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Improving road-side surveys for a better knowledge of road freight transport

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Abstract

This paper is focused on improving the observation and knowledge of interurban road freight transport. It investigates some directions for the improvement of a classic French road-side survey protocol, usually employed to gather origin-destination data. To do that, new questions are added to the classic roadside survey form, and the enhanced survey form is tested in the frame of two surveys. The new questions concern currently unobserved variables: the volume occupied by the freight in vehicles; the organizations (double crew, relays) set by motor carriers; the existence of specific logistic imperatives; and the breaks drivers have to take. The questions about the volume constraint and the organizations of carriers prove to be the most informative ones; as such, these two questions are two promising directions for improving French roadside surveys. The questions about specific logistic imperatives and about breaks prove less fruitful.

1 Introduction

Theoretical models, simulation models, as well as all kind of quantitative and qualitative analyses of freight transport are based on databases, which describe the activity of the freight transport system in various ways. Among these databases, one type is particularly interesting to study the activity, organization and costs of road freight transport: those obtained by roadside surveys. The objective of this paper is to present some directions for improvements of roadside surveys, in order to acquire better information on the practices and constraints of road freight carriers.

Before detailing why and how roadside surveys should be improved, let us discuss a bit the scientific importance of such efforts. In many models, and, more generally, in many representations of road freight transport, the technology of carrier is represented in a simple manner: the cost of transporting a given amount of tons on an origin-destination pair is assumed proportional to that amount, and the length of the trip, up to a per ton and per kilometer cost coefficient. While this assumption can prove sufficient in many situations, there are cases where a better understanding of the structure of road transport costs is desirable, especially when addressing such complicated questions as modal choice. However, when trying to examine in detail the structure of costs of road freight transport, a number of difficulties arises (for an indicative list of these difficulties, see e.g. [1], pp. 433–434). Some of them are briefly discussed below.

The complexity of the structure of road transport costs stems first from the network structure of the production of freight transport services. For example, on an origin-destination pair, main haul and back haul freight rates are closely related [2]; these spatial interdependencies become increasingly complex when more sophisticated network structures are considered [3].

Second, road freight transport operations take place in a logistic context, which is an issue because the microeconomic drivers of logistic decisions are yet only partially understood. In particular, the choice by shippers of shipment sizes and of transport modes is closely dependent on transport prices and particularly on the relationship between shipment size freight rates, relationship which is in reality more complicated than a simple linear relationship. Furthermore, freight rates are influenced by the choices of shipment sizes made by shippers. For a discussion of the microeconomics and econometrics of the choice of shipment size, and more generally of the introduction of logistic principles in freight transport modeling, see e.g. [4], and [5].

Third, if shipment sizes are represented, then it is necessary to account for the fact that carriers consolidate shipments in vehicles, and that this consolidation is limited by the capacity of the vehicles. This is known to be a complex problem of operation research, namely the bin-packing problem, and it has a complicated influence on the prices of freight transport [6, 7]. Besides, the capacity of vehicles is

48 an important lever of freight transport policies and, as such, has been
49 the object of econometric investigations (see e.g. [8, 9]).

50 A better understanding of the road freight transport technology
51 is thus desirable; and this encompasses not only theoretical refine-
52 ments, but also metrological and econometrical advances. This paper
53 is purported to present such metrological improvements. It is mainly
54 focused on interurban road freight transport; urban road freight trans-
55 port call for specific observation approaches [10].

56 Let us now present briefly the principles of roadside surveys, then
57 discuss to what extent they can be improved. Basically, roadside sur-
58 veys are data collection operations, where vehicles are stopped in the
59 course of their trips, and drivers asked some questions. In the case
60 of road freight transport in France, roadside surveys are mainly pur-
61 ported to build OD matrices per commodity type, transport mode
62 and conditioning. However, they may be improved in order to yield
63 useful information about other aspects of freight transport, without
64 increasing much their cost. The objective of this paper is to investi-
65 gate how this can be done, and to identify which type of information
66 can be obtained.

67 Four directions for improvements are investigated. First, we in-
68 vestigate whether the volume capacity constraint of vehicles can be
69 measured. Second, we try to obtain more details on the way road
70 carriers organize freight transport operations. Third, we assess the
71 possibility to observe the specific constraints set by shippers on carri-
72 ers, with respect to the transport operations. Finally, the places and
73 durations of the breaks drivers take are observed.

