Material change for a better environment

Exemplar case study

Influencing waste management at Blackfriars Station (pre-construction)

Blackfriars Station Redevelopment, Thameslink Programme, Central London
Developer: Network Rail

Artist's impression of the re-developed Blackfriars station

"Up front and continuing collaboration with our designers and Principal Contractor was vital, both for achieving high environmental performance from day one and for reducing the volume and cost of future waste."

Peter Bragg (Thameslink Programme Environmental Manager)

Best practice waste recovery achieved: 95% in first year

Based on 23,000 tonnes of waste up to 6 February 2010, and WRAP guidelines for waste diversion performance for the waste types collected

Table 1: Key waste and sustainable procurement targets for the Blackfriars Project in Balfour Beatty Civil Engineering Limited's Environmental Management Plan (EMP)

Blackfriars Project Objectives	Target Level
Diversion from landfill (by weight) of construction, demolition & excavation (CD&E) waste	90%
Recycled content in procured materials	15%
PFA content in cement production	35%
Use of FSC certified timber	100%

Achieving environmental excellence on a complex infrastructure project is not easy, but Network Rail and its supply chain are delivering waste management success.

Success factors:

- targets set for efficient use of materials and effective waste management;
- strong commitment by the supply chain;
- demolition waste separated and recycled;
- excavation waste decontaminated; and
- construction waste prevented through design

Network Rail worked with WRAP to investigate how the Blackfriars redevelopment project team surpassed good practice levels of waste diversion from landfill on one of Britain's largest and most complex infrastructure projects. They also reviewed how well the project team worked together during the pre-construction phase to:

- minimise waste in design; and
- identify cost effective construction waste management measures.

Project details

Reconstruction of Blackfriars station includes a new ticket hall and concourse for a metro service frequency of 12-carriage trains on London's main north-south rail link.

The new station platforms will extend across the River Thames on the widened Blackfriars Bridge to a new station entrance on the river's south bank.

"Pre-construction demolition and excavation waste will generate over 60% of the 60,000 tonnes of waste forecast by the project team."

Alan Cooke (Blackfriars Project Environmental Advisor)

Overcoming the challenges

Network Rail's £5.5bn Thameslink Programme will deliver major capacity improvements to London's main north-south rail link, which include upgrades to major stations, rail systems and platform extensions, while continuing to run regular services.

The Thameslink Programme has put a Sustainable Design and Construction Strategy in place to minimise the waste and environmental impacts of the programme and all of its projects.

Key themes in Thameslink's Sustainable Design and Construction Strategy:

- sustainable procurement and efficient use of materials; and
- the effective management of waste.

Blackfriars Station is being redeveloped as part of the Thameslink programme, and will generate around 60,000 tonnes of construction, demolition, and excavation (CD&E) waste.

Despite significant space, height and access constraints (see images below), the project team committed to:

- achieve a CEEQUAL 'Excellent' rating for the station and bridge redevelopment; and
- recover over 90% of the D&E waste generated by the project (this 90% recovery target was extended to construction waste in March 2010).

The site is constrained to a small area by surrounding offices, major roads, the River Thames, and railways above and below.

Working in a complex and multi-disciplinary stakeholder environment, the Blackfriars project team have clearly transferred corporate and programme sustainability performance requirements to the project supply chain.

This has allowed designers and the Principle Contractor, Balfour Beatty Civil Engineering Ltd (Balfour Beatty) to agree project waste and sustainable procurement targets with Network Rail (See Table 1 on page one).

Waste Targets in Procurement Documentation

With responsibility for two-thirds of D&E waste expected on the project, the capability to divert 90% from landfill was critical in the award of the station site demolition subcontract.

The appointed subcontractor, Keltbray, is signed-up to deliver and report against Network Rail's targets and Environmental KPIs (EPIs), as incorporated in Balfour Beatty's Environmental Management Plan (EMP).

Keltbray waste performance to 6 February 2010:

- over 13,000 tonnes of waste collected; and
- 95% of waste diverted from landfill.

Diagram 1 (see back page) illustrates how the sustainability objectives at a corporate level are set and documented in the supply chain, and also how the performance against targets and objectives at each levels will be confirmed as the project progresses.

Keltbray has put several measures in place to meet the project targets (See Box 1), and has experienced project-specific challenges in managing waste during the demolition.

Box 1: Project demolition waste management constraints and practices highlighted by Keltbray

- segregation of soft-strip and asbestos on site;
- transfer of metal and concrete waste to Keltbray Hunts (waste management partners to Keltbray) in Dagenham for separation and recycling; and
- Keltbray's control over the waste management and transfer supply chain assists in meeting project targets through:
  - inert material and remediated soil reuse at local and European sites; and
  - optimised haulage efficiency and communications (just-in-time transfer).

