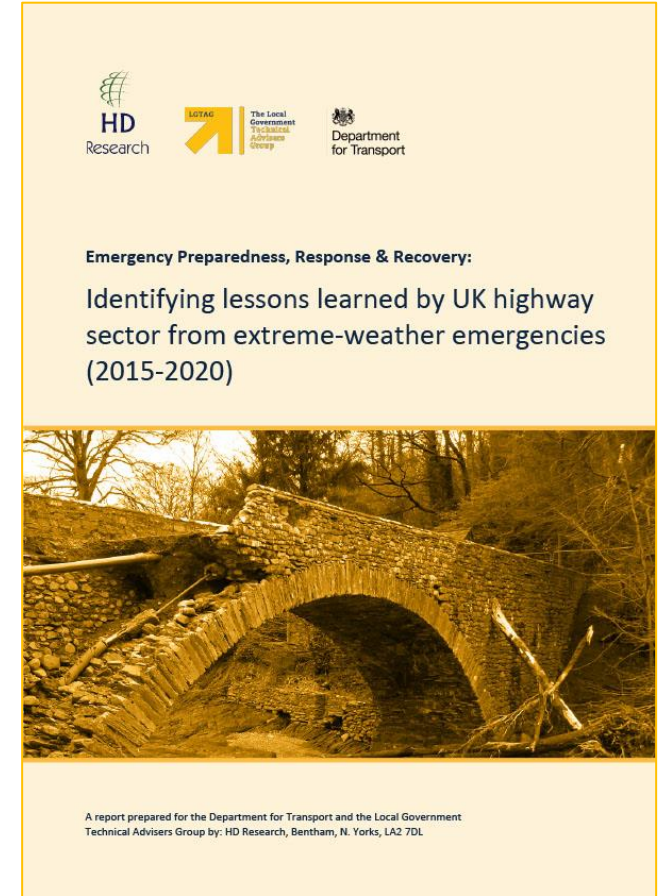
Domains of Resilience

- 1 Robustness**
physical resistance, up to design standard (e.g. high-spec materials)
- 2 Reliability**
continuity under a variety of conditions
- 3 Redundancy**
substitution (e.g. safe diversion routes, fall-back options)
- 4 Resourcefulness**
the ability to apply material (i.e., monetary, physical, technological, and informational) and human resources to meet established priorities and achieve goals
- 5 Rapidity**
meet priorities and achieve goals in a timely manner
- 6 Recovery**
recover from disruption, 'build back better'



Key recommendations from extreme-weather review

- The critical importance of **Suitably Qualified, Experienced and Empowered People** in delivering Highways emergency management.
- The need for consistent **Rapid Impact Assessment**
- For **mutual aid** contingencies to be developed **on a regional or national basis**.



