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Accrual Integrity, Payment Assurance, and the Economics of
Reconciliation in Enterprise Transportation Management**



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Freight Settlement and Accounts Payable Integration: Accrual Integrity, Payment Assurance, and the Economics of Reconciliation in Enterprise Transportation Management

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Abstract

Purpose: In an enterprise transportation management system, settlement is the financial control point where every planned movement is converted into an accrual, a payable, and eventually a payment. This paper treats settlement as an accounting-integrity function rather than a clerical step and asks what determines whether that function produces correct payments cheaply or incorrect payments expensively.

Methodology: We trace the settlement document lifecycle and the integration objects that carry cost from transportation management into materials management and financial accounting, examine the invoice-verification and self-billing paths that discharge the resulting payables, and model the economics of dispute generation using a stock-and-flow representation of the settlement queue, calibrated against a documented enterprise deployment.

Findings: Adding reviewers raises the clearance rate but leaves the arrival rate untouched, while an upstream charge correction lowers arrivals and alters the dynamics that generate the backlog. In the documented deployment, a sustained nine percent weekly decline in dispute arrivals, produced by correcting a charge-calculation defect rather than by adding staff, compounded to a reduction exceeding seventy percent in weekly arrivals across a single quarter and drove the standing backlog down by more than ninety percent.

Unique contribution to theory, practice and policy: The paper reframes settlement disputes as a stock-and-flow economics problem rather than a staffing problem, showing quantitatively that correction at the source dominates downstream processing. The findings offer transportation-management practitioners a basis for prioritizing charge-logic remediation over clearance headcount when addressing systemic settlement backlogs.

Keywords: *Accounts Payable Integration, Accrual Integrity, Dispute Economics, Freight Settlement Document, Queue Dynamics, Self-Billing.*

JEL Codes : *M41, L91, C63.*

1. INTRODUCTION

A transportation management system spends most of its attention on planning and execution, on getting the right goods onto the right vehicles along the right lanes. Settlement is what happens after all of that is done, and it is easy to treat as an afterthought: the freight moved, now pay the carrier. That framing understates what settlement actually is. Settlement is the moment when a physical event becomes a financial fact, when a completed movement is recognized as a cost, accrued in the general ledger, and discharged as a payment. It is, in accounting terms, a control point, and the quality of what passes through it determines whether the enterprise pays the right amount to the right carrier at the right time (Bardi, Coyle, & Novack, 2006).

This paper approaches settlement as a financial-integrity function rather than a processing task. The distinction matters because the two framings lead to different remedies when settlement goes wrong. Treated as a processing task, a settlement problem looks like a throughput problem, to be solved with more people and faster workflows. Treated as an integrity function, the same problem looks like a data-quality problem, to be solved by correcting whatever upstream logic is producing incorrect figures. The remedies are not equivalent, and the difference between them is measurable.

To make that difference precise, we develop a simple quantitative model of how settlement disputes accumulate. A dispute queue behaves like any other stock fed by an inflow and drained by an outflow: it grows when disputes arrive faster than they clear and shrinks when they clear faster than they arrive. This framing turns an operational headache into an arithmetic one, and the arithmetic points unambiguously toward the source. A backlog generated by a systemic charge defect cannot be cleared by raising the outflow alone, because the defect keeps the inflow high. Lower the inflow and the same queue drains on its own. This stock-and-flow framing follows the system dynamics tradition established by Sterman (2000) and is consistent with the arrival-service relationship formalized in Little's Law (Little, 1961).

1.1 Methodological Approach and Scope

This paper is a conceptual and analytical study rather than a primary survey-based investigation, and its methodology should be read accordingly. It proceeds by process analysis and documentary description of the freight settlement lifecycle as implemented in an SAP S/4HANA transportation-management landscape, and it develops an analytical stock-and-flow model of dispute generation and clearance, following the system dynamics approach of Sterman (2000) and grounded in the queueing relationship established by Little (1961). The model is then calibrated against a single documented enterprise deployment rather than a sampled population, using operational and financial figures observed over the reported period as the calibration data. Consistent with this design, the paper does not employ a survey instrument, a target population, or a sampling technique; the object of analysis is the settlement process and its dispute economics, not a population of respondents, and the documented deployment functions as an illustrative case against

which the model's predictions are checked rather than as a sample drawn for statistical generalization.

