Phases of an Event of Scale from a Relief, Response and Reconstruct Perspective[1, 2]

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Events of scale whether they are manmade or natural are becoming increasingly common events in an increasingly complex and networked world. The impact of natural events is further amplified by growing populations in vulnerable areas, prone to earthquake, wind or water driven disasters. Preparing for and addressing these events requires increased levels of engineering and logistical support, often requiring the mobilization and reconfiguration of global supply chains. Anticipating and understanding the nature of this engineering and logistical support and the prerequisites and lead times associated with effectively deploying it are essential to today's disaster response and reconstruction efforts.

To assist in better planning for the deployment of engineering and logistical elements post-disaster, a phased event of scale framework is laid out in the following figure. The intent is not to suggest that each of these activities is sequential but rather to define major phases for purposes of delineating precursor activities and required capabilities. Only then can the often-missing event master schedule be created at an early stage.

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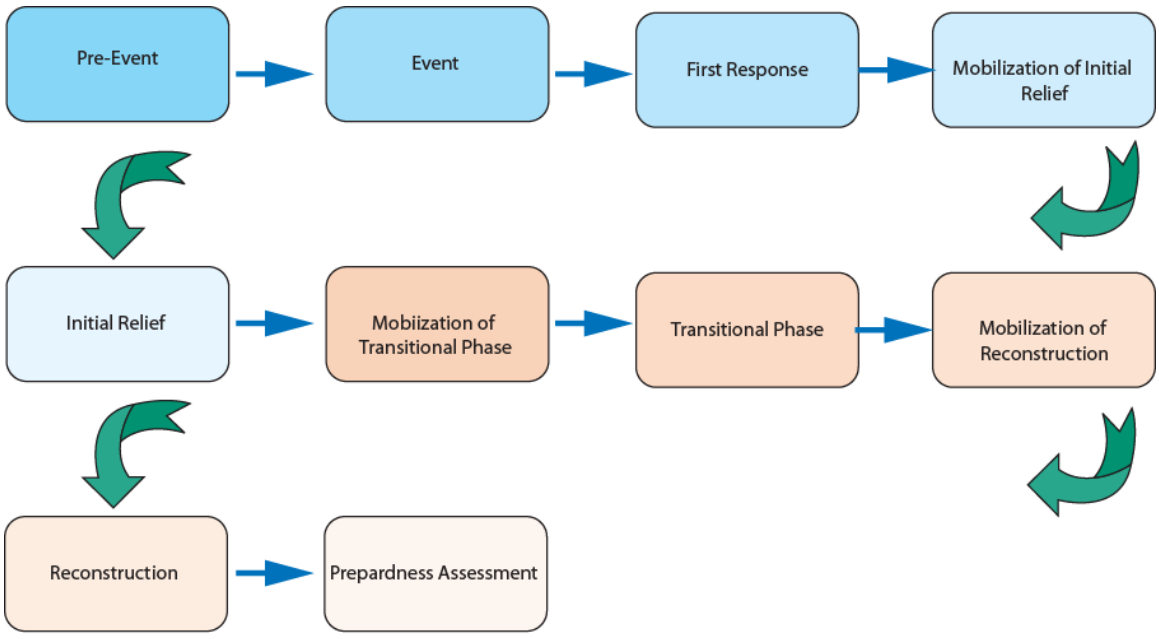

Phases of an Event of Scale

Pre-Event

Not all events of scale occur without warning and all do benefit from some degree of pre-planning and preparation. This paper will not look at preparedness as a precursor condition for an event of scale but rather only look at it in its aftermath. Having said that, certain events of scale do offer a narrow pre-event period. These may be measured in minutes to hours for tsunami and certain flooding events to days in the instance of major tropical storms, cyclones and hurricanes. Pre-event activities during this period should include:

1. Emergency notification, including a real time assessment of the emergency notification system for potential use during the event and the first response phase.

2. Evacuation or sheltering, including an engineering and logistical assessment of evacuation routes or major shelters for the extent of the operation anticipated.
    a. For example, attempting to evacuate populations in excess of logistical capability may result in a more exposed population than under a partial shelter in place scenario

   b. Similarly, sheltering decisions should consider ability to withstand the anticipated event and begin consideration of first response challenges posed by the selected sheltering strategy deployed

3. Pre-positioning of engineering first response and logistical teams
   a. Engineering first response teams should be focused on assisting first response efforts associated with life saving and rescue opportunities. Such activities may include structural advice associated with ruble entrapped individuals or continued habitability of damaged buildings. Risks to first responder operations would also be assessed.
   b. Damage assessment teams or dispatch and management functions related to such teams may be pre-positioned
   c. Logistical and communication teams may be pre-positioned during this period to quickly bring vital logistical communications up immediately after the event and to quickly identify available logistical routes and staging areas.

