Station Design Principles for Network Rail

Document no. BLDG-SP80-002

Contents:

1 Executive summary

This guidance document is the vehicle for Network Rail in defining a station design policy for new and existing station buildings. It reaffirms a commitment to an architecture that will reflect the synthesis of 'Firmness, Commodity and Delight'[1]. The document sets the 12 principles for delivering station designs by which Network Rail will assess the submissions of its suppliers, in section six of this document.

The imperative to review, update and consolidate Network Rail's existing design guidance is necessary to keep pace with both legislation and policy but also to go beyond the pragmatic and consider the tangible benefits that design quality brings. The objective is to provide a centralised source of design information on stations that is easily accessible both internally and externally to Network Rail.

In a time when passenger expectations are rapidly increasing, the provision of safe, accessible and inclusive station environments are to be provided as a minimum. Allied to this are a sustainable whole life-whole system approach to asset design, construction, operation, maintenance and decommissioning, all of which are required for effective asset management.

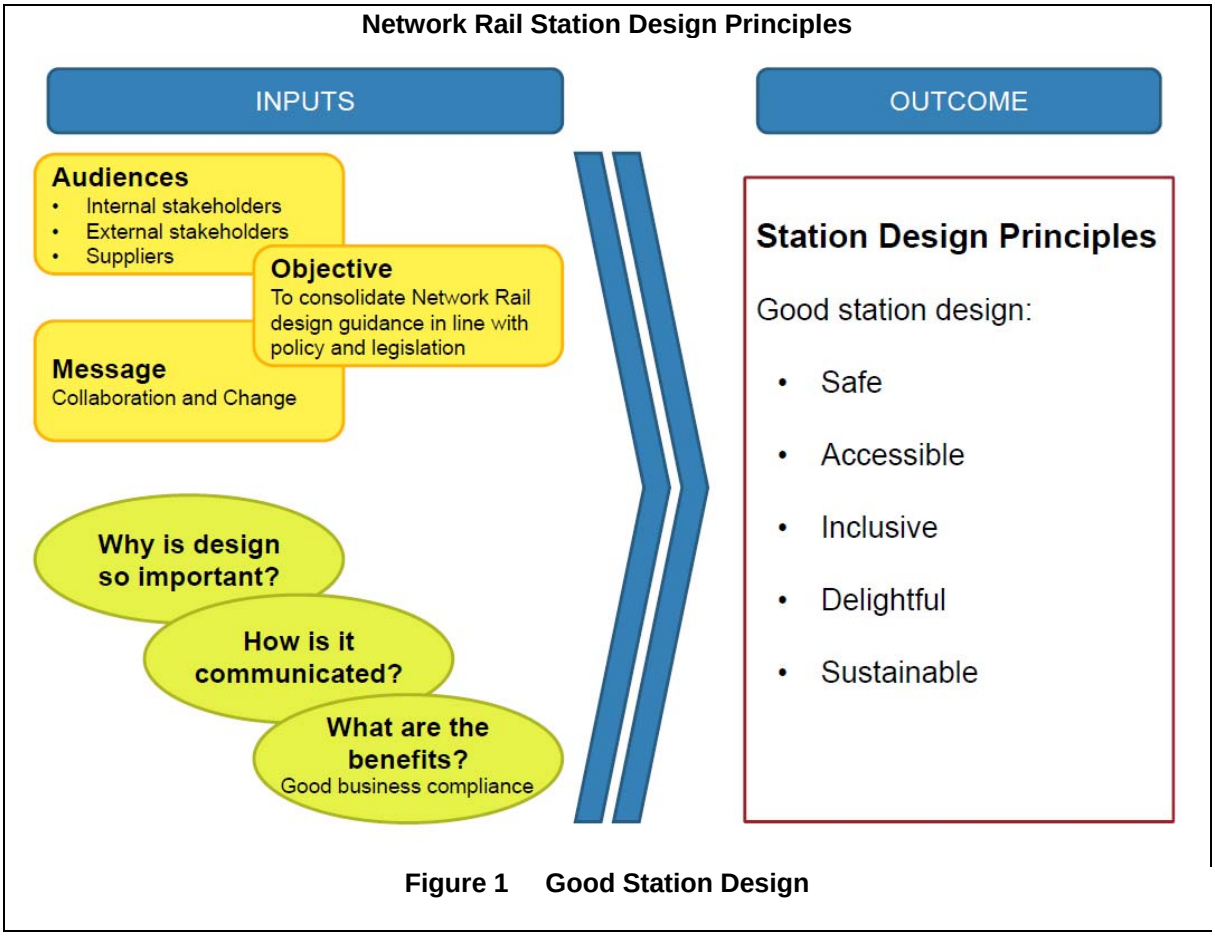

Figure 1 Good Station Design

[1] Vitruvius 27BC as translated by Henry Wotton

There is also the necessity to look ahead and consider how technology is changing the means of design production. There are fundamental shifts in the move from bespoke solutions to standard products for station building. Standardisation shall be refined by a transparent definition of criteria so that the delivery of stations will be simpler, efficient and more adaptable to change.

2 Purpose

Network Rail currently owns and manages 19 of the busiest stations in the UK and this number is increasing. As infrastructure owner of approximately 2,500 franchised stations, Network Rail is also delivering major station enhancements throughout the country as part of the CP5 programme, including but not limited to:

- Access for All
- National Station Improvement Programme
- Thameslink
- Crossrail

This document aims to set the objectives for station guidance, research, development and innovation within Network Rail.

This guidance also seeks to provide a route map for establishing a more standardised approach to the design, procurement and delivery of stations in the UK.

3 Scope

This guidance is of relevance to individuals who are involved in new construction, refurbishment, renewal, repair & maintenance, operation, decommissioning or demolition of a structure in or associated with a Network Rail station to include: buildings, platforms, canopies, footbridges, subways, shelters, forecourts, retail and car parks.

We aim to provide an overall structure and programme for the review and update of design guidelines for stations and facilities for the travelling public. The objective being to establish coherent guidance for anybody concerned with design of railway stations and associated commercial property:

- Sponsors
- Project managers
- Maintainers
- Station facility operators (SFO)
- Designers - architects and engineers
- Contractors and suppliers

4 References

A non-exhaustive list of legislation, standards and guidance notes are included in appendix B.

The design of the station environment is governed by railway specific standards that are issued both by Network Rail and by the RSSB. The diagram below describes the legislative hierarchy.

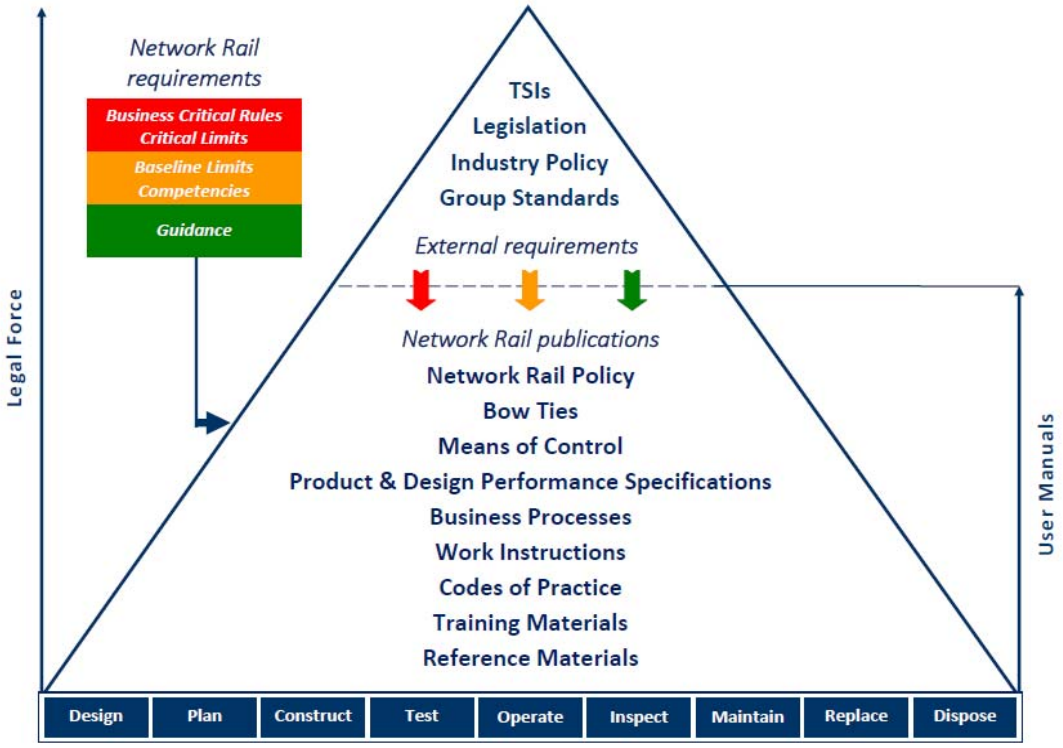

Figure 2 (Source: NR Business Critical Rules Programme)

5 Background

The following sections briefly describe a number of existing frameworks that influence the way station designs are developed and delivered.

