



valtech.

TRO Data Model Alpha Report

February 2022



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Executive Summary & High-level Recommendations

Executive Summary & High-Level Recommendations

Key Achievements in Alpha:

- The project met the GDS Peer Review standards, with some minor recommendations
- DfT ACB approved technical architecture, after 5 options were presented
- There has been strong stakeholder support for, and interest in, digitalisation (over 400 attendees at the TDI webinar; 100 respondents from 80 HAs to our user needs survey)
- Wide data model input and support from potential users
- Strong cost benefit case for cashable savings to Highway Authorities (HAs) and the wider industry
- Key areas to explore in the Beta phase identified

Executive Summary & High-Level Recommendations (cont.)

This project has shown that there is an appetite for, and significant benefits from, adopting a digital TRO model and its associated policy changes; to enable improvement to current highways authorities (HAs) & utility traffic operations and enable the move to facilitate the "*Future of Mobility*" strategy. This is shared across highway authorities, utilities, data aggregators and service providers currently constrained by the lack of a common standard and associated high-quality, single-source of road closure and restriction information.

To achieve this outcome, the Valtech team recommend the following five high-level actions:

- 1. Mandate use of the common data model, with mandated data and making available all TRO data to a central data store architecture defined by this project.** This would include: having one single standard digital model (DM) that HAs are mandated to use for publication and distribution; defining the quality and reporting stages of a TRO. **This would enable a trusted, consistent, single-source of all TROs**
- 2. Issue a clear statement of DfT's short and long term plans/strategy/approach to supporting HAs to digitalise their TROs.** This would include: showing this national initiative should not stop HAs changing to digital TROs - their investment will not be wasted; clarify current rules; provide early sight of the data model; provide a clear statement on dealing with backlogs of TROs; publish DfT's intentions, to be clear to the market and reduce uncertainty. **Stakeholders would then have confidence to invest now in digitalising TROs and services**

Executive Summary & High-Level Recommendations (cont.)

3. Support stakeholders in understanding and changing a common data model. This will include: validate the DM against further real world TROs; research scope for links between Digital TROs (D-TROs) & Street Manager permits; DfT supporting data quality and service adoption via training and guidance by developing a D-TRO community. Hence all HAs start to adopt current best practice right away and a level playing field created, especially for those reluctant to change
4. **DfT to drive data quality.** This would include: the DM data fields will encourage discrete lists or parameterised templates, with less free text; research, define and mandate better temporal and geographic accuracy; publish location data as coordinates that are agnostic to map type. **As an outcome, data quality can improve outcomes for today's services, emerging connected services and future automated vehicles**
5. Use a Beta project phase to drive delivery of the D-TRO solution and to prove the value to stakeholders (see 'Recommendations for Beta' section). **This means that wider stakeholder confidence should emerge, and current inertia be overcome by building trust**



Project Background

Project Background

- What problem are we trying to solve?
 - Why is the work being done? (DfT's *"Future of Mobility; Urban Strategy as part of the Future of Mobility Grand Challenge"*)
 - What are TROs?
 - The path to where we are now:
 - TRO Discovery, including initial Data Model
 - DM Validation Alpha
 - Policy Alpha
 - Alpha GDS Peer Review outcome
 - Problem to be solved
 - Who are the users and what do they need to do?
- Alpha Project timelines



What Problem Are We Trying To Solve?

Why is the work being done?

- The work is aligned to the DfT's "*Future of Mobility; Urban Strategy as part of the Future of Mobility Grand Challenge*". The Strategy prioritises providing a regulatory framework that evolves with transport technology and advocates data sharing to improve operation of the transport system
- Traffic Regulation Orders (TROs) are made under the Road Traffic Regulation Act (RTA) 1984 and set and enforce rules for the use of a road (speed limits, loading and unloading restrictions, parking bays and restrictions)
- The legal procedures for making TROs are paper based, process heavy, costly and TRO data provision is inconsistent and non-standardised
- TRO digitalisation would support new services, digital mapping, and the digital infrastructure for connected and automated vehicles

What Problem Are We Trying To Solve? (cont.)

What are TROs?

