

## Dar Al Riyadh Insight #71

### Construction Environmental Sustainability - Construction Planning

*Dar Al Riyadh Insights reflect the knowledge and experience of our Board, executives and staff in leading and providing PMC, design and construction management services. Dar Al Riyadh believes in the importance of broadly sharing knowledge with our clients and staff to improve project outcomes for the benefit of the Kingdom of Saudi Arabia.*

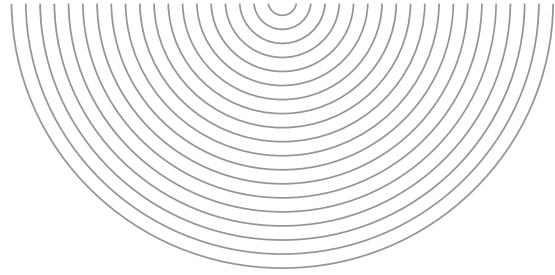
#### Construction planning

Construction planning is where the greatest improvements in construction environmental sustainability begin. In this Insight we will consider site staging, site logistics and transportation planning. Other aspects of construction planning also begin at this upfront stage but are treated separately in this series of Insights.

Often one of the first activities undertaken on industrial projects and greenfield infrastructure projects is rough grading of the site. In addition to limiting the area of disturbance, attention must be paid to the prospect of surplus material removal from the site. In one large highway project the specified centerlines (horizontal and vertical) would have resulted in significant amounts of material to be transported and disposed off-site adding cost, time and increased environmental risks. Small adjustments (6" and 3") in the centerlines allowed cuts and fills to be balanced on-site without undermining the integrity of the design and project. Similar minor adjustments to designs requested at this early stage are often easier to obtain approvals for and can contribute out-sized benefits.

Other early site staging activities often include the development of temporary parking facilities and construction offices. Base course materials for temporary parking should take advantage of recycled base course materials and final paving materials should provide adequate durability for their intended duty cycle and be suitable for recycling at the end of their life. The evolution of the site should be carefully considered especially if additional temporary parking at other site locations will be required. In addition, the ability to upgrade these facilities for required permanent parking lots should be considered both from the perspective of reducing site disturbance and in sizing the depths of required base courses.

The selection and placement of temporary offices creates several opportunities from a sustainability perspective. The constructor should identify any opportunities for meeting temporary office needs by early construction (partial or complete) of permanent facilities. While this approach may not alleviate the need for some initial temporary offices it may limit the extent

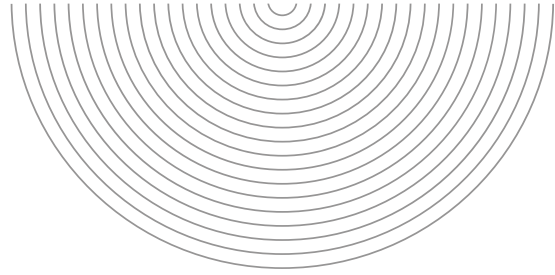


of such temporary facilities. Examples of permanent facilities that may serve as temporary offices during construction include security centers, planned administrative offices, control centers and warehouses. In addition to avoidance of temporary office construction two other considerations should be made. The first is the use of modular structures which facilitate quick installation and subsequent removal. These are more than just construction trailers and their use is becoming more common especially on larger project sites. The second is the construction of these temporary office facilities with an eye towards permanent use. This approach is best affirmed at the earliest stages of construction planning with the owner. On one project requiring labor surges for periodic turnarounds, a subset of these facilities were built and equipped with this future use in mind. On another project at a remote location, construction offices and a portion of construction labor housing were built to a standard suitable for use by the ultimate facility operating labor force.

The considerations described with respect to temporary offices and any onsite construction labor housing must also include consideration of the location, associated drainage, orientation for considerations related to solar (natural lighting; solar energy capture) and prevailing winds, and both short and longer term provisions for potable water and wastewater disposal. The use of increased insulation of these temporary structures is recommended from an energy efficiency perspective and is even more important if they are to take on a permanent character. One example of energy efficient layout was seen in a northern Canada project where there were no windows on the north side while maximizing southern exposure natural light.

Other considerations to enhance environmental sustainability during construction include minimizing encroachment (direct or indirect) into the surrounding ecosystem including removal of natural vegetation. On several projects which required restoration of disrupted ecosystems it became necessary to replant the affected areas. Several species were not commonly commercially grown and as such provisions had to be made to source these native species. Two approaches were used. The first, the early establishment of an onsite nursery area where a portion of the planted species could be relocated to other areas of the site requiring restoration. The second, contracting with a commercial nursery to grow the required species for later transplanting at the site. In both instances, species growth rates must be considered to ensure that they are in the right size range at the planned time of "harvesting". This allows for the purchase of smaller less mature plants than what we ultimately require. One caution from a delayed project should be highlighted. It is possible for the nursery raised plants to become too large in the event of a significant project delay. This occurred on one high profile urban project and actually required redesign and reconstruction of one project element.

In urban setting, disruption to the quality of life and logistical flows of the local community become important considerations. Dust, noise and spatial pollution all require careful attention.



This drives to much more detailed construction planning than many have undertaken but the result is a more supportive community and a more efficient construction execution process.

Construction is as much about logistics as anything else. As such, traffic studies and work process analysis studies should be carried out for both onsite and offsite logistical flows. Trip minimization should be sought for both labor and material flows. On one very large south-Asian construction site it was necessary to run multiple scheduled bus lines to move construction labor to, from, and around the site. On one very large urban project, zero lay-down area was available so dispatch of loads to the site from remote staging areas was required as was consolidation of loads for optimization of logistical access to the site.

Logistical considerations also encompass the movement of large modules especially those requiring restricted movements. In one large project with a number of modules to be moved along a single access road to a remote site, movement could only occur at night since road closure was required and at the end of each night a constructed temporary turnout facility served as home to the module and logistical crews including escort crews. Total transport time was about one month but longer transport windows on weekends allowed for greater spacing between turnouts but this required modules to begin their journey on a fixed day of the week. Modules were platooned to reduce road closures.

In urban areas, car pooling and the use of urban transit systems are encouraged. On one urban project the addition of an earlier bus on two routes, with a special added stop near the construction site was negotiated. On another urban project bending of rebar and fabrication of cages was performed at a remote location where parking was readily available for workers.

Before turning to another aspect of achieving environmental sustainability during the construction phase a few words on considerations in the outfitting of temporary offices is appropriate. The decisions here will rest on several considerations including anticipate project duration, assessment of productivity gains or losses, and relative cost advantages or penalties. Some tradeoffs will include new versus used furniture (no added carbon footprint for used); new versus used equipment (EPEAT) with sleep mode and double-sided printers; and use of recycled paper products. To the extent possible the construction site should strive to be paperless, with a strong document management function activated at the outset of construction (these habitually take too long to be stood up) and the use of Building Information Management (BIM) models.