AVINOR



System for queue and capacity management

Appendix 1 Attachment 1
Customer specification of requirements

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1 DOCUMENT GUIDANCE

This document serves as an introduction to the requirements specification, offering an overview of Avinor and our goals for this procurement. The detailed requirements are provided separately, while this document is intended to offer supplementary information.

1.1 Word explanation

Please do not include any brochures/leaflets with your answers. If you need more space to write your full answers for one or more of the requirements, please use a separate attachment with clear reference to the relevant requirement.

The requirements have the following classifications:

Shall requirement (A)	A “Shall requirement” is, in principle, an absolute and non-negotiable requirement in a procurement process that must be fulfilled for a supplier or a tender to be considered further in the competition. The requirements shall be answered with “Yes” (compliant) or “No” (not compliant). The answers to these requirements will not be evaluated; however, the Supplier shall describe and document how each requirement is met. Failure to meet a mandatory requirement may, depending on the nature and materiality of the deviation, result in rejection. The customer will make an overall assessment of the tender based on the purpose and needs of the competition.
Evaluation and Should requirement (B)	“Evaluation requirement” and “Should requirements”; The answers to these requirements are subject to evaluation. Suppliers shall provide a description that documents how the requirement is fulfilled.
Response Instructions	When completing the customer specification, it is not permitted to refer only to product catalogues, brochures, or external documents without a clear reference. It shall be easy for the Customer to understand and verify the Supplier’s response. If the Supplier wishes to refer to catalogues or other supporting documents, the exact document name, section, and page number must be clearly stated. The reference shall make it evident where and how the requirement is fulfilled. If the Customer is unable to locate the information at the specified reference, the requirement will be considered not fulfilled. The Supplier is therefore encouraged to provide clear and precise responses directly in the specification.

2 INTRODUCTION

Avinor is a state-owned limited company fully owned by the Ministry of Transport and is responsible for 43 state-owned airports. Avinor ensures safe and efficient travel for approximately 50 million passengers annually, half of whom travel through Oslo Airport.

Avinor is organized as a group and consists of several legal entities. Over 3,000 employees are responsible for the planning, development, and operation of efficient airport and air traffic services.

3 PURPOSE OF THIS PROCUREMENT

The purpose of this procurement is to establish a future-proof and scalable solution for measuring queues, waiting times, passenger flow, and capacity utilization at Avinor airports. This contract will mainly focus on security checkpoints in Trondheim Airport and commercial areas at Oslo Airport.

The solution shall support both operational needs, including resource management and capacity planning, and commercial needs related to the analysis of passenger movements and the development of terminal areas.

The procurement is expected to deliver the following outcomes:

- A comprehensive solution for passenger flow and capacity measurement.
- Acquisition of hardware and related equipment that can be deployed across Avinor airports.
- Improved decision support for operational management and planning.
- Enhanced insight into passenger flows to support commercial development and optimization of terminal areas.
- Reduced complexity compared to maintaining separate solutions for individual measurement and analysis functions.
- Improved scalability and lower total cost of ownership throughout the solution lifecycle.
- User-friendly and easy to configure by end users. The solution should not require programming skills in operational use.
- Commercially available “off-the-shelf” product with standard functionality for airport operations.

These goals will be important for Avinor when evaluating the quality of the tenders.

The system also needs to be configurable to support current and future work processes.

The customer reserves the right to determine which hardware to order under the Agreement based on the country of origin and information on the countries of origin of their sub-components.

The agreement will be for Avinor AS, and there shall be an option for other big airports at Avinor outside the main scope to use the system in the future if necessary for operations.

3.1 Information about Oslo Airport

Oslo Airport is Norway's main international airport and the second busiest in the Nordic region, connecting over 160 destinations.

For **security checkpoint** at Oslo Airport, we already have a system for queue measurement. The primary need for Oslo airport in this procurement is flow and capacity insight for the commercial areas; secondary it may be expanded to the operational areas in the future.

Oslo Airport provides a wide range of commercial services distributed throughout the passenger terminal, including retail outlets, food and beverage concepts, duty-free shopping, lounges, and convenience services.

The **commercial areas** are concentrated in three main zones:

Landside (public area before security screening): A limited selection of cafés, convenience stores, and service facilities serving passengers, visitors, and airport employees.

Airside Domestic Departures: A mix of restaurants, cafés, bars, convenience stores, travel retail, bookstores, and specialty shops located along the main passenger flow towards the departure gates.

Airside International and Schengen Departures: The largest commercial area in the terminal, featuring extensive duty-free retail, fashion and lifestyle stores, travel essentials, restaurants, cafés, bars, and other passenger services.

For passenger flow analysis purposes, commercial locations can generally be categorized into:

- Retail (duty-free, fashion, convenience, books, electronics, specialty retail)
- Food & Beverage (restaurants, cafés, bars, grab-and-go concepts)
- Passenger Services (lounges, currency exchange, pharmacies, service points)

The distribution of these commercial offerings creates several high-density passenger zones and influences passenger dwell patterns, making the commercial areas important locations for flow monitoring, occupancy measurement, and passenger behavior analysis. Described in the use cases later in this document, we want to measure the passenger flow outside and inside restaurants and shops at the airport.

3.2 Information about Trondheim Airport

Trondheim Airport, Værnes handled approximately 4.17 million passengers in 2025, confirming its position as Norway's third-largest airport in terms of passenger traffic, behind Oslo Airport Gardermoen and Bergen Airport Flesland.

Trondheim Airport Værnes has a single centralized security checkpoint serving the majority of departing passengers. The facility was significantly upgraded and expanded as part of the airport's terminal development project completed in 2013. During this upgrade, the security screening area more than doubled in size, while both capacity and technology were enhanced to accommodate increasing passenger volumes and improve the passenger experience.

Queue measurement and monitoring are used to ensure that the provider of security services is delivered due to the different SLA and KPI stated in the agreement between Avinor and the provider. Today's system is end of life and the Airport is in need of a new solution.

For this contract, the need is for queue measurement in the security checkpoint for departing passengers. The area has today five lanes, including Fast Track and one lane for staff. The masterplan for the airport describes an extension of the terminal building that will affect the security area. These reconstructions will start at the earliest, from 2030. The delivery of the service must therefore be adaptable to future changes or relocations of the security checkpoint area.

4 PROCESS DESCRIPTIONS

The main processes of queue and capacity management and stakeholders into the process are detailed in the sections below.

4.1 Queue and capacity management from an operational point of view

Queue and capacity management involve continuously assessing passenger flow through the security checkpoint and adjusting available capacity to meet current and expected demand.

The operational manager monitors waiting times, queue lengths, occupancy, and throughput to understand the current situation, while reviewing forecasts to anticipate peak periods and potential capacity constraints.

When queues build up or bottlenecks emerge, the manager assesses where the problem originates and takes appropriate action, such as redeploying staff, opening or closing control points, or adjusting passenger routing. This includes monitoring crowding in surrounding areas and supporting the safe handling of disruptions, incidents, and evacuation when necessary.

The manager follows up on the effect of these actions and reviews historical trends and performance against agreed KPIs to identify recurring issues, document results and improve future staffing and capacity planning.

4.2 Stakeholders / Users – Operational

Operational stakeholders depend on near real-time and reliable information on passenger volumes, queue lengths, waiting times and passenger flows to maintain efficient daily operations and make correct decisions in irregular situations. The system shall therefore support a common operational picture, enabling stakeholders to identify capacity constraints, respond to peaks and irregularities, adjust staffing and resource allocation, and coordinate operational measures. In addition, historical and forecast data shall support planning, capacity assessment and post-operational analysis. Access to data and functionality shall be adaptable to the responsibilities of each stakeholder, while ensuring that all parties work from a single, consistent data source.

Operational stakeholders include airport operations (APOC) personnel, terminal management, security screening operations, border control authorities, and airlines and ground handling agents.

4.3 Queue and capacity management from a commercial point of view

The commercial organization in Avinor needs a queue and capacity management solution to gain better insight into how passengers move through the terminal and utilize different areas. The solution shall provide a fact-based foundation for developing the terminal’s commercial offering, including retail outlets, food and beverage concepts, service functions, and other customer-facing areas.

Data on passenger flows, dwell times, and space utilization will enable a better understanding of how terminal layout, customer movement patterns, and capacity constraints influence exposure, accessibility, and commercial performance. This will support decision-making related to the development of existing concepts, introduction of new offerings, and evaluation of investments in terminal areas.

The solution should also contribute to establishing a common and standardized data foundation for commercial areas that can be used across Avinor airports.

4.4 Stakeholders / Users – Commercial

The primary users on the commercial side will be teams within commercial development, analytics, terminal development, and local commercial organizations at the airports. The insights will be used to analyze passenger behavior, evaluate initiatives, and identify development opportunities within the terminal environment.

Additional stakeholders include operational teams responsible for monitoring customer experience and operational performance of existing concepts, where opening hours and queue monitoring for specific concepts are important use cases.

The three most important user roles are:

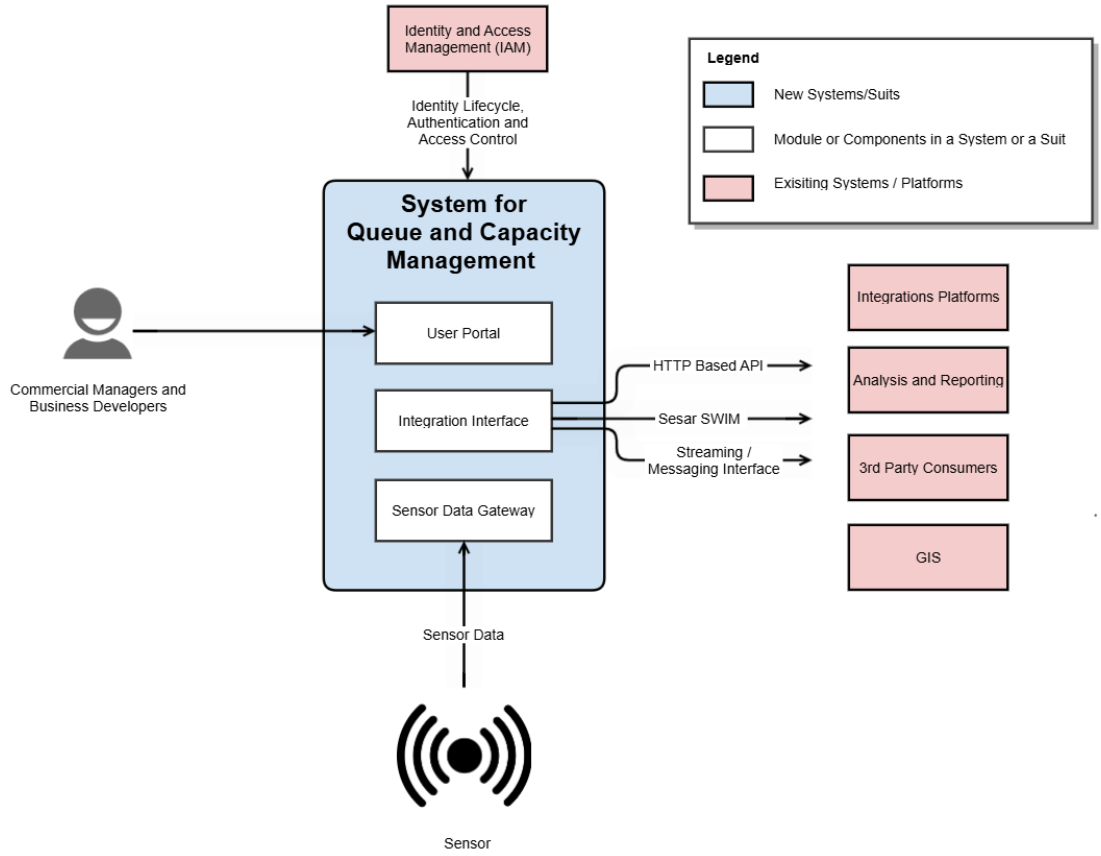
- **Commercial Strategic Managers (approximately 6 users)**
  - Require passenger insights at an aggregated shopping-centre level, with the ability to drill down into individual concepts and locations.

