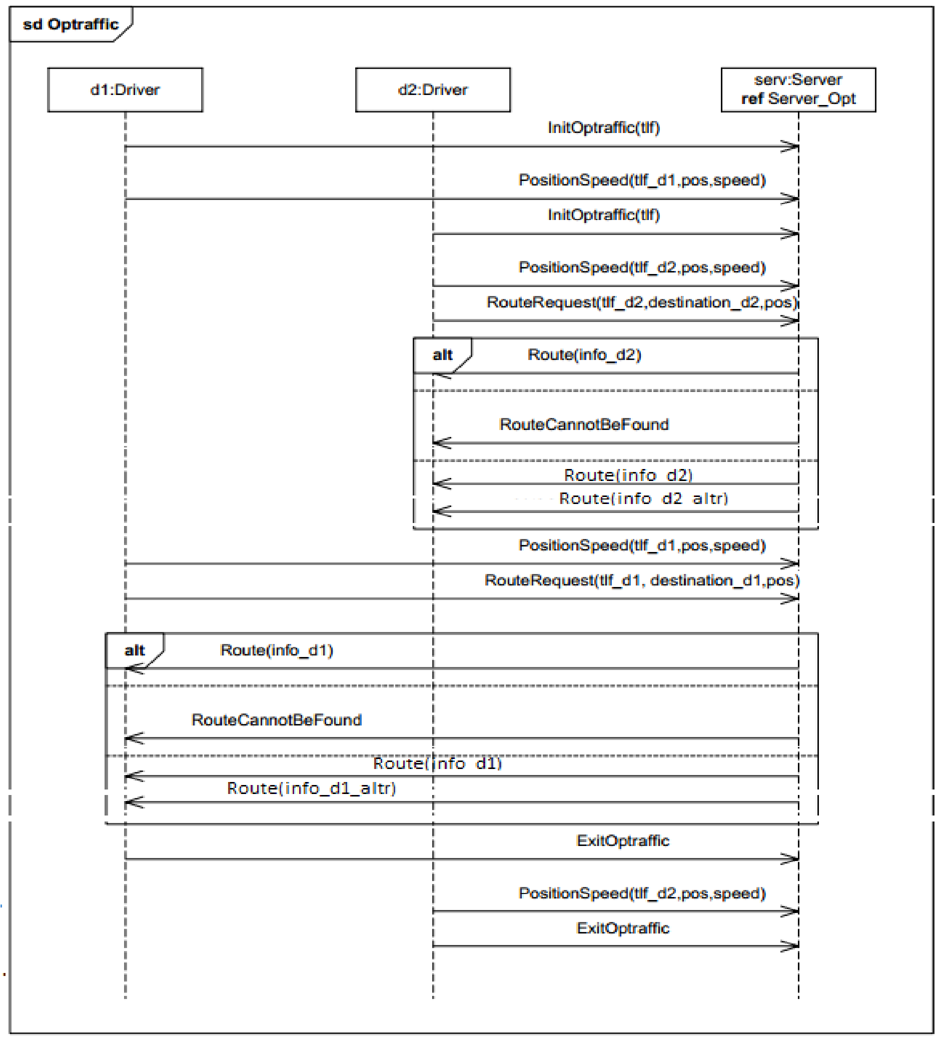
2a) There are two positive traces in each of the alt-constructions. For example:

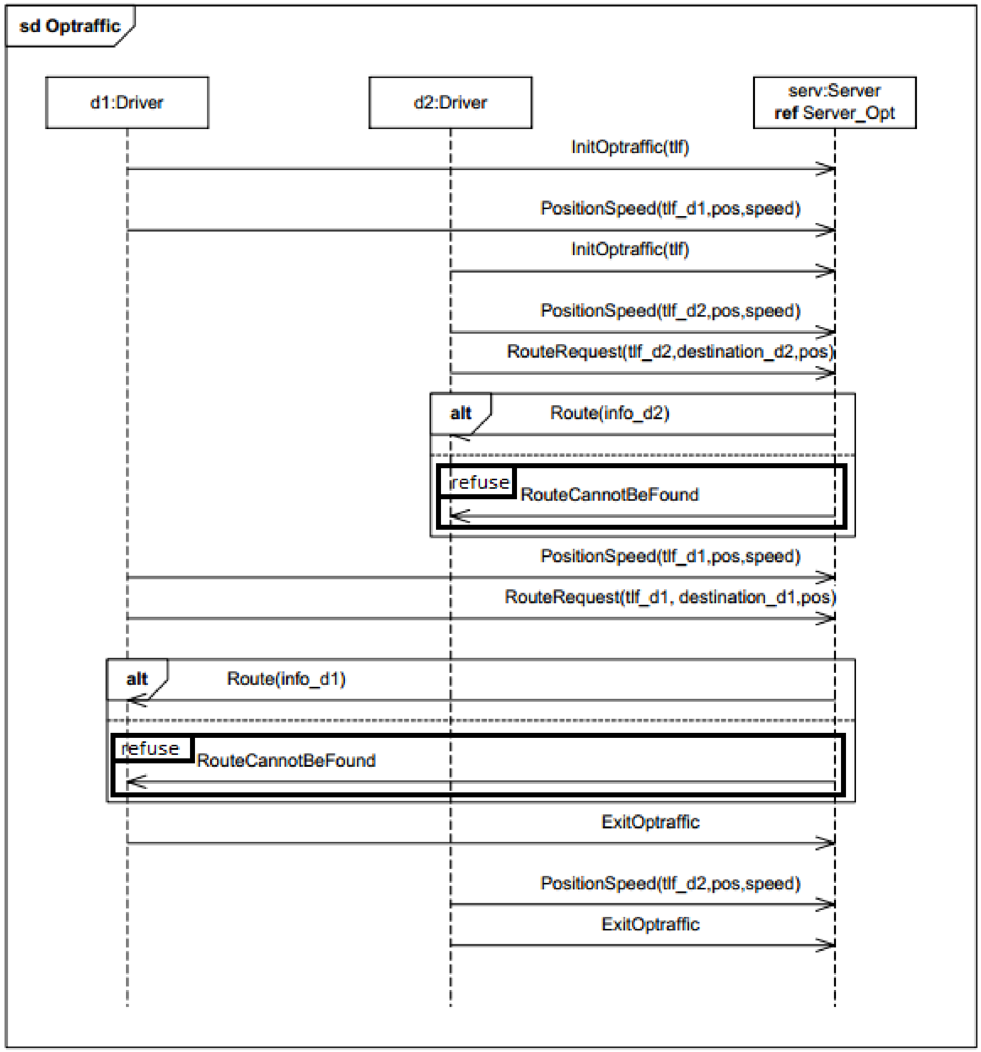
the 1st alt) <... !Route(inf_d2), ?Route(inf_d2)...>, <... !RouteCannotBeFound, ?RouteCannotBeFound... >
the 2nd alt) <... !Route(inf_d2), ?Route(inf_d1)...>, <... !RouteCannotBeFound, ?RouteCannotBeFound... >

2b) There aren't any negative traces, we do not have refuse, veto, assert or guards.

2c) Supplementing is a moving of inconclusive traces to a positive or negative set, thus we can add a new possibility to return together with a default route an alternative one:



2d) Narrowing is a moving of positive traces to a negative set.



2e) There is only one interaction obligation, since the sequence diagram does not have any xalt combined fragments.
$[[d1 \text{ alt } d2]] \stackrel{\text{def}}{=} \{o1 \uplus o2 \mid o1 \in [[d1]] \wedge o2 \in [[d2]]\}$
$(p1,n1) \uplus (p2, n2) \stackrel{\text{def}}{=} (p1 \cup p2, n1 \cup n2)$

2f) There are 4 interaction obligations, 2 interaction obligations are added by the first alt combined fragment, another 2 are added by the second combined fragments.
$[[d1 \text{xalt } d2]] \stackrel{\text{def}}{=} [[d1]] \cup [[d2]]$

2g) No. It is not a general refinement. Let us consider Optraffic3 = {o1, o2, o3, o4}, where o1=(p1,n1), o2=(p2,n2), o3=(p3,n3) o4=(p4,n4), and Optraffic = {o5}, where o5={(p1 ∪ p2 ∪ p3 ∪ p4), (n1 ∪ n2 ∪ n3 ∪ n4)}. If we take o1 and o5 than o1 is not a refinement of o5 since p2, p3, p4 and n2, n3, n4 of o5 become inconclusive in o1. The same procedure can be applied to o2, o3, o4. Thus neither of o1 nor o2 nor o3 nor o4 is refinement of o5.

2f) Yes. It is a general refinement. Strictly speaking it is a limited refinement which a subset of a general refinement. Let us consider from the previous exercise the definition of Optraffic3. By applying an assert operator all inconclusive traces become negative, all positive traces remain positive, meaning that n1 of o1 contains all traces, which were inconclusive in o1 of Optraffic3 etc. Thus o1 is a combination of narrowing and supplementing of o5, i.e. p2, p3, p4 of o5 is a subset of n1 of o1 (narrowing), while n2, n3, n4 of o5 are in n1 of o1 and all inconclusive traces are found in n1 of o1 (supplementing) etc. Thus each interaction obligation (o1, o2, o3, o4) of Optraffic4 is refinement of o5 in Optraffic.