5.1 Capacity

The industry has classified stations into six categories that are determined by the frequency of usage and complexity of interchange[2]. Below is the summary of the 2009 listing and revenue from ticket sales:

Category	No	Type of Station	Criteria per annum
A	25	National Hub	Over 2m trips: over £20m
B	66	Regional Interchange	Over 2m trips: over £20m
C	275	Important Feeder	0.5 – 2m trips: £2-20m
D	302	Medium Staffed (1 Network Rail)	0.25-0.5m trips: £1-2m
E	675	Small Staffed	Under 0.25m trips: under £1m
F	1,192	Small Unstaffed	Under 0.25m trips: under £1m
Total	**2,535**		

Table 1 (Source: DfT Better Rail Stations Report 2009)

Any project involving stations will be driven by the need to increase capacity or to improve existing facilities. Network Rail's Station Capacity Assessment Guidance provides all the necessary guidance as how to assess existing stations and proposals to ensure that the public circulation in stations is safe and convenient.

5.2 Legislation

As part of the European TSI legislation for lines on the European Network, station buildings and facilities have to comply with the 'Persons with Reduced Mobility' (PRM) requirements which are captured together with other UK legislation in the DfT Code of Practice entitled Accessible Design Standards for Railway Stations; previously Accessible Train Station Design for Disabled People.

The DfT code of practice mentioned above is actually the UK government's code of practice for protecting the interests of users of railway passenger services or station services who are disabled (under section 71B of the Railways Act 1993). In existing stations where it might be impossible to meet these requirements with conventional means, a dispensation should be sought from the DfT.

[2] Please note that as at March 2015 this method of categorisation is currently under review

Although Network Rail benefits from various permitted development rights it is best practice to liaise with the local authority. This should be done by first consulting Network Rail's town planning team regarding any development proposals. This team will advise on relevant planning matters, including advice on any consent required. Any station development that involves a joint venture with a developer will require a traditional planning application procedure.

The Guide to the Care and Development of Network Rail's Architectural Heritage provides the procedures to follow in case the station or railway property is listed or located within a conservation area. Network Rail is obliged to protect some assets as designated by the Railway Heritage Designation Advisory Board on behalf of the trustees of the Science Museum. This is a statutory protection and there are penalties if Network Rail fails to consult and agree before making any change or disposing in any way of a designated asset or record.

All new works in England and Wales should be designed to comply with the England and Wales Building Regulations and all appropriate codes of practices. In Scotland all new works must be designed to comply with the Scottish Building Regulations and all appropriate codes of practices

5.3 Design stages and approvals

The Network Rail Governance for Railway Investment Projects (GRIP) policy NR/L1/INI/PM/GRIP/100 defines eight design stages that are listed below and compared to the recently revised 2013 Royal Institute of British Architects (RIBA) plan of work stages.

GRIP Stage	NR Design Product	RIBA Stage [3]
1- Output definition	Sponsor's development instruction.	**0**-Strategic definition (**A**)
2- Feasibility	RRD Route requirement spec	**1**- Preparation & brief (**B**)
3- Option selection	Form 001 Approval in principle	**2**- Concept design (**C**)
4-Single option development	Form 004	**3**- Developed design (**D**)
5- Detailed design	Forms 002 & 003	**4**- Technical design (**E-H**)
6-Construction & commission	Approved for construction (AFC) drawings	**5**- Construction (**J,K**)
7-Scheme handback	As built drawings Health & safety file	**6**-Handover & close out (**L**)
8- Project closeout	Lessons learnt	
		7- In use (**L**)

Table 2 GRIP and RIBA comparison

[3] The letters in brackets refer to the RIBA stages as they were known prior to 2013.

The table above demonstrates that the two systems are now very much aligned. The RIBA describes in more detail parallel tasks to the core design activities such as procurement, town planning and sustainability checkpoints.

The following approvals have to take place before the closure of the GRIP4 design stage:

What	How	Who
Landlord' approval	Obtained from	Network Rail asset manager
Station change	Agreed with	Station facility operator
Facility closure	Obtained from	Regulator for any facility being removed
Signal sighting	Coordinated with	Route engineer
Maintenance strategy	Agreed with	Network Rail asset manager

5.4 Government review

This guidance coincides with and takes into account the publication of the government's Farrell Review of architecture and the built environment which has made a number of infrastructure specific and general recommendations which can inform the delivery of better station environments (www.farrellreview.co.uk).

The Farrell Review has adopted the methodology used in master-planning in recognition of the large number of stakeholders typically involved in an enhancement project. The acronym PLACE is conveniently used to identify the role of

Planning - **L**andscape - **A**rchitecture - Conservation - **E**ngineering

"Recommendation no.28
All government reviews and decision-making panels for major infrastructure proposals should have planning and design professionals represented."

The complexity of the operational rail environment requires a collaborative framework to be in place which encompasses the varied skills set, some of which are listed below:

- Sponsors
- Train operating companies
- Local transport authorities
- Network operations
- Asset managers
- Safety specialists
- Station heritage
- Station capacity teams
- Network Rail fire engineers
- British Transport Police
- Property managers
- Architects
- Urban planners
- Engineers
- Human factor specialists
- Project managers
- Local authorities
- Retail clients
- Access consultants
- Community groups

Consultations give industry stakeholders the opportunity to assess and contribute to proposed works on operational activities. This process assists in identifying risks and problem solving in advance of formal consultation activities, creating better certainty for the projects in regard to getting the necessary approvals.

It is important for these consultations to be followed up by feedback on the project once it is completed (lessons learnt) and further on in use reporting from the station operator.

5.5 Technology and innovation

Network Rail is committed to a future driven by innovation, identifying and bringing into use technical solutions that improve the railway across all key outcomes, including safety and performance. They line up with the rail industry's four key 4C challenges:

- increased **C**apacity
- reduced **C**arbon
- lower **C**osts
- improved **C**ustomer satisfaction

Network Rail is collaborating with partners including funders, suppliers and academics to direct, influence and monitor technology innovation. These collaborations have at their heart Future-Railway, a close working arrangement between Network Rail and the team at the RSSB that supports the cross-industry Technical Strategy Leadership Group.

The Network Rail-RSSB combined Future-Railway team co-ordinates research and development (R&D) investment starting from challenges that initiate solutions taking account of the whole railway system and are prioritised by their value. R&D programmes are being developed across the railway system which includes station design under customer experience and infrastructure portfolios. Station designers are encouraged to feedback challenges through the principal architect and professional head for buildings and architecture to help steer R&D investment.

However the safety and performance constraints of the complex railway industry demand that only well tested solutions can be implemented in conventional station projects. The maturing innovation capability, which is being developed alongside industry, is seeking to streamline commercialisation, validation and testing. This can increase the speed and accessibility to the railway market for innovators whilst fulfilling Network Rail's responsibility as infrastructure manager to introduce new products and approaches in a way that appropriately manages risks to the operational railway.

Current developments for the digital railway include rolling stock and command, control and communications systems which need to be closely connected with station design to ensure full benefits are realised. Ticketing and revenue control are areas where new technology application is likely to significantly impact station operation. There is an aspiration to replace the function of ticket gates and ticket offices using new technologies to increase capacity, reduce costs and improve customer experience, for example by allowing station staff to be more available to circulate among and support passengers.

5.6 BIM and asset information

Network Rail recognises that design, construction and asset management are part of a wider integrated system and aims to comply with the government target of Building Information Modelling (BIM) level two by 2016 of centrally procured government projects. Its application will provide a real opportunity for Network Rail to make efficiency savings.

BIM level two design work takes place in a collaborative environment using asset information models, underpinned by common reference systems and formats based on standards, shared libraries of elements and electronic information sharing. Adopting BIM principles leads to savings through reuse of information and a reduction in information handling, waste and rework.

BIM in a non-building context is about optimising value from lifecycle asset information; the introduction of collaboration leading to efficiency in the design process, combined with the creation of information which is fit for downstream operation and maintenance that can be reused for the next project.

The project delivery supply chain is asking Network Rail to articulate its BIM strategy and goals. The Infrastructure Projects division of Network Rail has produced a guide for employer's information requirements entitled Implementing BIM principles for Railway Infrastructure Projects'. Given the vast amount of asset information Network Rail manages the approach to BIM needs to be pragmatic and targeted at those elements which will deliver the greatest benefit.

