BERNER & MATTNER
AN ASSYSTEM COMPANY

SAFERAIL

SafeRail – Improving Safety At Railway Level Crossings

IAP Workshop

Für die Erde ins All - Transport & Logistik:
Herausforderungen und mögliche raumfahrtbasierte Lösungsansätze

3. Dezember 2013, Darmstadt

03.12.2013 | R. Grimm

SafeRail - Improving Safety at Railway Level Crossings

An activity within the Integrated Applications Program (IAP)
Funded by the European Space Agency (ESA)

BERNER & MATTNER AN ASSYSTEM COMPANY in partnership with

avanti communications · Brimatech BRIDGING MARKETS AND TECHNOLOGIES · JOANNEUM RESEARCH DIGITAL · TeleConsult AUSTRIA

Agenda

- **Quick Company Overview**
- **Project Background**
- **Project Overview**
- **Overview about Tasks**
- **Next Steps**

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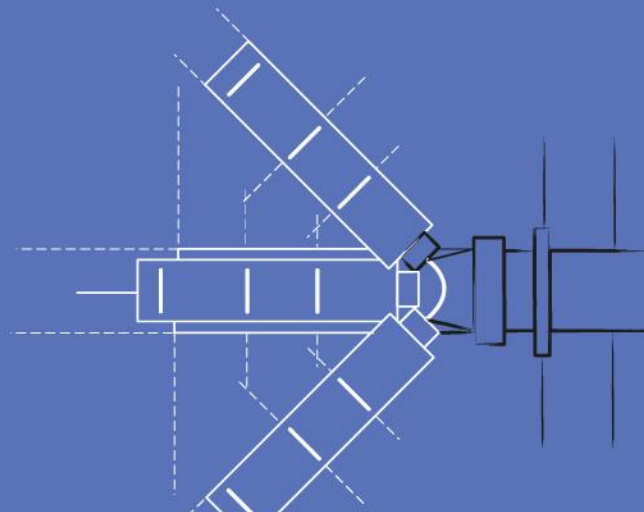
Company Overview



Berner & Mattner Systemtechnik

Key Data

- Foundation: 1979
- Employees: 470
- Locations 7

Portfolio

- Systems Engineering
- Software Engineering
- Safety Engineering

Sectors

- Space & Defence
- Engines & Energy, Machinery
- Transportation, Automotive

Customers

- MBDA, EADS, MAN, MTU, G&D, Siemens, DB, ÖBB, Bombardier, Audi, BMW, Daimler, VW, ESA, DLR, Astrium, Tesat