- Traffic Regulation Orders (TROs) are used by local councils and Highways England (HAs) to temporarily or permanently stop up a road, highway or pavement, to all or particular types of traffic and also for parking and other restrictions. A TRO might be used for a speed limit, a road closure for roadworks, a street party, to protect residents from 'rat-running' or from heavy vehicles.
- The Orders are the legally binding basis for parking, speed limits and road closures and so used for making penalties and fines. While this data can be captured by vehicle-based cameras, this relies on accurate yellow lines, signs and parking information plates being in place to actually survey. These are notoriously inaccurate/ incomplete.
- Permanent Orders can be used to avoid danger to persons or other traffic using the road, prevent damage to the road or to a building, facilitate passage of any class of traffic (including pedestrians) and prevent unsuitable vehicles. They can also preserve the character of the road where it is suitable on horseback or on foot, improve the amenities of the area through which the road runs; or preserve or improve local air quality.
- They are marked by signs but these do not always tie up with the TRO (e.g. missing signs). They are also being used to define for example new cycle lanes in the COVID crisis.

What Problem Are We Trying To Solve? (cont.)

What are TROs? (cont.)

- Temporary Orders (TROs) are used to close a road because works are proposed on or near it (like roadworks or tree felling) because of danger, or for litter clearing. Temporary orders have a maximum 18 months' duration but many are much shorter, e.g. for an event on a particular day.

Why are they important?

- TROs are the legal basis for road closures and regulations. So, they could give prior warning of road closures of all types, to give a legally binding view of regulations like speed limits and parking restrictions (and costs). For parking, they also show where a user can park as well as not.
- Hence, they are of potential value for navigation and other connected services, e.g. databases of speeds (e.g. to support Intelligent Speed Adaptation potentially deployed in 2022 across Europe) and for connected parking.

What is the current status?

- While some authorities have digital or map base copies of TROs that can be exported, the vast majority are on paper. There is also no single point to access TRO data across several hundred authorities.
- Hence this project is exploring a digital way of exporting TROs to data users, to add richness to the data to make them more useful and to potentially provide a single place to access them from.

What Problem Are We Trying To Solve? (cont.)

The path to where we are now:

- 2018 – North Highland report in local authority transport data, which recommended data projects which encourage and foster better local authority transport services, including streamlining and digitising Traffic Regulation Orders
- Dec 2018 – 6-month TRO Discovery by led by British Parking Association in conjunction with Ordnance Survey & GeoPlace, to examine user needs and issues with the TRO framework
- Aug 2019 – TRO Policy Alpha, by PA Consulting, to identify improvements to the legislative process
- Oct 2020 – TRO Data Model Validation report, by independent industry experts, to validate the draft TRO Data Model, based upon the Discovery findings
- Oct 2020 to Jan 2021 – 3-month TRO Data Model Alpha, by Valtech, with DfT

What Problem Are We Trying To Solve? (cont.)

Problem to be solved:

- Local authorities should be able to publish standardised and open TRO data for anyone to access, use and share
- The DfT has procured the draft TRO-DM (UML format) to provide consistent and data in a digital format. A further technical solution is required – developing a TRO data publication/distribution system which is flexible, open and usable and built on this model
- This system will be determined by iterative design and testing, looking at options (supported by cost benefit analysis/market testing), and prototyping
- The TRO-DM scope needs to be reviewed to consider sharing data at earlier TRO process stages, data licensing and the relationship with international data development



Alpha Project Timelines

- August 2020 – Valtech awarded contract
- September 2020 – Pre-inception workshop
- October 2020 – Project kick-off
- January 2021 – Final report issued & Alpha concludes



Solution Design

Solution Design

As stated above “A further technical solution is required – developing a TRO data publication/distribution system which is flexible, open and usable and built on the (earlier draft) model.”. To drive this forward, within the scope of this Alpha project, it is expected to deliver appropriate artifacts in support of the following:

- A Service Design
- A Data Model
- An Architecture Service Design

User Research has also been undertaken to understand user needs and to feed into the artifacts above:

- Users
- Current understanding of user needs
- Research methods and participants