The strategy for BIM is overarching; it embraces the Asset Information Offering Rail Better Information Services programme and the broader lifecycle asset information needs of the company to support the forward planning of the network with decision support models.

5.7 Customer focus and feedback

Network Rail has embedded into its culture the reporting of safety incidents through RIDDOR and reliability of service through live coverage of PPM. These are the two most important measures that are essential for the running of the service.

The Station Stewardship Measure (SSM) is the regulatory measure that Network Rail uses to report the asset condition of rail stations to the Office of Rail Regulation (ORR) in the UK. The data supporting the measure has been collected continuously since 2007; it is refreshed as new surveys are undertaken in a five yearly cycle. The SSM measures the asset condition of a station's building fabric and building services. The SSM score for a category of station gives a measure of the average remaining life of the stations in that category. If the SSM score remains stable this indicates the stations in that category are being maintained and renewed at a long term sustainable rate. However the score is not designed to be an indicator of passenger functionality or satisfaction.

Franchise agreements with station operators include a framework of key performance indicators covering areas such as the station environment and security; with financial penalties for the operator should it fail to achieve agreed targets.

When it comes to assessing the other factors that affect the customer experience (which are discussed in section six) the methodology for assessing existing stations prior to the project and subsequently is less established.

The National Passenger Survey (NPS) provides a network-wide picture of customers' satisfaction with rail travel. Passenger opinions of train services are collected twice a year from a representative sample of passenger journeys. Although these surveys also cover stations, they are more a reflection on the overall journey experience that is provided by the TOCs.

Sections of the network which operate within Passenger Transport Executives areas have developed their own station condition regimes such as SQUIRE ('Station Quality Incentive Regime') of the Scottish Executive. Their report of 2006 available online states that

"The top five reporting priorities for Station Aspects (in order of importance) are:

1. *Availability of information*
2. *Ticket office open and waiting times*
3. *General cleanliness*
4. *Shelters/waiting areas*
5. *CCTV/ security measures"*

At the national level Passenger Focus produces the National Rail Passenger Survey (NRPS) to guide the development of stations over the next control periods. Whereas capacity and accessibility are the main drivers for station projects, the results of passenger surveys can be very helpful indicators in identifying local issues that the projects should address to increase customer satisfaction.

6 Design policy and principles

The figure below highlights the factors that determine customer satisfaction and dissatisfaction.

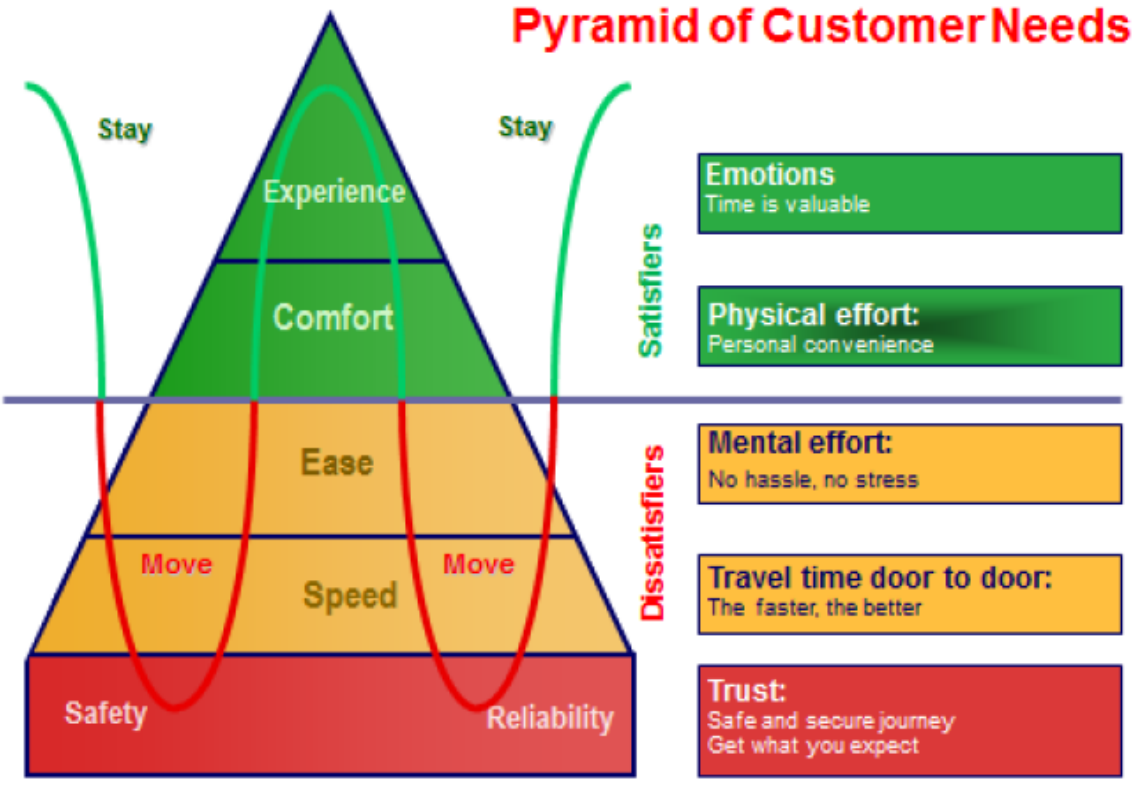

Figure 3 Customer Needs[4]

The following 12 criteria have been identified as prime drivers and metrics for the design and enhancement of stations. The first eight essentials are the 'Dissatisfiers' of the figure above; safety and reliability being the red trust elements:

- Safety and security
- PPM targets and reliability
- Inclusiveness and accessibility
- Capacity and future proofing
- Intermodal exchange and wayfinding
- Whole life cost and operation
- System Approach
- Sustainability

[4] extracted from report by Netherlands Railways "The 10 Commandments of How to Become a Customer Driven Railway Operator", Van Hagen & De Bruyn 2012

Whilst the last four enablers:

- Urban integration
- Standardised approach
- Retail, social and business
- Passenger experience and delight

are the 'Satisfiers' of customer expectations, once the preceding essential criteria have been met.

Each of the following sections is concluded with a table of useful design checklists for each principle.

6.1 Safety and security by design

Stations shall provide for the free and safe movement of people.

In addition to the hazards that are associated with any public building, the main hazards to be addressed in station design are:

- The movement of people in proximity to moving trains.
- The safety of passengers and personnel in proximity to electric lines.
- Congestion within a station in normal or abnormal operating conditions and the provisions to control the behaviour of people in enclosed areas, including overcrowding.
- The sizing and treatment of surfaces of concourses, passageways, ramps, stairs, escalators and platforms.
- The number, size and spacing of entrances, exits and the emergency evacuation arrangements.
- The considered positioning of booking offices, ticket machines, information screens and retail outlets to avoid congestion and blockages.
- The provision of adequate lighting and emergency escape lighting.
- The prevention of fire and the appropriate provisions in case of accidental or intentional fire (segregation, ventilation, suppression).
- Maintainability with acceptable safety criteria.
- Suicide prevention measures (in accordance with CP5 Suicide Prevention Strategy and National Suicide Prevention Steering Group)
- Separation of passenger and vehicular movement, to include adequate control measures at the interface between the two.
- Any security concerns identified by the British Transport Police as part of Secure Station certification.
- Mitigation of terrorism where applicable

The principle of Safety by Design aims to eliminate hazards; where this cannot be achieved the safety risks will be managed by application of the SFAIRP principle and by proper application of Construction Design Management (CDM) from inception to completion of the projects. The CSM REA defines the safety acceptance criteria that are mandatory for rail projects. The CDM Regulations along with CSM follow the principle of hazard identification and measures to manage risk:

Eliminate – Reduce – Inform - Control

Awareness of safety issues in the GRIP1 to GRIP3 stages is of prime importance, as they can have planning and cost impacts that require early identification.