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Assystem Group

ASSYSTEM, INDUSTRIAL ENGINEERING

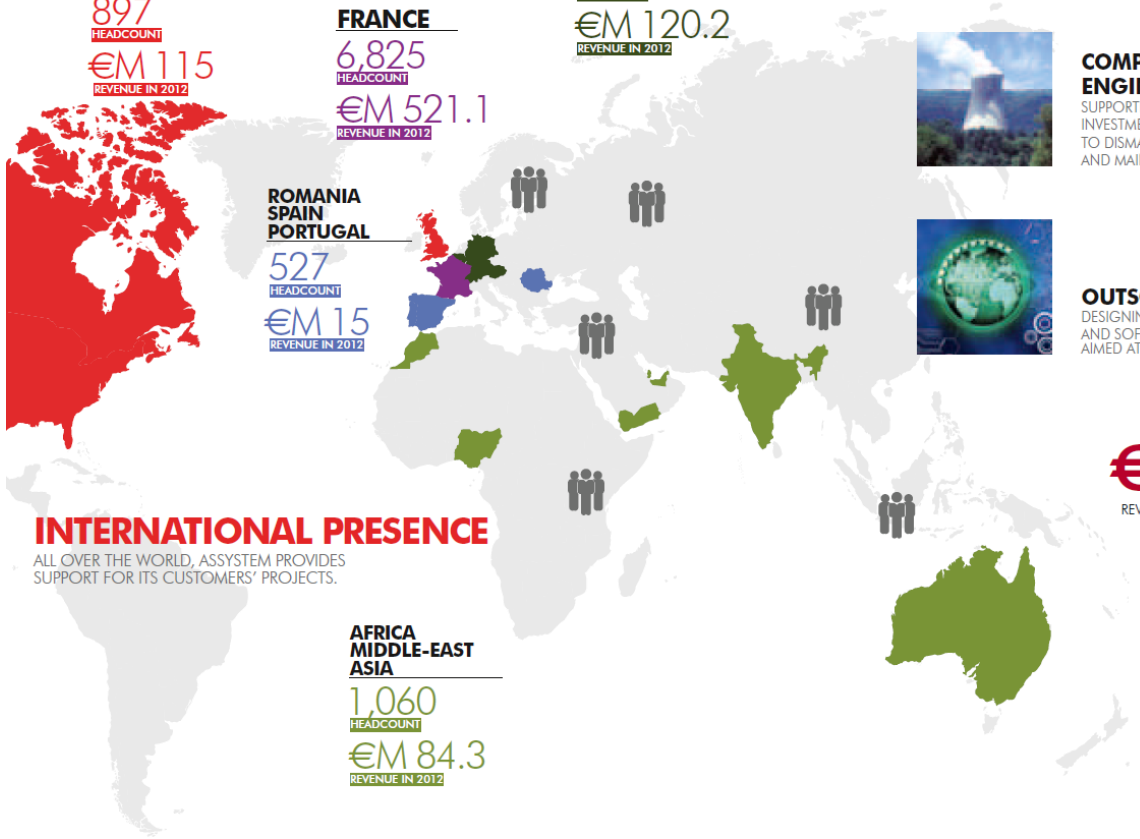
IN PARTNERSHIP WITH KEY INDUSTRY PLAYERS AND ON THE STRENGTH OF ITS BALANCED BUSINESS PORTFOLIO, GLOBAL ORGANISATION AND SOLID FINANCIAL FOUNDATION, ASSYSTEM CONTINUES TO BUILD SUSTAINABLE GROWTH.

CANADA
UNITED STATES
UNITED KINGDOM
897 HEADCOUNT
€M 115 REVENUE IN 2012

FRANCE
6,825 HEADCOUNT
€M 521.1 REVENUE IN 2012

GERMANY
AUSTRIA
BELGIUM
SWITZERLAND
1,436 HEADCOUNT
€M 120.2 REVENUE IN 2012

ROMANIA
SPAIN
PORTUGAL
527 HEADCOUNT
€M 15 REVENUE IN 2012



INTERNATIONAL PRESENCE

ALL OVER THE WORLD, ASSYSTEM PROVIDES SUPPORT FOR ITS CUSTOMERS' PROJECTS.

AFRICA
MIDDLE-EAST
ASIA
1,060 HEADCOUNT
€M 84.3 REVENUE IN 2012

2 BUSINESS AREAS

ASSYSTEM DEVELOPS EXPERTISE IN INDUSTRIAL ENGINEERING WITH GLOBAL CHAMPIONS, AT THE CUTTING EDGE OF THE NEEDS OF A DIVERSIFIED MARKETPLACE.

COMPLEX INFRASTRUCTURE ENGINEERING
SUPPORTING BUSINESSES IN MANAGING THEIR INDUSTRIAL INVESTMENTS, FROM INFRASTRUCTURE DESIGN THROUGH TO DISMANTLING, INCLUDING COMMISSIONING, OPERATIONS AND MAINTENANCE.

OUTSOURCED R&D
DESIGNING, TESTING AND VALIDATING HARDWARE AND SOFTWARE DEVELOPMENT FOR PRODUCTS AND SYSTEMS AIMED AT INDUSTRY SECTORS AS WELL AS NEW TECHNOLOGIES.

€M 855.6
REVENUE IN 2012

10,745
GLOBAL WORKFORCE

40%
OF REVENUE ACHIEVED INTERNATIONALLY

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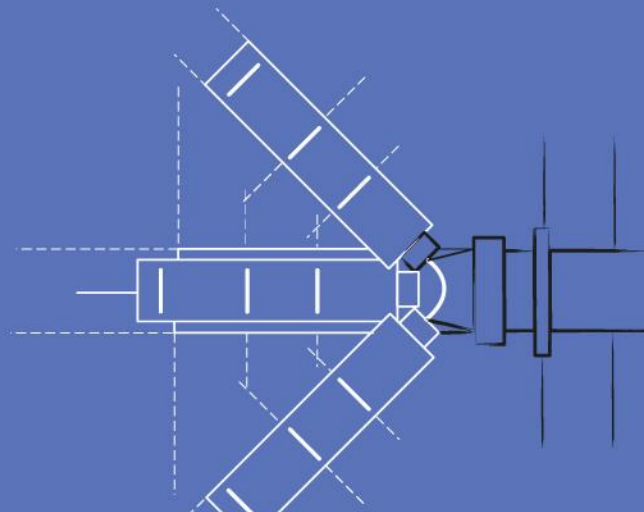
Background



