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Safer, Fairer and More Efficient Urban Food Delivery

Evidence-Based Governance from the SINERGI Project

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This report focuses on the case of Amsterdam. There are some aspects that are universal when it comes to interactions between meal delivery platforms and cities, but not all aspects are generalizable as the results highly depend on the delivery ecosystem of each city and business models of companies.

KEY MESSAGES

1 Governing food delivery does not require choosing between safety and efficiency. Algorithmic redesign, safety-aware routing, consumer information, and distributed infrastructure all improved public outcomes at low cost to platform operations, according to SINERGI's research. Congestion-aware restaurant ranking reduces delivery times by 5–14% at a revenue cost of roughly 1–3%.

2 Without public policies, platform algorithms act as unregulated logistics managers. Restaurant ranking determines where demand concentrates, which neighborhoods experience congestion, and how rider workloads are distributed. These are public outcomes shaped by private software, yet no public authority monitors them.

3 Simple information changes behavior on both sides of the transaction. Presenting crash-risk information in navigation apps to riders can nudge them toward safer route alternatives. Riders are willing to travel an additional 2 minutes if doing so reduces the probability of a crash or near miss by 10%. This is based on the study conducted in Amsterdam. Evidence from the consumer side suggests that safety-conscious consumers are willing to pay approximately up to €4 and accept approximately 19 minutes of delivery time for 10% reduction in rider crash risk.

4 Delivery infrastructure should be distributed, not centralized. Multiple small logistics hubs outperform single large facilities. Dynamic capacity redistribution, where vehicles are reassigned across zones based on temporal demand shifts, consistently outperforms fixed coverage assignments.

5 Improving food delivery services will require data that cities do not yet access. No Dutch municipality systematically tracks rider numbers, delivery vehicle kilometers, or courier-involved accidents. Every policy lever in this brief depends on mandatory platform data-sharing.

THE SINERGI PROJECT

SINERGI — Sustainable city-logistics in the age of digitization —is a research project funded by JPI Urban Europe, running from 2023 to 2026. The project is coordinated by TU Delft (Europe) and Tongji University (China), with partners including Just Eat Takeaway.com, Gemeente Amsterdam, Vervoerregio Amsterdam, AMS Institute, Copenhagen Business School, Hyke, Statistics Denmark, Singapore Management University, Meituan, and Tsinghua University. It operates across five pilot cities: Amsterdam, Copenhagen, Singapore, Beijing and Shanghai.

The project examines whether platform-based food delivery can be made safer and fairer without undermining commercial viability. Its research covers algorithmic design, rider behavior, consumer demand, and physical logistics infrastructure. This brief synthesizes the main research outputs from the Amsterdam use case. The table below lists the key SINERGI publications that inform and support this policy brief.

Study	Focus	Policy Lever
Xia et al. (2025)	Dynamic restaurant ranking, dispatch, congestion	Algorithmic governance

Study	Focus	Policy Lever
Kavta et al. (2025a)	Rider route choice under safety information	Safety-aware routing
Kavta et al. (2025b)	Consumer willingness to pay for rider safety	Demand-side incentives
Qi et al. (2024)	Micro-logistics center location planning	Infrastructure design
Yang et al. (2025)	Mobile Fleet Inventories for on-demand delivery	Dynamic rebalancing

(Frederiek) Backers (2025) Designing Services for Meal Delivery Platforms an Integrated Optimization of Restaurant Selection and Rider Allocation, Master thesis.

CONTEXT: URBAN FOOD DELIVERY AS A GLOBALLY UNREGULATED MOBILITY SYSTEM

Food delivery is an urban mobility system managed by no one

Thousands of courier movements pass through Amsterdam's dense cycling infrastructure every day, movements that no public authority plans, monitors, or regulates. The Netherlands' online food delivery market reached approximately €7 billion by 2024 (Statista, 2024). According to RTL Nieuws (2022), approximately 50,000 delivery riders were active daily across the Netherlands at the 2021–2022 peak, up from roughly 20,000 before the pandemic. Thuisbezorgd (Just Eat Takeaway.com) accounts for the majority of Dutch meal delivery orders (Statista, 2024).

The quick-commerce boom and bust exposed how rapidly this sector can reshape city streets and how few regulatory tools exist to respond. Between 2020 and 2022, four operators opened dark-store locations across Amsterdam. Resident complaints surged. Amsterdam froze dark-store openings in January 2022 and later imposed a permanent citywide zoning ban in May 2023 (Gemeente Amsterdam, 2023). That response demonstrated effective municipal action on one dimension of the delivery economy. But the underlying challenge of governing the daily movement of thousands of delivery riders remains overlooked.