Below are the main Network Rail Safe by Design principles applicable to stations:

- Red zone working should be eliminated
- Working at height should be avoided
- Working on or near the line should be avoided
- A preference shall be given to not using bespoke components
- A preference shall be given to offsite fabrication
- Eliminate restricted access and the need for personnel to enter confined spaces
- Access to concealed services shall be provided in suitable locations and never at door thresholds or corridor junctions
- Electrical switch gear must not be hidden or obstructed in relation to the surrounding environment
- Eliminate the use of carcinogenic substances
- Preference should be given to methods, materials and technology that eliminate or reduce the need for manual handling
- All heavy / large items of plant shall be capable of being replaced within agreed time limits
- All fragile or breakable building fabric shall be capable of being replaced within agreed time limits
- Combustible materials should be reduced and avoided in public areas
- Materials that can give off noxious fumes shall be avoided
- Void formers that provide structural performance shall have no risk of decomposition
- Priority shall be given to wayfinding that is intuitive
- Wayfinding, customer information systems (CIS) and signage shall be integrated into the station capacity design
- A designated space for an emergency vehicle shall be provided
- Railway systems risk evaluation and assessment shall be integrated to the station risk evaluation and assessment
- The risk and impact of stray currents shall influence material selection in affected areas

- Doors should not open outwards into the flow of passengers and alcoves should be avoided
- The design should include the natural surveillance of public areas. Alcoves and dead ends should be avoided
- The station design must discourage animal/insect infestation
- Under-platform heating shall be considered where frost is anticipated
- The use of natural light shall be promoted and glare avoided.
- Lighting should be even between different areas
- Air quality shall not be made worse and where possible improved
- The station design shall encourage encumbered passengers to use the lifts that should be easily accessible and visible
- The station design is to follow “Security in Design of Stations” and the station be accredited under the Secure Stations Scheme
- All station car park design should be accredited under the “Park Safe” scheme
- Cash in transit arrangements shall be incorporated in the design
- Platform design should dissuade passengers from waiting on platform edges
- Measures to reduce the incidence of slips, trips and falls and the need to rush within the station environment

The overall safety case for the station will be owned and managed by the SFO.

The security guidelines of the British Transport Police are available on the DfT web site: www.gov.uk/government/publications/secure-stations-scheme-guidelines

Image 1 Bijlmermeer Metro station, Netherlands (photo by Luuk Kramer)

The main areas of approval required in respect of station safety and security are:

1. Fire safety: Network Rai fire safety engineers and local fire brigade
2. Operational safety: station operator / customer services and ORR
3. Personal safety: British Transport Police
4. National security: British Transport Police and Home Office

Suicides are a societal issue which Network Rail considers necessary to address in terms of its own business; due to the impact it has on performance and the costs associated with running the network. More recently Network Rail recognises the part it has to play in society and the role that suicide prevention has in achieving a sustainable business.

Network Rail is working with third parties such as mental health specialists and the Samaritans in the community to conduct outreach work with the aim of reducing the incidence of vulnerable individuals taking their lives. Analytical data has been collated and interpreted to inform physical mitigations which have been used as exemplars on some routes.

The creation of a calm environment and the avoidance of over-stimulation are recognised as desirable in this respect. Physical mitigations to reduce both trespass and suicide in selected stations have included:

- Witches hats (cone shaped platform-end markers)
- Platform end gates
- Smart CCTV cameras
- Mid platform fencing

Safety - Station Design Check List

1	Are potential hazards and risks in the station properly identified, understood and recorded? Are they minimized for all station users?
2	Does the station design comply with all statutory emergency requirements?
3	Has the British Transport Police been consulted to identify areas that need to be addressed through appropriate design?
4	Does the layout, material treatment and lighting allow for clear visibility and CCTV coverage of all public station areas?
5	Has safe access been considered for construction, operations and maintenance of all station areas?
6	Is a fire consultant appointed and has the Network Rail fire officer approved the design?
7	Have CDM principles been properly applied to the design and its delivery stages?
8	Are the materials specified hazard-free?

6.2 PPM targets and reliability

The station has an important role in allowing the rail industry to achieve the performance and reliability targets that are set by the DfT and it is the designers' responsibility to assist in achieving these objectives. By ensuring adequate space for the public to access their trains in an efficient and legible way, the station plays its part in directing the flow of passengers onto the trains in a regular and predictable manner.

Measures such as the provision of canopies and platforms that are wide enough can be very effective means of reducing the dwell time[5]. The size, number and location of platform entrances influence passenger distribution and clearance times. Factors such as this have to be considered and integrated with capacity (item 6.4), safety (item 6.1) and accessibility (item 6.3). Legibility of spaces, correctly designed wayfinding measures and CIS play a very important role in ensuring that this is achieved.

Network Rail has standards to support the structured application of ergonomics in the development or modification of railway infrastructure and supporting systems. Human safety, health and performance can be affected by inappropriate design of equipment, work processes, working environments and passenger facilities. This can result in risks to individual staff operating or maintaining the railway infrastructure. It can also result in risks to the safety of passengers, and can impact on the efficient operation and maintenance of the infrastructure.

Reliability - Station Design Check List

1	Has adequate spatial provision been allowed for decision points, queue locations and passenger cross-flows?
2	Have passenger facilities been located to minimise conflicts with movement routes and station operations?
3	Have passenger waiting rooms and weather protection been provided appropriate to station function, use and capacity?
4	Has an ergonomics and/or human factor specialist reviewed the project in line with Network Rail standards?
5	Has the design considered the need for resilience against climatic change and extreme weather?
6	Can regular maintenance be undertaken efficiently, with minimal impact to station operations?

[5] Dwell time: the time that the train has to park in the station before safe departure

6.3 Inclusiveness and accessibility

The principle of making the station accessible to all users in an inclusive and integrated manner is a recurring theme in every area of the station design. The DfT code of practice Accessible Design Standards for Railway Stations covers, in a very clear manner, the legislation and guides concerning this vital element of any station design and operation that SFOs have to follow. This guide should also be applied when designing associated retail and catering facilities.

All licences issued to passenger train and station operators by the ORR contain a condition that, in drawing up their Disabled People's Protection Policies (DPPPs) the licensees will pay due regard to the code of practice. Where a non-exempt station scheme, undertaken by a licensed operator, cannot meet the European or national standards in the code of practice, the scheme promoter must contact the DfT to apply for a dispensation. Dispensations against the European TSI's are to be directed to the head of interoperability at the DfT.

In franchised stations, where Network Rail is not the operator of the station, it still has the responsibility, as a landlord, to follow the guidance and provide the operator with a station environment that will allow the operator to comply with the requirements of the code of practice.

Both retail and catering facilities on our stations shall make these accessible to all passengers, and consider the needs of all customers when designing their internal layout. With an ageing population the placement and size of way-finding signage requires careful consideration.

Image 2 Colchester station

In stations with large demand a mobility assistance reception has to be included and the storage and movement of assistance vehicles has to be allowed for. Local accessibility groups and stakeholders shall always be consulted when stations are being modified as they will provide very useful general insights as well as context specific issues that they experience on a regular basis.

Accessibility - Station Design Check List

1	Are spaces free of clutter with appropriate tonal contrast between wall and floor surfaces?
2	Have escalators and lifts been located on or adjacent to desire lines with good natural surveillance?
3	Has provision been made for mobility buggies avoiding impacts on other station operations?
4	Is the station compliant with DfT code of practice?
5	Has advice been sought from a Network Rail or external accessibility consultant?
6	Has a diversity and inclusion assessment of the project taken place?
7	Can service information be accessed and understood by all users?

6.4 Capacity and future proofing

Station capacity is the ability of a station to safely, comfortably and conveniently accommodate and circulate the forecast passenger numbers. It is the critical starting point for any station modification and design. A station capacity assessment will provide the necessary information relating to passenger movements at a station.

Network Rail has a dedicated station capacity team that will either carry out capacity assessments internally or oversee assessments by external parties. They produce the Station Capacity Assessment Guidance document which outlines the factors that should be taken into consideration during an assessment.

By carrying out a station capacity assessment Network Rail can minimise safety risks relating to passenger congestion as well as optimise station layouts and plan for future growth.

Depending on the information available and depth of the exercise undertaken station capacity work can also help to:

- assess the capacity of critical points
- assess capacity constraints at stations
- assess the implications of degraded, emergency and perturbation scenarios
- consider how an area may operate in future years with forecasted movements
- assess significant timetable changes
- assess the impact of retail proposals
- highlight design issues and influence design
- understand where the movement of people needs to be managed
- understand station demography

- inform where way-finding / directional signs or other methods to direct people are required
- determine if and where peoples' decision point is according to their direction and destination
- determine operational control mechanisms during major events

Capacity - Station Design Check List

1	Has the project been assessed by a Network Rail or external accessibility consultant?
2	Does spatial provision meet with current and predicted future needs?
3	Does the design facilitate convenient and safe access for pedestrians and other feeder modes to meet with passenger and operational needs?
4	Has sufficient capacity been provided at entrances to avoid conflicts?
5	Does the design anticipate the need and potential for future change?

6.5 Intermodal exchange and wayfinding

The designer is expected to ensure that journeys are as seamless as possible. The station design has to take into account that passengers do not start and end their journey in a station. Their travel experience is very much determined by their approach and departure from the station. Depending on location this can be any combination of the following forms of transport:

- Walking
- Cycling
- Car drop off or taxi
- Bus or tram
- Car parked in station car park
- Underground railway
- Airports
- Boat

The station has to cater to the requirements of all the above customer groups and accessibility is of prime importance. Interchange between all modes must be efficient and obvious to the traveller with clear signage, minimum changes of level and where possible protected from the elements.