Objectives

Improve safety at Railway Level Crossings (RLC)

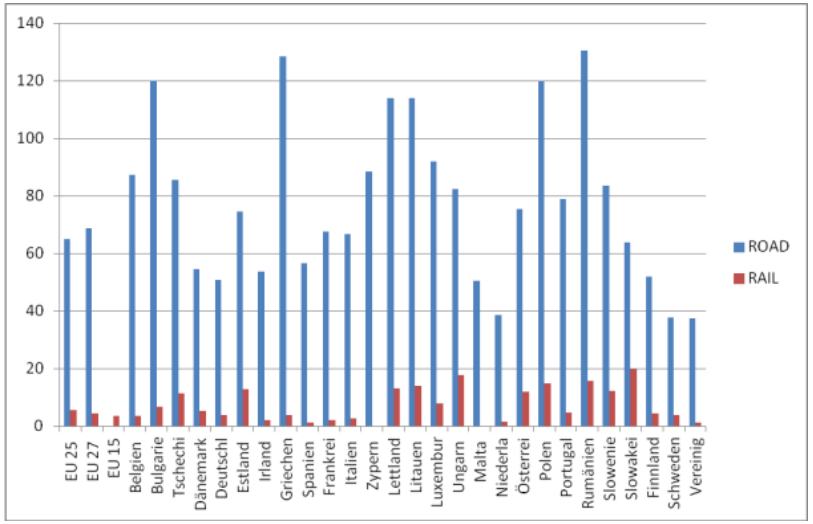
- Benchmark: Reduce number of fatalities/accidents at RLC
- Requirements: Needs and constraints of relevant users and stakeholders
- Approach: Develop an “Integrated Solution” (Rail/Automotive/Space/ …)
- Method: Road Safety Concept of “5 Es” (Engineering, Education, Enforcement, Encouragement, and Evaluation)

Scope

- Entire Lifecycle of RLC (planning, authorization, operations, ..)
- Any User / Stakeholder: Authorities (Road/Rail), Traffic Planners, Road Users, Rail Infrastructure Manager, Railway Undertakings, Enforcement Bodies, Insurance Companies, Emergency Services, …
- Any kind of RLC: main lines (dense traffic), secondary lines (passive RLCs)

Challenges

1. **Main accident cause: Distraction of Road User**
2. **Railway safety ignores Human Factors**
3. **High invest in RLC in Europe (>100 Mio per country per year)**
4. **Transition in safety ideology from rule based to risk based**
5. **RLC account for 50% of Rail fatalities**
6. **RLC account for <1% of Road fatalities**
7. **Acceptance / Approval of Space Techn. is very difficult for Rail Sector**



Comparison of Fatalities per Million Habitants in 2009

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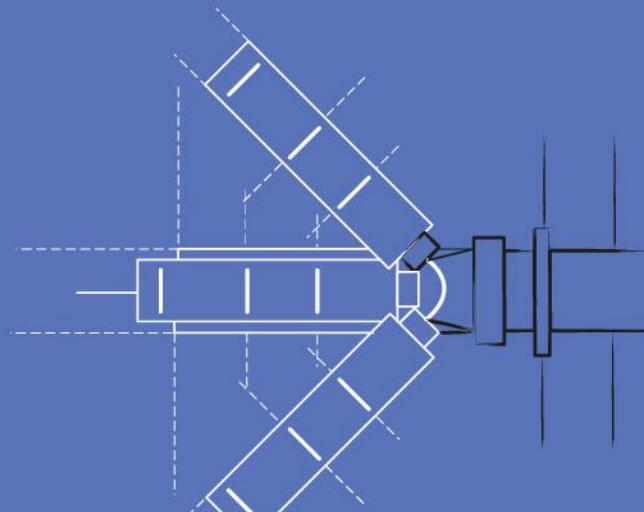
Project Overview



Project Partners

Berner & Mattner Systemtechnik (Lead, Germany)