The gap is fundamental: Amsterdam does not know how many delivery riders are operating at any given time, what vehicles they use, how many kilometers they generate, or where and when courier-involved accidents occur.

Delivery rider safety: evidence from two studies

Cyclist fatalities in the Netherlands have followed a rising long-term trend (CBS, 2024). The fatality risk for cyclists is nine times higher per kilometer than for car occupants (SWOV, 2025). In Amsterdam, e-bike accidents doubled from 2021 to 2022, though the absolute numbers remain modest (DutchNews.nl, 2023).

Two studies paint a seemingly contradictory picture of delivery rider safety. TeamAlert's 2022 survey of flash-delivery riders reported riding on sidewalks, riding with phone in hand, regularly violating red lights (TeamAlert, 2022). SWOV's 2025 observational study of standard e-bike meal delivery couriers reached a different conclusion: couriers are no more dangerous than ordinary cyclists of the same age (Stelling et al., 2025). Observed red-light violations were less for couriers than for ordinary cyclists. In SWOV's survey, delivery couriers reported that their collisions were caused by other road users.

The SINERGi project team believes that these issues require deep discussions between main stakeholders and deserve investigations in the context of different meal delivery ecosystem with diverse business models and city-based regulations as well as infrastructural asset availabilities. In the next section, we summarize the findings of the SINERGI project mainly focused for the case of Amsterdam.

WHAT SINERGI FOUND

Algorithmic restaurant ranking and congestion management

Restaurant ranking algorithms on food delivery platforms determine the spatial distribution of demand across urban zones. The order in which restaurants are displayed affects where orders concentrate, which neighborhoods absorb demand surges, and how courier workloads are distributed. Xia et al. (2025) developed a multi-stage optimization framework that jointly optimizes restaurant ranking, order-courier matching, and courier routing, tested on a calibrated network covering Delft with 131 restaurants and 18 service zones.

Computational experiments show that dynamic restaurant ranking, where the displayed order changes in response to real-time conditions, increases fulfilled orders (satisfied demand) by 9.9–68.7% compared to fixed rankings. Platform revenue increases by 3.0–30.4%. The effect is strongest when customers browse only the first few displayed options, which is the dominant behavior on mobile platforms.

Metric	Improvement range	Conditions
Fulfilled orders	+9.9% to +68.7%	Dynamic vs. fixed ranking
Platform revenue	+3.0% to +30.4%	Dynamic vs. fixed ranking
Average delivery time	–4.9% to –13.8%	Congestion-aware vs. congestion-blind
90th-pctl delivery time	–2.4% to –11.6%	Congestion-aware vs. congestion-blind

When congestion information is incorporated into ranking decisions, the mechanism is spatial demand redistribution: the algorithm shifts orders away from overloaded zones toward restaurants with spare capacity, reducing peak congestion ratios from above 10 to approximately 6.

The relationship between dispatch fairness and efficiency is nonlinear. In 80% of tested instances, fairness improvements exceeded twice the corresponding efficiency loss, indicating that moderate fairness gains are achievable at low cost.

> **Data dependency:** *Congestion-aware ranking requires zone-level demand-capacity ratios. This is the data that is not currently fully collected by operators or shared with municipalities.*

> **COST OF ACTION:** Improvements require no public spending. The revenue cost to platforms is roughly 1–3%. The gains in bike lane congestion reduction, delivery speed, and workload fairness are an order of magnitude larger. The current approach, that is, fixed ranking that ignores congestion is the expensive choice.

Rider route choice under safety information

Kavta et al. (2025a) conducted a stated preference experiment with 202 food delivery riders in Amsterdam and Copenhagen, recruited through food delivery platform and via email, WhatsApp, and local rider hubs. The experiment presented riders with choices between a shorter but riskier route and a longer but safer alternative, systematically varying travel time, crash-risk reduction, and monetary compensation.

Presenting crash-risk information on different routes shifts rider choice toward safer alternatives, even when those routes are longer. No financial incentive is required for the effect to occur. The additional travel time riders accept is approximately 1.85 minutes (approximately 2) per 10% reduction in crash risk. By implication, a route that is 40% safer justifies roughly 7.4 extra minutes. Monetary compensation of approximately €1.80 for a 10-minute detour further amplifies the shift.