Image 3 Stratford station

In 2011 Network Rail issued the Managed Stations Wayfinding Guide to provide a consistent approach that will improve the passenger experience. The document's recommendations should be extended, wherever possible, to cover franchised stations in coordination with the station operators. In major stations or stations with large interchange a wayfinding consultant should be appointed for the design and supervision of any significant signage alterations.

Interchange - Station Design Check List

1	Does the spatial organisation provide for efficient vehicle movement, while minimising conflicts between vehicles, pedestrians and other means of transport?
2	Does the design include conveniently located pick-up and drop-off areas for taxis, buses and private vehicles?
3	Is there an integrated local transport strategy and is the design coordinated with other means of transport?
4	Have appropriate bicycle facilities been provided?
5	Have appropriate cark parking facilities been provided?
6	Does way-finding comply with Network Rail's wayfinding standards?
7	Has an independent[6] way-finding consultant been appointed to determine location and specification of signage?
8	Does way-finding and information support onward movement beyond the station footprint?

[6] Not a supplier

6.6 Whole life cost and operation

Consideration of all phases of a station's life, from design and procurement through operation, maintenance and end-of-life salvage establish the most effective allocation of fiscal resources.

Optimising functionality of the station design minimises operational costs and waste, and the consumption of natural resources. This can deliver significant cost and energy savings over the life of the building and provide an economic return. The following considerations will help in reducing the whole life cost of any project:

- A building configuration plan and specification of materials and equipment to minimise operational and maintenance costs
- Design for ease of access for replacement, repair and cleaning of building fixtures and components with minimal impact on station operations and users
- Design for preventative as opposed to corrective maintenance and a maintenance strategy that is factored into the design
- Minimised energy use and costs through consideration of passive environmental design strategies (eg natural light and ventilation)
- Detail for weather resistance, protection against corrosion between dissimilar materials
- Suitability of design to local climate and circumstances
- Standardisation
- Sustainability

In 2014 Network Rail has produced its Whole Life Cost Manual to demonstrate its commitment to carry out its activities at the lowest whole- life / whole-system cost. These cost considerations are adopted in defining asset policies. The asset policies define the intervention rules for renewing and maintaining assets and therefore drive the majority of Network Rail's expenditure as well as the condition and performance of the infrastructure.

Materials used for station enhancements and repairs are required to be 'fit for their intended function' and represent the best whole life value. All 'designers' have a duty to record:

- The forces the material can withstand in its specified location
- The materials expected design life
- What to do in the event of material failure
- How the material is to be maintained, the frequency of its maintenance and how it will be accessed.
- How the material is to be repaired or replaced, the frequency of its replacement and how it will be accessed.

The Building Research Establishment Environmental Assessment Method (BREEAM) assessment tool (Material 05) provides practical objectives for designers to design out risk and provide due consideration when specifying materials to vulnerable areas. BREEAM (Management 04) promotes the creation of a Building User Guide (BUG) to inform how to maintain an asset. The format and content of all Operation and Maintenance documentation is to be agreed at GRIP 4.

Whole Life Cost - Station Design Check List

1	Have all phases of the station's life been considered?
2	Has the design been optimised to minimise ongoing operational costs, waste and the consumption of natural resources?
3	Has end of life reuse and disposal been considered to minimise waste and allow for positive reuse and regeneration of components?
4	Does the design exploit opportunities to maximise energy efficiency over the station's whole-life?

6.7 System approach

A railway station can be seen as the most complex part of the railway system. It is the most visible part of the railway to the travelling public and it has to work seamlessly in delivering the various functions such as arrival, ticketing, retail, information and departure, as well as back office and storage facilities. From the first concept design to the final handover a scope and remit needs to consider the following possible interfaces with rail systems:

- Potential requirements for traction power accommodation
- Connections to the electric grid and potential power supply equipment
- Electrical clearances from overhead lines
- Communications equipment and rooms
- Sufficient and safe maintenance access
- Trackside services equipment
- Integration with rolling stock
- Train dispatching
- Security systems and control
- Human factors

Network Rail has a dedicated human factors team that will undertake human factor assessments or oversee assessments by external parties.

- Review any changes to the station building design or use and assess the impact to operational staff and to the station operational concept to derive operational requirements.
- Design of station control room, station reception and ticket offices and input into the design of operational equipment (eg building management systems or station management systems)
- Development of an integrated wayfinding solution for the station that includes the requirements for signs and CIS screens to support passenger decision making and efficient passenger flow management
- Definition of the information required on CIS screens though analysis of the specific passenger journeys at that station
- Definition of the size and position of display screens and signs to ensure that the required information is readable at relevant decision and confirmation points

System Approach - Station Design Check List

1	Have convenient and comfortable staff facilities been provided appropriate to the station size, location and functions?
2	Have management and maintenance requirements been considered and agreed to with all relevant stakeholders?
3	Does the station design take full account of heritage assets and needs?
4	Have management and maintenance requirements been considered and agreed to with all relevant stakeholders?
5	Have other projects affecting the station been integrated and coordinated with the project?
6	Has an interdisciplinary design coordination (IDC) taken place and approved by Network Rail?
7	Has a project notification form 004 been submitted to Network Rail ergonomics team prior to the closure of GRIP3?

6.8 Sustainability

With the predicted two degree Celsius rise in global temperatures[7] in the next 100 years bringing with it further extreme weather station design is required to adapt to a changing climate.

[7] Intergovernmental Panel on Climate Change

Network Rail's Buildings Policy states that for new construction, major refurbishment and enhancement of operational buildings with a budget above £2m a recognised sustainability assessment tool should be used to benchmark performance.

Established sustainability assessment tools are developing to not just assess energy but also to address the social and economic impacts of development which is more aligned with the true meaning of 'sustainable development'.
Network Rail has produced the Sustainability Requirements for Network Rail Buildings in 2013 stating that wherever Network Rail is responsible for new, major refurbishment, renewal, enhancement and maintenance schemes for buildings and operational properties, a recognised sustainability measurement and assessment method should be used. It is suggested that, until a railway specific tool is available, a well-recognised method such as BREEAM or Civil Engineering Environmental Quality Assessment Tool (CEEQUAL) shall be used where appropriate for the assessment and certifications purpose.

What is apparent when using any of these assessment tools is that in order for the best outcomes to be achieved sustainability needs to be embedded and agreed at the earliest opportunity in a projects life cycle or else the developments environmental performance will be compromised.

BREEAM has a wide ranging of suite of methods which could be used for operational and refurbishment stages of the building cycle. The BREEAM tools have the aim of also providing post-handover aftercare to the building occupant during the first year of occupation to ensure the building operates in accordance with design intent and operational demands. Any new station building would require a BREEAM assessment with the minimum objective of very good.

The Network Rail Sustainable Development Strategy focuses on the company's strategic objectives which with regard to buildings highlights

- Take a longer term view of building design and construction, integrating sustainability into specifications for new and refurbishment work prior to design stage
- Put in place plans to change behaviours in the users of buildings to reduce energy consumption.
- Work with colleagues and external contractors to facilitate prioritised retro-fits for energy and resource efficiency across our building stock.
- Provide training and leadership to colleagues across the organisation to ensure that existing buildings are used and managed as efficiently as possible
- Benchmark and audit our existing buildings portfolio to enable SMART targets and performance metrics to be agreed
- Utilise our buildings to benefit the local economy, support the needs of local communities and, where possible, support national regeneration and development schemes

To facilitate the delivery of Sustainable Development Strategy procurement tools have been developed for anybody with sourcing or purchasing responsibilities which prioritises

- Engage suppliers & communicate our sustainability requirements
- Sustainable design – minimise environmental/social impacts
- Challenge standards & encourage innovation
- Understand the risk in the supply chain (suppliers & materials)
- Focus on value not cost
- Understand & monitor supply chain performance
- Align commercial and technical strategies
- Relationship management (both suppliers & stakeholders)

Sustainability - Station Design Check List

1	What environmental assessment method is being used and has it started before GRIP3 completion?
2	Have materials been selected to avoid complicated repair, removal or disposal processes?
3	Has expansion been facilitated or inhibited in any way by the design? How will the station cope in the future?

6.9 Urban integration, heritage and stakeholder interface

Any major intervention in a station and certainly any new station construction must take into account the aspirations of the people using it or being affected by it. Typically being the first impression of arriving in a locality, the station and its urban integration with the surrounding environment are of prime importance and often act as catalysts for future development.