74 These four directions for improvement are comprehensively tested
75 in the frame of a specific pretest survey, which will thereafter be re-
76 ferred to as the RN10 survey, according to the geographic area where
77 this survey took place. A subset of these questions, which were iden-
78 tified to yield useful information, were tested again in the frame of
79 a confirmation survey, referred to as the A10-A20 survey.

80 The outline of this study is the following one: the classic French
81 roadside survey protocol and survey form are first presented in Section
82 2. Next, Section 3 presents the design of the pretest survey form, and
83 the results of the RN10 pretest survey. Third, the outcome of the
84 confirmation A10-A20 survey is presented in Section 4, before some
85 conclusions are discussed in Section 5. All survey forms are available
86 from the authors, or in the appendices of [4].

87 **2 The classic roadside survey protocol** 88 **for freight transport**

89 The purpose of a roadside survey is, among others, to observe the
90 origin and destination of trips made by vehicles passing through a
91 given road. They consist in stopping vehicles on that road to ask
92 them some questions. These questions typically concern the origin and

93 destination of the trip, its length, motive, the number of passengers
94 for passenger transport, and, in the case of freight transport, the type
95 and amount of commodity transported.

96 Technically, the roadside survey consists concretely in diverting
97 momentarily a number of vehicle from the road, so that interviewers
98 can administer them a survey form. The operation's presence is in-
99 dicated by traffic cones and mobile signs. The trucks are diverted by
100 policemen, who alone are authorized to operate inside the traffic (the
101 availability and willingness of the police to participate to the survey is
102 thus absolutely necessary, and sometimes not enthusiastic). They are
103 directed to an available area on the side of the road to be interviewed
104 (typically a service area for highways), after which they resume their
105 trips. There can be several interviewers, so that several drivers can
106 be interviewed simultaneously.

107 Roadside surveys are used extensively in France to gather data on
108 the origins and destinations of passengers and freight vehicle trips.
109 One of their uses is to yield information on local transport practices.
110 Another one is to be combined with traffic data to build origin desti-
111 nation matrices at the regional and national levels. They usually last
112 2 to 6 days, and 100 to 150 vehicles can be surveyed each day. Their
113 locations are usually chosen so that all the roads getting in and out
114 of a relatively big city are surveyed, which is necessary to build OD
115 matrices. Broadly speaking, the cost of roadside surveys is about 10€
116 per observation.

117 The contents of the survey form can vary, but the questions asked
118 to truck drivers are generally the following ones.

- 119 - *Number of axles.* Observed by the interviewer, the answer is
120 generally comprised between 2 and 5.
- 121 - *Type of vehicle.* Also observed by the interviewer. In case
122 of a semi-trailer, the interviewer must fill in the semi-trailer
123 type. The types distinguished are usually: container, box (rigid
124 sider), tanker (for liquid and gas), reefer (equipped with a heat-
125 ing/cooling unit), dry bulk (for dry powder materials), flatbed
126 (a load floor with removable side rails), tautliner (curtain sider),
127 other.
- 128 - *Origin of the trip.* The driver is asked his last compulsory stop,
129 whether is was to load or unload freight, or to take the vehicle.
130 Note that the two possibilities are distinguished when asking the
131 question, because the origin of the freight's trip can be different
132 from the origin of the driver's trip.
- 133 - *Destination of the trip.* The driver is asked his next compul-
134 sory stop, whether is is to load or unload freight, or to take the
135 vehicle.
- 136 - *Length of the trip.* The interviewer asks the trip length. The
137 driver's answer is sometimes approximate.
- 138 - *Empty or loaded.* The interviewer asks whether the vehicle con-
139 tains freight or not.

- 140 - *Commodity type*. In case there is freight in the vehicle, the
141 interviewer asks its nature. Note that when the semi-trailer
142 holds a container, the commodity type is generally unknown to
143 the driver. In other cases, the driver generally holds documents
144 which describe the freight, the pickup and delivery times, as well
145 as the route.
- 146 - *Freight amount*. The driver is asked how many tons of freight
147 he is carrying. This data is also available on the documents
148 accompanying the freight.
- 149 - *Hazardous materials*. Some questions can concern specifically
150 hazardous materials.