The effect is not uniform across rider groups. Non-EU citizens are more likely than EU citizens to choose the platform-recommended route, which, by design, was the safer route in the experiment. Riders under time pressure are less likely to select the longer, safer platform-suggested route. Less experienced riders, who make up 76% of the sample, show a stronger preference for the platform route, whereas more experienced riders tend to favor shorter routes they already know. Taken together, these findings suggest that safety interventions are likely to have uneven effects across the rider population.

> **Data dependency:** *Safety-aware routing requires crash-risk data by road segment, which does not currently exist in any integrated form for Amsterdam's cycling network.*

> **COST OF ACTION:** Safety information provision costs platforms virtually nothing. Compensation for safer routing costs approximately €1.80 per delivery for a 10-minute detour, a modest cost relative to total delivery expenditure.

Consumer willingness to pay for rider safety

Kavta et al. (2025b) conducted a stated preference experiment with 350 food delivery consumers in Amsterdam and Copenhagen, using a hybrid latent class choice model to capture preference heterogeneity and incorporate attitudinal factors. The analysis identifies two distinct consumer segments: one largely indifferent to rider safety information, and one that responds to it with measurable changes in ordering behavior.

	Safety-insensitive segment (49.7% of sample)	Safety-sensitive segment (50.3 % of sample)
WTP* per 10% risk reduction	€0.12 (not significant)	€4.06
WTT per 10% risk reduction	0.19 min (not significant)	18.75 min
Profile	Older riders, lower education	Younger riders, higher education

**WTP: Willingness to Pay*

Consumer willingness to pay (€4.06 per 10% risk reduction) is likely to exceed the compensation riders require for safer routing (€1.80 per 10-minute detour). This difference suggests that a consumer-facing labeling mechanism, through which customers can choose safer delivery options, may provide a way to share the costs of safety improvements more broadly among stakeholders.

Platforms could introduce an optional “safer delivery” mode, analogous to eco-labels or fair-trade certification. The supply-side and demand-side findings are complementary: riders accept safer routes when informed, consumers are willing to pay for them, and platforms can capture the difference.

The indifferent segment limits the reach of voluntary labelling. For universal coverage, mandatory minimum standards are needed alongside voluntary options. Labelling reaches willing consumers; regulation ensures a baseline for all riders.

> **COST OF ACTION:** Labelling is a design change, not an infrastructure investment. Consumer willingness to pay already exceeds what riders require. Without such a mechanism, safety costs continue to be borne by riders rather than shared across the system.

Infrastructure: distributed logistics hubs

Algorithmic interventions address demand routing and rider behavior, but the physical infrastructure determines where deliveries originate and how much street space they consume.

In Qi et al. (2024), we applied a mixed-integer optimization model to Amsterdam's meal delivery network, testing how micro-logistics centers should be located and sized under mixed operational models. Multiple strategically located centers reduce repositioning costs and improve courier accessibility. Optimal locations maximize courier access to the network, not just proximity to demand hotspots. Dynamic capacity redistribution, in which vehicles are reassigned across zones in response to temporal demand shifts, consistently outperforms fixed-coverage assignments. These findings connect directly to Amsterdam's existing planning where the Autoluw agenda has established many neighborhood mobility hubs (Gemeente Amsterdam, 2024).

To further investigate the topic, in Yang et al. (2025), we developed an optimization framework for deploying Mobile Fleet Inventories (MFIs) (e.g., logistics units that reposition to match spatial-temporal demand fluctuations) and demonstrated on Amsterdam case that MFIs reduce system costs by 17% and rider idle time by 35% compared to stationary facility operations.

> **Data dependency:** *Hub planning and MFI deployment both require demand distribution data across neighborhoods and hours including the data that platforms hold but cities do not.*

> **COST OF ACTION:** Hub planning requires zoning accommodation, not large capital investments.

THE MISSING PREREQUISITE: DATA

Every finding in this brief including algorithmic improvement, safety-aware routing, consumer labelling, hub planning is based on our research within SINERGI based in Amsterdam as our use case. Important to point out that the city does not currently collect such information that can be used for decision making and research. Some of the findings are generalizable and can be applied with cities with similar micro-delivery ecosystems. However, this still needs to be carefully investigated. **Our aim is to highlight the potential opportunities and a possibility for a paradigm shift that can improve the delivery ecosystem's efficiency, equity and safety in urban areas for all stakeholders including cities, platforms, consumers or riders.**

Consider what the city does not know. It does not know how many delivery riders are operating at any given time, using which type of vehicles. It does not know how many delivery-related kilometers are generated daily, or where. It does not know where or when courier-involved accidents occur, because neither police registration nor hospital records capture whether a delivery rider was involved.

