

**HUMAN FACTORS
&
ERGONOMICS**

SYSTRA

**Integrating human capabilities
to support
design development**



WHY A ROBUST INTEGRATION OF HUMAN FACTORS AS A PART OF A WIDER SYSTEMS ENGINEERING APPROACH IS CRITICAL FOR SUCCESS

In a world where advanced technology is becoming a key medium of everyday life, the need for design solutions that cater for human capabilities and limitations is paramount.

Technological progress in recent years has brought more intimate human-automation interaction which is transforming the public transport landscape.

Automatic and autonomous systems such as trains, trams, automobiles and proposals for urban air mobility solutions (e.g. e-VTOL), to name a few, are being progressed at an exponential rate.

The result of these applications means the nature and type of user interactions will inevitably change.

It is crucial to remember that humans will use, operate, maintain and, ultimately, accept technologically advanced public transport systems.

If these systems and technologies are to bring the expected benefits, human factors integration in their design and development recognises the significance of the human component as having an equally important part in the wider system.





Understand in detail how end-users interact, use and operate equipment, tools and systems within their operational environment prior to committing to design decision.

Provide designs that have been developed with the user in the centre rather than trying to make the human fit the system.

Understand how the wider social and organisational environment affects end-users' ability to perform their roles.

Early end-user engagement, participation and buy-in to the design which enhances acceptance.

Liaise with other Systems Engineering disciplines (such as Safety, Performance, Reliability, Availability and Maintainability) as part of an all-around offering.

Identify and mitigate early in the design human factors issues and constraints.

Reduce costly re-designs late in the project lifecycle.

HOW WE DELIVER HUMAN FACTORS AND ERGONOMICS INTEGRATION

SYSTRA considers the human at the centre of the system with input provided from project conception through to decommissioning. Human Factors and Ergonomics apply established principles, methodologies and techniques to support the design development lifecycle to optimise human and system performance.





1. KEY SERVICES

- Human factors integration planning into systems development
- Interface as part of a wider systems engineering offering
- Human error and workload assessments
- Task analyses
- Physical ergonomic and anthropometric assessments
- Training needs capture
- Working environment design and assessment
- Postural assessments and reduction of musculoskeletal risk
- Fatigue and shift work assessments
- Inclusive design, including compliance to PRM TSI
- Human-machine interface design
- Human factors research projects

2. KEY DOMAINS

→ RAILWAY

- Rolling stock new designs and modifications to cabs and passenger saloons
- Depots and sidings
- Station designs and refurbishments
- Signalling, electrical control and signaller workload
- Station control rooms and ticket offices

→ GENERAL INFRASTRUCTURE

- Operations and Maintenance
- User requirements
- Change management

→ AVIATION

- Signage and wayfinding
- Assets and facilities relocation and expansion
- Airport operations centres
- Collaborative decision making

→ TRANSPORT OPERATIONS

- Multimodal travel
- Operating new and/or modified systems, equipment and other human-machine interfaces
- Human factors in the introduction of new operational procedures
- Human-automation interaction

CASE STUDIES

A SNAPSHOT OF OUR PROJECTS



→ Transpennine Route Upgrade (TRU) - UK

CLIENT NETWORK RAIL

SUMMARY PMO level responsibility for Human Factors integration on infrastructure upgrade project

DATE 2017 - ongoing

DESCRIPTION Railway • Infrastructure • Digital



→ Crossrail Signalling Operational HAZOP - UK

CLIENT BOMBARDIER

SUMMARY Driver workload and human error assessment for mode & level transitions on Class 345.

DATE 2018

DESCRIPTION Railway • ETCS • Driver interface



→ Risk Based Training Needs Analysis (RBTNA) - AUSTRALIA

CLIENT SYDNEY TRAINS

SUMMARY Predictive task analysis and RBTNA for two new control room roles at Sydney Trains

DATE 2016 - 2017

DESCRIPTION Railway • Non-technical skills & behaviours



→ Three Bridges Railway Operations Centre (TBROC) - UK

CLIENT GOVIA THAMESLINK & NETWORK RAIL

SUMMARY Develop new operating model for a world class control centre, integrating Joint Emergency Services Interoperability Principles (JESIP)

DATE 2018 - 2019

DESCRIPTION Railway • Control room design

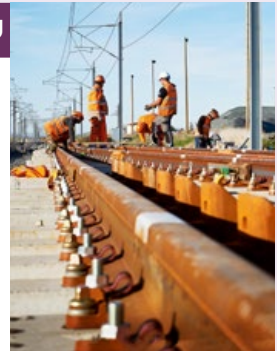
→ Australian Level Crossing Assessment Model (ALCAM) - AU

CLIENT	METRO TRAINS MELBOURNE
SUMMARY	Upgrade of ALCAM to enable risk quantification and to incorporate the influence of human factors on risk contribution
DATE	2019 - 2020
DESCRIPTION	Railway • Infrastructure • Risk



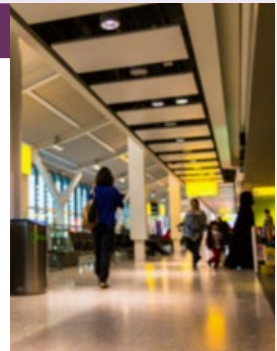
→ Optimisation of the Enterprise Asset Management system - AU

CLIENT	TRANSPORT FOR NEW SOUTH WALES
SUMMARY	Human-centred design evaluation, operational and system hazard analyses to support the roll out of the new system for asset management
DATE	2015 - 2016
DESCRIPTION	Railway • Infrastructure • Risk



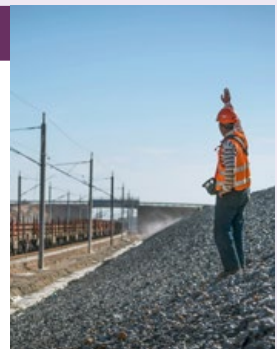
→ Systems Engineering (SE) services to Heathrow - UK

CLIENT	HEATHROW AIRPORT HOLDINGS LIMITED
SUMMARY	Human factors input as part of wider SE offering to ensure upgrade works at the airport do not impact current capabilities
DATE	2019
DESCRIPTION	Aviation • Infrastructure • Operations



→ Human Factors in Depot design - UK

CLIENT	LONDON UNDERGROUND
SUMMARY	Develop and implement a Human Factors strategy to support the depot upgrade works
DATE	2017 - ongoing
DESCRIPTION	Railway • Infrastructure



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