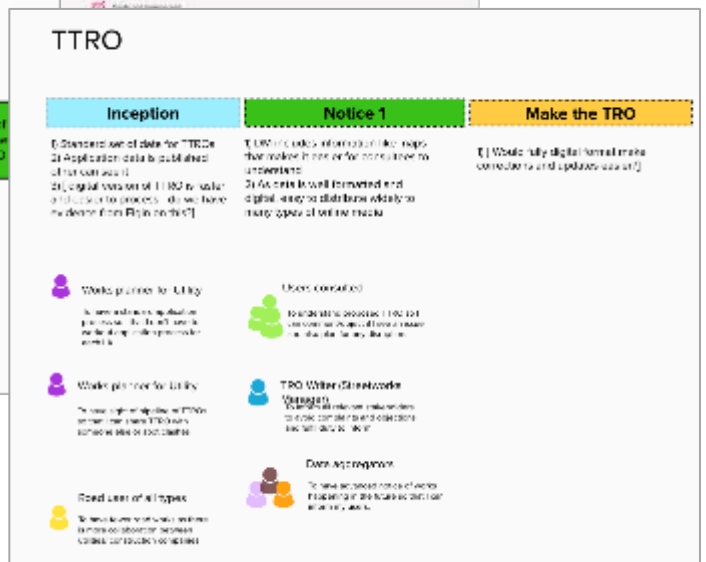
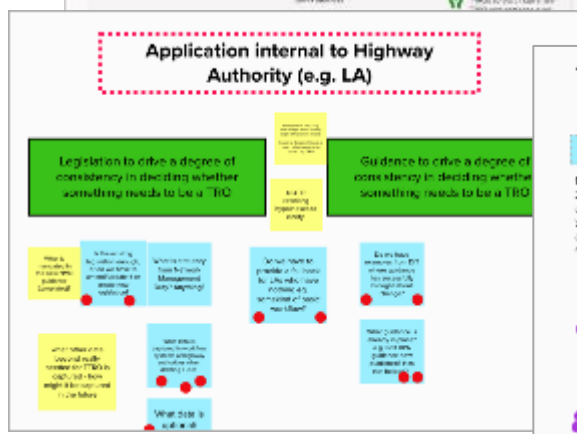
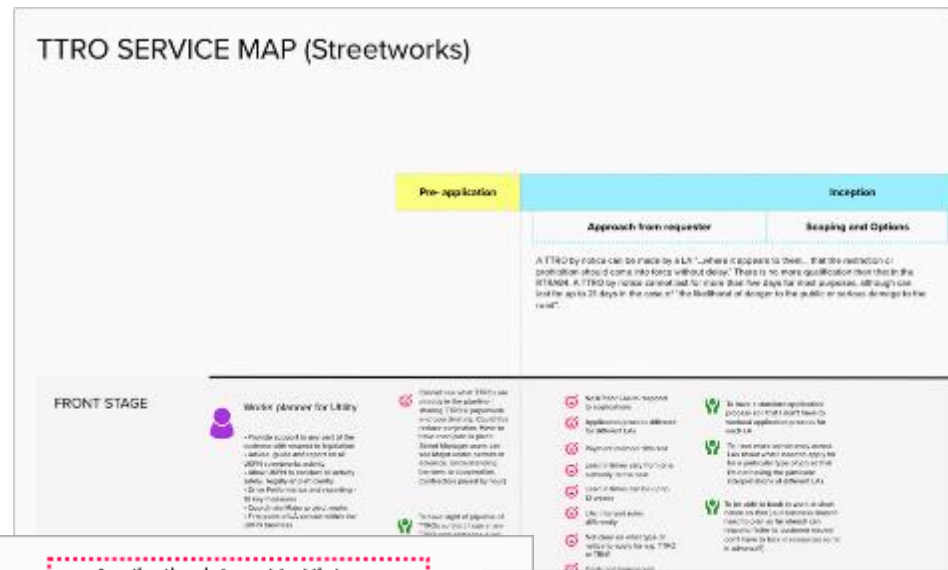


User Research

User Research

Approach:

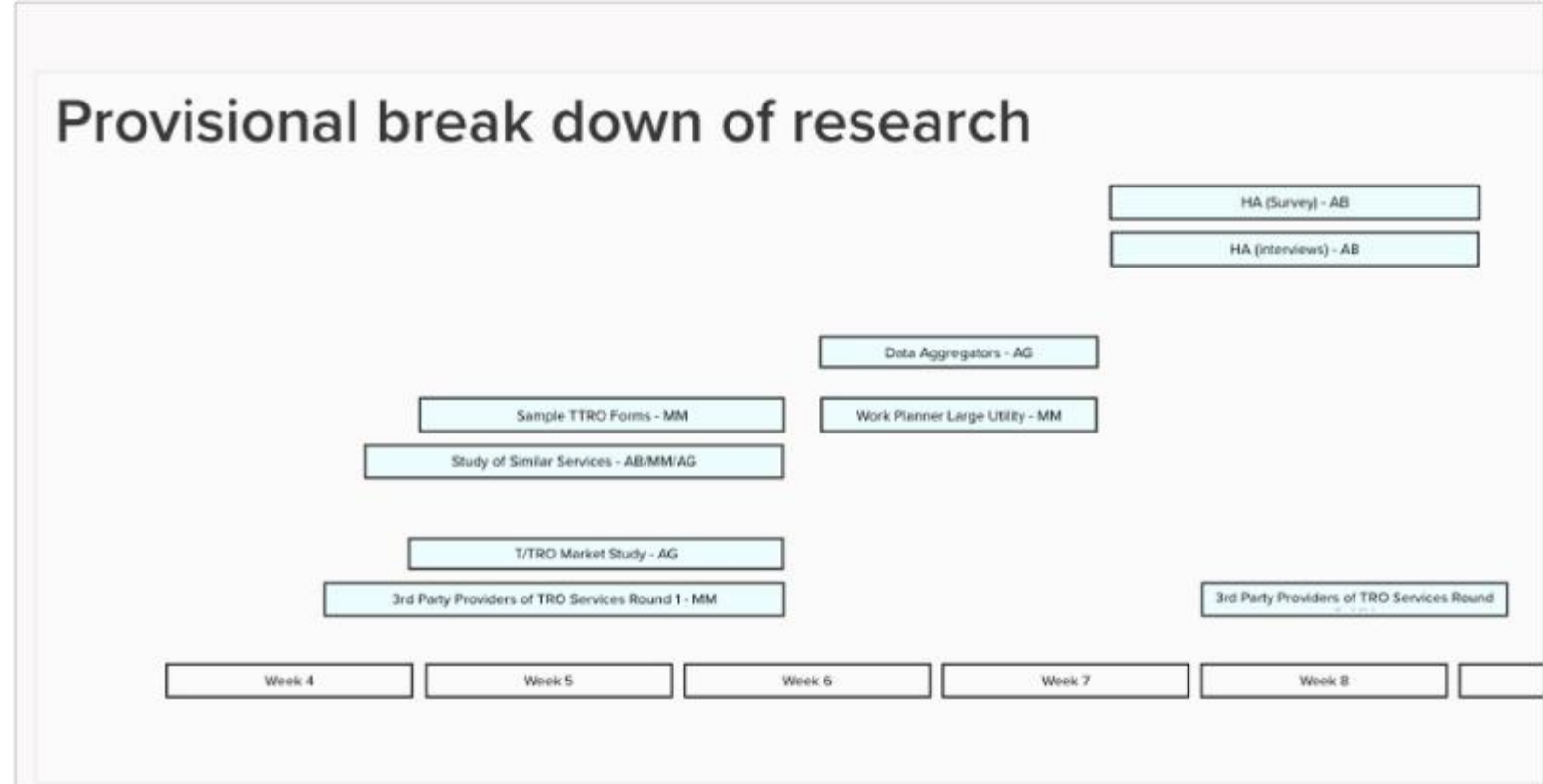
- Reviewed research from Discovery and Policy Alpha and summarised in context of Data Model Alpha
- Defined hypotheses, declared assumptions and identified risky assumptions about users
- We did *not* attempt to speak with all possible stakeholders. That would not have been possible within a single Alpha. Instead, we focused on our riskiest assumptions.



User Research

User groups we spoke with:

- 3rd Party Providers of TRO Services
 - 4 x interviews (two rounds)
- Market of Potential Providers of TRO services
 - 5 x interviews
 - Desk research
- Data Aggregators
 - 10 x interviews (multiple rounds)
- Utilities
 - 5 x interviews
- Highway Authorities
 - 14 x interviews
 - Online survey (responses from 80 HAs)
- Study of Similar Services
 - 3 x interviews



User Research

Findings, needs and recommendations:

The user groups we spoke with were diverse and had their own particular interests and needs.

A detailed summary of finding, needs and recommendations can be found in the Appendices.

However, there were some common themes that cut across these groups and have informed our recommendations.

A common data model is welcome

HAs are not wedded to their individual models and believe a uniform data model is viable and that DfT should lead on its development

TRO service providers want a common data model to reduce customisation for individual HAs

Utility businesses are very keen to see common data requirements for order applications which will dramatically simplify their work.

Everyone is closely watching DfT and waiting to see its next move. While they wait, they delay investment.

Data quality will need to improve

Data aggregators were clear that TRO data quality must improve if the benefits of digital TROs are to be fully realised. They need a orders that are easy to access, of high temporal and geographic accuracy and comprehensive.

These quality demands will require change from order applicants, highway authorities and providers of TRO software services.

Help will be needed interpreting the common data model

Highway authorities will need help to understand what they need to change. They want to know what is the minimum standard, what providers are approved, what they should do about their backlog, who are model HAs etc.