151 This list of questions may vary with the circumstances. An example of
152 a classic French roadside survey survey form is provided, translated,
153 in Appendix A.1 of [4].

154 On the whole, this list of questions reaches the objective of pro-
155 viding OD information. There is, anyway, a strong limitation. It is
156 for example sometimes impossible to follow the route of the freight,
157 if there is a transshipment on a cross-docking platform, or to another
158 transport mode, etc. The transport chain, *i.e.*, the number of op-
159 erations involved by the transport of a given shipment, cannot be
160 observed using roadside surveys. Roadside surveys do not necessar-
161 ily provide vehicle OD data either, as the drivers can change in the
162 course of a given trip. As a consequence, there is no certitude as to
163 whether OD matrices obtained using these surveys are vehicle OD or
164 freight OD data [11].

165 However, roadside surveys provide valuable data on freight flows,
166 and on the productivity of carriers. In the next section, we examine
167 how they can be improved to yield even more information.

168 **3 Design of the new survey form, and** 169 **pretest survey**

170 Truck drivers are not managers, and they are not necessarily fully
171 aware of the potentially complex processes which determine which trip
172 they have to do and when. However, they know more about freight
173 transport operations than what they are asked about in classic sur-
174 veys. In order to identify the directions in which roadside surveys can
175 be improved to yield more information about road freight transport,
176 a new survey form, addressing various topics, was tested. The results
177 are presented here.

178 This survey form is based on the classic roadside survey form.
179 General statements about the survey are first provided in Section 3.1.
180 Then, the four new topics specifically addressed by the survey form:
181 freight volume, transport organisation, specific schedule imperatives,
182 location and duration of breaks, are presented respectively in Sections
183 3.2 to 3.5. The survey form itself is provided in Appendix A.2 of [4].

3.1 The RN10 survey

The survey took place between the 4th december and the 12th december 2007 at 50 kms of Bordeaux, France, on the RN10 main road, which is part of one of the main routes between Bordeaux and Paris. Both traffic directions were surveyed. Due to the unavailability of police force, the roadside protocol presented in the previous section could not be applied rigorously. As a consequence, the drivers were interviewed on a nearby service area, during their breaks. For this reason, there may be a series of bias in the results presented below. 693 truck drivers were interviewed, 686 of these interviews yielded workable data.

Before getting into the detailed description of the original questions, the sample is briefly described. Some general remarks on interurban freight transport by road are made. 89.8% of the vehicles in the sample have 5 axles. The survey is located on a main road between two big cities, and on a major route of international freight traffic, notably between France and the Iberian peninsula, so that large vehicles, adapted to interurban transport, are expected to prevail. For the same reason, the nationalities of the vehicles is not surprising: 45.5% of the vehicles are French, 24.6% Spanish and 20.4% Portuguese. With respect to their origins and destinations, 42% of the trips are national, 58% international. 56.9% of the international trips are transit trips.

The vehicle types depend strongly on the number of axles. The trucks with 2 axles are mainly reefers or tautliners, the 3 and 4 axles are mainly flatbeds or dry bulk. About a half of the 5 axle vehicles are tautliners. The other types are by and large equally distributed, except for the containers, which are rare. Tautliner vehicles can be considered as general purpose vehicles, while the other vehicles are used for commodities with specific constraints (handling, temperature, safety, etc.). The use of specific equipments in road freight transport is thus significant. The distribution of vehicle types is relatively similar in both directions.

The commodity type is encoded along the French commodity type nomenclature called NST (*Nomenclature Statistique Transport*, Transport Statistics Nomenclature). The commodity type is observed for 86% of the loaded vehicles. Interestingly enough, while commodity flows appear to be symmetric when commodity types are examined at the least detailed level (10 categories in the NST), this symmetry is broken when considering commodity types at the most detailed level (176 categories in the NST).

10.8% of the vehicles interviewed were running empty. However, this percentage depends strongly on the type of vehicle. Some transport techniques, such as tautliners, are quite versatile, and present low empty running factors, below 10%. More specialised trailers, such as tankers and dry bulks, show much higher empty running factors, more than 20%. This can be explained by the higher difficulty to find backhaul freight for a specialised vehicle type, compared to a versatile

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one.