- Railway Safety: Software + Systems Engineering
- Automotive: Telematics, Driver Assistance, …

Avanti Communications (UK)

- Satellite Operator

Brimatech Services (Austria)

- Technology Viability Analysis / Stakeholder Involvement

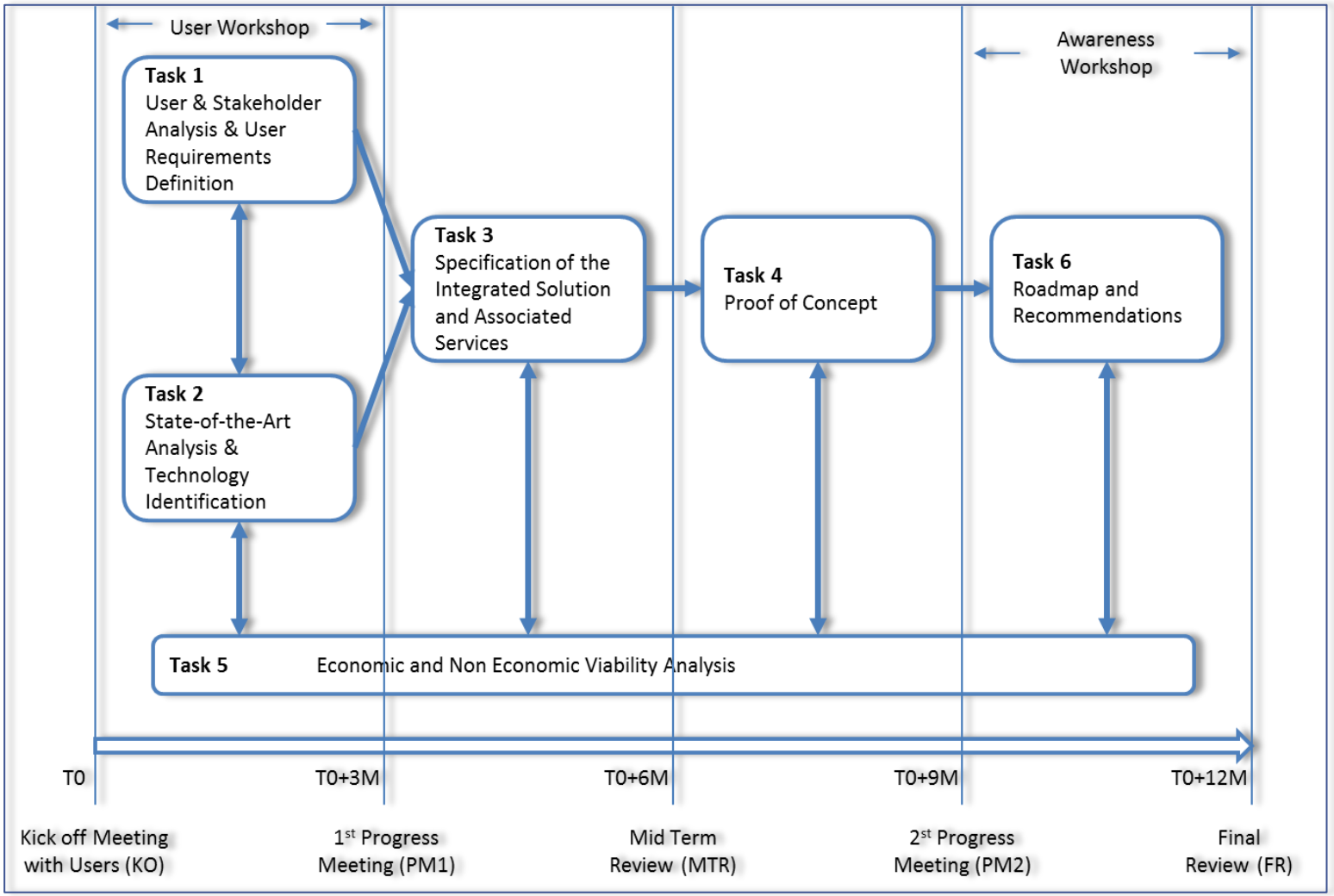
JOANNEUM RESEARCH (Austria)