Demolition waste management constraints:

- the small site footprint, with materials below ground, at height and in confined spaces limits material segregation, crushing, transport and stockpiling on site for local reuse; and
- limited records of historic use and backfill depths reduce the certainty of demolition audit forecasts.

Steel is segregated on-site where possible. When noise constraints occur the separation can take place off site.

River transport

The River Thames brings a significant material transport opportunity to the project:

- barges transport the spoil removed from the piling works to local soil washing and recycling facilities; and
- from early 2010, the same barges that will transport 14,000 tonnes of construction material to the bridge site will also transport 8,000 tonnes of waste away from the site.

Designing out waste

Jacobs Engineering is responsible for the Blackfriars station and bridge superstructure designs.

Jacobs Engineering Blackfriars design status:

- option and detailed design for the north station and bridge roof superstructure completed early 2010; and
- detailed design ongoing for the south station (Jacobs were engaged at end of option design).

The Blackfriars project team is aware of the significant opportunity to reduce waste during the design phase.

Jacobs Engineering developed a Site Waste Management Plan (SWMP) for the design phase. This helped to ensure the consideration of waste during design for construction, operation and deconstruction.

By reducing the material demand in the build specification, less material is designed-in and the associated waste level is designed-out.

Jacobs Engineering put measures in place to design out waste (See Box 2).

Box 2: Project designer waste management constraints and influences highlighted by Jacobs:

- planned reuse of abutment stone and south station brick (subject to off-site processing);
- bridge roof modules will be constructed off site, reducing risk of installation waste and ensuring efficient delivery to site;
- material specification optimised for installation and performance requirements:
  - architect and design team knowledge of material stock sizes allows design to,
    - incorporate repeating patterns (e.g. for roof modules and glazing); and
    - match standard sheet dimensions and joint positions to fixing positions;
  - reduced material demand for soffit and wall finishes in 'back-of-house' areas;
- waste efficient procurement and flexibility:
  - high recycled content and future reuse potential expected from Aluminium and steel components; and
  - use of mechanical fixings (no welding) will reduce damage and promote reuse upon deconstruction;

Design waste management constraints:

- material selection subject to numerous performance and stakeholder factors; and
- programme durations for complex infrastructure works limit contractor involvement.

Some of the bridge stonework will be retained on site for reuse in the new station.

Construction waste measures

As a live document, the SWMP waste forecast was developed with input from the project team, subcontractors and actual waste data.

Principal Contractor's SWMP

The SWMP was developed using WRAP's guidance and includes:

- waste management responsibilities and EPIs;
- expected waste arisings by waste type and key work streams (using input from demolition audits and construction waste estimates); and
- the measures used in demolition and construction to minimise waste, maximise beneficial recovery of waste and minimise landfill disposal of waste.

Box 3 summarises the waste management practices planned by Balfour Beatty to minimise waste during construction.

Box 3: Balfour Beatty's waste management practices planned for the construction phase:

- reduce waste in construction and site management methods:
  - standard formwork/shuttering design;
  - efficient and protected material storage optimised within space constraints.
- staff waste management training and enhancing waste aware behaviours:
  - waste awareness certification and toolbox talks (e.g. waste segregation colour coding);
  - minimising over-excavation, over-ordering and over-supply.
- seek local reuse alternatives for office furniture and furnishings.
- optimise work with waste collection strategy:
  - plan activities with common waste type generation together to suit Keltbray's just-in-time waste transfer methodology.

Construction industry comparison

Compared to WRAP's industry waste diversion targets:

- the project has targeted CD&E waste diversion levels that surpass good practice levels; and
- the actual performance up to 6 February 2010 has reached industry-wide best practice levels.

Table 2: Forecast, target and actual landfill diversion performance

Forecast Performance (on waste arisings from SWMP forecast)	% landfill diversion*
WRAP standard practice forecast	62%
WRAP good practice forecast	84%
WRAP best practice forecast	93%
Minimum performance target	**90%**

Actual Performance (on waste arisings to date from waste records)	% landfill diversion**
WRAP standard practice forecast	70%
WRAP good practice forecast	89%
WRAP best practice forecast	95%
Actual performance to date	**95%**

* Based on SWMP forecast of total project waste and WRAP guidelines for waste diversion performance by waste type (Table 5.1 in www.wrap.org.uk/document.rm?id=5175 at 30/03/10)
** Based on 23,000 tonnes of waste up to 6 February 2010

Based on work with WRAP and site performance, the Blackfriars project team extended the 90% minimum recovery target to construction waste in March 2010.