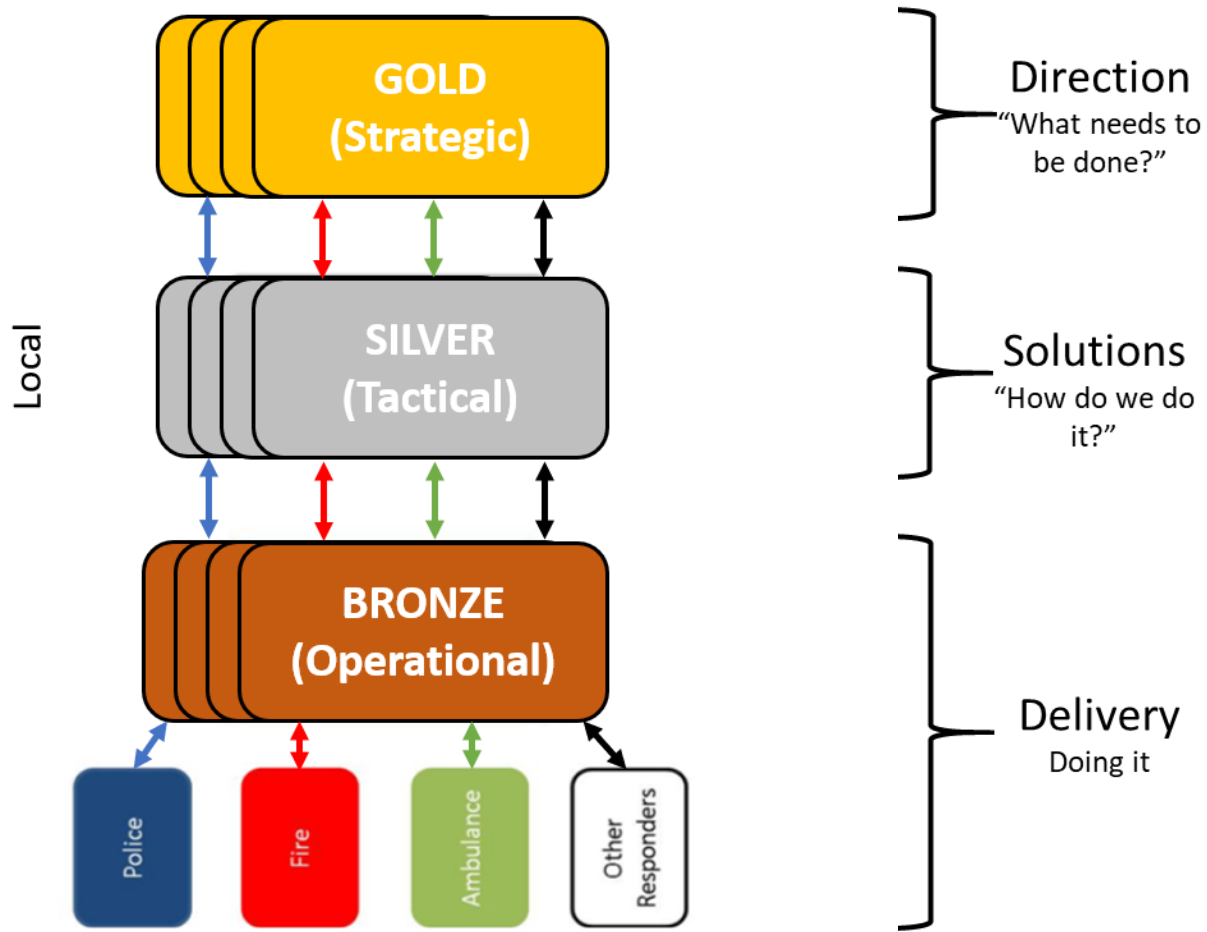
Interoperability

Interoperability: The extent to which organisations