- **Commercial Operational Managers (approximately 5 users)**
  - Require the same capabilities as Commercial Strategic Managers, in addition to monitoring operational KPIs at concept level, such as queue formation, opening hours, changes in visit conversion, and deviation in passenger flow patterns.

- **Business Developers with a Strategic and Operational Shopping-Centre Perspective (approximately 4 users)**
  - Require the same capabilities as Commercial Strategic Managers, in addition to access to underlying raw data for advanced analysis. This role typically works on projects and initiatives that generate analytical needs beyond what is available through predefined dashboards.

5 SYSTEM LANDSCAPE

The system landscape below is the desired architecture related to in- and output for the system:



Simplified description of components:

- System for Queue and Capacity Management: Avinor requires a system for queue and capacity management that collects and processes sensor data to provide insight into passenger flow and waiting times.
- Sensor Data Gateway: The solution will typically include a gateway for collecting sensor data from installed sensors. This gateway is responsible for receiving, forwarding, and preparing sensor data for further processing in the Queue and Capacity Management System.
- Integration Interface: The solution shall provide solutions for integration with other systems and platforms.
- Analysis and Reporting / Data Consumption / Integration Platforms: The solution shall support analysis and reporting capabilities and enable consumption of wait time data by other systems and platforms through the relevant integration mechanisms stated above.
- Sesar SWIM: System-Wide Information Management
- GIS: Geographical Information System
- Identity and Access Management: Identity lifecycle, authentication and access Control
- User Portal: A user portal shall be provided for commercial managers and business developers.

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6 GENERAL REQUIREMENTS

General requirements				
Nr.	**Requirement**	**Classification**	**Fulfilled Yes/No**	**Response and/or reference to attachment/document**
6.1 - Technology, Architecture and Scalability				
TK-01	**Technology-neutral requirement** The solution should be based on either LiDAR, 3D camera technology, or other proven technology that meets the requirements for accuracy and data privacy. **Documentation Requirements:** The supplier shall describe the sensor technology used.	B		
TK-02	**Architecture** The solution should support secure, resilient, and highly available local processing of sensor data. Sensors and all associated components shall automatically recover and resume normal operation following power outages, network disruptions, or system failures. The solution should be fault tolerant and support local buffering of data during communication outages, with automatic recovery and synchronization of buffered data once connectivity is restored. The solution shall support DNS-based addressing and provide documented mechanisms for redundancy, cybersecurity, software updates, configuration management, and maintenance. The Supplier shall provide detailed information regarding the operating system, security architecture, hardening measures, patch management procedures, software	B		

	lifecycle, and any hardware or software dependencies applicable to the edge devices. **<u>Documentation Requirements:</u>** The Supplier shall describe how the solution supports local processing of sensor data, including which data is processed on edge devices and which data, if any, is transmitted to central systems or cloud services. The description shall include mechanisms for high availability, redundancy, and automatic recovery following failures or power outages. The Supplier shall further describe support for DNS-based addressing, security controls, authentication mechanisms, logging, and access management. For all edge devices, the Supplier shall document the operating system, patching and update regime, security hardening measures, lifecycle support, and any dependencies on third-party software, services, or cloud platforms. Any limitations, prerequisites, operational requirements, or environmental dependencies shall be clearly identified and described.			
TK-03	**Scalability** The solution should be scalable and capable of being centrally managed across multiple airports. The platform should support the addition of new sensors, measurement points, and sensor technologies without requiring significant architectural changes or affecting existing installations. Sensors should be replaceable, recalibrated, and commissioned with minimal impact on surrounding	B		

	measurement areas and without unnecessary service interruptions or downtime. The Supplier should provide mechanisms that support efficient deployment, operation, and lifecycle management of sensors, including the delivery of pre-configured devices where applicable. The solution should support the coexistence and management of both existing and future sensor technologies, enabling gradual technology refresh and expansion without requiring replacement of the overall platform or disruption to operational services. **Documentation requirements:** The Supplier shall describe how the solution can be scaled and centrally managed across multiple airports and locations. The description shall include the overall architecture, scalability characteristics, capacity limits, and the mechanisms available for adding new sensors, measurement points, and locations without requiring significant changes to the existing infrastructure or system architecture. An architecture diagram shall be included. The Supplier shall further describe the procedures and requirements for installing, replacing, and commissioning sensors, including the activities required when replacing existing sensors and the impact such activities may have on adjacent measurement areas and ongoing operations. The Supplier shall explain how calibration and commissioning of new sensors are performed, including any requirements for planned downtime, reconfiguration, or recalibration of neighboring sensors and measurement points.			

	The response shall also describe how new generations or types of sensors can be introduced into existing environments and how interoperability and coordination between different sensor technologies are managed. The Supplier shall document the deployment process for new sensors, including the use of pre-configured devices, centralized management capabilities, and any operational or technical prerequisites associated with deployment and commissioning. Any limitations, capacity constraints, dependencies, assumptions, and recommendations for future expansion and growth shall be clearly identified and described.			
TK-04	**Data Management, Ownership and Operational Responsibilities** The solution should provide transparency regarding which data is transmitted from the airport and/or sensors to central systems or cloud services. The customer shall retain ownership of all data generated by or through the solution, including raw data, processed data, historical data, derived datasets, reports, analytics and calculated KPIs. The solution should provide the Customer with unrestricted and efficient access to and user of such data. There should be a clearly defined division of roles and responsibilities between the Supplier and the Customer for the operation and maintenance of the solution, including any locally installed components. **<u>Documentation requirements:</u>** The Supplier shall describe which types of data are transmitted from the airport and/or the sensors, including whether raw data, images, video, point clouds, metadata, aggregated measurements, derived data, or other information are	B		

	transferred to central systems or cloud services. The description shall distinguish, where applicable, between data processed locally and data transmitted off-site. The supplier shall confirm the customer's ownership of all data and describe any technical restrictions applicable to Avinor's access to, export of, retention of, or reuse of such data. The supplier shall describe the division of roles and responsibilities between the Supplier and the Customer, including the local IT organization, for operation, monitoring, maintenance, incident handling, troubleshooting, updates, and support of the solution and any locally installed components.			
6.2 - Performance, Accuracy and Data Quality				
TK-05	**Accuracy / Environmental Conditions** The solution should achieve at least 95% accuracy in passenger counting under normal operating conditions, maintain high measurement quality in areas with high passenger density, handle overlapping sensor fields without double counting, operate reliably under varying lighting, climatic, and environmental conditions, and distinguish people from baggage, trolleys, strollers, wheelchairs, and other relevant objects. **Documentation requirements:** The supplier shall describe how the solution achieves and documents passenger-counting accuracy, including the validation method and results obtained. The description should cover the handling of high passenger density, overlapping sensor fields, and mechanisms for preventing double counting. The description should also include information about how the solution is affected by various environmental conditions, such as lighting, reflections, temperature variations, vibrations, and temporary obstructions, as well as how people are	B		

	distinguished from baggage, trolleys, strollers, wheelchairs, and other objects. Any limitations, assumptions, and recommended installation requirements shall be specified. Also, the load, lighting and environmental conditions to which the guaranteed values apply, and the limitations that apply outside these conditions.			
TK-06	**Accuracy per KPI** The supplier should state and guarantee the accuracy of each measurement included in the offered solution. This applies to counting, direction, occupancy, dwell time, queues, waiting time and journey analysis where these measurements are offered. **<u>Documentation requirements:</u>** The measurements included in the offered solution, guaranteed values, the test method and assumptions for each relevant KPI, including how accuracy is measured and documented.	B		
TK-07	**Missing data and reduced data quality** The solution should clearly indicate to users in presented dashboards or otherwise where measurements or analyses are affected by missing data, reduced measurement coverage or insufficient data quality. Where results are based on extrapolation or estimation, the method and uncertainty should be shown. **<u>Documentation requirements:</u>** Describe how missing data, reduced coverage and insufficient data quality are detected and indicated.	B		

6.3 - Monitoring, Administration and Lifecycle Management				
TK-08	**Operations, Maintenance and Monitoring** The solution should provide robust mechanisms for monitoring, operation, and management of sensors and measurement systems. The solution should be fault tolerant and support local buffering of data during communication outages, with automatic recovery and synchronization of buffered data once connectivity is restored. Furthermore, the solution should support integration with established monitoring and observability tools through standardized interfaces. It should be capable of detecting fault conditions and anomalies that may impact data quality and should provide centralized administration, version control, and remote configuration of sensors and measurement setups. **<u>Documentation requirements</u>** The Supplier shall describe how the solution's monitoring, operations, and management functions are implemented and administered in practice. The description shall include monitoring of sensor status, system health, data quality, and service availability, including the metrics, indicators, and alarm mechanisms that are provided. The Supplier shall further describe the methods and procedures used for calibration, synchronization, coordination between sensors, management of overlapping coverage areas, and recalibration following changes to the physical installation environment. The Supplier shall document how the solution handles communication outages, local buffering and storage of data, automatic recovery of normal operations, and synchronization	B		

	or transfer of buffered data once connectivity has been restored. The Supplier shall describe how the solution ensures continuous operation in the event of failures of individual components, as well as how conditions affecting data quality, including so-called “silent failures”, are detected, monitored, and reported. The Supplier shall also describe how the solution integrates with external monitoring and observability systems, including available APIs, logging mechanisms, and support for standardized monitoring protocols. Furthermore, the Supplier shall provide details regarding capabilities for centralized administration. Any limitations, prerequisites, operational dependencies, infrastructure requirements, and maintenance obligations shall be clearly identified and described.			
TK-09	**Software Maintenance and Updates** The solution should provide centralized management of software, firmware, and configuration settings for sensors and associated components. Software and firmware updates should be deployable centrally, and all configuration changes should be logged and traceable through comprehensive audit records. The solution should support controlled deployment of changes, including the ability to test and validate updates prior to production rollout. It should also provide mechanisms for rollback to previously approved software, firmware, and configuration versions where necessary. **<u>Documentation requirements:</u>**	B		