The average trip length is 1176 km, its median 1103 km and its standard deviation 864 km. It varies a lot with the commodity type, number of axles, and vehicle type. The average trip length by commodity type ranges from 406 km for the vehicles carrying building materials to 1480 km for the vehicles carrying manufactured goods. Similarly, dry bulk vehicles cover on average 310 km, against 1550 km for reefers.

It would be possible to proceed to a myriad of analyses of this kind. However, this is not the objective of this work, so this won't be done here. The points specifically addressed by the novel survey form will now be examined. To ensure a minimal homogeneity of the transport operations analysed, the following discussion is limited to the 5 axle vehicles, which represent about 90% of the sample.

3.2 The volume constraint

The weight capacity is a major technological constraint of freight transport. The ability of carriers to fill their vehicles up to their capacity is a critical driver of their productivity. It can be measured by the loading factor, the ratio of the weight of freight carried to the vehicle capacity. This ratio is used in almost all spatialised models to convert commodity flows into vehicle flows, which constitute road traffic (for example, the loading factor has been chosen as one of the key factors of freight transport demand in the REDEFINE European project [12]).

Freight weight can be measured accurately by roadside surveys, because it is indicated on documents drivers have at their disposal. Vehicle capacity is also indicated. Therefore, the average loading factor is easily computed; the influence of the weight constraint on the organization and costs of carriers can be assessed correctly. However, another constraint limits the productivity of carriers: that of the volume constraint. Contrarily to the loading factor, this constraint is usually disregarded in transport statistics. The influence of this constraint on road freight transport costs is thus not well known.

The difficulty with measuring the volume constraint is that freight volume is usually not available. Therefore, this question is absent from the classic roadside survey form. However, even if the drivers are not able to tell the exact volume of their freight in m^3 , they are approximately aware of the place the freight takes in their vehicle, and can tell if the vehicle is, say, half empty, or two thirds full. A specific question is thus asked to drivers in the new survey form: if the vehicle is not empty, the interviewer asks the driver if a quarter, a half, three quarters or the totality of the vehicle's volume is used. It appears that, in most cases, drivers understand the question correctly, and are able to answer it.

The question is now to know if the volume and the weight constraint do play the same role. If yes, then asking the two questions is

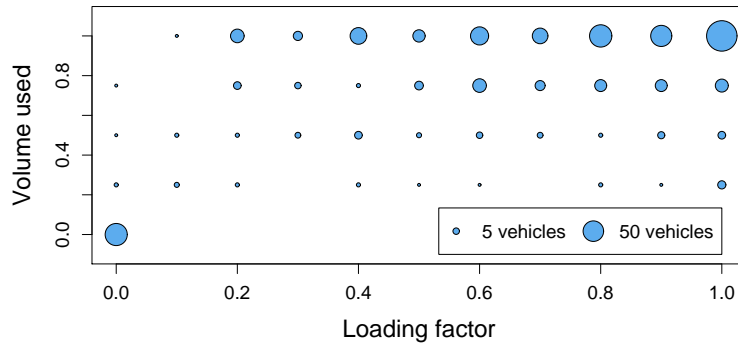
Table 1: Weight and volume constraints, RN10 survey

		Full volume	
		No	Yes
Full weight	No	23.2%	42.0%
	Yes	8.6%	26.1%

278 not really instructive. If not, then it is important to obtain informa-
 279 tions on both dimensions. From the examination of these two vari-
 280 ables (Table 1), the two constraints do appear to play the same role;
 281 furthermore, it seems that the volume constraint is often more binding
 282 than the weight constraint. In particular, increasing the weight limit
 283 while leaving the volume limit unchanged would only impact 8.6% of
 284 the vehicles in the sample, against 42.0% for a change in the volume
 285 limit with a constant weight limit.

286 The relationship between weight and volume is detailed by Figure
 287 1. This, combined to the correlation between the freight weight and
 288 the weight volume for loaded vehicles, which is only 0.16, implies that
 289 weight alone is not a complete measure of the productivity of road
 freight transport.