Providers of TRO software services (existing *and* potential), will want to participate in the development of a common model and receive guidance on minimum standards.



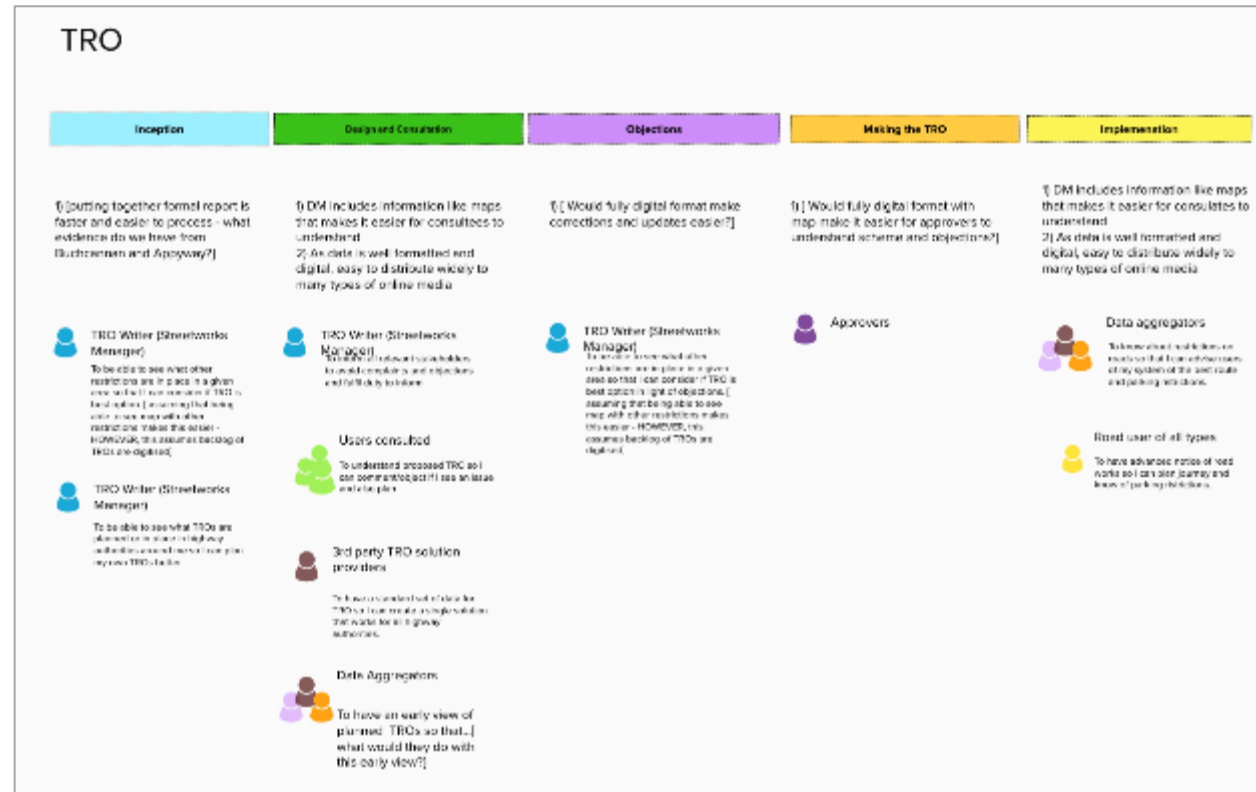
Service Design

Service Design

Consolidated learning from previous research

From previous rounds of research we constructed a service map and layered users and their assumed needs.

We also agreed on a set of principles that should be used to shape the service.



Service Design

Experimenting with different models

We looked at different models and considered how well the met user needs and agreed with our set of principles.

1. Mandate only

Set out standards of what data needs to be collected, to what quality and how it should be made available to others. i.e. publish data model, API standards etc

Support HAs with toolkits for custom development, grants, community of practice, negotiating discounts with ABE etc

2. Build 'keystone' parts of the service

Build the data pool and mandate that mandate that HAs have to publish to this data pool. This way standards can be policed and quality managed.

The strategy here is to build just enough of system to shape the wider system that will be developed by the HAs themselves.