	The Supplier shall describe how software, firmware, and configurations are managed, deployed, and maintained throughout the lifecycle of the solution. The description shall include the tools and capabilities available for centralized management of sensors and associated components, including the distribution and deployment of software and firmware updates. The Supplier shall further describe how configuration changes are logged, tracked, and audited, including the audit trails, version histories, and change logs that are available. The Supplier shall explain how new software versions and configuration changes can be tested and validated prior to deployment in the production environment, as well as the mechanisms available for approval workflows, phased rollouts, and rollback to previously approved versions in the event of errors, incidents, or unintended consequences. Any limitations, prerequisites, dependencies, and operational, maintenance, or administrative requirements shall be clearly identified and described. The Supplier should also describe how the solution supports version management, change control, configuration management, and long-term traceability throughout the lifecycle of the system.			
TK-10	**Equipment, configuration and lifecycle management** The solution should support efficient administration and lifecycle management of installed equipment and its configuration. Configuration and setup should be capable of being securely backed up, exported and restored. **<u>Documentation requirements:</u>** Describe how equipment and configuration are registered and	B		

	followed up, how versions and upgrades of e.g. firmware are handled, and how backup, export and restoration are carried out. Describe your typical life cycle management.			
6.4 - Data Model, Integration and Traceability				
TK-11	**Identifiers** The solution should use unique identifiers for the airport, terminal, zone, measurement point, sensor and data source. **Documentation requirements:** Describe how the identifiers are structured, used and linked to each other in the data model.	B		
TK-12	**Timestamping and time synchronisation** All events and aggregates shall have an unambiguous timestamp with a documented time zone and time synchronization. **Documentation requirements:** Verify how events and aggregates are timestamped, the time zone used, and how time synchronisation between data sources is maintained.	A		
TK-13	**Data model** The data model should represent the measurements and analyses included in the offered solution using the relevant fields for direction, origin zone, destination zone, dwell time, count, data quality and data source. **Documentation requirements:** Describe which fields are relevant and available for the offered measurements and analyses, and how they are represented in the data model. A schema or an example API response shall be included.	B		

TK-14	**Enrichment and traceability** Where measurement data is enriched with gate, flight or schedule data, the original measurement data should be retained, and the enriched data should be traceable to its source. **<u>Documentation requirements:</u>** Describe the enrichment supported by the offered solution, how original measurement data is preserved, and how the relationship between measurement data, enriched data and the data source is documented.	B		
TK-15	**Terminal maps and authorisation** Maps, heatmaps and reports should use versioned terminal maps and comply with the user's authorisation to see data for different areas and locations. **<u>Documentation requirements:</u>** How terminal maps are versioned and linked to map views, heatmaps and reports, and how user authorisation controls access.	B		
6.5 - Privacy and Data Management				
TK-16	**Privacy and data retention** The supplier should document when data are anonymised and which data exist before anonymisation. Data should not be retained longer than necessary. **<u>Documentation requirements:</u>** The data that exist before anonymisation, when anonymisation takes place, and how long the different data are retained. A technical and legal explanation shall be included.	B		

6.6 - Installation, infrastructure and implementation				
TK-17	**Installation** The sensors shall support installation at varying ceiling heights and be mountable on ceilings, walls, or dedicated mounting brackets without any significant reduction in performance or accuracy. The supplier shall document the installation requirements, including the recommended mounting height, field of view, and coverage area for each sensor type. The sensors shall primarily support power supply via Power over Ethernet (PoE). **<u>Documentation Requirements:</u>** The supplier shall describe how the solution can be installed at different ceiling heights and using various mounting options (ceiling, wall, and mounting bracket), as well as how different installation conditions affect the coverage area, performance, and measurement accuracy. The supplier shall document the recommended mounting height, field of view, coverage area, and any installation limitations for each sensor type. The supplier shall also describe how the sensors are powered, including support for Power over Ethernet (PoE) and any deviations or additional requirements. In addition, the supplier shall describe how any edge equipment is to be installed and connected to the sensors.	A		
TK-18	**Existing infrastructure** The solution should support efficient implementation and use of existing infrastructure in a technically sound manner that safeguards security and privacy. **<u>Documentation requirements:</u>**	B		

	Describe if the existing infrastructure can be used, the adaptations required, and how security and privacy are addressed. Product documentation and a data flow diagram shall be included.			
TK-19	**Implementation and installation planning** The supplier should carry out a site survey and provide coverage, zone and installation plans before the final solution design is approved. **<u>Documentation requirements:</u>** Describe how the site survey is carried out, the conditions surveyed, and how the results are incorporated into the coverage, zone and installation plans.	B		
6.7 – Roadmap				
TK-20	**Roadmap** The supplier should have a roadmap for future development of the solution offered. **<u>Documentation requirement:</u>** Attached User Story #8, points to some of the future needs the Customer envisage that your technology can solve. If you could address the topics described and align them, if applicable, with your roadmap, that would be appreciated. In any case we would value if you could share your roadmap with us.	B		
6.8 – Environment				
TK-21	**Sustainability reporting** The Supplier shall have access to necessary technical insight and resources to assist the Customer with inquiries related to sustainability based on the content of this Agreement, as well as the operation of Data Centers.	A		

	Documentation requirements: Confirmation that the Supplier will provide annual sustainability reporting on the delivered solution that includes information on the Customer's total carbon footprint (CO2e).			
TK-22	**Environemental advisory** The Supplier shall, in cooperation with the Customer, advise on measures related to the service provided that can help reduce the carbon footprint. **Documentation requirements:** Confirmation.	A		

7 OPERATIONAL FUNCTIONAL REQUIREMENTS

Operational functional requirements				
Nr.	**Requirement**	**Classification**	**Fulfilled Yes/No**	**Response and/or reference to attachment/document**
OK-01	**Real-time queue monitoring** The solution should be capable of displaying real-time queue status data for defined queue and process areas, including actual or estimated waiting time, queue length, the number of people in the area, and throughput. **Documentation requirements:** Please describe which queue and capacity metrics are included in the standard solution, the data refresh frequency, the data sources and sensor types used, how waiting times are calculated, how queue areas are defined, and how measurement uncertainty is managed.	B		
OK-02	**Forecast Waiting Times and Queue Development**	B		

	The solution should be capable of calculating and displaying predicted waiting times and expected queue development within defined areas, based on real-time data, historical data, and relevant operational data where available. **<u>Documentation requirements:</u>** Please describe which predictive capabilities are included in the solution, the forecasting horizon, the data sources that can be utilized, how the predictive model is updated to reflect changing operational conditions, and how forecast accuracy can be measured, documented, and monitored over time.			
OK-03	**Historical Data, Analysis, and Trend Data** The solution should store and present historical measurement data, enabling users to analyze performance over time, identify patterns and trends, compare different periods, and document compliance with KPIs and contractual service commitments. **<u>Documentation requirements:</u>** Please describe the historical data retained by the solution, the applicable data retention periods, filtering and reporting capabilities, export options, support for analysis by area, process, and time period, and how data quality and data consistency are maintained over time.	B		
OK-04	**Queue Build-up and Bottleneck Detection** The solution should be capable of detecting queue build-up, bottlenecks, and abnormal passenger flow patterns within defined areas, including situations where a queue changes shape, shifts location, or forms outside a predefined queue area.	B		

	Documentation requirements: Please describe how the solution detects queue build-up, whether dynamic and unstructured queues are supported, which indicators are used, how bottlenecks are visualized, and any limitations associated with different terminal layouts or configurations.			
OK-05	**Area Occupancy and Crowd Detection.** The solution should be capable of measuring and visualizing the number of people within defined zones or areas, including support for assessing capacity utilization, crowding, safety, evacuation scenarios, and irregular events. **Documentation requirements:** Please describe how areas are defined, which measurement parameters are supported, the accuracy and limitations of the measurements, how occupancy levels and crowd density are visualized, and how such data can be used in operational incident management and decision-making.	B		
OK-06	**KPI Visualization.** The solution shall be capable of visualizing relevant KPIs at multiple levels, including airport, terminal, area, process, queue, and time period. KPIs shall be capable of being correlated with both real-time measurements and historical performance data. **Documentation requirements:** Please describe which KPIs can be configured, the levels at which they can be displayed, how KPI status is visualized, whether threshold values can be associated with KPIs, and how users can drill down from summary views to detailed information.	B		

8 COMMERCIAL FUNCTIONAL REQUIREMENTS

Commercial requirements				
Nr.	**Requirement**	**Classification**	**Fulfilled Yes/No**	**Response and/or reference to attachment/document**
KF-01	**Definition and classification** The solution shall distinguish between passing traffic, organized queues, dwell in commercial areas and visits to an outlet or a defined zone. **Documentation requirements:** Please describe how the categories are defined and distinguished in the solution. Additionally, please include an illustration of the distinction between an organized queue and other groups of people staying in an area.	A		
KF-02	**Passers-by, visitors** The solution shall show the number of passers-by, the number of visitors and the ratio between them for a commercial area (e.g. Visitor Conversion Rate for a commercial concept). **Documentation requirements:** Please describe how passers-by and visitors are defined and counted, and how the Visitor Conversion Rate is calculated and presented. Explain how historical data is visualized and analyzed, including hourly, daily, and weekly patterns and trends.	A		
KF-03	**Purchase Conversation Rate** Where the necessary transaction data is available, the solution should also be able to show how many visitors make a purchase (E.g. Purchase Conversion Rate). **Documentation requirements:**	B		