2. THE FREIGHT SETTLEMENT DOCUMENT

2.1 Origin and Content of the FSD

Settlement is organized around a single object, the freight settlement document. It comes into existence when a planner, having built and released a freight order or freight booking that subcontracts transportation to a carrier, triggers the settlement step. At that point the system assembles an FSD that carries the logistical particulars of the movement together with the commercial data, above all the charges, needed to reconcile the enterprise position against the carrier position (Muir & Reddy, 2018).

The provenance of the charges on the FSD is the single most consequential fact about settlement, and it is worth stating in the strongest terms. In the ordinary case the FSD does not compute charges at all; it inherits them, copying the figures the planning process already calculated on the freight order. A fresh calculation against the governing freight agreement is available when circumstances require it, and manual override is possible, but the default and dominant path is inheritance. Whatever the freight order got right, the FSD carries forward; whatever the freight order got wrong, the FSD carries forward just as faithfully. The document has no independent capacity to detect an error it has inherited.

An FSD is downstream of the charge, and it can be no more correct than the charge it receives.

2.2 Individual, Collective, and Partial Forms

The document takes several forms depending on how much it settles at once. A single freight order or booking settles through an individual FSD. Several orders bound for the same carrier can be gathered into one collective FSD, which cuts document volume when many small movements would otherwise each generate paperwork. Creation runs either online, one document at a time from the relevant apps, or in bulk through a mass-creation report when volume demands it.

Partial settlement handles a freight document already carrying an invoice that must absorb an additional charge. Issuing a partial FSD steps the freight order back from fully invoiced to partially invoiced, and only then is the new document raised. The governing rule is asymmetric by design: charges may be added to an already-invoiced order but never silently removed. That asymmetry is a control. It forces every reduction to travel through the auditable correction mechanism rather than through deletion, which is precisely what keeps a settlement history trustworthy after the fact.

3. INTEGRATION AND THE ACCRUAL AS A CARRIER OF RISK

3.1 The Posting Path

Once created, an FSD leaves transportation management and posts into materials management, a transfer executed in an embedded S/4HANA landscape by a background remote function call. Because the call is asynchronous, the document advances through a sequence of lifecycle states, and its current state reports exactly how far the posting has progressed at any moment. The path is not a single leap but a chain of dependent objects, and each link is a place the chain can break.

It begins by resolving a valid purchase order out of five inputs, the carrier plus the purchasing organization, purchasing group, plant, and item category. On that order it then raises a service entry sheet that itemizes the carrier services with their quantities and values. Neither object represents a genuine procurement; both are technical scaffolding whose purpose is to carry the cost into financial accounting through the standard machinery. Understanding them as scaffolding rather than as commercial documents is the key to reading the posting correctly when it fails (Kappauf, Lauterbach, & Koch, 2012).

3.2 The Accrual and Where Cost Lands

The decisive financial event is the acceptance of the service entry sheet, because acceptance is what raises the accrual. An accrual is an accounting statement that a cost has been incurred but not yet paid, and it is the object that holds settlement risk between the moment of service and the moment of payment. If the charge behind it is wrong, the accrual is wrong, and the error is now sitting in the general ledger rather than in a spreadsheet. Account assignment decides where that accrual lands, with the system resolving the general ledger account and the controlling assignment for each cost item at whatever level of granularity the enterprise has configured, from coarse cost pools to lane-level attribution (Bowersox, Closs, & Cooper, 2020).