can work together coherently as a matter of routine.

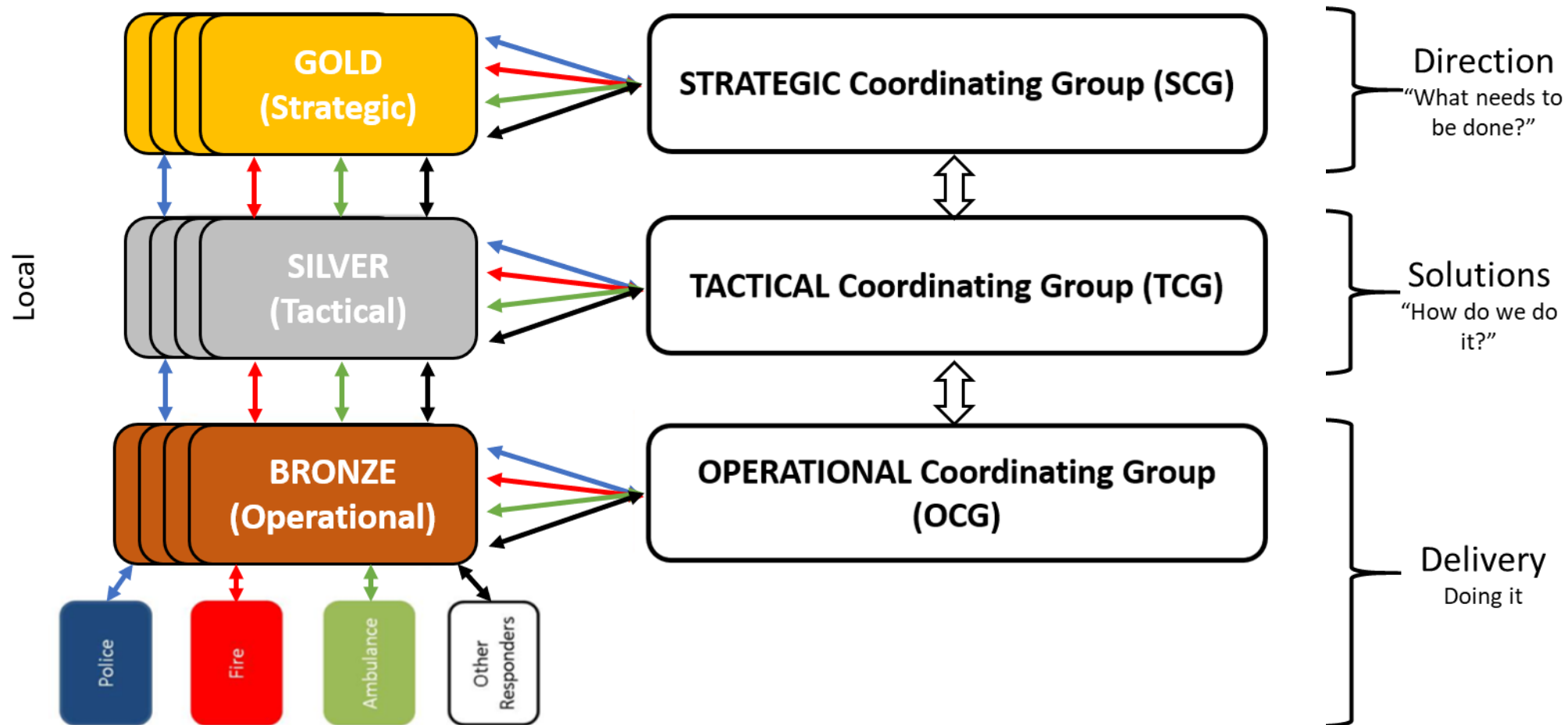
JESIP (2021)

