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FROM FLEET INVESTMENT TO DEPLOYABLE CAPABILITY

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Abstract. Fleet purchases create technical capacity, but supporting facilities determine where that capacity can be used. This study examines the Latvian State Fire and Rescue Service (SFRS) from 2022 to September 2026 through an embedded documentary case study of procurement, station infrastructure and legacy-asset transfers. Fourteen official records are analysed using administrative-stage distinctions and an analytical framework separating capability, feasible assignments, fleet stocks and life-cycle costs. Liepāja and Sabile provide documented accommodation constraints followed by different organisational responses: relocation to a new centre and closure with personnel reassignment. The 2025 annual report records 62 Scania fire engines received in two categories and 16 fire engines transferred to Ukraine; their difference is a partial flow contribution, not the annual net fleet increase. A separate 2026 municipal programme covered 48 fire engines, with 30 handovers reported by mid-June. The contribution is an integrated assessment approach linking accommodation constraints, completed fleet movements and life-cycle cost boundaries. The findings identify relocation, closure and redistribution as distinct changes whose implications for deployment cannot be inferred from procurement totals alone.

Keywords: *Emergency vehicle fleet; fleet modernisation; infrastructure compatibility; life-cycle costing; operational capability; public asset management.*

JEL Classification: H54; H57; M11.

INTRODUCTION

Emergency fleets provide readiness, not simply transport output. Fleet size, spatial distribution and collaboration therefore matter alongside purchase cost and utilisation (Luzon et al., 2025). A further condition is whether the intended station can accommodate and support the selected vehicle. Procurement can expand technical capacity without making that capacity deployable at every location where it is needed. This study examines the Latvian State Fire and Rescue Service (Valsts ugunsdzēsības un glābšanas dienests, VUGD). Its vehicle-renewal programme coincides with investment in Disaster Management Centres (DMCs). An assessment identified 414 operational vehicles at their useful service-life threshold and a need for

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315 additional equipment units (Ernst & Young Baltic, 2023). These are renewal and capability requirements, not counts of unusable vehicles.

The analysis retains a system-wide perspective: funding and procurement, compatibility and allocation, then replacement, redistribution and disposal. Acquired fleet capacity means delivered vehicles and their technical characteristics. Deployable fleet capability also depends on facilities, personnel, technical readiness and allocation. These concepts differ; a comparison of vehicle counts cannot measure the whole capability gap. In the case analysis, "fire engine" denotes a pumping firefighting vehicle with an onboard water tank (Latvian: ugunsdzēsības autocisterna), not every vehicle in the wider fire and rescue fleet. Research question 1 (RQ1) asks what documented station-infrastructure constraints imply for assessing the deployability of fire and rescue vehicles. Research question 2 (RQ2) asks which documented responses address accommodation constraints. Research question 3 (RQ3) asks how renewal and subsequent transfers change the relevant asset-system boundary. The contribution is an evidence-linked assessment framework distinguishing physical feasibility, monetary consequences and fleet accounting, illustrated with Latvian records rather than presented as an impact estimate.

1. LITERATURE REVIEW

Capability-based planning relates resources to mission requirements and their integration rather than equipment holdings alone (Davis, 2002). In civil preparedness, core capabilities are likewise organised around mission areas (Federal Emergency Management Agency, 2015). ISO 55000:2024 provides a complementary asset-management perspective, linking life-cycle management to organisational objectives and value (International Organisation for Standardisation, 2024). These perspectives support distinguishing acquired capacity from deployable capability.

Allocation research explains why procurement volume is insufficient. Pérez et al. (2016) model improved standard-response provision by reallocating an existing fire fleet. Liu et al. (2022) jointly address station location and assignment of multiple vehicle types, while Ming et al. (2022) incorporate uncertainty into station-location planning. Luzon et al. (2025) examine fleet design and delayed-service costs. Eslamzadeh et al. (2022) organise the broader fire-department resource-allocation literature. These studies motivate attention to assignments and service requirements rather than vehicle numbers alone.

Infrastructure research supplies a complementary perspective. Choi and Yoon (2025) compare fire-station spatial composition and functional relationships. Bralewska (2024) connects the station environment with vehicles, contaminated equipment, ventilation and decontamination. Physical accommodation and supporting functions are therefore relevant dimensions, although these publications do not measure effects on Latvian response performance.