Event

Engineering and logistical activities during the event and continuing into its immediate aftermath should be focused on predictive forecasting of the nature, type, extent and pattern of damage. Areas at risk from secondary effects (such as flooding) should be identified and prioritized. Geospatial models may need to be updated to reflect any significant modifications caused by the event itself (new or blocked flow channels or basins as an example).Additional event phase activities should include:

1. Selection and refinement of disaster assessment checklists to be initially used
2. Pre-mobilization (alert) of first response and initial relief capabilities that were not or could not be pre-positioned as described above
3. Updated inventory of engineering, logistical and supply chain capabilities based on initial and evolving predictive modeling of event requirements.
4. Identification of legal, regulatory, insurance, contractual or other enabling frameworks that must be activated or modified.
5. Activation of disaster response teams associated with supplemental engineering assessment or logistical support to first responders
   a. These may come in part from established disaster response organizations but, based on the likely extent of the event, require supplement from other NGO or commercial organizations. Management plans must be in place for a coordinated engineering and logistical response

First Response

Engineering and logistical activities during the first response phase must, out of necessity, rely largely on resources already on the ground in the disaster area. When it has been possible to pre-position resources during the pre-event phase, these can provide a valuable complement and organizing framework for local resources. Engineering and logistical activities during the first response phase include:

1. Prime focus on life saving activities such as providing assistance on assessing structural stability of collapsed or partially collapsed structures and ruble.
2. Focus on minimization of additional loss of life, including loss of first responder lives, by identifying, categorizing and assessing potential life threatening hazards associated with subsequent engineering failures.
3. Updating disaster assessment checklists to reflect the realities of the specific event
4. Identifying evolving engineering and logistical needs during the First Response and Initial Relief phases and providing valuable input into mobilization plans for the Initial Relief phase
    a. These may include assessments of transitional shelter needs; availability and time to repair potable water, power and sanitary waste systems
    b. Changing logistical patterns including staging areas and locations for the Initial Relief phase and inputs into option analysis for the Transition Phase.
5. Establishing logistical centers to meet the needs of the First Response phase and identifying engineering or other logistical limitations that must be addressed to meet First Response or Initial Relief phase activities

Mobilization of Initial Relief

The mobilization of initial relief activities are typically the domain of the principle national or international disaster relief organizations. The focus during this phase is very much about the saving and preservation of life either in support of the first responder organizations already on the scene or as added first responder capability where such capability proved to be inadequate for the scale of event involved. Initial relief activities will consist of continued rescue efforts such as those described above and, in this regard, additional engineering resources may be deployed for what are effectively extended rescue operations. These must be fully mobilized early in this mobilization phase.

During this phase emergency sheltering will be defined and part of the mobilization activity must include assessment of existing structures for continued use. In addition plans for review of selected transitional shelter sites for safety will also be developed during the Mobilization of Initial Relief such that during the Initial Relief phase these assessments can be completed in a timely manner before desirable sites become committed to less than optimum usage. These site assessments are important even in the Initial Relief phase for example to ensure shelters are not in potential flood plain as a result of event.

Disaster assessment teams should be coming into full swing at this stage and logistical centers for initial relief activities fully stood up. Planning for transitional phase activities including identification and action on enabling activities should be begun and completed early in the Initial Relief phase. Long lead transitional requirements should be initially established and supply chains organized to meet these needs. This last item will evolve as the post event period plays out.

At each stage, engineering and logistical efforts must be focused not only on meeting current phase needs but also on establishing the framework for “vertical launch” of the subsequent phase.

Recapping, during the Mobilization of Initial Relief, engineering and logistics activities include:

1. Continued engineering support for rescue operations including:
    a. Ruble field assessment
    b. Structural stability assessments
    c. Mobilization and deployment of heavy lift equipment
2. Assessment of integrity and adequacy of existing sheltering options
3. Definition of required emergency shelter requirements and review of selected sites from a safety and logistics standpoint
4. Assessment of transitional shelter requirements
5. Development of review plans for transitional shelter sites
6. Complete deployment of disaster assessment teams
7. Standup logistical centers for initial relief activities
8. Planning of transitional phase activities including:
    a. Identification and initiation of enabling activities
    b. Establishment of long lead requirements
    c. Configuration of event specific supply chains
9. Planning for subsequent phases of event response initiated

Initial Relief

The initial relief phase comes quickly on the heels of the First Response phase and in many ways the two overlap and the transition from one phase to another will likely be uneven at best. While the First Response phase is very much focused on rescue and life saving operations, the Initial Relief phase is focused on preserving life and avoiding an even greater human tragedy by ensuring that the most basic human needs of shelter, food, water and basic medical care are met.