At the top of the stakeholder list which at times can be very long (see section 5.4) is the local authority which is normally the custodian of any local plans for the future. Integration with local transport policies and requirements will be an essential part of any such consultation.

It is recognised that a good relationship with stakeholders is the best recipe for a project that will succeed and be well received by the public. The effort that this requires at the beginning of the project will normally pay itself back by avoiding unpleasant surprises and objections at the later stages. It is also a good way to understand and capture site specific requirements that could not have been anticipated from precedents of other projects.

Image 4 Sheffield Station

In stations that are listed, no work can be undertaken without prior consultation with the Railway Heritage Trust.

Place - Station Design Check List

1	Does the station design integrate seamlessly with the surrounding public realm?
2	Have surrounding public spaces been designed to provide high quality places where people will want to linger and enjoy?
3	Has the relationship of the station and any surrounding development been considered to ensure a positive integration that opens up views, sightlines and maximises energy optimisation opportunities?
4	Is the design appropriate and responsive to its local context?
5	Has a Form 004 been submitted to Network Rail buildings and architecture prior to closure of GRIP3?
6	Is the station listed or in a conservation area? Have the appropriate stakeholders been consulted?

6.10 Standardised approach

There are clear efficiency advantages to be gained from standardisation in design, procurement and maintenance of station properties. Furthermore if it is managed in a well-considered way, this will complement and become part of the corporate branding, as is the case with companies that successfully manage their property portfolio.

Network Rail has a clear incentive to develop a standardised approach to building and maintaining its built assets. Section 7.3 describes how this should be achieved. Below are some of the potential benefits of this approach:

- Reduction of repetitive design efforts and costs
- Consistency of appearance (branding)
- Ease of maintenance by using familiar components
- Economy of costs through management of bulk procurement
- Potential for feedback and product improvement
- Higher control of quality and reliability
- Reduction of hazards and human error through familiarity
- Better control of whole life costs

Rail customer expectation is rapidly increasing. However, there are some constants which form part of the 'operational corridor' of any station that need to be optimised which include:

- Wayfinding
- Accessibility
- Personal safety
- Cleanliness
- Shelter
- Interchange

These service essentials are under review by Network Rail to ensure that their provision is both high quality and consistent across the network.

Standardisation - Station Design Check List

1	Have materials been selected to provide a balance between function, performance, sustainability, cost efficiency and appearance?
2	Have standardised and modular elements been considered where appropriate?

6.11 Retail, social and business

It is increasingly the case that travel facilities are being mixed and integrated with other social and commercial activities. As long as these activities do not hinder the safe and efficient operation of the stations, they will have a very positive effect on the economic viability and the public perception of the rail industry. The extent of these activities will be very much be determined by location.

In city centres there is increasing scope and demand for this kind of activity as evidenced in King's Cross, Waterloo and Birmingham New Street to name just a few such examples. However, even small stations can benefit from the addition of a retail unit inside or outside the station. In a small station this can have a very positive effect of increasing surveillance, promoting social interaction and satisfying basic customer needs.

In the case of the large and managed stations there is a clear need for each station to have a master-plan to allow any commercial development to be integrated with

the station's operational requirements. With the increase of activities around the station there will also be an increased demand on the operators to provide additional services such as car and cycle parking, rest rooms, change rooms and additional toilet facilities. All these facilities shall comply with the DfT code of practice. Network Rail Group Strategy & Planning has produced a guide to assist promoters investing in railway stations called Station Investment Guidance.

Retail - Station Design Check List

1	Have passenger amenities, such as retail and toilet facilities been provided appropriate to use and context?
2	Does the design provide for mix of uses and development opportunities appropriate to the station context and location?
3	Is signing provision balanced with retail frontage and advertising to avoid visual clutter?
4	Have potential clashes with passenger movement been identified and avoided?
5	Has the operator of the station agreed in principle to the proposals?

6.12 Passenger experience and delight

"We delight in complexity to which genius has lent an appearance of simplicity" (Alain de Botton 2006, The Architecture of Happiness)

The treatise quoted above tries to explain in modern terms what the virtues of architecture might be and suggests the following four:

Order Balance Elegance Coherence

These are certainly qualities that one would seek in any building although the route to achieving them may differ depending on the historical, geographical and social context. The search for formulas that will produce good buildings was the origin of architectural theory and continues to this day, although it is generally recognised that there is surely is an element of intangible art to the most successful buildings.

Image 5 Sudbury Town Underground
Ordered, spacious, uncluttered, beautifully lit

It could be argued that consistency of offer as seen in a supermarket chain has some benefit but so often this is at the expense of character and sense of place. London Underground's stations designed by Charles Holden and commissioned by Frank Pick are still held in high regard as exemplars of stations that, although not identical in design, exhibit a commonality of parts that successfully gives coherence and order to the whole.

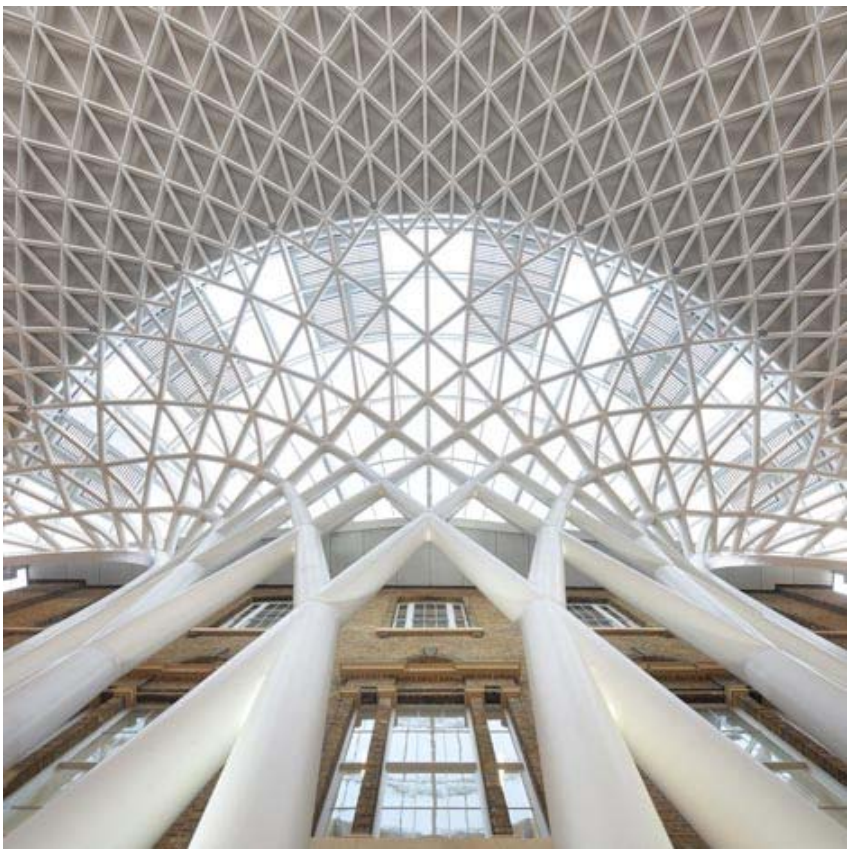

Image 6 Kings Cross 2012 (photograph Hufton + Crow 2012)

There is no debate however that our appreciation of the art is perceived by our senses. When considering the comfort of passengers and operators in the busy and sometimes chaotic station environment, the senses must be given due consideration in the development of a design to lift it from the prosaic.

Light - It is the role of the designer to maximise and control the amount of natural daylight in the station as well as to carefully consider the artificial lighting.

Colour -The palette of colours must be calm and also compatible with the branding of the station operator. For the people with visual impairments the surfaces must not be too reflective and vertical planes well contrasted from horizontal surfaces.

Sound - The acoustics of the spaces must be well considered and adapted to the use of public announcement systems.

Volume – The spatial volumes must be well proportioned, appropriate for their use and feasible to maintain.

Station buildings matter and they have an impact beyond their immediate boundary and should be regarded as place makers which influence the local economy, its cultural identity and environmental wellbeing.

Unlike any other building typology (with the possible exception of markets) stations are buildings where the distinction between indoor and outdoor is ambiguous. These transitory spaces are complex and require functional efficiency as a minimum and the intelligence of architects to bring Order, Balance, Elegance, and Coherence and to satisfy the public.

Delight - Station Design Check List

1	Does the spatial design allow clear sightlines and views between principal destinations?
2	Are the volumes appropriately sized and naturally lit?
3	Does the local status or demand justify a distinctive, landmark design? If so, does the design foster a distinctive identity?
4	Is the design appropriate and responsive to its local context?
5	Is the design balanced and coherent?