Despite project complexities and site constraints, the project team is aiming for best practice performance.

Future actions and cost benefits

Network Rail will continue to work in collaboration with its supply chain to:

- refine construction waste forecasts in line with design element completion;
- estimate the net commercial, environmental and other performance savings of proposed waste management measures; and
- review waste diversion performance and targets against industry benchmarks through to the end of construction activities.

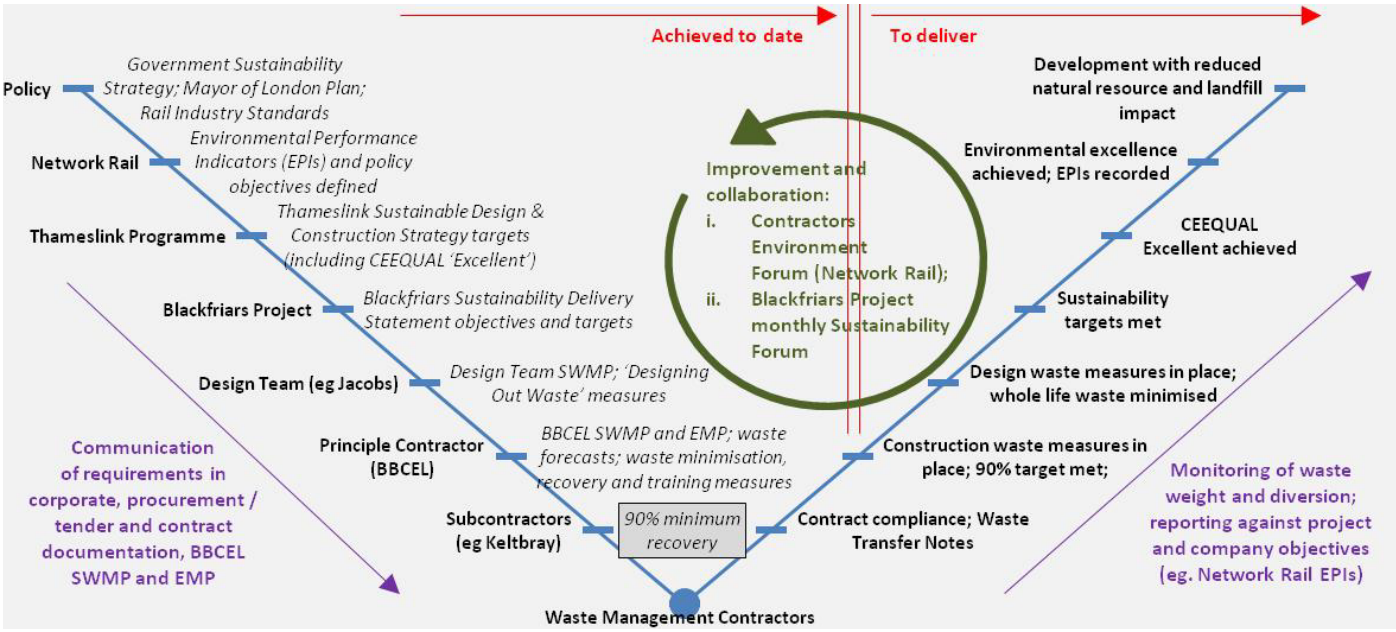
Network Rail and Balfour Beatty are incentivised together to minimise the financial impact of waste. Under their target-cost contract arrangement, they will share any cost savings achieved through more effective waste management.

Net cost benefit analysis

The net cost benefit of a waste management measure should consider:

- reduced material purchase costs;
- reduced waste disposal costs;
- reduced waste handling and effort on-site; and the
- impact on the project performance

Diagram 1: The sustainability objectives and measurement structure



Targets are set and documented at a corporate level. They are transferred down the project supply chain in project and contractor documentation, and adapted to the specific project and contract scope. The performance against targets and objectives is measured at each level to assess performance. The review of performance against objectives allows adaptation of waste forecasts at a regular series of collaborative sustainability review meetings.

Further material

For more information, visit the procurement pages on our web site at www.wrap.org.uk/construction You can access:

- a range of other exemplar and cost benefit case studies;
- information on procurement guidance and model wording;
- products which contain higher recycled content;
- the Net Waste Tool and Designing out Waste tools (free online tools for quantifying waste arisings on construction projects);
- WRAP's Site Waste Management Plan Template; and
- ･guidance on designing out waste

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