During this initial relief effort the engineering and logistics effort is focused on supporting these primary human relief efforts in several different ways, including:

1. Ongoing assessment of existing shelter stability
2. Identification of safe drinking water sources including emergency restoration of drinking water treatment and distribution systems where possible
3. Identification and stabilization of infrastructure essential to relief operations including airport, port, landing zone, road and rail access. Activities may include:
    a. Removal of debris
    b. Structural assessment and as required structural reinforcement
    c. Re-rating of damaged structures for emergency use in the Initial Relief phase
    d. Emergency dredging
    e. Reconfigured logistical chains associated with landside cargo handling at airport and seaports
    f. Restoration of power or provision of temporary power in support of Initial Relief phase logistical operations
4. Ongoing assessment of physical safety of sites associated with Initial Relief activities (structural collapse; flooding; mud slides)
5. Operation of Initial Relief phase logistical centers
6. Deployment of man camps to support Initial Relief phase activities including:
    a. Supporting infrastructure such as temporary power, water and waste treatment, and communications
7. Assessment of physical infrastructure and potential sites for transitional shelters to:
    a. Identify current condition, constraints and requirements to restore utility for the Transition phase
    b. Select and reserve primary locations for transitional housing

c. Facilitate long lead procurements
d. Mobilize initial design and site preparation activities
e. Identify requirements and availability of specialized labor; employment and training requirements to meet Transition phase needs

8. Identification of logistical needs for transition phase activities and initiation of enabling activities

Mobilization of Transition Phase

As Initial Relief operations stabilize the post event situation, attention turns to providing the affected population with transitional assistance until reconstruction and other restoration activities can begin in interest and ultimate transition to a new permanent condition completed. Much like the shift from First Response to Initial Relief phases, there will be an overlap and staggered shift from Initial Relief to Transition phase activities. This changeover is marked by the undertaking of various mobilization activities in anticipation of the Transition phase.

During this mobilization for the Transition phase, engineering, construction and logistical activities grow in relative importance when compared to other relief activities. This shift in relative importance of the engineering and construction role is characteristic of post event periods. By contrast, logistical operations, while growing throughout the post event period, shift increasingly to more normal conditions.

Essential engineering, construction and logistical activities during Mobilization of the Transition Phase include:

1. Identification of elements of permanent potable water system to support Transition phase and mobilization of engineering and construction resources required
2. Identification of elements of permanent waste disposal system (liquid and solid wastes) to support Transition phase and mobilization of engineering and construction resources required
3. Identification of additional infrastructure repairs to be undertaken to support Transition phase and support initial Reconstruction phase activities and mobilization of engineering and construction resources required.
4. Identification of permanent power generation repairs and replacements required and mobilization of engineering and construction resources required.

5. Identification of reconfigured power distribution networks required to support Transition phase and early Reconstruction efforts and mobilization of engineering and construction resources required.
6. Mobilization of engineering and construction resources to deploy Transition infrastructure including and transition shelter site infrastructure.
7. Mobilization of construction and logistical resources to deploy transition phase shelters.
8. Mobilize labor related training and employment activities including targeted local hire programs
9. Award long lead contracts to support engineering, construction and logistical activities including:
    a. Package treatment plants
    b. Power generation and distribution equipment
    c. Bulk material supply contracts related to aggregate, concrete and steel
    d. Ruble and debris processing equipment
    e. Hazardous material cleanup contracts to the extent not addressed in the Initial Relief phase
    f. Logistical operations

Transition Phase

Transition phase activities recognize that in events of scale there may be an extended period after the initial relief phase before permanent reconstruction begins in earnest, providing final solutions to the problems created by the event. During the transition phase the focus is on returning some semblance of normalcy in meeting population and local economy needs while at the same time completing the planning, approvals, resourcing for permanent reconstruction. During this period engineering and construction activities continue to ramp up and logistical efforts shift to a more normalized footing.