Fire-station guidance addresses apparatus accommodation, supporting spaces and their relationship to the operating mission (U.S. Department of Defence, 2019, Section 2-3.1 and Table 4-1). It is used here as international design guidance, not as a binding Latvian requirement. Public-procurement guidance extends life-cycle costing beyond purchase price to subsequent cost flows (Organisation for Economic

Co-operation and Development [OECD], 2022). The European Commission (2015) distinguishes financial from economic appraisal and provides guidance on consistent discounting.

Complementary investment is explicit in transport research. Rogge et al. (2018) combine fleet composition and charging infrastructure; Zeng et al. (2023) integrate charger deployment and fleet management through life-cycle cost analysis. Nath et al. (2024) compare coordinated and sequential decisions for electric buses. Their technological setting differs from emergency services: the findings are secondary analogies for coordinated planning, not direct evidence about fire-service deployment or a basis for transferring savings estimates. Giglio et al. (2018) address life-cycle public-asset management, while De Giacomo et al. (2019) examine adoption of life-cycle costing (LCC) in public procurement. The novelty claimed here is not the existence of vehicle-facility interdependence or the individual accounting equations, but their evidence-linked application to accommodation responses and asset transfers within one fire-service renewal setting. It identifies a practical integration problem: how to connect a physical assignment constraint with acquisition accounting, transition costs and the subsequent use of replaced assets. The framework below makes these different quantities explicit instead of treating compatibility as another euro-denominated cost or delivered vehicles as an operational outcome.

2. METHODS AND PROCEDURES

2.1. Documentary Design and Evidence Boundaries

An embedded, document-based case study covers 2022 to 23 September 2026. The embedded units are procurement procedures, accommodation events and outgoing asset flows within the national modernisation programme. Following the document-analysis approach discussed by Bowen (2009), records are interpreted according to their purpose and administrative stage. Event reconstruction and cross-case comparison are used; no causal process-tracing test or representative station survey is claimed.

The purposive corpus contains 14 records: one capacity-assessment presentation, one funding communication, three procurement notices, two annual reports, four SFRS event communications, two infrastructure records and one transfer order. Records were selected for direct evidence on programme scale, procurement stages, accommodation, implementation or transfers. Scientific articles, standards and guidance provide the interpretive framework and are not Latvian observations. All 14 empirical records are cited in Sections 3.1–3.4 and listed in the references; extraction rules and calculation boundaries are reported within this article.

Extraction records the issuer, date, quantity, unit, transaction, administrative stage and supporting passage. A completed event requires a record reporting completion, not merely an intention or legal authorisation. Transaction-specific documents take precedence for that event; later annual reports may establish implementation of earlier announcements. Institutional sources can repeat the same underlying information and are not automatically independent corroboration.

Compatibility is coded as explicitly constrained, explicitly verified for a defined pairing, or unknown. The response is recorded separately as announced, implemented or unresolved. A new DMC is a facility characteristic, not an ordinal compatibility score. Unreported dimensions remain missing; a total floor area does not establish doorway clearance. No inter-coder reliability coefficient is claimed. Conflicting object statuses are retained rather than resolved by assumption.

Liepāja and Sabile are compared on six dimensions: reported physical constraints, event timing, implemented response, other stated decision factors, linkage to an identified procurement vehicle, and measured operational outcomes. Table II applies these common questions. Unidentified vehicles and unmeasured outcomes remain missing evidence. The targeted literature review covers capability-based planning, preparedness, asset management, fire-station design and public-sector life-cycle costing; it is not a systematic literature review.

2.2. Capability and Feasible Assignments

The expressions below combine a conceptual dependence and a physical screening constraint with established accounting and discounting conventions. They organise the assessment rather than introduce new mathematical methods. The conceptual distinction is expressed in (1):

$$Q_t = f\left(\mathcal{V}_t, C_t, U_t, P_t, X_t\right), \tag{1}$$

where Q_t denotes task-specific deployable capability at time t; $\mathcal{V}_t$ the delivered vehicle portfolio; C_t vehicle-station compatibility; U_t technical availability; P_t personnel and supporting readiness; and X_t vehicle allocation. The function f states a conceptual dependence, not a fitted production function. Its arguments are not interchangeable quantities, and no scalar capability score is estimated.