Figure 1: Loading factor and volume used, RN10 survey



290 While the figures given in this section should be considered with
 291 care, due to the possible bias resulting from the survey protocol, the
 292 feasibility of measuring approximately the volume used in the vehicles
 293 is clear. Such data can be a useful basis for TS & W (Truck Size and
 294 Weight) studies, in which one difficulty is to evaluate the elasticities of
 295 road freight transport demand with respect to weight limit and vehicle
 296 dimensions. They also explain why increasing the useful volume while
 297 keeping the outer dimensions unchanged is as much a major axis of
 298 innovation of the trucking industry as reducing the curb weight of
 299 vehicles.
 300

3.3 Transport organisation

From a microeconomic perspective, road freight transport is not considered to be a complicated technology. Consider the two inputs that are vehicles and drivers, they are generally assumed to be perfect complements: they must be used in fixed proportions to produce a given amount of transport, measured in vkm. The cost function of road freight transport is thus proportional to the vkm output, and road freight transport's speed is fully determined by the vehicle limit speed and the breaks drivers must take. The complementarity of drivers and vehicles is confirmed econometrically. For example, [13] found by fitting a CES production function which takes the number of vehicles and drivers as its arguments, that the elasticity of substitution between these two factors is 0.2, which is low.

However, motor carriers can, in some cases, organise themselves so as to decrease the travel time on a given origin destination pair. If two drivers are present in a vehicle (double crew), one of them can drive while the other one sleeps, so that the truck does not have to stop due to the regulatory breaks. A more complex organisation, in relay, is also possible: the idea is to organise the trips of several drivers and vehicles so that each vehicle is always driven and each driver drives the time he is supposed to drive. The characteristic of an organisation in relay is that the driver and the freight do not have the same origins and destinations. In both cases, the vehicle is always running, so that its average speed is increased. For long distances, the carrier is thus able to reduce the travel time, provided the shipper agrees to pay the extra cost.

Roadside surveys can measure these practices. This is done with the survey form presented here. The interviewer asks "How many drivers are there on board?", and "Are you doing the same trip as the freight?", as well as, if it is a relay, the origin, destination, and length, of the part of the trip done by the current driver (questions Q11 to Q15).

Except for two cases, all the double crews and relays are observed for 5 axle vehicles. Their frequencies are given in Table 2, as well as the corresponding average distances and speeds. These frequencies are low: it seems double crew and relay organisations are a minority. However, they should be taken with extreme care. Indeed, the objective of relay and double crew organisation is to avoid breaks, so that the pretest survey, which was made on a rest area, most probably underestimates them. The average trip length and speed corresponding to each organisation are also indicated in Table 2. The double crew and relay organisation, which are more expensive than the simple crew organisation, also allow for a higher speed. They are used on longer trips. From an economic standpoint, double crew and relay are expected to be used on long distances and for high value of time or high depreciation cost goods, such as agricultural products and foodstuff. This seems to be confirmed by the comparison (not detailed here) of commodity types with transport organisations.

Table 2: Organisation of transport operations, RN10 survey

Organisation	Freq.	Dist. (km)	Speed (km/h)
Simple crew	93.1%	1182	33.9
Double crew	5.4%	2143	40.6
Relay	1.5%	1606	50.8

All these statements require confirmation from in-depth economic analyses and more numerous data. However, the capacity of roadside surveys to yield detailed information on which such studies could be based is demonstrated.

3.4 Logistic imperatives

The increasing role of logistic imperatives imposed by shippers to carriers in the recent evolution of freight transport markets has been much discussed. The notion of logistic imperative is however not precisely defined, and seems to consist of several aspects. One may quote, among others, the greater importance of the preferences of customers in the logistic organizations of the shippers, the closer integration of logistic decisions and production or marketing decisions, or the rationalization of logistic and transport operations.

A first approach of the latter point has been attempted with the present survey form. Indeed, the interviewers asked the drivers both their expected arrival times, and imperative arrival times, making a clear distinction between these two (questions Q18 and Q19 of the survey form). The existence of a specific logistic constraint, distinct from a classical expected arrival time, is thus investigated.