- Satellite Communication, Earth Observation

TeleConsult Austria

- Precise and Reliable Positioning Systems

Project Logic



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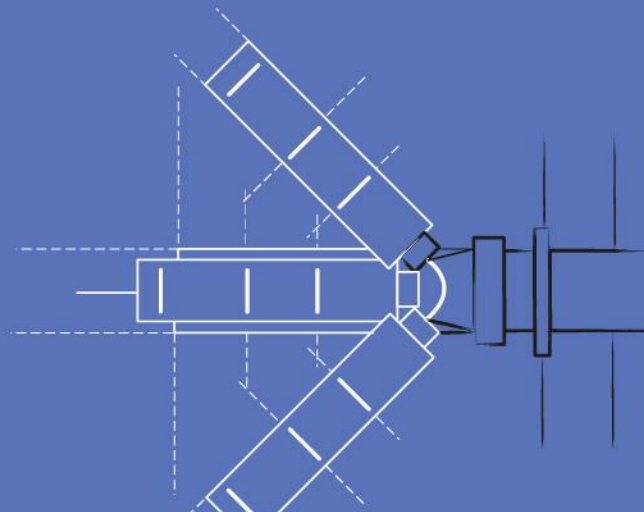
Task 1
User & Stakeholder Analysis & Requirements Definition



Requirements Process

2 Workshops /
25 Phone Interviews

Users / Stakeholders
from DE, AT, PL, FR, CZ, …

- Rail Safety Authorities
- Road Safety Councils
- Rail Companies
- Insurance Companies
- Transport Safety Research
- Car Driver Associations

Literature Studies

Directives /
Standards

- EN 5012x
- TSIs
- ISO 26262
- …

Hazard Logs

Accident
Reports

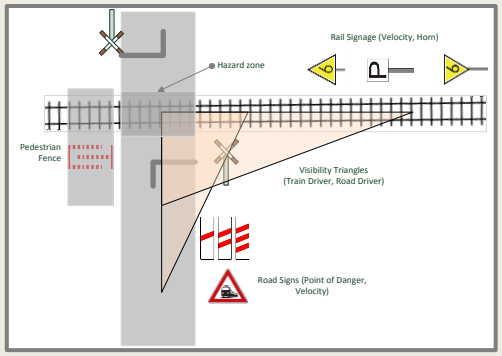
Current shortcomings

User Needs /
User Requirements

“As a car driver I don’t want to stop”

Users / Stakeholders

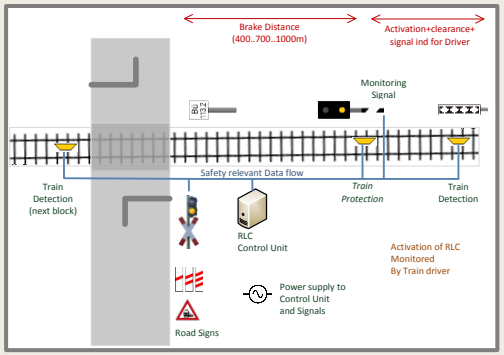
User Requirements



Stakeholders

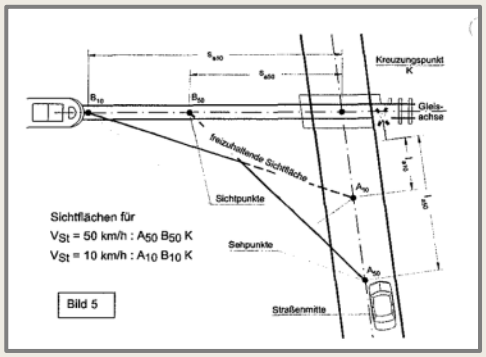
Nominal Operations

Scenarios



Level Crossing Lifecycle

User Requirements



Operational Principles

Constraints

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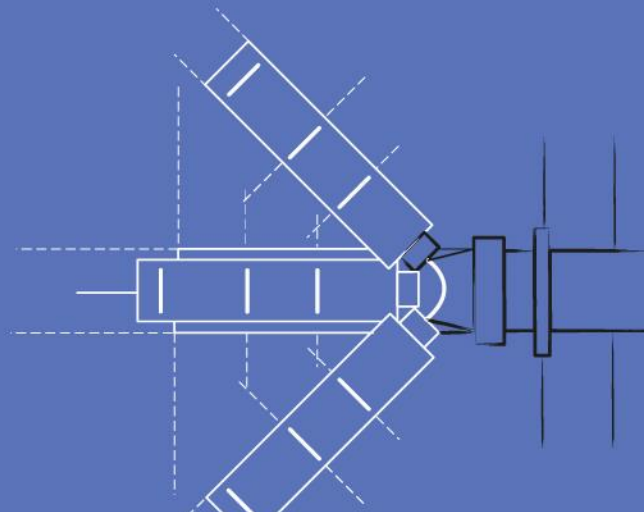
Task 2
State of the Art Analysis & Technology Identification