7 Future guidance

Network Rail has identified three major areas that will be addressed in order to provide users and designers with more clarity:

- Documentation
- Master plans
- Standardisation

7.1 Documentation

The list of guidance notes for stations is included in Appendix B revealing a multiplicity of documents. There is considerable duplication in the documentation that will be reorganised and formally issued in accordance with quality control standards. Great care must to be taken with regards to the purpose of documents. The distinction between mandated requirement and advice will be clarified. The next version of the Construction Handbook will address the issues raised above.

7.2 Master plans

It is noted that a number of major stations do not have a master-plans. For significant stations, master-plans should be created and reviewed by design panels.

Typically a master-plan for a major station should cover the following headings:

- The history of the station
- The urban context
- Developments and third party schemes
- The condition of the station
- Capacity issues and forecasts
- Existing interchange
- Accessibility issues and wayfinding
- Ticketing – sales and gates
- Rolling stock and platforms
- Future transport projects and expansion
- Retail and commercial opportunities
- Deliveries and refuse collection

In the case of listed stations conservation management plans should be prepared in consultation with Railways Heritage Trust.

7.3 Standardisation

Network Rail has lagged in comparison with some of its European counterparts in embracing standardisation as an effective means of producing a more consistent and cost effective way of delivering quality stations. This is partly exacerbated by the fact that the franchised stations in the UK are being maintained by a number of SFOs with differing branding and procurement strategies.

Previous attempts at modular station design by Network Rail have not been very cost effective because they were delivered as isolated items and not as part of an overall programme of works so the inherent benefits of modularity were never realised.

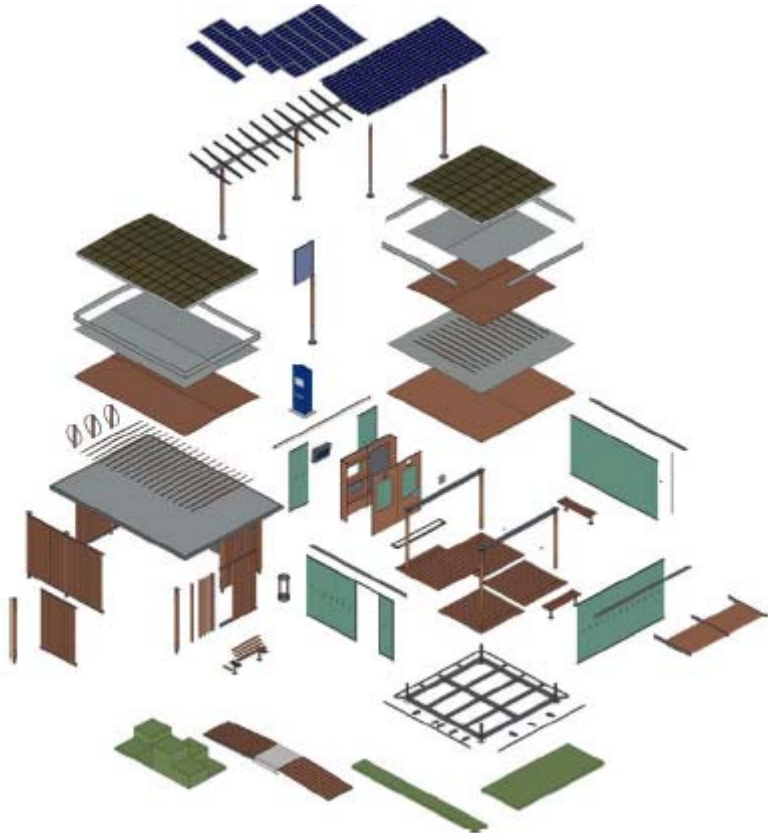

Figure 4 Example of Standardised Station components in France

Network Rail will provide leadership in promoting that quality materials and products are being used in stations by establishing the criteria for selection of components in its stations. Standardised solutions for station environments will also be developed as part of the drive to increase capacity, improve quality and reduce costs.
The adoption of collaborative BIM techniques and the creation of a rationalised product component/ library is part of a conscious move away from bespoke solutions to agreed products, which will bring longer term efficiencies and assets which are:

- Safe
- Fit for purpose
- Durable/ maintainable
- Low carbon
- Affordable

Network Rail will establish its assessment criteria for selection of materials, products and components in stations. These will not be very dissimilar to the option selection criteria that have been established for assessing GRIP3 in the Guide to Station Planning and Design.

This assessment shall take into account the life cycle stages of a product from raw material extraction to decommissioning along with objective assessments of the following:

- Quality
- Whole Life Cost and availability
- Safety
- Maintenance requirements

The above criteria will be used to establish a list of standardised products that can be used throughout the country for any maintenance, enhancement or investment project. This will inevitably lead to more coherent designs resulting in more consistency, improved efficiency, better quality assurance and reduced design and procurement costs.

This activity has commenced with the preparation of an integrated assessment of suitable products for platform and public area floor surfaces.

Alternative and new products will not necessarily be excluded but would have to pass the same rigorous assessment criteria against which they will be tested so innovation will not be stifled. Once Network Rail establishes its standardised components this approach will be extended to the design and delivery of new local station buildings.

8 Appendix A – Definitions

AfA
The DfT 'Access for All' programme is delivered by Network Rail and provides accessibility improvements at selected stations.

ATOC
The Association of Train Operating Companies, representing the TOCs in the UK. www.atoc.org

BIM – Building Information Modelling
BIM is an acronym for Building Information Modelling, or Building Information Model. It describes the process of designing a building collaboratively using one coherent system of computer models rather than as separate sets of drawings.

CP5 (Control Period 5)
Control Period 5 is the delivery and business plan set by the ORR that Network Rail is committed to deliver for the period between April 2014 and 2019. This includes a programme of investment works.

CPNI
Centre for the Protection of National Infrastructure. www.cpni.gov.uk

DPE
The Designated Project Engineer and the project engineers working with him are responsible for ensuring the technical compliance of the design and the delivery in accordance with NR/L2/CIV/003

CDM
Construction Design and Management refers to regulations issued in 2007 by the Health and Safety Executive that place legal duties on clients, designers and contractors involved in construction activity.

CSM and CSM REA
Common Safety Method for Risk Evaluation and Assessment is an ORR imposed European regulation that places duties on those in charge of projects who wish to implement a change to a technical, operational or organisational aspect of the railway system.

CRE
The Contractor's Responsible Engineer is accountable for the day-to-day management and coordination of the technical and engineering activities within a specific engineering discipline for a specific contract. The CRE is appointed in accordance with **NR/L2/INI/02009** and is

a) authorised to sign the forms associated with this standard on behalf of the design and/or contracting organisation
b) responsible for confirming that the engineering deliverables satisfy the requirements of the contract and also meet the requirements of this standard.

Deviation or Derogation
For Network Rail and Railway Group Standards, a deviation is defined as “a departure or alternative approach” from the originally specified requirement.

The Network Rail process is defined in NR/L2/EBM/STP001/04 ‘How to manage deviations to Network Rail and Railway Group Standards’

FOC
Freight Operating Company

Form NR/L2/CIV/003
The design project engineers and the project engineers working with them are responsible for ensuring the technical compliance of the designs and the delivery in accordance with Network Rail Standard.

HMRI
Her Majesty’s Railway Inspectorate established in1840, became part of the HSE (Health and Safety Executive) in 1990, transferred to the ORR in 2006 and ceased to exist in 2009 when it was renamed the Safety Directorate.

IP
Infrastructure Projects is the part of Network Rail that delivers large or complex projects that are beyond the remit of the regional routes.

Managed Station
19 major stations in the UK are not only owned but also managed by Network Rail and are called so to distinguish them from the franchised stations that are managed by the SFOs.

ORR
The Office of Rail Regulation is the independent safety and economic regulator for Britain's railways. www.rail-reg.gov.uk

OHLE
Over Head Line Equipment refers to the electrification lines of trains that occur above the track and over the train.

NSIP
The National Stations Improvement Programme (NSIP) is a DfT backed programme to deliver improvements to medium sized stations in England and Wales, working together with local sources of funding. At present there is not an equivalent programme in Scotland; however Transport Scotland has worked closely with First ScotRail and with Network Rail to improve stations in Scotland and they are considering the future programme.

PPM
The Public Performance Measure shows the percentage of trains which arrive at their terminating station on time.

PRM TSI
'Persons with Reduced Mobility -Technical Specification for Interoperability' is a European standard which provides the accessibility requirements of rail vehicles and railway stations.

RRD
Route Requirement Document is the project brief. This was previously known as project requirement specification (PRS).

RIDDOR
Reporting of Injuries, Diseases and Dangerous Occurrences Regulations that are published by the Health and Safety Executive.