	Describe what transaction data, technical integrations, and other prerequisites are required to calculate Purchase Conversion Rate. Explain how transaction data is linked to individual commercial concepts, how the conversion rate is calculated and presented, and any limitations in distinguishing transactions from unique purchasing visitors.			
KF-04	**Passenger flow between zones** The solution should provide insight into passenger movements between defined terminal zones, including but not limited to passenger numbers, travelling groups, direction and typical movement patterns. **Documentation requirements:** Please describe and illustrate which movement information the solution provides and how it is analyzed and visualized. The description should include information about how travelling groups are identified or estimated, the data used, measurement coverage, assumptions and limitations. Include example views.	B		
KF-05	**Passenger journeys and cross-visits** The solution shall support visualization and analysis of passenger journeys through the terminal, including the sequence of areas and commercial concepts visited, cross-visitation between concepts, and the ability to link or estimate passenger journeys across areas without measurement coverage. **Documentation requirements:** Please describe how visit sequences and cross-visits are analyzed and presented. Explain whether and how journeys can be linked across gaps in coverage within Avinor's privacy requirements. State the method, coverage, uncertainty and limitations. Include examples of selected visit combinations and aggregated visit proportions where supported.	A		

KF-06	**Data basis and coverage status** The solution should present the data basis and coverage status for each section as part of the visualized passenger journey. **Documentation requirements:** Please describe how observed data, estimated data and sections without coverage appear in the passenger journey. Show how the data basis and uncertainty are presented to the user.	B		
KF-07	**Analysis by gate and flight** The solution should support the analysis of departing and arriving passenger movements in relation to assigned gates and, where the necessary data is available, individual flights. **Documentation requirements:** Please describe whether and how movement data can be associated with a gate or flight, the data sources and method used, and any assumptions, uncertainty and limitations. State whether the association is based on observation, estimation or aggregated data. Include examples of movements through the terminal to the departure gate and from the arrival gate to the exit. Continuous tracking or identification of an individual passenger is not a prerequisite for this requirement.	B		
KF-08	**Commercial campaigns** The solution should provide insight into passenger exposure to specific commercial campaigns in relation to subsequent visits to and use of commercial concepts and zones. **Documentation requirements:** Please describe how campaign exposure (E.g. commercials) can be analyzed together with subsequent visits and use. Describe data requirements and limitations and illustrate relevant views.	B		

KF-09	**Passenger flow optimisation** The solution shall support optimisation of passenger flow in the terminal by showing opportunities for improvement through analysis and visualisation. **<u>Documentation requirements:</u>** Describe how the solution is used to identify opportunities to improve passenger flow. Include a specific example of analysis and visualisation used for this purpose.	A		
KF-10	**Shop opening and closing times** The solution shall detect and present actual opening and closing times for each store. **<u>Documentation requirements:</u>** Describe how opening and closing times are detected, the applicable prerequisites, and how the times are presented for each shop.	A		
KF-11	**Food outlet opening and closing times** The solution should monitor opening and closing of food outlets without shutters and detect deviations from agreed opening and closing times. **<u>Documentation requirements:</u>** Describe whether and how opening and closing are detected for food outlets without shutters. Describe prerequisites and limitations and illustrate how times and deviations are presented.	B		
KF-12	**Available seating capacity** The solution should show the proportion of available seating capacity at food outlets and in seating areas.	B		

	Documentation requirements: Describe how available seating capacity is calculated and presented, and the applicable assumptions and limitations. Include example views.			
KF-13	**Queues at commercial concepts** The solution should monitor queues outside shops and food outlets and show when and how often queues occur during the day. **Documentation requirements:** Describe how queues are identified and distinguished from other dwell, and how their occurrence and frequency are presented during the day. Include example views. Please explain how the solution tracks and stores historical queue data for each commercial concept, and how this data is presented and analyzed. Include available metrics (e.g., average, maximum, and minimum queue lengths and waiting times) and reporting capabilities, such as hourly, daily, and weekly breakdowns	B		
KF-14	**Analysis and decision support** The solution should support evaluation of commercial and terminal-related measures by comparing relevant passenger behaviour and movement indicators before and after a defined change or initiative. **Documentation requirements:** Describe how users can define and compare analysis periods and evaluate changes in relevant commercial indicators, such as passenger flow, exposure, visits, dwell and cross-visits. Include examples of before-and-after analysis.	B		

KF-15	**Views for user roles** The solution should provide views adapted to commercial and operational users and support both strategic analysis and operational follow-up. **Documentation requirements:** Describe which views are provided for the different user roles and how they support relevant tasks. Illustrate views for strategic and operational use.	B		
KF-16	**Usability and configuration** The solution should be intuitive, suitable for mobile use and configurable for different airports and user groups. **Documentation requirements:** Describe how relevant tasks are performed, how the solution works on mobile devices, and which configuration options are available for different airports and user groups. Include examples.	B		
KF-17	**Self-service access for tenants** The solution should support self-service access for tenants to data relating to their own concept(s). **Documentation requirements:** Describe how tenants access their own data, how users are administered, and how access control limits each tenant's access to its own concepts.	B		

9 CASE FOR OSLO AIRPORT (OSL)

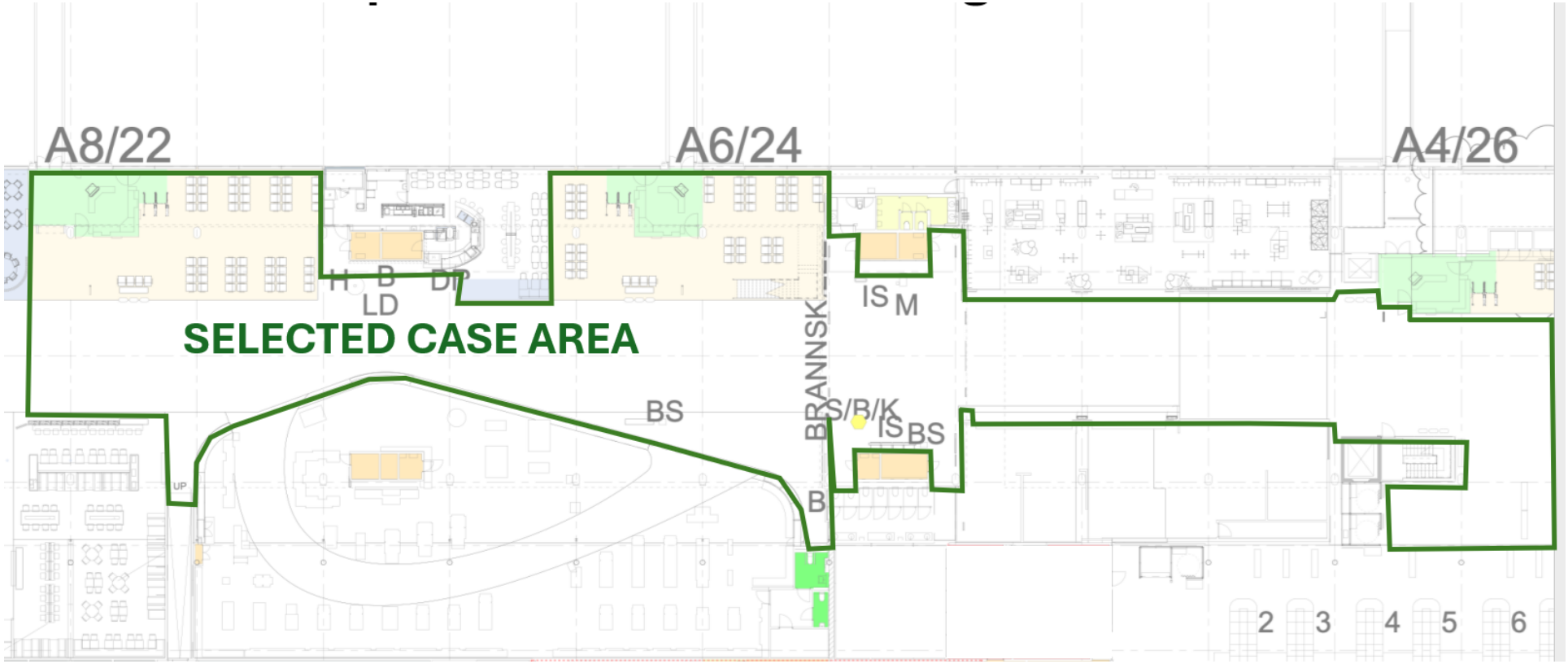
Based on the information on commercial needs in flow- and capacity management at the beginning of this document we have prepared two cases that we want to see how you would solve based on your system and technology.

9.1 Case 1 – Simplified case to evaluate curb to gate opportunities

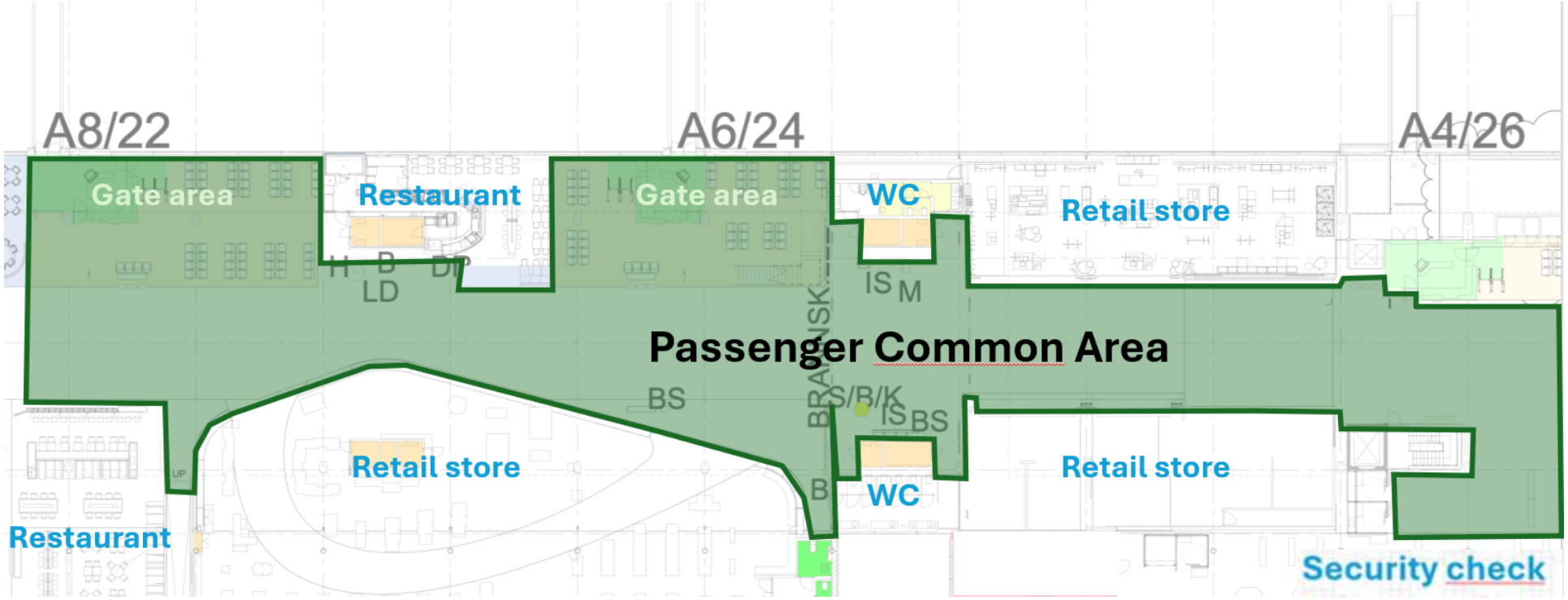
The highest commercial value of passenger monitoring lies in a comprehensive curb-to-gate solution. Such a solution would provide insights into how passengers interact with and utilize commercial concepts throughout their journey, linked to specific flights and departure gates.
To evaluate the potential of a curb-to-gate solution, the following case has been developed. The scope has been simplified to cover a limited section of the terminal rather than the entire terminal. The selected area offers a relatively large space with varying ceiling heights, allowing the supplier to demonstrate how the solution can accommodate different spatial conditions.