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State-of-the-Art Analysis

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Technologies / Solutions

- Positioning Systems
- Communication Systems
- Earth Observation
- Navigation support services
- Road Safety Technologies

Current railway level crossing systems

- Evolution of RLC over time
- Train Control Systems
- RLC Components and Functional Analysis
- Risk Models

Analysis of R&D projects

Projects related to…

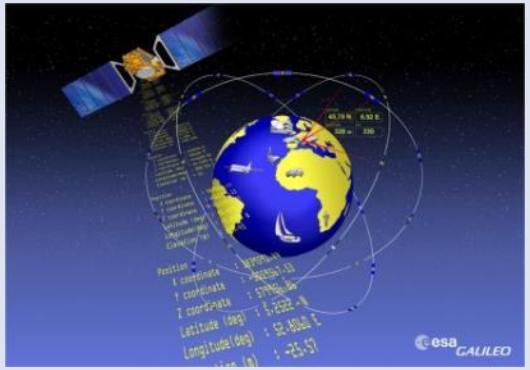
- Rail Activities
- Navigation Support Systems
- Road Signs
- User Terminals Augmenting
- Road User Awareness

Critical Analysis

Technology Identification

Technology Identification












User Requirements

Gap Analysis

Suitable Technologies

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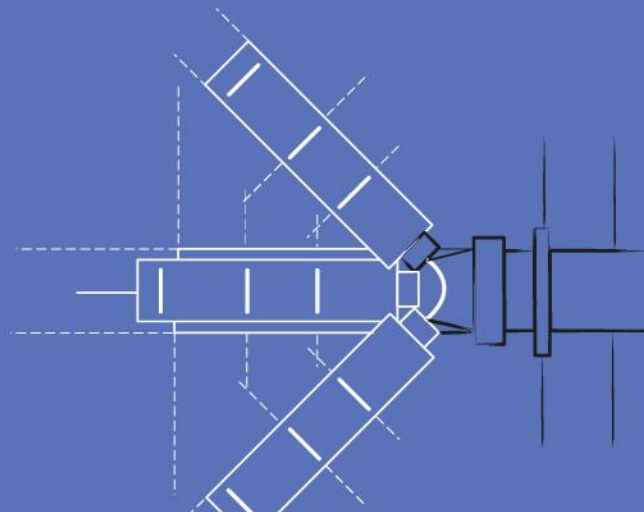
Task 3
Specification Integrated Solution & Associated Services



Service and System Definition

Service Definition

Service Requirements
- "What is delivered to whom and when?"
- "How well is it delivered?"
- "How is the information delivered?"

Service Provisioning Chain
- Information sources and flows
- Involved actors
- Responsibilities of actors

System Requirements & Architecture

System Requirements
- Functions
- Performance
- Interfaces
- Operational environment

System Architecture
- Technical architecture
- Sub Systems & Interfaces
- Design Justification
- Concept of Operations

Feasibility Assessment

Integrated Service

Ref.: ESA Guidelines for Service and System Definition

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Selection of SafeRail Services

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ID	Description
1	Road User assistance functions
1a	- Comfort assistance functions (strategic routing)
1b	- Support the situational awareness (Information and Warnings)
1c	- Active safety (automatic braking, ...)
2	Wireless Train Detection
2a	Optimization of closure times
2b	Cost-effective/affordable upgrade from passive to active level crossing
3	Enable rescue operations in case of permanent break-downs in the hazard zone of level crossings
4	Reduction of rail traffic suspension due to exceptional road vehicles
5	Inspection of sight triangles
6	Support for enforcement operations
7	Increase safety at level crossings by collecting and analysing of risk factors
8	Blue Force Rerouting
9	Improve compliance with traffic rules by detecting temporary and illegal level crossings

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Selection of Integrated Services