Route asset manager (RAM)
Route asset managers are responsible for defining the scope of work via the PRS. They participate in the selection and approval of the selected design (AiP form 001) as they will be eventually in charge of the new infrastructure.

RSSB
The Rail Standards and Safety Board measure safety performance and analyse risk for the UK rail industry, and publishes Railway Group Standards.
www.rssb.co.uk

Secure Stations Scheme
A voluntary accreditation scheme launched in 1998 and directed by the Department for Transport and the British Transport Police.

SFAIRP
An acronym for " So Far As Is Reasonably Practicable ". Reasonably practicable involves weighing a risk against the trouble, time and money needed to control it.
www.hse.gov.uk/risk/theory/alarpglance.htm

SFO or TOC
Usually the Station Facilities Operator or Train Operating Company franchises the station from Network Rail and is legally responsible for its operation. Hence it has a major interest in all design stages.

In managed stations, it is not uncommon for Network Rail to be the operator of the station (the SFO) that provides service to a number of train operators (TOCs) using the station.

Station category
The DfT's station categorisation reflects the number of passengers using the station and the importance of the station.

TSI
Technical Specification for Interoperability is the European regulatory set of standards that are intended to ensure railway interoperability throughout Europe on designated routes. (See figure 2).

The TSI's apply to the entire UK rail network with the exception of the exclusions listed on the DfT web-site.

9 Appendix B- Applicable legislation, standards & guidance

Legislation:	
DfT code of practice	'Accessible Design Standards for Railway Stations' . Previously 'Accessible Train and Station Design for Disabled People'
The Building Regulations	The Building Act (1984) Approved Document parts A to P
Scottish Building Standards	Technical Handbook Non Domestic (2013)
TSI PRM	Technical Specification for Interoperability : Accessibility for Persons with Reduced Mobility for High Speed and - Conventional Lines on the Trans- European Rail Network
BS 8300	Design of Buildings and their Approaches to meet the needs of Disabled People-Code of Practice
Government Equalities Office	Equalities Act (2010)
CDM Regulations	Construction and Design Management Regulations (2007)

NR Guidelines:	
	Station Capacity Assessment Guidance (2011)
	Managed Stations Way-finding (2011)
	Operational Property Design & Construction Handbook (2010)
	Station Flooring Guidance & Floor Selection (2014)
	Station Safety Policy (2015)
	Guide to Sustainable Design for operational Property (2012)
	Sustainability Requirements for NR Buildings (2013)
	Stations Heritage and Design Strategy Report (2011)
	Guide to the Care and Development of Network Rail's Architectural Heritage (2012)

	Whole Life Cost Manual
	Arch Design Guide (commercial exploitation of Arches)
	Station Investment Guidance
	Design Guide for Station Street Furniture (2009)
	Implementing BIM principles for Railway Infrastructure Projects (2014)
	Suicide Prevention Best Practice Guide
Other Guidelines:	
ATOC	Motorcycle Parking at Rail Stations (2013)
ATOC	National Rail & Underground CCTV Guidance (2010)
BTA	Review of Customer Toilets for Network Rail (2011)
BTP	Retail watch
BTP	CCTV output requirements stations car-parks and trains (2009)
CPNI	Integrated security
CPNI	Operational Requirements for Security Measures
CPNI	EBP 04/13: July 2013 (Blast Performance of Laminated Glass)
CPNI	CPNI EBP 01/13 (Fixed Point Glass Fixings)
BRE	Building Research Establishment New Construction Manual 2014
BPA	British Parking Association Park Mark Safer Parking Scheme
BSI	BS 6180:2011 - Barriers in and about buildings COP
BSI	PAS 2030:2012 - Improving the energy efficiency of existing buildings
CABE / Design Council	Urban Design Principles
CABE / Design Council	The Value of Urban Design
CIBSE	Transportation Systems in Buildings (Guide D 2010)
Centre for Window & Cladding Technology	Technical note 66 - Safety and Fragility of Glazed Roofing - Specification
Centre for Window &	Technical note 66 - Safety and Fragility of Glazed Roofing

Cladding Technology	– Testing and Assessment
CIRIA	C722 - Safer stairs in Public Places (2013)
CIRIA	C652 – Safer Surfaces to walk on (2010)
DfT	Better Rail Stations (2009)
DfT	Inclusive Mobility (2011)
DfT	Cycle Infrastructure Design 2008
DfT	Security in Design of Stations (SIDOS) Guide
Dept of Health	Preventing Suicide in England
English Heritage	Protocol for Care of Government Estate
English Heritage	Transport Buildings Selection Guide (2007)
European Lift Assoc.	Escalator and Moving Walk Safety
HSE	Railway Safety Principles & Guidance Part 2 Section B—Guidance on Stations
HSE	Guidelines for the safe operation of Escalators (2011)
HSE	Assessing Slip Resistance of Flooring
HSE	Workplace (Health, Safety and Welfare) Regulations 1992.
HSE	HSG65 - Managing for health and safety (2013)
HSE	L138 -Dangerous substances and explosive atmospheres
HSE	INDG370 - Controlling fire and explosion risks (2013)
ISO	16933:2007 - Explosion-resistant security glazing
MENCAP	Changing Places the Practical Guide
ORR	Guidance on the application of the CSM on REA (2012)
RNIB	Building Sight
RIBA	Green overlay to Plan of Work
RIBA	BiM overlay to Plan of Work
RIBA	Good Loo Design (2004)
RSSB	Station Capacity

TfL	Interchange Best Practice Guidelines (2009)
TfL	Colour Standard (2009)
TfL	Parking Standards in Rail Stations Study (2010)
TfL	Highways Design Index
TfL	Climate Change and Mitigation
UK Power Networks	Standards for Secondary Substations & Switchrooms

RSSB Standards:	www.rgsonline.co.uk
GIR/RT 7016	Interface between Stations Platforms and Track (2009)
RIS-7700-INS	Rail Industry Standard for Station Infrastructure (2007)
GE/RT8025	Protective Provisions for Electrified Lines (2001)
GI/GN7520	Lighting in Railway Premises
GC/RT5212	Railway Clearances
GC/RT5033	Buffer stops and Impact Walls (2007)
GC/RT5633	Risk assessment of Buffer Stops (2007)
RIS- 7701-INS	Automatic Ticket Gates at Stations (2011)
	Wayfinding at Stations Good Practice Guide

NR Standards:	
NR/L2/CIV/003	Engineering Assurance of Building & Civils Engineering works-
NR/L3/MTC/SE0115	Confined Space Regulations (1997)
NR/L3/CIV/ 162	Platform Extensions (2010)
NR/L3/CIV/ 030	Platform Components and Prefabricated Construction
NR/L2/RMVP/27228	Specification for new and upgraded lifts
NR/GN/RMVP/27230	Guidance note for new and upgraded lifts
NR/GN/TEL/50017	CCTV for Stations (2006)
NR/L3/CIV/060	CIS Information (2009)

NR/E/G/00027	Incorporating Ergonomics Guidance Note
NR/L2/ERG/24020	Engineering assurance requirements for Ergonomics
NR/L2/OCS/040	Specification for use of protective coating systems
NR/L3/CIV/ 160	The Design of Car Parks for Railway Stations
NR/SP/OHS/069	Line-side Facilities (2005)
NR/L3/CIV/151	Technical Approval of Standard Designs and Details for Building and Civil Engineering Works
NR/SP/CIV/087	Management of Existing Buildings and Station Structures (formerly RT/CE/S/087)
NR/L2/INI/CP0069	Route Requirement Management & Engineering Remit Production
NR/L1/INI/PM/GRIP/100 NR/L1/INI/PM/GRIP/101	Governance for Railway Investment Projects (GRIP) – Policy Manual and Project Management (Suite of Documents)
NR/L3/OCS/044/FS14K	Managed Stations Environmental Management
NR/L2/OHS/005	High Street Environment & work outside Network Rail
NR/L2/OHS/0047	Application of the Construction (Design & Management) Regulations to NRCP
NR/L2/OHS/00117	Specialist Risk Assessment – New and Expectant Mothers
NR/L3/OCS/043/7-1	Weather Management
NR/L2/RMVP/27176	Design of retention toilet servicing facilities
NR/L2/INI/CP0043	Health and safety management of third party works.
NR/L1/FIR/100	Fire Safety Policy
NR/L3/CIV/164	The control of legionella bacteria in water systems
NR/GN/CIV/163	Management of water supply
NR/L2/CIV/003/F1990	Technical Design Requirements for BS EN 1990
NR/L2/INI/02009/F0046	Certificate of Interdisciplinary Check

Safety Technical & Engineering Guidance

Document Identity

Station Design Principles for Network Rail

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This document was greatly influenced and shaped by Network Rail's principal architect Nick Shaw who tragically passed away just before its publication.