For a single base assignment at a specified time, physical feasibility can be formalised as:

$$x_{ij,t} \le c_{ij,t}, \quad \sum_{j \in J_i(t)} x_{ij,t} \le 1, \tag{2}$$

where i identifies a vehicle and $J_i\left(t\right)$ contains stations with verified accommodation status for that vehicle at time t. For a station j in this set, $x_{ij,t} \in \{0,.1\}$ indicates the proposed assignment, and $c_{ij,t} \in \{0,.1\}$ indicates verified physical accommodation. A value of "1" for $c_{ij,t}$ requires defined dimensional and access checks; missing evidence is not coded zero. Equation (2) is applied only to verified pairings. It prevents assignment to an incompatible station but does not ensure sufficient crews, bay capacity, maintenance or geographical coverage. These require additional constraints; (2) is not a complete allocation optimiser. The verified set includes both compatible and incompatible pairings; verification does not imply compatibility. Unverified pairings remain unresolved and require further evidence before physical feasibility can be established. They are not treated as compatible or as physically impossible.

2.3. Fleet Stocks and Completed Transfers

The standard stock-and-flow identity preserves the central service boundary:

$$F_t = F_{t-1} + A_t - T_{\mathrm{DOM},t} - T_{\mathrm{INT},t} - D_t, \tag{3}$$

where F_t is closing fleet stock, F_{t-1} is opening stock, A_t is completed acquisitions, $T_{\mathrm{DOM},t}$ is completed domestic transfers, $T_{\mathrm{INT},t}$ is completed international transfers, and D_t is other permanent withdrawals during period t. All terms count vehicles within the same category and interval. Exit categories are mutually exclusive; internal reassignment is not an exit. Incomplete records support partial flow calculations, not an inferred fleet balance.

2.4. A Consistent Life-Cycle Cost Boundary

For an alternative vehicle-station configuration, conventional life-cycle cost components are grouped within the following financial accounting boundary (European Commission, 2015; OECD, 2022):

$$L_s = V_s + I_s + O_s + K_s - R_s, \tag{4}$$

where s identifies the alternative and every term is a present value in euros: L_s is total life-cycle cost; V_s is vehicle acquisition; I_s is attributable infrastructure investment; O_s is operating, maintenance and end-of-life expenditure; K_s is additional transition expenditure; and R_s is realisable residual proceeds or consistently assessed terminal asset value. Cost categories must be non-overlapping. Transfers within a consolidated public-system boundary cancel as internal payments; low book value is not a benefit estimate.

A common discounting convention is required for every component:

$$\mathrm{PV}\left(Z_s\right) = \sum_{\tau=0}^{H} \frac{z_{s,\tau}}{\left(1+r\right)^{\tau}}. \tag{5}$$

Here Z_s is a component's payment or value stream, $z_{s,\tau}$ is its euro amount in year τ, H is the common assessment horizon, and r is the annual discount rate.

Real prices require a real rate; nominal prices require a nominal rate. Different asset lives require consistent terminal values. Shared buildings must be counted once, using a stated attribution rule. Non-monetised coverage, compatibility and operational usefulness remain separate assessment criteria; they are not added to euro costs. Expressions (1) and (2) organise conceptual and physical assessment, while Expressions (3)–(5) apply standard stock-flow and financial accounting conventions. Their contribution lies in coordinated application, not mathematical novelty. Financial and social discounting are not interchangeable; a wider economic appraisal would require separate treatment of social costs and benefits (European Commission, 2015).

3. RESULTS

3.1. Programme Scale and Procurement Stages

The assessment's 414 vehicles represented 51 % of the operational fleet at its useful service-life threshold; the additional 315 equipment units concerned a proposed capability model (Ernst & Young Baltic, 2023, slide 20). The funding communication listed EUR 23 070 823 for 2023, EUR 78 188 135 for 2024 and EUR 65 046 151 for 2025, totalling EUR 166 305 109, with 547 equipment units envisaged (Ministry of the Interior of Latvia, Communications Department, 2024). Equipment units are heterogeneous. Neither this denominator nor the planned budget measures deployed road vehicles or verified cumulative expenditure.

The selected notices already specify LCC (Table 1). Their existence does not demonstrate whether station adaptation entered the underlying calculations; the complete calculation annexes were not available for this review. The analysis therefore identifies an assessment boundary to examine, not a proven omission in procurement practice.

Table 1. Procurement evidence and administrative stage

Procedure	**Documented LCC field**	**Outcome and interpretation**
IeM NVA 2022/63	Life-cycle costs; weight 100 in three lots.	Contract notice establishes the criterion, not award or delivery.
IeM NVA 2024/26	Life-cycle costs; fixed total score 100.	Corrected notice and later award; contract signed 31 October 2024. Award does not establish delivery.

Source: Provision State Agency of the Ministry of the Interior (2022, 2024a, 2024b). The fields are not converted into assumed percentage weights.