SINERGI Recommendation	Data Required
Congestion-aware ranking	Zone-level demand-capacity ratios
Safety-aware routing	Crash-risk data by road segment

SINERGI Recommendation	Data Required
Hub planning towards decentralization	Demand distribution across neighborhoods and hours
Fairness monitoring	Anonymized rider workload data across platforms
Policy evaluation	Baseline measurements for progress tracking

Without this data, the interventions described in this brief cannot be designed, calibrated, or evaluated. Establishing a plausible data-sharing framework seems to be Amsterdam's necessary first step based on our studies in SINERGI project.

REGULATORY CONTEXT: COUPLE OF DEADLINES CONVERGE IN 2026

Based on our non-expert opinion in legal affairs, we found out there are several opportunities that can be explored by the right experts together with main stakeholders in delivery platform ecosystems.

The EU Platform Work Directive (Directive 2024/2831), adopted on 23 October 2024 establishes the EU's first algorithmic management transparency rules, requiring platforms to inform workers about automated monitoring and decision-making.

Amsterdam has strong foundations to build on: the dark-store zoning ban, the zero-emission zone, the Autoluw agenda with its 30 km/h speed limits and 14 neighborhood mobility hubs (Gemeente Amsterdam, 2024), and a logistics strategy backed by substantial funding (Gemeente Amsterdam, 2022). What is missing is to establish a transparent delivery-specific strategy for safety, for data, and for algorithmic oversight.

RECOMMENDATIONS

For City Authorities

Mandate platform data-sharing as a condition of operation. To collaborate with platforms to report quarterly on rider numbers, modal split, delivery volumes by zone, and courier-involved incidents. Data-sharing should be a universal condition, not a voluntary initiative.

Integrate delivery hub locations into the Autoluw mobility hub strategy. Zone for distributed micro-logistics centers that accommodate land-based and mobile logistics operations. Optimal locations should maximize courier network accessibility, not just demand proximity.

Invest in crash-risk mapping. Partnering with platforms and researchers will help building a publicly available crash-risk layer, road segment by road segment, for integration into navigation systems.

Set bounded fairness thresholds for courier dispatch. Working with platforms to limit workload disparities among couriers while avoiding extreme equity targets that trigger disproportionate efficiency losses.

Target support for vulnerable riders. Non-EU nationals and financially precarious riders face the greatest safety trade-offs. Language-accessible safety training, fair compensation floors, and reduced algorithmic time pressure would disproportionately benefit those most at risk.

For Platform Operators

Embed crash-risk layers in rider navigation systems. Safety information alone shifts route choice. No financial incentive is required. This is the lowest-cost, highest-impact intervention in this brief.

Use restaurant ranking for congestion management. Ranking can be treated as a spatial demand-management tool. Congestion-aware ranking delivers 5–14% faster delivery times.

Offer safety labelling to consumers. Enable consumers to select a "safer delivery" option. Consumer willingness to pay substantially exceeds what riders require for safer routing.

For National and EU Regulators

Transpose the Platform Work Directive with algorithmic specificity. Algorithmic transparency provisions should cover ranking logic, dispatch fairness metrics, and safety-routing capabilities, not only employment classification.

Reform accident registration to capture delivery riders. Neither police registration nor hospital data currently identifies whether a traffic victim involved a delivery rider. This is a low-cost administrative reform with high social benefit values.

SUMMARY MATRIX

	City Authorities	Platform Operators	National / EU
Data	Mandate data-sharing	Report rider/volume/incident data	Reform accident registration
Algorithms	Set fairness thresholds	Congestion-aware ranking	Algorithmic transparency
Rider Safety	Crash-risk mapping	Safety-risk layers in nav	—
Consumer	—	Safety labelling	—
Infrastructure	Zone for distributed hubs	—	—

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ABOUT SINERGI

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About This Brief

This brief synthesizes peer-reviewed and working-paper evidence from the SINERGI project (2023–2026). Results from Xia et al. (2025) and Qi et al. (2024) are derived from computational experiments on calibrated urban networks and indicate the direction and order of magnitude of effects rather than measured outcomes on operating platforms. Results from Kavta et al. (2025a, 2025b) are based on stated preference experiments and reflect intended behavior in controlled settings. External statistics are sourced from CBS, SWOV, Statista, RTL Nieuws, and Amsterdam municipal documents; full references are provided above. Factchecking was conducted against original sources in April 2026.