Table 1: Freight Settlement to Materials Management: Integration Objects

Integration Object	Created By / From	Purpose in Settlement
Freight Settlement Document (FSD)	Freight order or booking, on settlement	Carries logistical data and charges from TM into the settlement process. Basis for all downstream MM and FI postings.
Purchase Order (PO)	Determined by carrier, purchasing org, group, plant, item category	Technical object required for transfer to Financial Accounting. Can be created per settlement or monthly per carrier.
Service Entry Sheet (SES)	Created against the determined PO	Lists services performed by the carrier with quantities and values. Accepting the SES triggers the accrual posting.
Accounting Document	Generated on SES acceptance	Posts accruals to Financial Accounting. Account assignment determines the correct G/L account and Controlling object per cost item.
Invoice / Credit Memo	MIRO (manual) or ERS self-billing	Verifies or generates the carrier invoice. Posts payables by canceling the accruals, completing settlement.

3.3 Posting Actions

Because posting is a multi-step financial transaction with several points at which it can break, the FSD exposes a set of recovery actions rather than a single commit. The routine action saves and posts, creating the purchase order and service entry sheet and booking the accrual. When a posted accrual must be undone, one action cancels it along with the service entry sheet and purchase order; a separate reversal raises a return service entry sheet against an existing purchase order, which the carrier can only receive if enabled for self-billing. Where service entry creation itself failed, a dedicated action cancels the stranded purchase order so posting can restart, and a reprocess action resumes a transaction that stalled at an intermediate step. Each action exists so that a half-completed posting can be driven forward or safely unwound without leaving the ledger inconsistent.

Table 2: FSD Posting Actions and System Effects

Action	System Effect
Save and Post	Creates the purchase order and service entry sheet, then posts accruals to Financial Accounting.
Cancel Document	Cancels posted accruals and cancels the service entry sheet and purchase order. Applies when lifecycle status is Accruals Posted.
Reverse Document	Creates a return service entry sheet for a previously created purchase order. Requires the carrier to be enabled for Evaluated Receipt Settlement.
Cancel PO	Cancels the purchase order when service entry sheet creation failed. Posting must be restarted after successful cancellation.
Reprocess Failed Document	Continues the posting process when document creation failed at an intermediate step.

4. DISCHARGING THE PAYABLE: VERIFICATION AND SELF-BILLING

4.1 Two Paths

An accrual is a promise to pay, not a payment. Discharging it, and converting it into a settled payable, happens along one of two paths. The first retains the carrier invoice: when it arrives, a clerk matches it to the settlement figures inside logistics invoice verification, tax is derived and layered onto the net freight amount, and posting occurs only once the residual balance reaches zero, whereupon the document flow refreshes the freight order and FSD statuses. The second path drops the carrier invoice out of the sequence. Working under the credit-memo procedure, which the literature also labels evaluated receipt settlement or self-billing, the enterprise builds the settlement straight from its FSD data, pushes the computed cost into the ledger, and lets the carrier audit the result after payment, any discrepancy landing later as a supplementary debit or credit.

The choice between these paths is really a statement about confidence in one's own charge data. Self-billing pays before verification, which is efficient precisely to the extent that the underlying charges are trustworthy and reckless to the extent that they are not. An enterprise whose charge logic is sound converts self-billing into pure cycle-time savings; an enterprise whose charge logic is flawed converts it into automated overpayment or underpayment, and thereby into the very disputes it hoped to avoid. The payment mechanism inherits the reliability of the number that feeds it.

4.2 Verification as a Financial Control

Manual verification is deliberately gated: only a user carrying the required parameter may perform freight invoice verification, which enforces separation of duties around the act of committing a payable against a carrier. More than an access rule, the verification step is the last reconciliation checkpoint before money leaves. The balance must resolve to zero, and a balance that will not resolve is a signal that the enterprise and carrier positions disagree. When the upstream charges are correct, that checkpoint clears as a formality. When they are not, the checkpoint is exactly where the disagreement becomes a dispute, because no clerk can reconcile to zero a figure the configuration computed incorrectly. This separation-of-duties control mirrors long-standing accounts-payable verification practice in transportation and logistics operations (Bardi, Coyle, & Novack, 2006).