The answers are quite instructive, but not fully as expected. Indeed, for the 5 axle vehicles, most drivers (77.0%) answered they had no imperative arrival time. 6.9% answered they had an imperative arrival time, which was in fact their expected arrival time. By the way, the question was ill received by many drivers, who considered it questioned their autonomy. It seems that in the end, the notion of imperative arrival time is mainly a matter of perception of drivers. Eventually, 16.2% drivers announced an imperative arrival time clearly distinct from the expected arrival time. For these drivers, the margin between the expected and imperative arrival time increases with the trip's length.

On the whole, the existence and definition of logistic imperatives for motor carriers is not really striking. The large amount of drivers for whom there is no imperative, or no clear distinction between the expected arrival time and the imperative arrival time, can be interpreted as the result of a correct reliability of road freight transport. Motor carriers commonly give drivers a margin just large enough for the delivery to be done on time in case of an unexpected delay, thus ensuring the delivery time reliability. However, maybe roadside sur-

387veys can prove useful observing trends with respect to imperative
388arrival times.

389 **3.5 Location and duration of breaks**

390For drivers to keep watchful and drive safely, breaks are enforced by
391regulation. This regulation describes precisely when the breaks have
392to be taken, and how long they have to last. Subsequently, drivers
393have little choice but to respect closely this regulation.

394Two important issues of transport policy, at least, are closely re-
395lated to the regulation of breaks. One of them is the effective speed
396of road freight transport, and its productivity. Besides, as already
397discussed in Section 3.3: motor carriers can introduce specific organi-
398zations to increase the effective speed of trucks while respecting the
399regulation.

400Another one is the congestion of service areas on highways and
401major roads. Breaks being compulsory, the drivers who don't find
402room on a service area will park somewhere else, which entails road
403safety issues as well as increased robbery risks. Drivers can also re-
404consider their route choice, due to these issues. As such, it is both
405an important question for infrastructure operators and from a road
406infrastructure planning perspective.

407The usefulness of roadside surveys in investigating these effects has
408been tested with the present survey form, where drivers are asked the
409number of breaks they have taken since their departure, the location
410and duration of their longest break, and its motive (questions Q20
411to Q23). Unfortunately, their answers yield little useful information,
412which will subsequently not be presented here. Indeed, apart from
413choosing the place where they can park, the drivers have little initia-
414tive on their breaks. The data only illustrates the rules they follow. A
415geographical approach, where the route and parking choices of drivers
416would be analyzed together with the occupancy of rest areas. This is
417not possible using roadside surveys alone.

418 **4 Final survey form, and confirmation** 419**survey**

420The survey form tested in the frame of the RN10 survey yields much
421more information about freight transport than the classic survey form.
422However, the RN10 survey disregarded some constraints that usual
423classic roadside must respect. In particular, the survey form used in
424the RN10 survey is much too long to be used as is in regular roadside
425surveys. It is thus necessary to reduce this survey form. According
426to the previous section, the most useful results concern the volume
427constraint and the organisation of carriers. These questions are thus
428kept and applied in the frame of a new roadside survey, with the
429objective to confirm their interest and to obtain unbiased results.

Table 3: Weight and volume constraints, A10-A20 survey

	Full volume		
		No	Yes
Full weight	No	28.0%	34.4%
	Yes	11.8%	25.7%

Table 4: Organisation of transport operations, A10-A20 survey

Organisation	Freq.	Dist. (km)
Simple crew	92.7%	572
Double crew	1.9%	829
Relay	5.3%	735

This survey took place between May the 14th and May the 20th 2008, on a number of roads between the cities of Limoges and Poitiers, in France, including the A20 highway passing near Limoges and oriented North-South, and the parallel A10 highway, located between 100km and 200km to the West. The survey form that was applied consisted of the classic roadside survey form, as presented in Section 2, plus the following questions:

- How much of the vehicle's volume is used?
- How many drivers are there on board?
- Is the driver making the same trip as the freight?

The sample obtained by this survey consists of 630 vehicles. 75% of them are 5 axle vehicles, the average trip length is 514km, and 21.9% vehicles are running empty. This sample is thus not directly comparable to the previous one: the survey has obviously targeted a much more local and diffuse freight transport.