Interoperability: a shared system of technology and teamwork built upon trust, identification, goals, communication, and flexibility.

Power, *et al.* (2023)



Single-Agency Command and Control Structures



Single-Agency Command and Control Structures

Multi-Agency Coordination Structure

Regional,
Inter-/
National

NATIONAL-STRATEGIC
Cabinet Office Briefing Room (COBR)
Lead Government Departments,
Resilience and Emergencies Division (RED)

- Establishes national strategic shared situational awareness
- Sets national strategic direction
- Coordinates the central response
- Addresses cross-cutting issues
- Coordinates support to local responders

National
context

Response Coordinating Group (ResCG)

Local

GOLD
(Strategic)

STRATEGIC Coordinating Group (SCG)

- Sets local strategic direction (Local Resilience Forum)
- Coordination of responder agencies
- Prioritises scarce resources

Direction
“What needs to be done?”

SILVER
(Tactical)

TACTICAL Coordinating Group (TCG)

- Interprets strategic direction
- Coordinates activities & assets in area of operations

Solutions
“How do we do it?”

BRONZE
(Operational)

OPERATIONAL Coordinating Group (OCG)

- Executes tactical plan
- Commands single service response
- Coordinates actions at the scene

Delivery
Doing it

Police

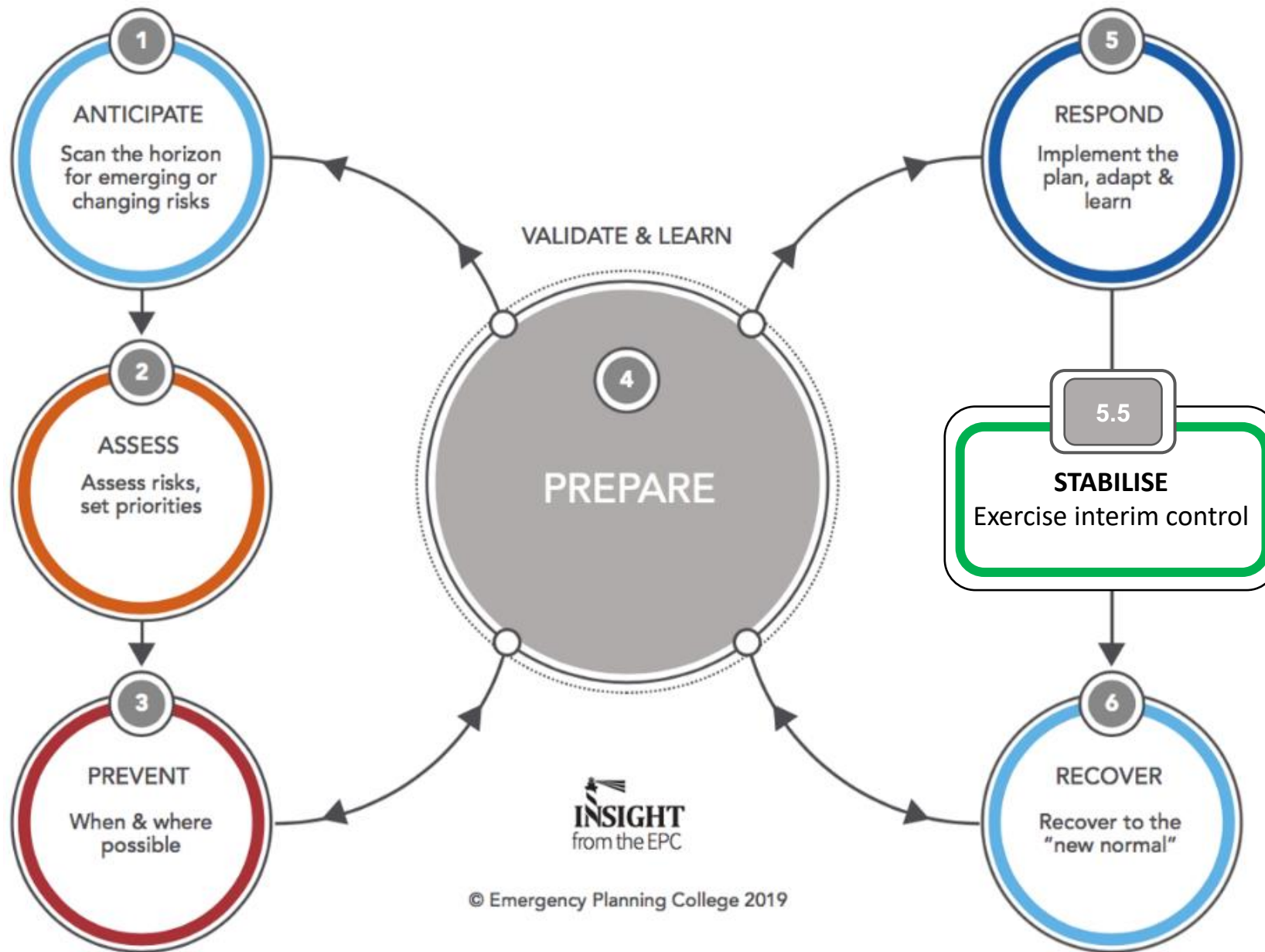
Fire

Ambulance

Other
Responders

Single-Agency Command and Control Structures




Multi-Agency Coordination Structure



Stabilisation - definition

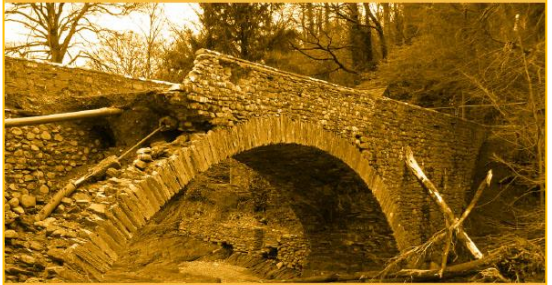
“The exercise of interim control following an incident in order to increase public safety, mitigate further damage and to reduce the likelihood of secondary consequences occurring”





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Highways as 'Lifelines'



- “Lifelines are the most **fundamental services** in the community that, **when stabilized**, enable all other aspects of society to function
- Lifelines are the **integrated network** of assets, services, and capabilities that are used day-to-day to support the recurring needs of the community
- When disrupted, **decisive intervention** is required to stabilize the incident”

Situational Awareness (SA)

Perception

Getting / Gathering Information



Comprehension

Understand / Interpret



Projection

Think ahead / Anticipate future states

What?