The material provided is intentionally simplified, and suppliers are expected to make reasonable assumptions where information is missing. All assumptions must be clearly stated and documented as part of the proposed case solution in Appendix 2 – Attachment 2.
Dimensions are provided in a separate drawing (see **Appendix 1 Attachment 1.1**).

Note that commercial concepts (restaurants, retail stores, etc.) are operated by commercial partners and are therefore not directly included in the case. The case primarily concerns monitoring of passenger flow in the common areas of the terminal. However, we would also like to see conversion rates for the shops within the defined area.

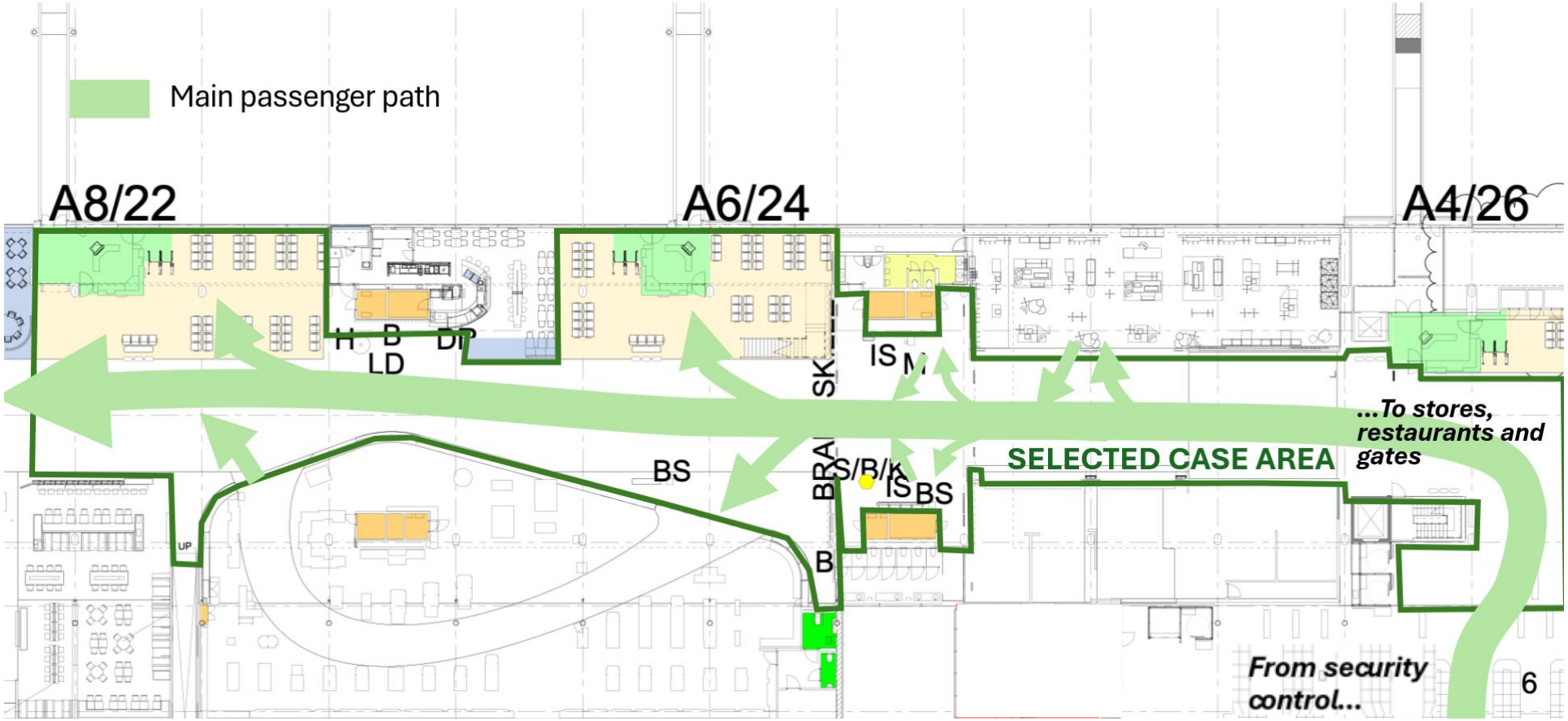


Picture 1 – Area for simplified “Curb to gate” case

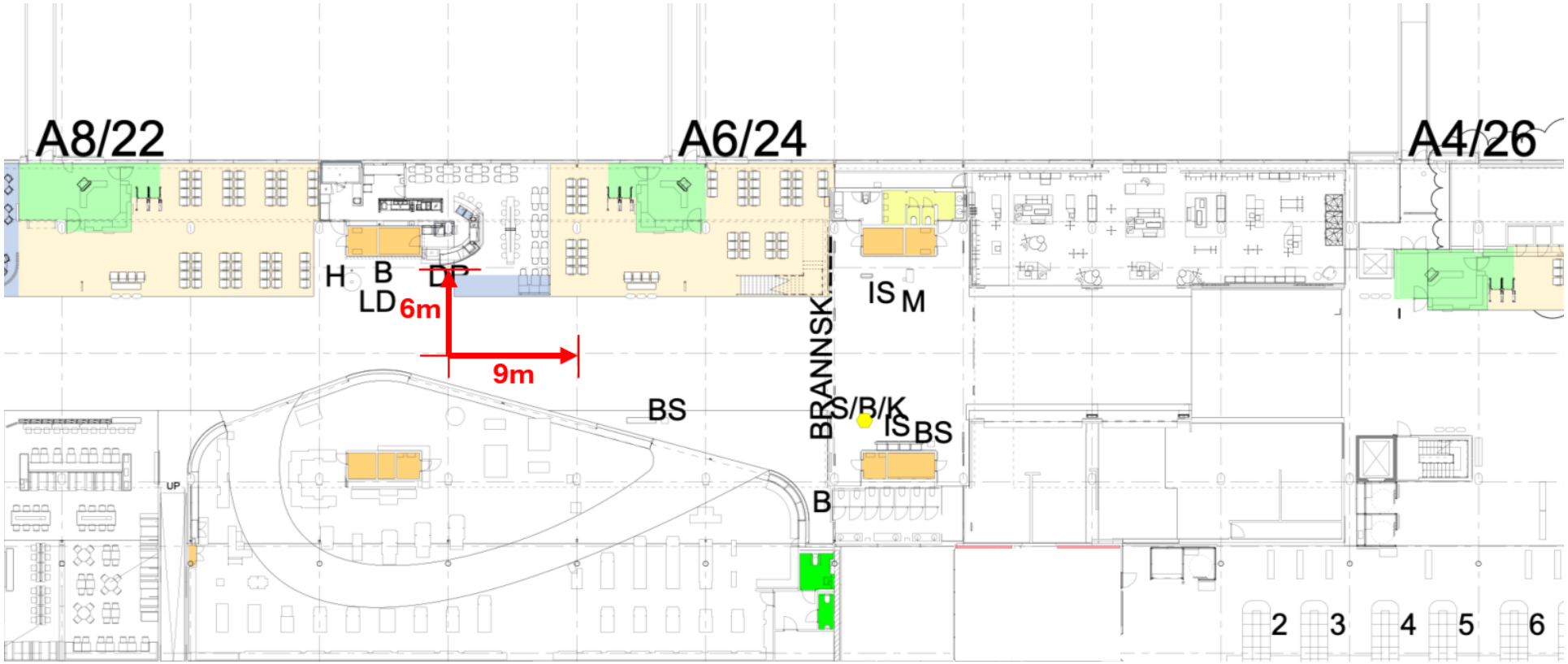


Picture 2 – Layout description

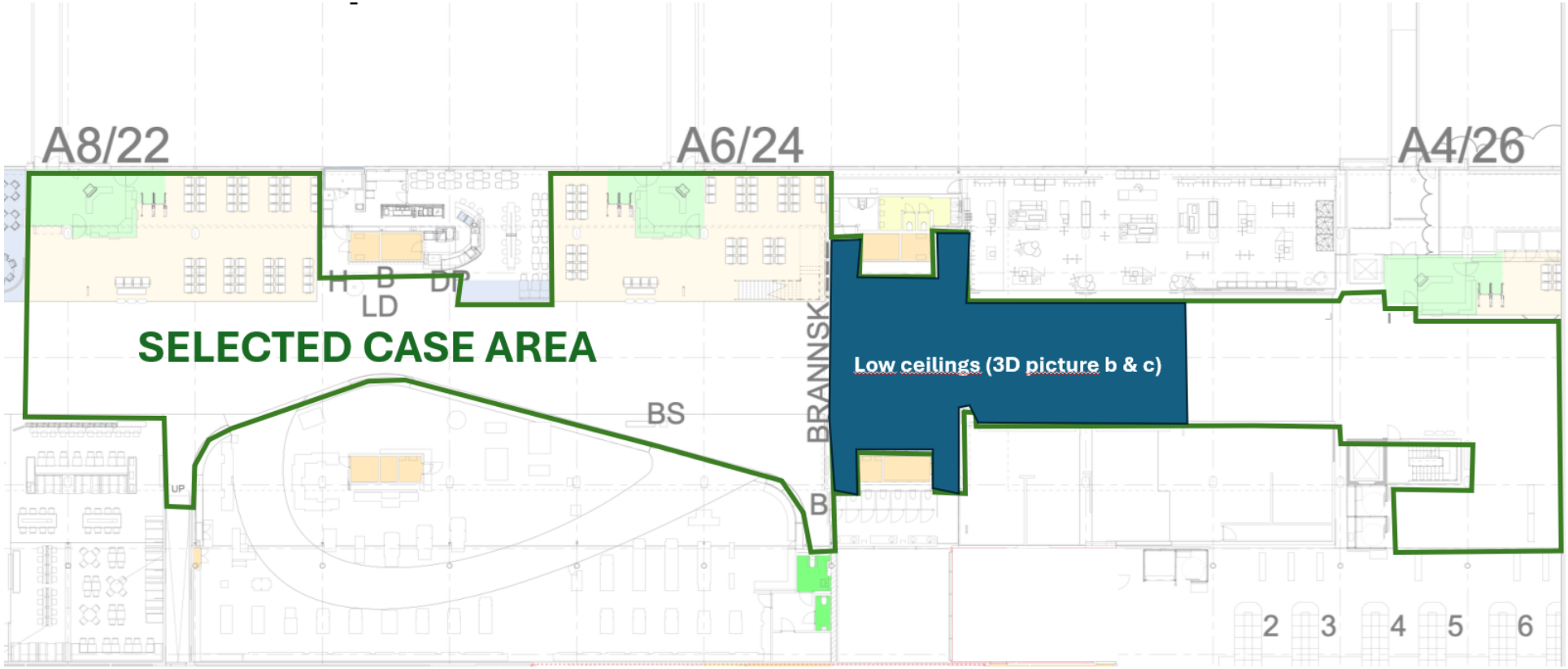
1



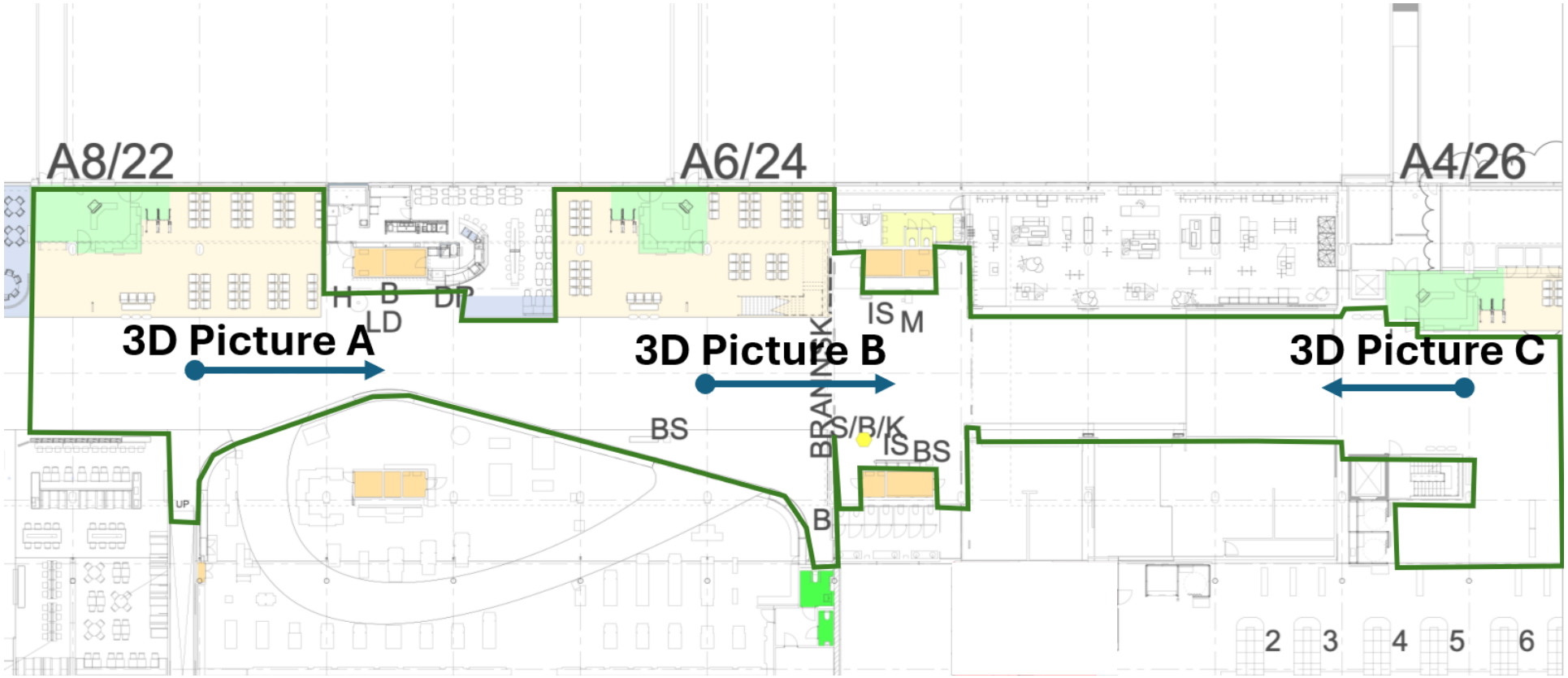
Picture 3 – Illustration of passenger flow from security control to commercial areas and gate



Picture 4 – Dimensions (The attached drawing is provided to scale, allowing suppliers to independently measure and extract the dimensions required to develop the proposed case solution.)