Despite these dissimilarities, the respective roles of the weight and volume constraint seem to be relatively stable. The figures of Table 3, which correspond to the 5 axle loaded vehicles, are by and large consistent with those of Table 1. However, it seems the weight constraint is a bit more important in this survey than in the RN10 survey. However, the quality of data is limited: the volume is only an estimation of the driver, not an accurate measure of the actual volume of the freight.

Similarly, double crew and relay organizations are identified. The results are given in Table 4. We find again that double crew and relays are relatively rare, and that the average distance is greater with double crew or relay organizations. However, the ranks are inversed: double crews are much less frequent in this sample than in the RN10 sample; this can be both due to the distinct survey protocol, and to the fact that the traffics differ in nature.

460 On the whole, the A10-A20 survey confirms the potential of the
461 new survey form. To a marginal cost, roadside survey forms can
462 be enhanced to yield useful information on interurban road freight
463 transport.

464 5 Conclusion

465 The classic French roadside survey form is generally used to obtain
466 origin destination data. In the case of freight transport, vehicles are
467 diverted from the traffic, and their drivers are asked their trip's ori-
468 gin, destination, length, the nature and amount of the commodities
469 they carry. Although truck drivers are not motor carrier managers,
470 a possibility remains that the classic roadside survey form does not
471 make the most of what they know. The objective of this paper is to
472 investigate this possibility.

473 In order to determine how roadside surveys can be enhanced, an
474 original, comprehensive survey form has been developed and tested.
475 Apart from the classic questions, four additional subjects are ad-
476 dressed by this survey form: the freight volume, the transport orga-
477 nization, the presence of specific logistic imperatives, and the breaks.
478 The conclusions derived from this pretest survey have been confirmed
479 by another survey, using a reduced survey form.

480 Generally, drivers can tell precisely how many tons of freight they
481 carry, because they bear documents on which this information is writ-
482 ten. This is not the case for the freight's volume. However, they are
483 able to tell approximately how much of their vehicle's volume is occu-
484 pied by the freight they carry. The role of the volume constraint can
485 thus be measured, although imperfectly: it even seems to be at least
486 as important in determining road freight transport's productivity as
487 the weight constraint.

488 If some aspects of road freight transport operation are complex,
489 the ratio of one driver per vehicle is generally assumed fixed and
490 universally valid. In fact, carriers sometime use other organizations,
491 such as double crews or relays. Roadside surveys can yield useful data
492 on these practices, on which studies could be based to investigate when
493 and why such organizations are chosen by motor carriers.

494 Investigating logistic imperatives is more complicated. Drivers
495 have been asked whether they have an imperative arrival time distinct
496 from the expected arrival time. Most answered that they had no
497 imperative, a fraction answered that their expected arrival time was
498 imperative, and about a sixth had both an expected and an imperative
499 arrival time. However, it has been difficult to discern any relation
500 between this answer and the other variables of the model.

501 Similarly, drivers have been asked a series of questions about their
502 breaks. Although the choice of the place the drivers park for their
503 breaks, and the related problems of safety, theft, and service area
504 congestion are important, the answers of the drivers mainly reflect
505 the regulation in force. It seems roadside surveys can provide little

506 information on this question, if they are not combined with other in-
507 formation sources, such as, for example, service area occupancy levels.

508 Finally, it should be noted that the surveys presented in this paper
509 have a major shortcoming. Indeed, the distinction has not been made
510 between public and private carriers. It is certainly possible to ask
511 drivers this question, and highly relevant, insofar as public and pri-
512 vate road freight transport are clearly distinct sectors or road freight
513 transport. This is a recommended extension to this work.

514 As explained before, the objective of this paper was not to proceed
515 to econometric analyses, but to investigate the possibility to enhance
516 roadside surveys, so that they provide useful additional information
517 on freight transport. This possibility appears to be significant. Road-
518 side surveys prove efficient in measuring the role of the volume con-
519 straint, even if the approach is approximate, and this role appears
520 to be quite important. They also prove efficient in observing specific
521 road freight transport organizations, such as double crews and re-
522 lays, two questions on which depends closely the productivity of road
523 freight transport. If these questions were asked systematically, given
524 the number of roadside surveys done in France each year, abundant
525 data would be quickly available to analyze these questions in more
526 depth, to a small extra cost.

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