Engineering, construction and logistics activities during this phase include:

1. Engineering and construction of elements of permanent potable water system to support Transition phase
2. Engineering and construction of elements of permanent waste disposal system (liquid and solid wastes) to support Transition phase
3. Engineering and construction of additional infrastructure repairs to support Transition and initial Reconstruction phase activities

4. Engineering and construction of permanent power generation repairs and replacements
5. Engineering and construction of reconfigured power distribution networks to support Transition and early Reconstruction efforts
6. Engineering and construction of Transition infrastructure including transition shelter site infrastructure.
7. Construction and logistical support of transition phase shelters.
8. Implementation of labor related training and employment activities including targeted local hire programs
9. Construction, installation and operation of:
    a. Package treatment plants
    b. Power generation and distribution equipment
    c. Bulk material supply contracts related to aggregate, concrete and steel
    d. Ruble and debris processing equipment
10. Hazardous material cleanup
11. Transition phase logistical operations
12. Initial lessons learned assessments from an engineering, construction and logistics standpoint

Mobilization of Reconstruction

The mobilization activities for the Reconstruction phase are likely not to occur at singular period of time; will likely have different development rates for different regions and different elements of the built environment; and will occur throughout much of the Transition phase, Specific engineering, construction and logistics activities will include:

1. Reconstruction planning
    a. Public buildings including government buildings, hospitals, schools, memorials
    b. Infrastructure
    c. Privately owned utilities and infrastructure
    d. Housing
    e. Industrial and commercial developments
2. Surveying to re-establish property lines and rights
3. Code modification to build on lessons learned at the earliest stages of reconstruction
4. Permitting and approvals
5. Estimates and budget development

6. Funding and program management, engineering and construction contracting activities
    a. These will vary by sector and funding source
    b. Coordination to ensure broad priorities are met and logistical chain is adequate is required
7. Construction labor agreements
8. Definition of requisite safety, quality and inspection programs

Reconstruction

Reconstruction activities, while representing the largest engineering and construction efforts post-event, also mark a return to relative normalcy. Normal contracting strategies will tend to take hold except for the most critical elements of infrastructure which may be undertaken on an accelerated basis. Logistical chains during this period will have normalized to reflect the now stabilized post event conditions.

Preparedness Assessment

Key to long term learning and preparation for the inevitable “next event” is the performance of a Preparedness Assessment. This process acts to ensure that we have truly learned and provided for the vital lessons we have learned through each stage of the post-event period. As we have moved through the post-event period not only will our insights have become deeper but so too will our perspective on some of the actions we undertook at the earliest stages of the post-event response.

Did decisions on ruble disposal create delays or unneeded costs during the transition phase or reconstruction phase? Did temporary infrastructure decisions result in wasted efforts when permanent fixes could have been accomplished for marginally more time or money? Did management frameworks established at the earliest stages of the post-disaster period represent barriers for efficient reconstruction?

The list of post-event lesson learned questions goes on. But more important may be whether what we have rebuilt will provide a better pre-event condition that what existed before the last event, or have we merely reconstructed a built environment the sows the seeds for shortfalls in responding to the next event of scale.

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Bob Prieto is a senior executive effective in shaping and executing business strategy and a recognized leader within the infrastructure, engineering and construction industries. Currently Bob heads his own management consulting practice, Strategic Program Management LLC. He previously served as a senior vice president of Fluor, one of the largest engineering and construction companies in the world. He focuses on the development and delivery of large, complex projects worldwide and consults with owners across all market sectors in the development of programmatic delivery strategies. He is author of nine books including "Strategic Program Management", "The Giga Factor: Program Management in the Engineering and Construction Industry", "Application of Life Cycle Analysis in the Capital Assets Industry", "Capital Efficiency: Pull All the Levers" and, most recently, "Theory of Management of Large Complex Projects" published by the Construction Management Association of America (CMAA) as well as over 700 other papers and presentations.

Bob is an Independent Member of the Shareholder Committee of Mott MacDonald. He is a member of the ASCE Industry Leaders Council, National Academy of Construction, a Fellow of the Construction Management Association of America and member of several university departmental and campus advisory boards. Bob served until 2006 as a U.S. presidential appointee to the Asia Pacific Economic Cooperation (APEC) Business Advisory Council (ABAC), working with U.S. and Asia-Pacific business leaders to shape the framework for trade and economic growth. He had previously served as both as Chairman of the Engineering and Construction Governors of the World Economic Forum and co-chair of the infrastructure task force formed after September 11th by the New York City Chamber of Commerce. Previously, he served as Chairman at Parsons Brinckerhoff (PB) and a non-executive director of Cardno (ASX)

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