A.10. Transport & Infrastructure

Transport & Infrastructure: advances in the infrastructure sector. This stream invites contributions that cover advances in SE in the Infrastructure, particularly in the areas of leadership, organisational integration, tailoring of approach, next-generation software tools, digitalisation, information management and other topics of interest that advance the application of SE in Infrastructure.

Lead: Ruben Welschen, Tom Castor, Sameera Bandara
Domains: Transport & Cities, Digital Futures

Submissions Summary:

1. **A Systems Engineers Reflection on Data Reporting in Major Infrastructure and Transport Projects**
   Full Paper
   Fernanda Tavares 1, Systems Engineering, SYSTRA ANZ, Sydney, NSW, Australia
2. **Operational Readiness for Brisbane Metro**
   Full Paper
   Monica Dryden 1, Andrew Purcell 2, Mott MacDonald, Melbourne, VIC, Australia, Operational Readiness, Brisbane City Council, Brisbane, QLD, Australia
3. **Systems Engineering (SESA) in Rail: benefits, challenges and why we need it**
   Paperless Presentations
   Caroline Crete 1, Aurecon, Melbourne, VIC, Australia
4. **Multi-Dimensional Systems Architecture Modelling for Transport and Infrastructure Projects**
   Paperless Presentations
   Daniel Spencer 1, Spencer Tech Pty Ltd, Tonsley, SA, Australia
5. **Novel uses of digital engineering tools for SESA processes**
   Paperless Presentations
   Nikhil NB Bharadwaj 1, Lina LL Legenhausen 1, KBR, Melbourne, VICTORIA, Australia

20648 A Systems Engineers Reflection on Data Reporting in Major Infrastructure and Transport Projects

Authors
Fernanda Tavares 1, Systems Engineering, SYSTRA ANZ, Sydney, NSW, Australia
Provided Keywords
requirements management, information management, DOORS Next Gen, Report Builder
Natural Language Keywords
data, differences, ibm, information, infrastructure, major, management, projects, requirements, systems
Presentation format decision
Full Paper - Poster Preference
Stream submitted
A.10. Transport & Infrastructure
Stream proposed
A.10. Transport & Infrastructure

Abstract

Overview:Major infrastructure and transport projects require a systematic and structured approach to information management. Such projects typically entail documenting, controlling, and managing relationships between various levels of requirements and their associated design, and verification and validation activities. Handling such a significant volume of artefacts poses considerable challenges.

Context:Requirements management tools play an important role in capturing, organising, managing, and tracing requirements throughout the lifecycle of a system. These tools help manipulate and display data in tailored formats so that progress statuses and relationships can be easily visualised. One of the most common requirements management tools among systems engineering practitioners is the IBM Dynamic Object-Oriented Requirements System (DOORS), and the IBM Report Builder offers a variety of options for generating metrics and reports.

Purpose:While pivotal for project analysis and decision-making, open-source information on report generation is scarce online. Only scattered information can be found on the internet across a few blogs, IBM documentation, and forum discussions. The paper aims at discussing differences in terms of handling and presenting data depending on the data source of the report.

Approach:The points of discussion of the paper are based on the lessons learnt over several years of systems engineering practice in Major Infrastructure and Transport Projects in Australia using DOORS Next Gen. It will present examples elucidating differences between the use of Data Warehouse (DW) and Lifecycle Query Engine (LQE).

Insights:In many cases, both data sources can meet the same reporting needs. However, key differences were observed in how long the data takes to update, the ability to add attributes, set filters and conditions to reports, and the ability to create custom expressions.

21304 Operational Readiness for Brisbane Metro

Authors
Monica Dryden 1, Andrew Purcell 2, Mott MacDonald, Melbourne, VIC, Australia, Operational Readiness, Brisbane City Council, Brisbane, QLD, Australia
Provided Keywords
Metro, operational readiness, assurance, operation, System engineering and integration
Natural Language Keywords
brisbane, city, delivery, metro, network, new, operational, projects, readiness, transport
Presentation format decision
Full Paper - Presentation Preference
Stream submitted
A.10. Transport & Infrastructure
Stream proposed
A.10. Transport & Infrastructure

Abstract

Brisbane Metro, an all-electric, high-capacity turn-up-and-go public transport system, is designed to link the city to the suburbs, through two new Brisbane Metro lines. Reducing congestion bottlenecks in the city for a better-planned network, the new service aims to meet the growing demand for reliable travel options. Brisbane Metro delivery includes the introduction of 60 new battery electric metro vehicles, a new technologically advanced depot, new and upgraded infrastructure providing targeted investment to augment the capacity of Brisbanes busway network, a new operational bus network, policy and operational changes, and a new intelligent transport system.

The novelty of the project, the first of its kind in Brisbane, Australia, and the southern hemi-sphere, will unintentionally set a precedent for how future projects of similar nature may implement and delivery a successful operational service. While Brisbane City Council has delivered a wide range of major projects, the planning and delivery of Brisbane Metro has been its largest and most complex undertaking to-date. The integration of new and novel systems into an existing transport ecosystem has required a holistic network planning approach.

The unique elements of Brisbane Metro has driven the need to assess Councils model for operational readiness and the implementation of a systems engineering and integration approach, particularly in regard to the transition to operations and handover of the assets. Utilising experience from different industries and external support, a methodology of combining best practice from the rail industry and bus industry along with scaling processes and approaches enabled the definition of its own distinct assurance process.

This paper will discuss the process and methodology undertaken as part of operational readiness activities, highlighting lessons learnt, and how this can be applied to future projects as they transition into operations.