5. CHARGE CORRECTIONS

5.1 Adjusting a Posted Settlement

Even a disciplined settlement process encounters charges that turn out, after posting, to differ from what was recorded, whether from a retroactive rate change, a misapplied surcharge, or a missed accessorial. The instrument for handling this is the charge correction document, which posts only the differential rather than unwinding and rebuilding the whole settlement. The platform offers two such instruments, chosen by transport mode: a credit memo covers every mode except air, while air freight bookings take a charge correction advice. Each is a settlement document of a particular category fixed in FSD type configuration, and that categorization means both travel the identical route into materials management and lean on the same integration customizing that governs any settlement document.

A structured correction earns its keep by leaving evidence behind. Each credit memo yields a document, a posting, and a durable record, and that paper trail is what lets an enterprise correct at volume while keeping its financial data under control. Corrections that flow through this mechanism are auditable; adjustments that bypass it are not, and an unaudited adjustment is simply a future dispute that has not surfaced yet. The mechanism is what separates a settlement history that can be trusted from one that merely looks settled. A correction that leaves a record is control. A silent one is a liability in waiting.

6. RESULTS AND FINDINGS

6.1 A Stock-and-Flow Model of the Dispute Queue

The economics of settlement disputes become clear once the dispute queue is modeled as a stock governed by two flows. Let the backlog be a reservoir. Newly generated disputes flow in; resolved disputes flow out. The level of the reservoir rises whenever the arrival rate exceeds the clearance

rate and falls whenever clearance exceeds arrival. Nothing about a backlog is fixed; it is at every moment the running integral of the difference between these two flows.

This framing separates the two available remedies cleanly. Adding reviewers, tightening workflows, and escalating aggressively all act on the clearance flow, raising the rate at which existing disputes leave the reservoir. Correcting the upstream charge logic acts on the arrival flow, lowering the rate at which new disputes enter it. When a backlog is generated by a systemic defect, raising clearance alone is a losing race, because the defect refills the reservoir at the same time the team empties it. Lowering arrival changes the sign of the net flow, and the reservoir drains even at an unchanged clearance rate. A backlog is a balance, not a pile.

The distinction is quantitative, not merely rhetorical, and a documented enterprise deployment lets us calibrate it. At the North America operations of a large global shipping company, the settlement environment carried on the order of four thousand open disputes, a reservoir sustained not by slow clearance but by a high arrival rate that traced to a charge-calculation defect concentrated in a single family of fees. The defect raised the arrival flow continuously, which is why prior efforts aimed at clearance had failed to drain the queue.

Correcting the defect acted directly on the arrival flow, and the arrival rate of new disputes then fell by approximately nine percent each week and continued falling at that rate. A sustained proportional decline compounds, and the compounding is where the significance lies. At nine percent per week, the weekly arrival rate halves in roughly seven to eight weeks; across a single thirteen-week quarter it falls to under thirty percent of its starting value, a cumulative reduction exceeding seventy percent in the rate at which new disputes enter the reservoir, achieved without adding any clearance capacity. Once arrival dropped below clearance, the standing backlog drained as a matter of arithmetic, falling by more than ninety percent.

These results corroborate the operations-management literature on queue dynamics. The direct relationship between arrival rate, service rate, and steady-state queue length formalized in Little's Law (Little, 1961) explains why a sustained reduction in arrivals, rather than added clearance capacity, is the more efficient lever for draining a backlog, a conclusion consistent with the stock-and-flow modeling tradition in system dynamics (Sterman, 2000) and with queueing-based capacity analysis in operations management (Hopp & Spearman, 2011). Where the present findings diverge from that literature is in emphasis rather than mechanism: prior work treats clearance-side interventions as the default lever, whereas the calibrated deployment reported here shows the arrival-side correction yielding the larger and faster effect.