Table 1 documents selected procurement practice, not a verified procurement-to-delivery chain. The analysed records do not establish a complete cross-reference between these procedures, the 124-vehicle Scania cohort and the 62 receipts reported for 2025. IeM NVA 2024/26 concerns fire engines with aerial-lift systems and is not treated as evidence identifying the Scania cohort in Section 3.2.

3.2. Delivered Vehicles and the Stock Boundary

An April 2025 communication described a cohort of 124 Scania fire engines delivered during 2023–2025, valued above EUR 58 million, and announced the final ten-vehicle handover (Latvian State Fire and Rescue Service, 2025b). This establishes the reported cohort scale, not a matched deployment history for every vehicle.

The 2025 annual report records receipt of 39 Scania 4×4 and 23 Scania 6×6 fire engines, together 62, and transfer of 16 fire engines to Ukraine (Latvian State Fire and Rescue Service, 2026a, pp. 17–18). The selected completed flows contribute $62 - 16 = 46$ vehicles to the fire-engine stock identity in (3). This is not the annual net fleet increase: other acquisitions or withdrawals and opening and closing fire-

engine stocks are not reconciled here. Nor are the 62 added to the multi-year cohort of 124; the categories may overlap. No one-to-one replacement chain or corresponding increase in deployable capability is inferred.

3.3. Infrastructure Scale and Local Feasibility

The Ministry of the Interior of Latvia (2026) reported 21 completed DMCs. The object register maintained by the Provision State Agency of the Ministry of the Interior (2026) provides floor areas and construction or handover statuses, not a verified vehicle-station compatibility dataset. Floor area does not establish garage clearance or operational readiness. The register places Tukums under a completed-and-operational heading while its entry reports construction at 10 %. Its operational status therefore remains unresolved. The analysed records do not establish whether Tukums is included in the Ministry's aggregate total of 21. The total is retained as the Ministry's statement; Tukums is not independently classified as operational, and no revised operational total is calculated.

Liepāja and Sabile demonstrate different responses to inherited constraints (Table 2). In Liepāja, the source explicitly connects low garage ceilings with difficulties accommodating the higher and longer new equipment being received. Operations in the new centre began on 1 December 2025 (Latvian State Fire and Rescue Service, 2025a). The intervention changed accommodation and consolidated units, but the record does not isolate an effect on response times.

Table 2. Accommodation constraints and implemented responses

Case	Physical constraint	Response and interpretation
Liepāja legacy depots	Low ceilings and larger vehicle dimensions restricted accommodation.	Relocation and consolidation at a new DMC from 1 December 2025. The source also reports poor conditions in the former premises. No identified procurement-vehicle link or isolated response-performance effect is established.
Sabile post	Historic-site restrictions prevented sufficient gate enlargement and garage deepening.	Closure from 1 February 2023 and personnel reassignment, confirmed retrospectively. Staffing and demand also informed the decision. No identified procurement-vehicle link or isolated response-performance effect is established.

Source: Latvian State Fire and Rescue Service (2023, 2024, 2025a). Kandava is receiving-area context, not a separate incompatibility case.

For Sabile, the January 2023 announcement described building restrictions together with staffing and demand considerations (Latvian State Fire and Rescue Service, 2023). The 2023 annual report confirms closure from 1 February and reassignment of personnel, including to Kandava (Latvian State Fire and Rescue Service, 2024, Section 1.8). Closure removes a base from the assignment network rather than converting an incompatible building into a compatible one. Relocation

or consolidation must therefore be assessed against coverage and staffing as well as accommodation.

The cases illustrate the assessment question in (2), rather than provide vehicle-specific values for that constraint. They do not supply the identified vehicles and measured clearances needed to populate a national binary matrix. For Liepāja, the response changed the available facility; for Sabile, it changed the network of operating bases. This distinction is lost if both are reduced to the same generic "infrastructure improvement". Neither case identifies an affected vehicle from the reported procurement cohort. The evidence informs assessment of deployment conditions rather than establishes a programme-specific accommodation failure.

3.4. Redistribution and Residual Public Usefulness

Cabinet Order No. 398 authorised the transfer of 16 fire engines to Ukraine, with equipment and a combined book value of EUR 21 080.10 (Cabinet of Ministers of Latvia, 2025, paras. 1 and2). This is the recorded book value of the combined vehicles and equipment transferred without compensation, not sale proceeds, market value or an estimate of remaining operational usefulness. The annual report subsequently records the transfer during 2025 (Latvian State Fire and Rescue Service, 2026a). Post-transfer performance remains unmeasured.