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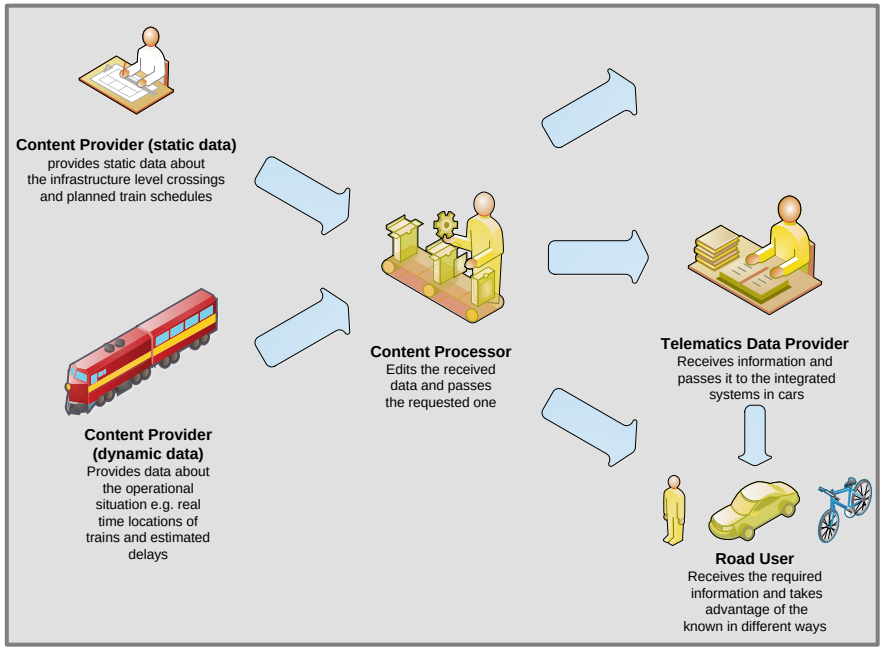
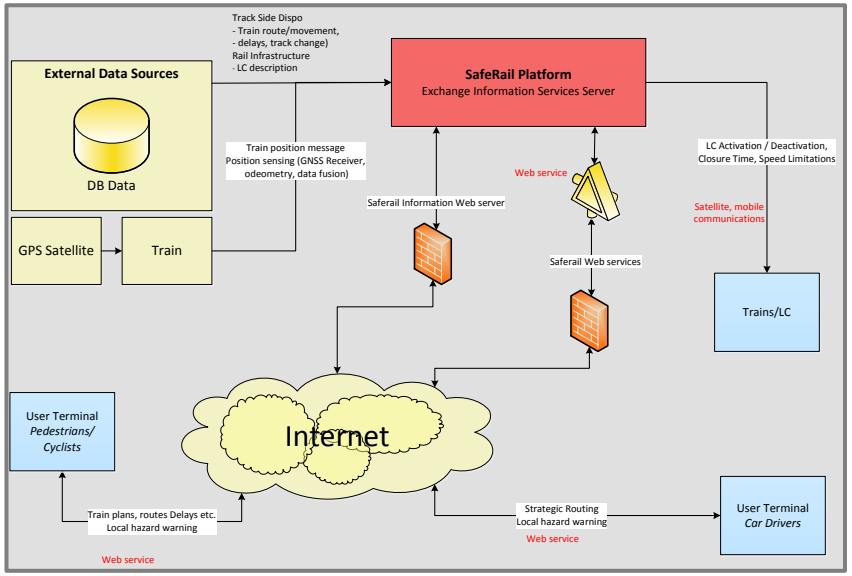
ID	Service Title	Integ. Solution
1a	In advance information for Road User	Road User Operations
1b	Hazard warning for Road User	
1c	Protecting the Road User	
2a	Reducing closure times	Railway Operations
2b	Cost affordable level crossing upgrade	
5	Inspection of level crossings	Maintenance Railway