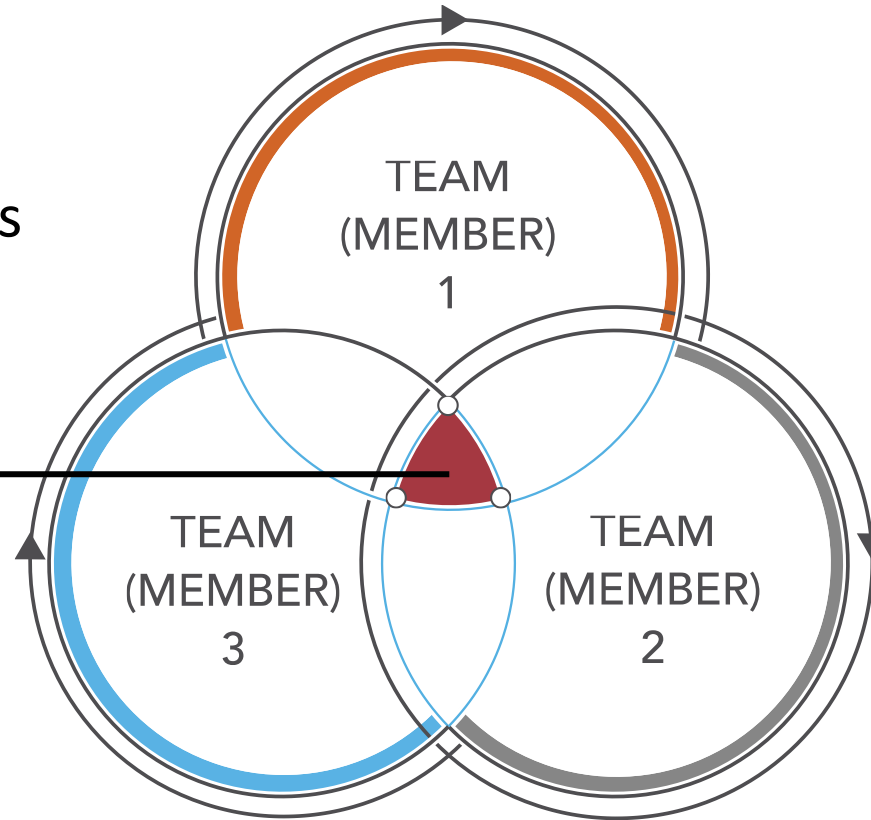
So What?

What Might?

Situational Awareness (SA)

- Commanders **jointly assess risk** to achieve common Shared Situational Awareness (SSA) of threats and hazards
- This is the **Common Operating Picture**

Part of the purpose of the COP is to articulate the team's shared mental model of the situation; its SSA



Risk Matrix

Impact	Extreme					
	Significant					
	Moderate					
	Limited					
	Negligible					
		Rare	Unlikely	Moderate	Likely	Almost Certain
		Likelihood				



Impact =



x



+

Database | 1. Flood Hazard Assessment | 2. Vulnerability | 3. Risk Calculation | 4. Layers | 8

Social Vulnerability

Build your own vulnerability index

Indicators

- ☐ English_SPH
- ☐ NonEnglish_SPH
- ☐ English_SPH
- ☐ EnglishIndicators
- ☐ EnglishInd

Build your own vulnerability index

Indicators

- Elderly (75yrs+)
- One parent households
- No access to a vehicle
- Long term illness and disability
- Household over-crowding
- Unemployment
- Non-home ownership
- Townsend Index of Deprivation
- Index of Multiple Deprivation

Property

- High
- High
- Low
- High
- Medium
- Low
- No
- No
- No

Construct District Index **Construct Local Index**

MAP

Select 7 for guidance

Update MapView

Damage

Consequences

Impact Matrix



Impact Matrix



		None-visible or suspected	Limited	Moderate	Severe	Total Failure
		Damage to Asset				

Impact Matrix

Consequences for the community	Extreme					
	Significant					
	Moderate					
	Limited					
	Minor					
		None-visible or suspected	Limited	Moderate	Severe	Total Failure
		Damage to Asset				

Impact Matrix

Consequences for the community	Extreme					
	Significant					
	Moderate					
	Limited					
	Minor					
		None-visible or suspected	Limited	Moderate	Severe	Total Failure
		Damage to Asset				

Impact Rating Matrix

Consequences for the community	Extreme	x20	x25	x35	x45	x50
	Significant	x10	x20	x25	x40	x45
	Moderate	x3	x15	x15	x25	x30
	Limited	x2	x10	x10	x10	x10
	Minor	x1	x1	x1	x1	x1
		None-visible or suspected	Limited	Moderate	Severe	Total Failure
Damage to Asset						

Total Assets	0
Total Impact Score	0

Highways Resilience: Response Assumptions

- Highways are Lifeline Infrastructure
- Highway authorities are responsible for *leading* on the creation of shared situational awareness of, and decision making in respect to, the stabilisation and recovery from impacts on lifeline road networks
- Highway Operations and Traffic Managers are Suitably Qualified, Experienced and Empowered to declare and manage a **Major Incident**:

“An event or situation with a range of serious consequences which requires special arrangements to be implemented by one or more emergency responder agency.”