3. Build a light weight case management tool

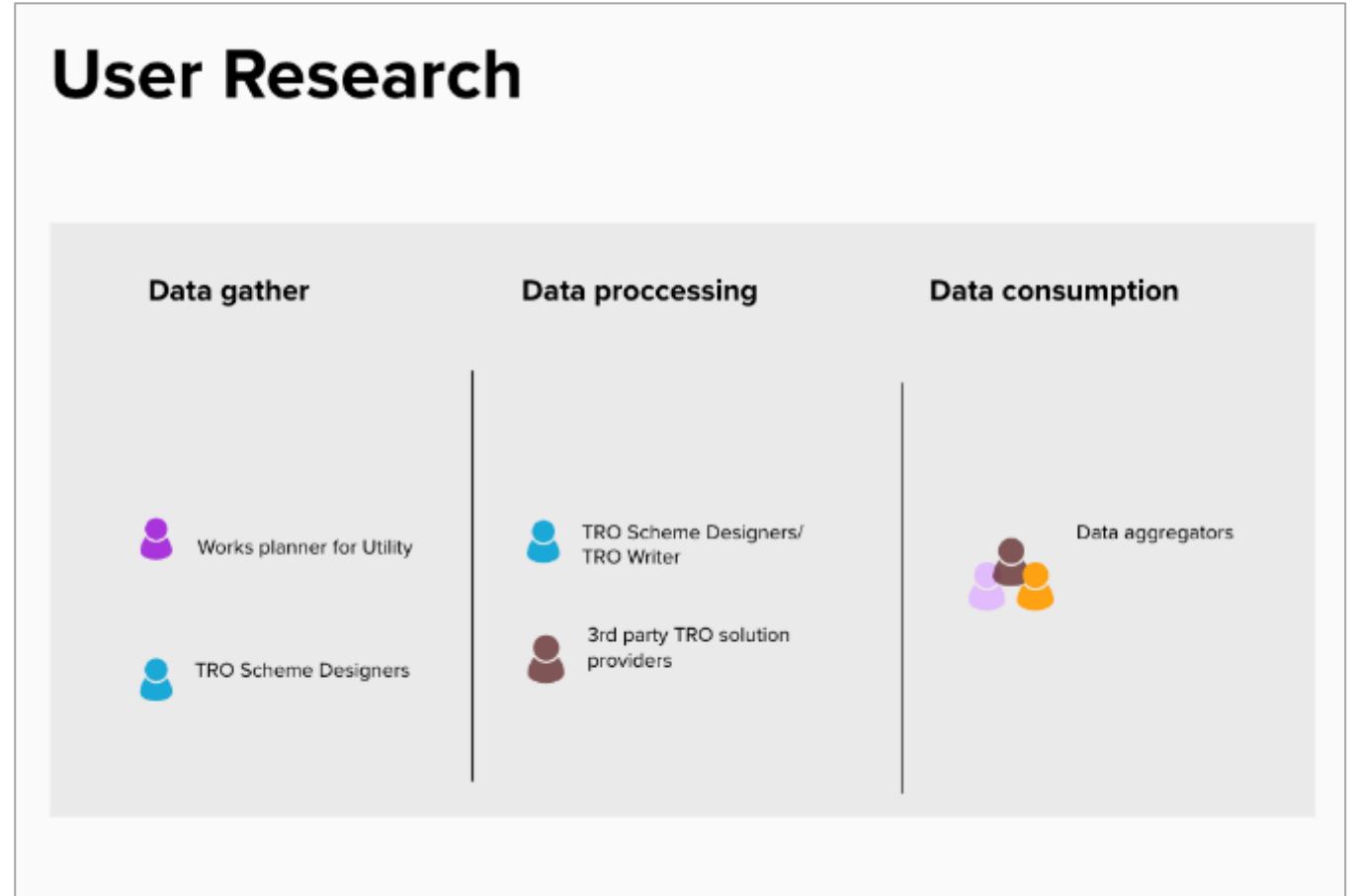
This assumes the market is unable to provide a service that is appropriate or affordable for HAs.

It is therefore necessary for DfT to commission the development of a TRO service which may include some or all types of TROs

Service Design

Learned more about user needs

Our user research helped us test the assumed needs we had defined earlier in the project and reconsider the service design.





Service Design

Experimenting with different models

The service model evolved into a design that we believe strikes the right balance of enabling the market to develop new and better services and supporting highway authorities to meet their responsibilities.



Data Model

Data Model

Scope

- The Discovery DM focused on a narrow scope: publication of TRO data at the "made" point.
- The Alpha DM expanded the scope to address:
 - Recommendations arising from Discovery and Policy Alpha,
 - The full gamut of planned user research.
- The scope was expanded to:
 - Traffic Regulation Orders: concerning types of order, the process behind each type, consultation
 - Legal Documents: concerning the structure and cross referencing between TROs and legislation
 - Traffic Regulation: comparable in scope to the Discovery DM
 - Place: concerned with elaborating the types of place susceptible to traffic regulation
 - Road Networks and Location Referencing: concerned with the precise specification of geospatial coordinates for Places.