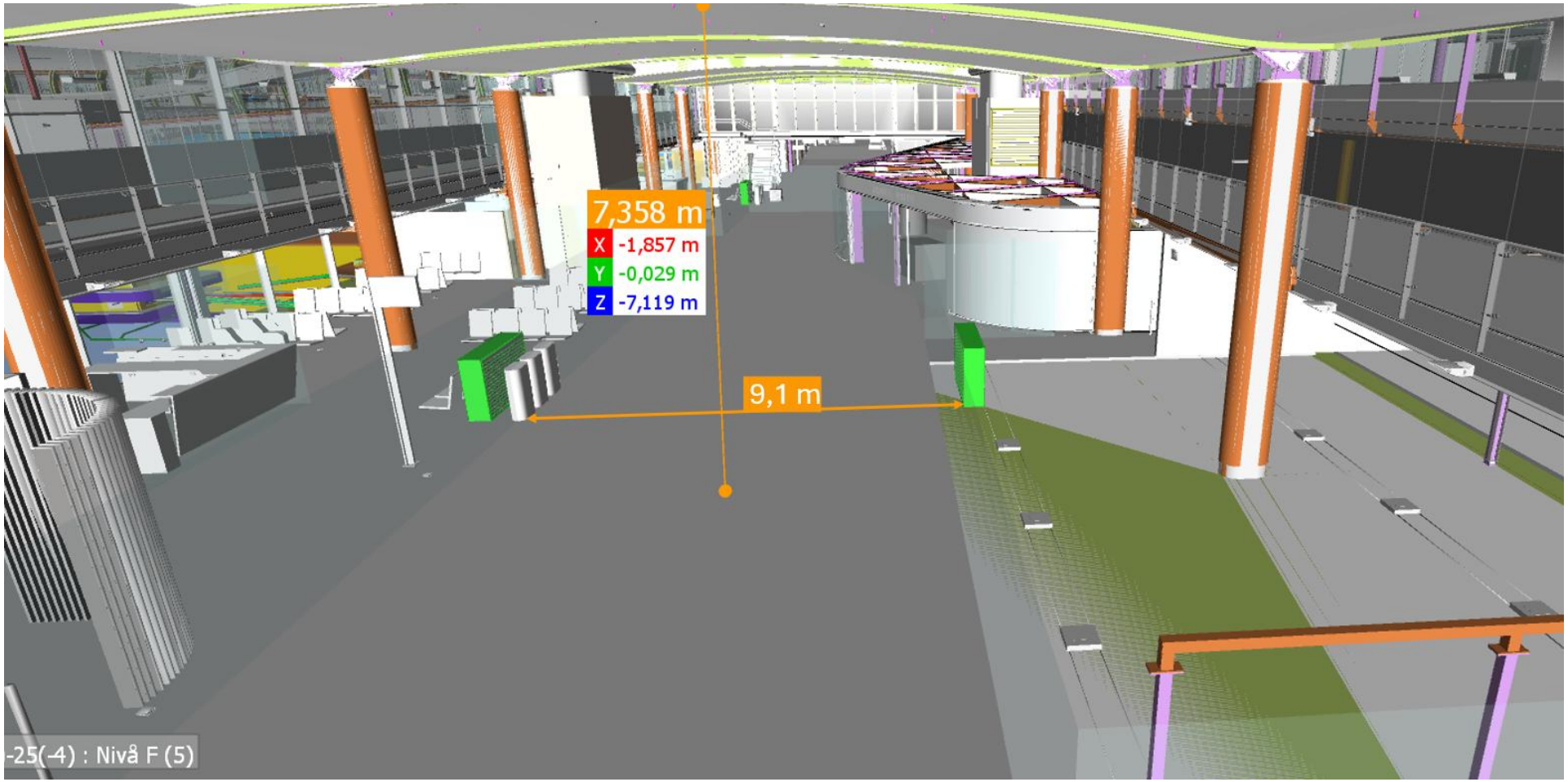


Picture 5 – Dimensions – Focus on low ceiling part of selected case area

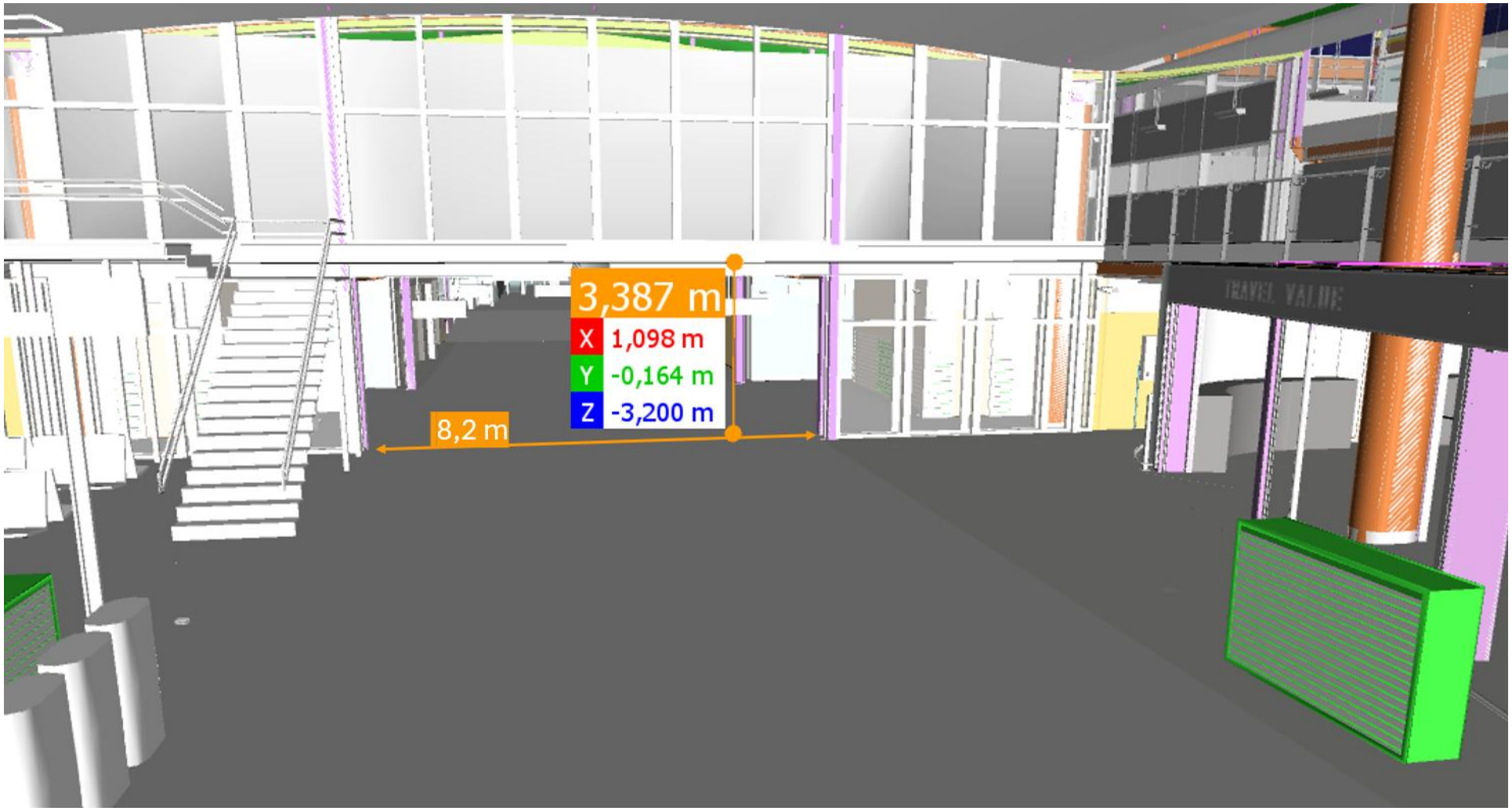


Picture 6 – Connection between 3d Pictures and layout drawing

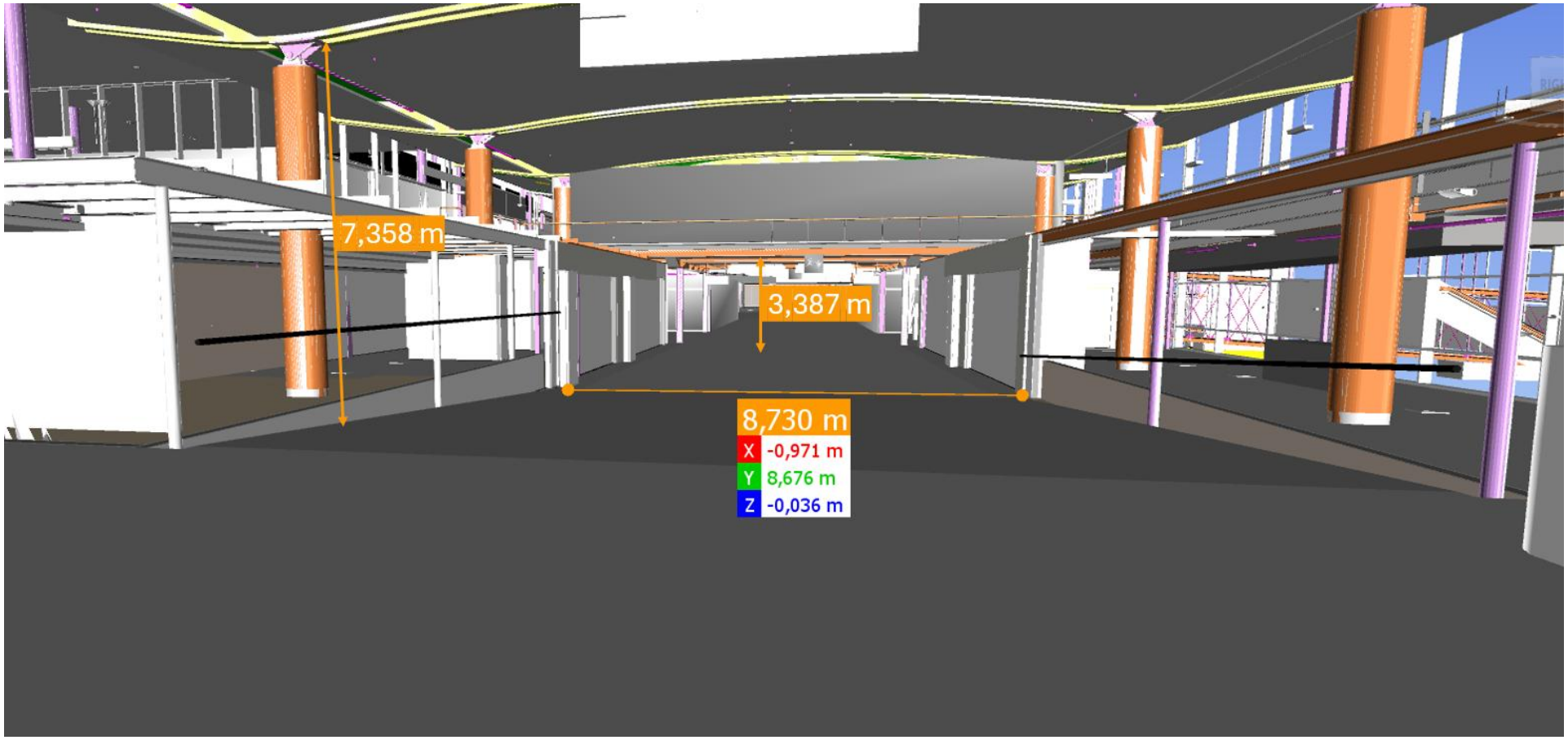