The municipal programme covered 48 fire engines for 16 municipalities; 30 handovers were reported by mid-June 2026 (Latvian State Fire and Rescue Service, 2026b). Programme scope is not a completed transfer. These 2026 flows do not enter the 2025 calculation. Intended firefighting use does not establish recipient reliability or service outcomes.

Completed domestic transfers reduce central-service stock in (3), but redistribute assets within a wider national public-service boundary. This distinction does not establish unchanged national capability. Training, technical condition and operating resources must be assessed before attributing residual operational value. Book value cannot substitute for the terminal value in (4) or for non-monetary public usefulness.

4. DISCUSSION

4.1. Interpretation and Managerial Implications

The contribution is not that fleet, infrastructure and personnel have never been considered together. The capacity assessment itself recognises their interdependence (Ernst & Young Baltic, 2023, slide 6). Rather, the framework prevents three substitutions: procurement totals for usable capability; a physical constraint for a monetary cost; and transfer from a central fleet for final loss of public use. The equations state the boundaries under which each comparison becomes meaningful.

The joint assessment distinguishes decisions that procurement totals alone cannot resolve. Liepāja involves accommodation alternatives, whereas Sabile involves a changed station network, including staffing and coverage. The selected

2025 flows contribute +46 vehicles, but even the direction of the complete annual stock change remains unknown without the other movements. A domestic transfer changes central-service stock without necessarily ending national public use. For cost comparison, (4) requires attributable expenditure rather than the entire cost of a multi-function centre. The value of the framework is to make these assessment boundaries explicit and reproducible, not to infer an optimal decision from incomplete records.

For services facing documented accommodation constraints, the vehicle-station-location combination provides a useful unit of assessment. Screening compatibility before confirming an assignment is a proposed managerial implication, not a universally validated result of this study. When a pairing is unsuitable, alternatives include adapting the building, selecting another technically adequate configuration, changing allocation or replacing a facility. Sabile adds a distinct network alternative: discontinuing a base. An accommodation solution is not necessarily a service solution, so economic comparison must retain coverage, readiness and staffing requirements.

The coordinated-planning literature supports comparing complementary assets, but supplies no Latvian savings estimate (Nath et al., 2024; Rogge et al., 2018; Zeng et al., 2023). Under (4) and (5), adaptation and temporary relocation can be compared only with consistent cost attribution and service requirements. A multi-agency DMC serves functions beyond vehicle storage; charging its entire cost to vehicle compatibility would distort the comparison. Conversely, excluding attributable adaptation costs would leave the selected financial boundary incomplete. Which treatment applies in a particular tender requires its full methodology.

The framework also separates financial efficiency from service benefit. A technically feasible alternative with lower present-value cost need not offer equivalent geographical coverage. Nor does a transferred vehicle's low accounting value prove economic waste or public benefit. Evaluation should follow the asset into the receiving organisation and record operational availability, support costs and actual use. These dimensions preserve the broader modernisation perspective beyond procurement alone.

4.2. Limitations and Further Research

Purposive document selection may favour publicly reported problems or programme achievements. Two explicit accommodation cases do not establish network prevalence. Institutional reporting, unavailable LCC annexes, incomplete vehicle identifiers and the unresolved Tukums entry limit verification. The equations provide definitions, a screening constraint and accounting conventions, not empirical calibration or external validation; no causal effect, optimal allocation or system saving is estimated.

The next empirical step is a vehicle-station dataset linking dimensions and access, allocation history, staffing, downtime, commissioning and costs to completed transfer records. It would permit direct testing of feasible assignments, reconciliation of (3), and alternative-specific calculation of (4) and (5). Response and recipient-use data are needed separately to evaluate whether feasible and

affordable configurations deliver the intended public service. Matched vehicle-station measurements, a vehicle-level allocation dataset and independent interview evidence are absent from the analysed corpus. These would be needed for vehicle-specific application and further triangulation.

CONCLUSIONS

The Latvian case illustrates the interdependence of fleet renewal, station accommodation and subsequent asset transfers. Documented constraints at Liepāja and Sabile were followed by different responses, and completed acquisitions and transfers changed the central fleet's composition. None of these observations alone measures national deployable capability.

The framework connects vehicle acquisition with station suitability, fleet movements and life-cycle costs. Its practical use is to identify which records and comparisons are needed to assess whether acquired vehicles are deployable. The cases support considering vehicles and facilities together, but do not establish the effectiveness of a particular investment or the best solution for every station.

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