20776 Systems Engineering (SESA) in Rail: benefits, challenges and why we need it

Authors
Caroline Crete 1, Aurecon, Melbourne, VIC, Australia
Provided Keywords
Rail, SESA
Natural Language Keywords
approach, benefits, challenges, design, engineering, industry, project, projects, rail, systems
Presentation format decision
Paperless - Presentation or Poster
Stream submitted
A.7. Rail Systems Engineering
Stream proposed
A.10. Transport & Infrastructure

Abstract

Overview

The Rail industry is shifting towards a Systems Engineering oriented approach for major projects. This new way of delivering projects comes with challenges that the industry needs to overcome in order toachieve the benefits of this change.

Context

The past century has seen a significant increase of Rail Projects throughout Australia. Over the years, the evolution of the environment in and around major cities as well as in rural areas has introduced new levels of complexity for the design and delivery of Rail Projects.

In this context, State Governments have started to shift their approach and mandate Systems Engineering to be applied on the most recent Rail Projects.

Purpose

For an industry historically adopting a Design and Construct approach, what does this mean? What are the benefits, but also the challenges of this shift?

Approach

This presentation gives an overview of the legacy Design and Construct approach and proposes a definition of SESA, as well as an overview of what this includes and where it applies in the lifecycle of a project. Drawing on data from projects in other industries where Systems Engineering methodologies have been applied for decades, we present the benefits and assess the relevance of Systems Engineering to the Rail Industry.

Insights

Based on observations from recent rail projects in Australia, we identify some of the challenges faced by multi-disciplinary teams to implement Systems Engineering, focusing on some differences between adding Systems Engineering on a project versus embedding Systems Engineering in the framework of the project.

We discuss some aspects to consider when it comes to implementing better embedded Systems Engineering on projects, ultimately aiming at delivering projects through a Fully Integrated Systems Engineering process to see improvements in the delivery outcomes, including quality, costs, conformance to contractual requirements and client satisfaction.

21299 Multi-Dimensional Systems Architecture Modelling for Transport and Infrastructure Projects

Authors
Daniel Spencer 1, Spencer Tech Pty Ltd, Tonsley, SA, Australia
Provided Keywords
MBSE, Rail, Architecture, Methods
Natural Language Keywords
approach, architecture, consistency, engineering, infrastructure, model, multiple, projects, systems, transport
Presentation format decision
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A.10. Transport & Infrastructure
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A.10. Transport & Infrastructure

Abstract

Overview: This presentation explores approaches in Model-Based Systems Engineering that provide benefits for transport and infrastructure projects. These projects can be characterised by a focus on a detailed systems architecture, and the need for consistency and traceability in applying this architecture across multiple geographic locations. Using examples in an MBSE tool, this presentation will demonstrate how to rapidly build a coherent system model and provide meaningful artifacts to stakeholders and design teams.

Context: A simplistic approach is often taken to systems architecture in teaching and initial project implementation. There is a system of interest, which is built from a hierarchy of systems components (from segments and subsystems down to individual configuration items). In many large projects, the physical systems architecture can be multi-dimensional, with multiple levels of system breakdowns, with implementation at multiple locations, along with the need for specific customisations or variants.

Purpose: A sample model being presented demonstrates the basic characteristics of a rail transport infrastructure project. This sample is explored and extended via features available in MBSE tools, to show techniques that can improve the quality, speed and consistency of the models and artefacts being produced.

Approach: For this approach, practical methods from product-line engineering, in object-oriented methods and in existing model-based systems engineering tools are explored and demonstrated. This includes aspects of model reuse, abstraction, inheritance and parameterisation, specifically applied to the physical architecture of a systems model.

Insights: Using these techniques, improvements can be shown in the elegance of design (defined by forming the least complex sufficient solution), the minimisation of effort in modelling (and increased efficiency of implementing changes), and the quality, clarity and consistency of diagrams and representations drawn from the model content.

21207 Novel uses of digital engineering tools for SESA processes

Authors
Nikhil NB Bharadwaj 1, Lina LL Legenhausen 1, KBR, Melbourne, VICTORIA, Australia
Provided Keywords
Digital Engineering, SESA Process, Digital Tools, Novel Approach
Natural Language Keywords
digital, engineering, projects, rail, requirements, safety, sesa, systems, tools, workshops
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A.10. Transport & Infrastructure

Abstract

Rail transportation plays a pivotal role in facilitating economic growth and enhancing mobility; however, rail projects are often large and complex, requiring systems engineering and safety assurance (SESA) inputs. This paper explores how digital solutions can support and enhance traditional SESA frameworks.

Traditionally, SESA tasks involve structured but sometimes time-consuming approaches for identifying stakeholder needs, defining system requirements, and integrating subsystems to achieve project objectives.

While existing SESA frameworks provide a solid foundation for managing rail infrastructure projects, the use of digital engineering tools to solve the unique complexities of such projects are allowing SESA works to be completed more effectively and efficiently.

Through the integration of Revizto on some NSW and Victorian rail projects, the SESA team along with the digital engineering team, were able to run safety in design workshops more effectively and efficiently by allowing participants to have accurate depictions of equipment locations and to see the exact location of hazards through the creation of tags.

There are potential advances that can be made by integrating model-based systems engineering, architecting tools, requirements management tools, digital design simulation and modelling tools to further automate and streamline SESA tasks such as safety in design workshops, inter-disciplinary workshops, systems architecture, safety arguments, requirements management and development of assurance case reports.