Examples from Service „Operations“





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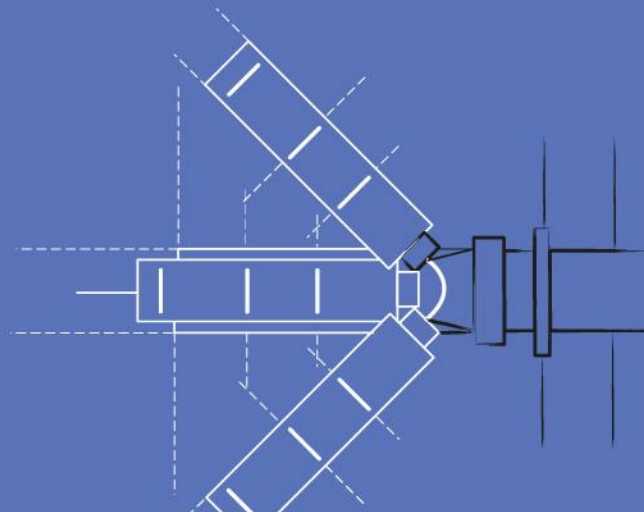
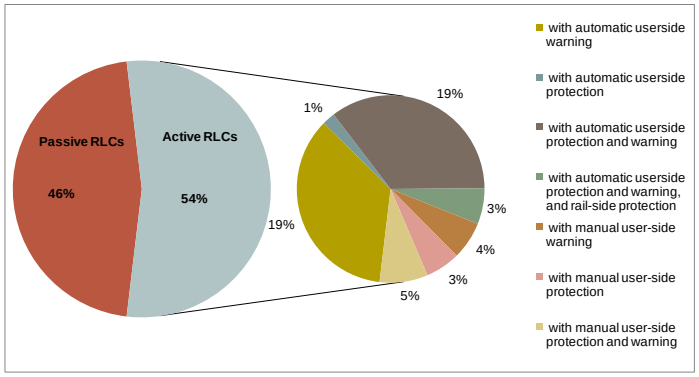
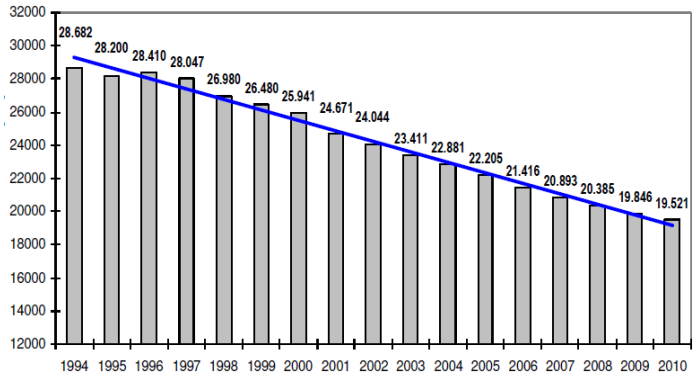
Task 5
Economic & Non Economic Viability Analysis



Viability Analysis





Number of RLCs of DB Netz from 1994 to 2010

Objective

"Identify non-technical aspects which are relevant to a successful implementation of the integrated solution and associated services in a sustainable manner and assess the influence of these aspects on the implementation"

Market Analysis

- Market Segmentation / Size
- Drivers and Barriers
- Competitive Analysis

Cost Benefit Analysis

- Cost Drivers
- Commercial Benefits

Revenue Indicators

Non-Economic Viability Aspects

e.g. Regulatory and Legal Frameworks

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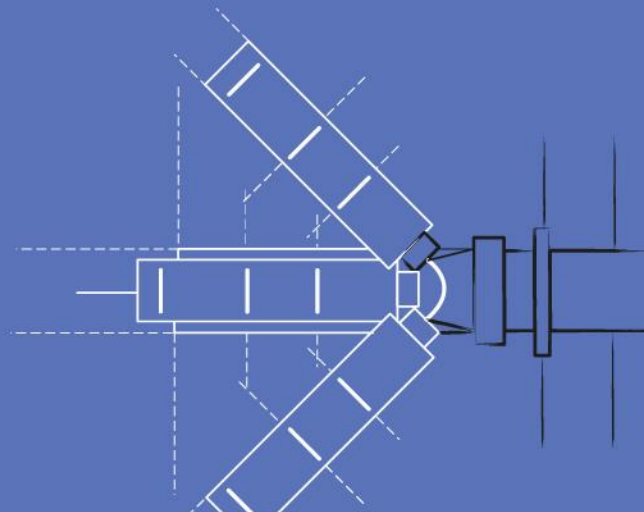
Next Steps



Next Steps

- Proof of Concept
- Awareness Event
- Roadmap and Recommendations
- Preparation of Demo Phase

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Vielen Dank für Ihr Interesse!

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