6.2 Quantified Outcomes, Separated by Flow

Reading the outcomes through the model rather than as a flat list clarifies which numbers are causes and which are consequences. Table 3 separates the leading indicators, the quantities that

act on the flows, from the lagging indicators, the quantities that report the resulting change in the stock, and from the financial magnitudes that give the whole picture its weight.

Table 3: Dispute Economics Separated into Flow, Stock, and Financial Magnitude

Indicator Type	Measure	Documented Value
Leading (arrival flow)	Weekly decline in new-dispute arrival rate	~9% per week, sustained
Leading (arrival flow)	Compounded decline in weekly arrivals over one quarter	>70% (to under 30% of baseline in 13 weeks)
Leading (arrival flow)	Half-life of the weekly arrival rate	~7 to 8 weeks
Leading (root cause)	Concentration of arrivals in one charge family	Carbon tax-related fees, the correction target
Lagging (stock)	Reduction in the standing dispute backlog	From ~4,000 to under 400 (>90%)
Lagging (stock)	Improvement in North America dispute timeliness	+88%
Lagging (stock)	Global carrier turnaround within target timelines	84% (up 9 percentage points)
Financial magnitude	Aggregate exposure carried by the backlog	Tens of millions of dollars
Financial magnitude	Implied order-of-magnitude exposure per disputed invoice	On the order of several thousand dollars per case

Description for the contents of the above table: two features deserve emphasis. First, the leading indicators are the ones the enterprise acted on, and the lagging indicators are the ones it was ultimately judged by; the causal arrow runs from top to bottom, from arrival flow to standing stock. Second, the financial magnitudes convert the operational story into the language that governs investment decisions. A backlog of roughly four thousand disputes carrying tens of millions in aggregate exposure implies, as an order of magnitude, several thousand dollars of exposure riding on each disputed invoice, which is why a defect that inflates the arrival flow is expensive out of all proportion to the effort required to correct it at the source.

The economics therefore point in one direction. A settlement organization can spend continuously on clearance capacity and, against a systemic defect, never catch up, because it is bailing a

reservoir that is still filling. The same organization can spend once on correcting the arrival flow and watch the reservoir drain on its own. Measured by cost of resolution per dispute eliminated, upstream correction dominates downstream processing by a wide margin, and the margin widens the longer the defect is allowed to run.

7. CONCLUSION

Settlement is the point at which a transportation management system stops moving goods and starts moving money, and this paper has argued that it should be engineered as a financial-integrity function rather than a processing queue. We have traced the freight settlement document from creation through the accrual that carries its risk into the ledger, through the verification and self-billing paths that discharge the resulting payable, to the audited corrections that adjust it. At each step the same dependency has held: the settlement can be no more accurate than the charge it inherits, because nothing in the settlement chain manufactures accuracy that the upstream configuration failed to supply.

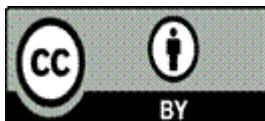
The stock-and-flow model turns that dependency into economics. A dispute backlog is the running balance between an arrival flow and a clearance flow, and a systemic charge defect is a pump on the arrival side that no amount of clearance capacity can outrun. The documented deployment quantifies the payoff of shutting off that pump: a nine percent weekly decline in arrivals, sustained, compounds past seventy percent within a quarter and drains a standing backlog by more than ninety percent, all without adding a single reviewer. The cost of correcting the source is bounded and one-time; the cost of processing around it is unbounded and recurring.

For practitioners the guidance follows directly from the arithmetic. Instrument the arrival flow, not just the backlog, because the arrival rate is the leading indicator that reveals a systemic defect while the backlog is only the lagging consequence. Concentrate remediation on the charge logic that feeds settlement, since that is where the arrival flow is set. Reserve clearance capacity for genuine one-off exceptions rather than for absorbing a defect the configuration keeps regenerating. Engineer the source, and settlement becomes what it should be: a quiet control point where correct numbers meet, agree, and are paid. Do not staff the queue. Close the valve that fills it.

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