To provide a better understanding of the selected area there are presented three 3D pictures on the next pages.



Picture 7 – 3D picture A



Picture 8 – 3D Picture B



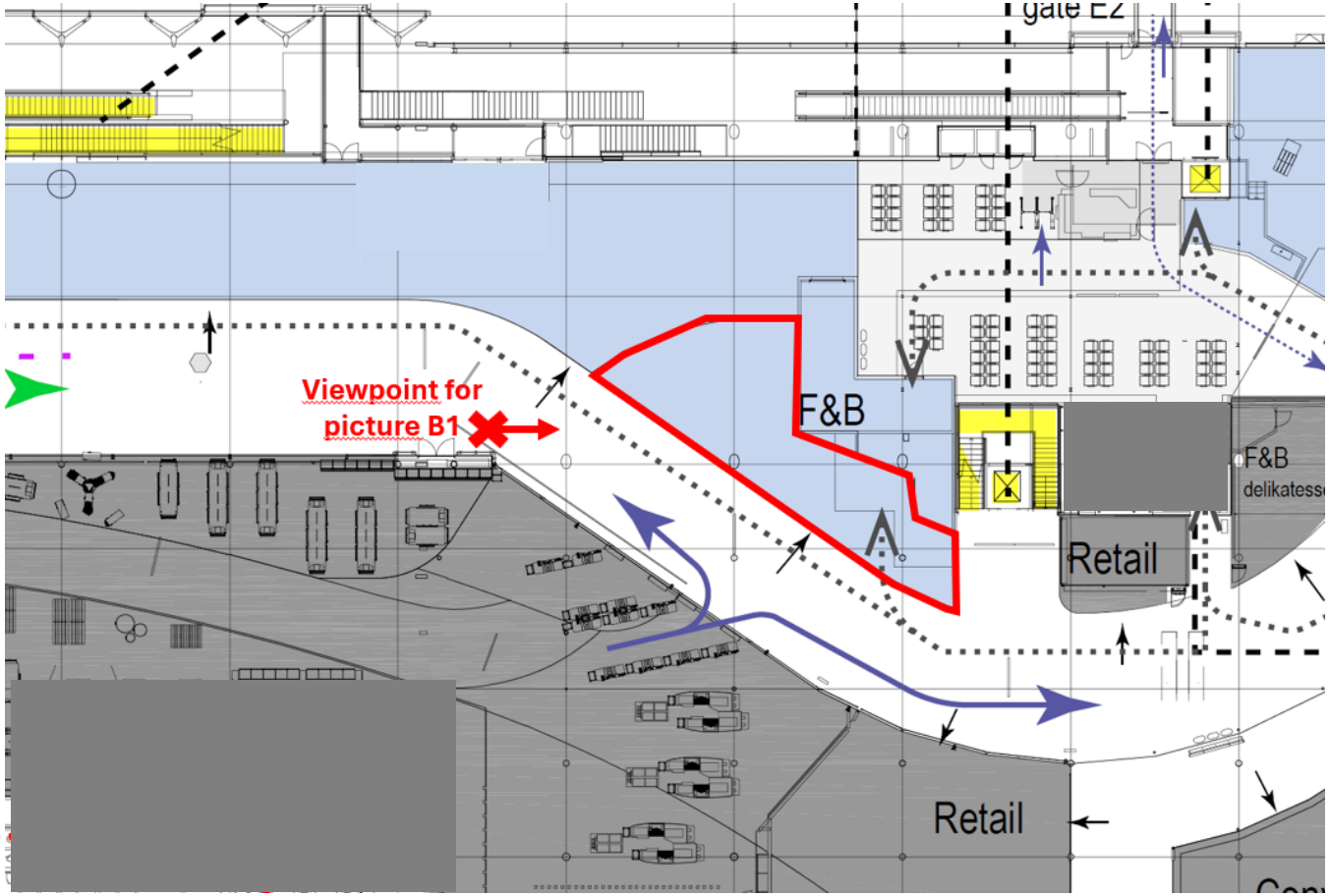
Picture 9 – 3D Picture C

Assignment:

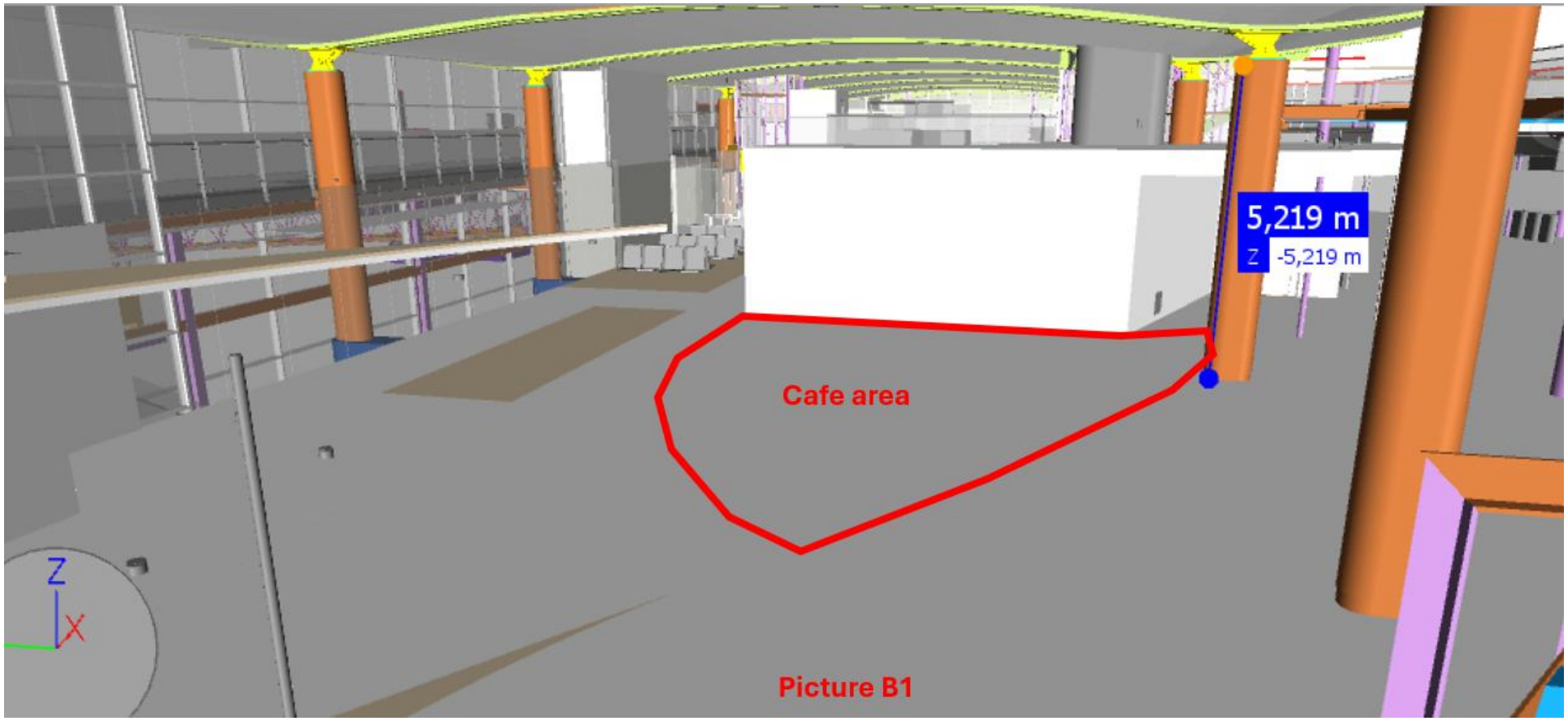
- The supplier should make a solution description of how they will set up a solution to meet our requirements for this “curb-to-gate” case and how use of technology will mitigate the challenges in layout.
- The solution description should showcase the amount and placing of hardware to utilize desired functionality in your solution.
- The solution description should include but not be limited to a price breakdown list with the necessary equipment to fulfill this case.

9.2 Case 2 – Undefined concept boundaries

This location has a relatively undefined concept boundary and is situated directly within a high-traffic passenger flow area. We would like to understand how the solution handles the complexity of a non-boundary store front. Also, this part of the terminal has an exceptionally high ceiling. We would like to understand how ceiling heights impact the technical solution.



Picture 9 - Layout of the area with indication of passenger flows



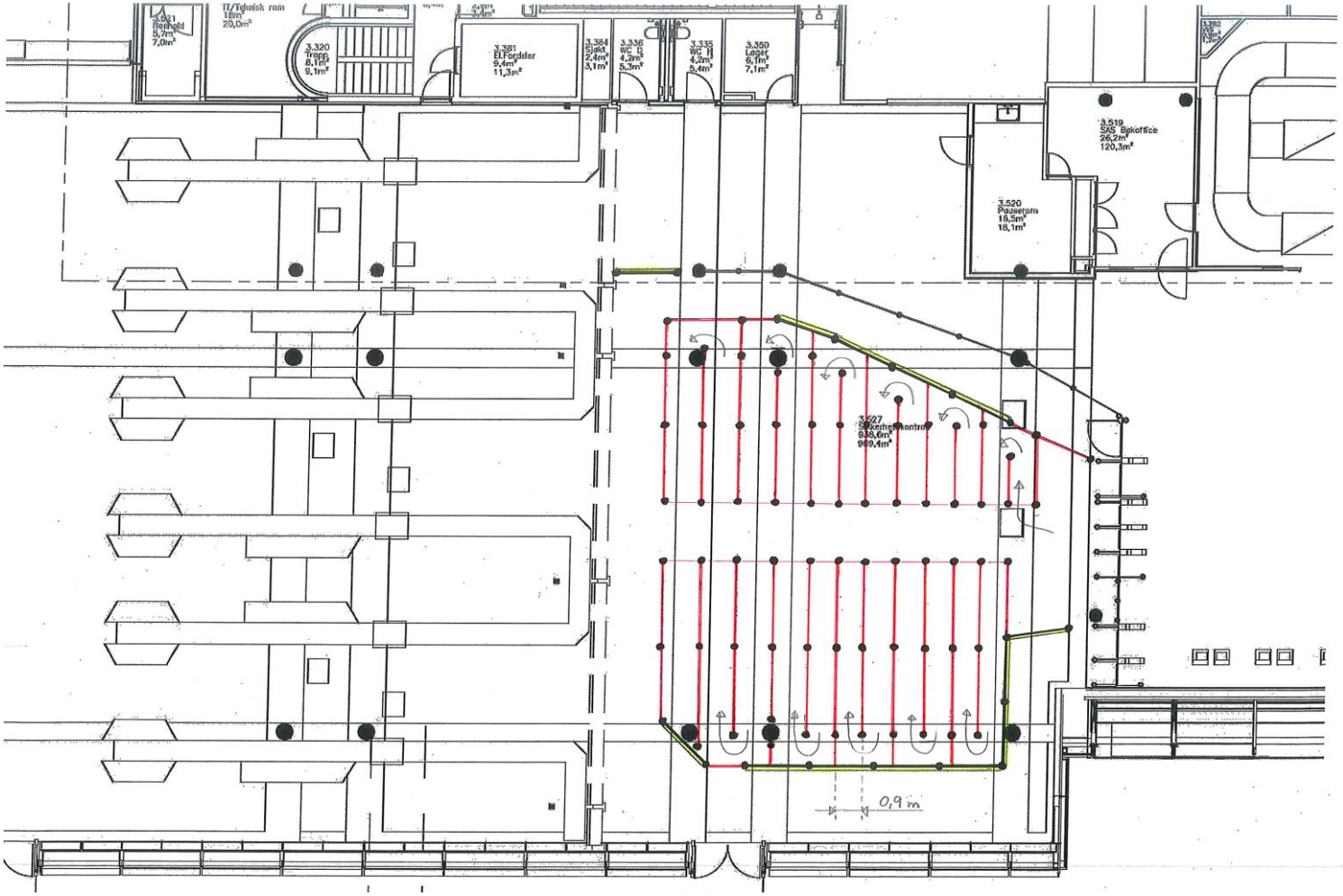
Picture 10 – Dimension of the area

Assignment:

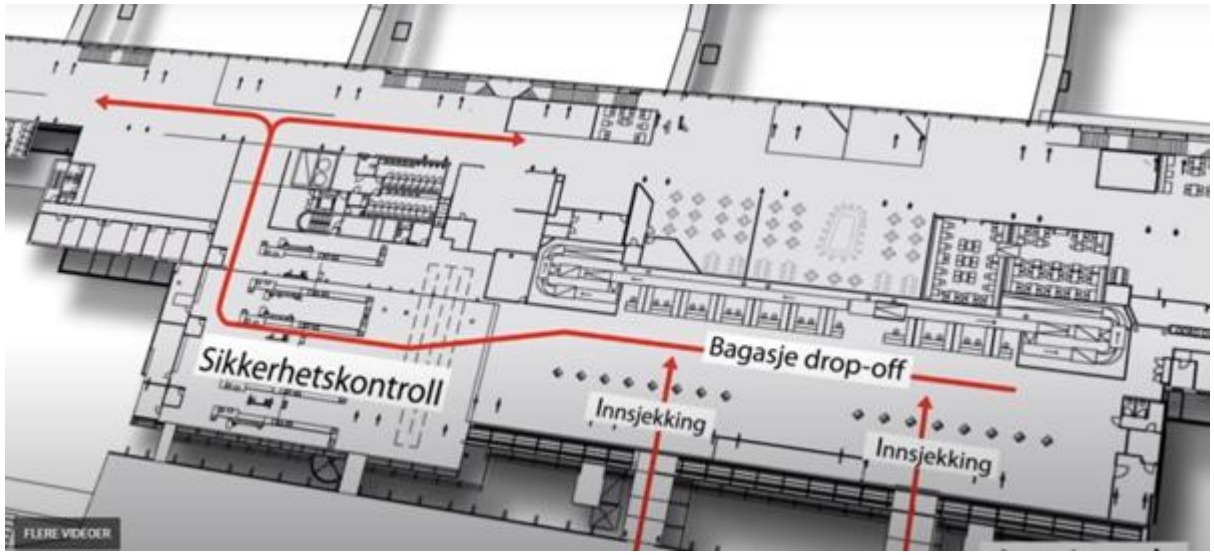
- The supplier should make a solution description of how they will set up a solution to meet our requirements for this case and how use of technology will mitigate the challenges in layout.
- The solution description should showcase the amount and placing of hardware to utilize desired functionality in your solution.
- The solution description shall include but not be limited to a price breakdown list with the necessary equipment to fulfill this case.

10 CASE FOR TRONDHEIM AIRPORT (TRD)

Based on the information on operational needs in flow- and capacity management at the beginning of this document we have prepared a case that we want to see how you would solve based on your system and technology. The case covers the security checkpoint at Trondheim Airport.



Picture 11 – Overview of security checkpoints at Trondheim Airport



Picture 12 – Overview of the flow through the terminal towards and throughout the checkpoint area

Sikkerhetskontroll = Checkpoint
Innsjekking = Baggage Check-in

Assignment:

- The supplier should make a solution description of how they will set up a solution to meet our requirements regarding queue- and capacity management.
- The solution description should showcase the amount and placing of hardware to utilize the functionality of your solution.
- The solution description shall include but not be limited to a price breakdown list with the necessary equipment to fulfill this case.
- The solutions description should also demonstrate how the functionality in the user stories attached in Appendix 1 Attachment 2 are covered in the solution. The user stories are adding further value to the requirements set out in this appendix.