Data Model

Principles

- Readable modelling style but with precise semantics: to capture specialist domain knowledge
- Separation of concerns: each domain model addresses one distinct aspect of TROs
- Plug and play approach to data exchange standards: DATEX II, TN-ITS, or both
- Map agnosticism: users will necessarily use a diverse set of base maps
- Coordinate independent formalisation of Place: from the perspective of scheme designers
- Maintainable and extensible: the Data Model is robust against change

Iterations

- First: Consolidate knowledge developed in the Discovery and Policy Alpha Phases
- Second: Formalise knowledge gained from 3rd party providers of TRO services
- Third: Formalise knowledge gained from Data Aggregators and OS/GeoPlace
- Fourth: Formalise knowledge gained from HA scheme designers and TRO writers



Technical Architecture Solution Design

Technical Architecture – Project Recommendation

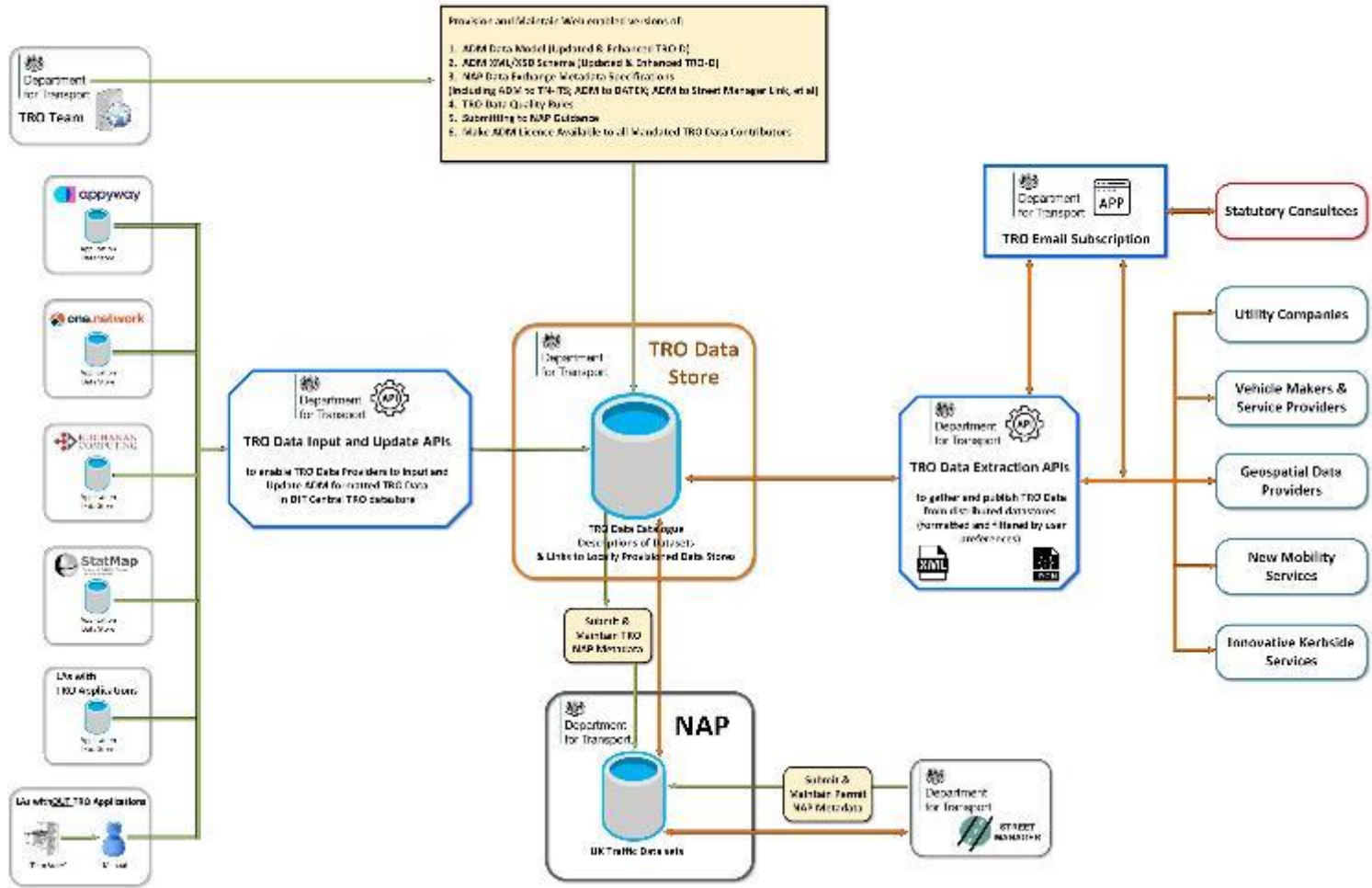
The project recommendation is that in order to meet user needs and DfT policy aims, a Digital TRO Service consisting of:

- **Input APIs** – to enable the ingestion of TRO data from TRO Management Market place TRO Data Management Solution Vendors and other Highway Authorities that create TRO data, into a central Data Store who will also send data via the APIs.
- **Data Pipelines** - to process and store the data received via the APIs.
- **A BigQuery Dataset** - to Store, Quality Audit and provide mediated external access to TRO data.
- **Extract APIs** - to enable TRO Data Subscribers to access TRO data.
- **Email Subscription Service** - to proactively inform the TRO Statutory Consultees of new “made” TROs.
- **Automated NAP Update** – to facilitate open data access

Technical Architecture - Solution Architecture Overview



TRO Alpha – Service Option 3 – Centralised Data Store



Technical Architecture – Other Data Store Options Considered

The other Data Store solution that was considered is to require TRO data providers to provision 24x7 availability Web enabled data stores of all of their TRO data, and utilise the DfT NAP (National Access Point) to catalogue, index and facilitate access to TRO Data.

This option is not preferred due to the following key issues and risks:

- Reliance upon all TRO Data Providers providing and maintaining 24x7 availability Web enabled data stores of all of their TRO data
- Difficulty of encouraging and enforcing Data Quality
- Difficulty of Access by External Subscribers
- Difficulty of Ensuring Legally Enforceable “tamper proof” TROs in the distributed data stores

Technical Architecture – Web Portal Options Considered

As part of reviewing the alternative end-to-end solutions, the option of DfT developing a TRO Web Portal was considered.

The reasons for not recommending this option include:

- Building and maintaining a new DfT TRO Web Portal would be expensive and time consuming and the demand for such a portal is not clear.
- DfT creating a “competitive product” would negatively disrupt the existing market place.
- After DfT have mandated the statutory obligation for highways authorities to digitally publish TRO data, it is expected that the market will rapidly react to offer cost effective products.

The option of developing a DfT TRO Web Portal, however, remains open should a need be identified at some point in the future.



Suggested Policy Changes

Suggested Policy Changes

The user research conducted during the Data Model Alpha has suggested that some areas of transport policy may need to change to support the proposed TRO data publication/distribution system. **These are for DfT to consider as part of the legislative reforms it is considering during 2021.**

Some are new:

- Highways Authorities (HAs) to make all TROs available at appropriate points in the lifecycle (see Beta Recommendations)
 - Using the data model with mandated fields to drive data quality improvements including data quality assessment
 - With updates of status, aligned to Street Manager mandated 'timeliness' requirements
- Move away from a 'send to all' notification model for statutory consultees (needs policy advice, as this has wider implications on government consultation)
- Where diversion routes are required, mandate the use of Unique Street Reference Numbers (USRNs) to identify the affected roads (predefined by HAs, rather than utilities, where possible)

Some are suggested guidance rather than mandated policy to be explored in BETA:

- Utility companies should check for existing TROs or street works permits before making a new application, to avoid duplication and clashes of work, via a voluntary sharing of applications
- Show confidence in dates given at each stage in the making available cycle, e.g. "confirmed"

Suggested Policy Changes (cont.)

Some serve to validate findings from the Policy Alpha:

- Remove the need to advertise in local newspapers
- There needs to be transparency of the TRO costs (charged by HAs)
- Minimise the response times for TTROs and their updates on street
- Closer link with Street Manager for permits that require TTROs to reduce duplication of data entry
- Guidance on how to complete the mandated data for TROs to reduce interpretation
- Business rules in the data store to check that mandated data is entered, and the quality is sufficient (rules to be elaborated in Beta)
 - TRO software suppliers should do much of this already but LAs may not with home developed systems
 - No manual checking but guidance from experts when business rules fail
- Guidance on how to improve data quality e.g. mapping and to self-declare the quality of data
- Guidance around use of pre-defined exemptions in the data model