Earthworks Renewals Cost and Volume Transparency

Targeted Assurance Review

25 May 2021

Contents

Acronyms and Abbreviations

CP6 – Control Period 6 (April 2019 to March 2024)

CP7 – Control Period 7 (April 2024 to March 2029)

DEAM – Director of Engineering and Asset Management

EC7 – Eurocode 7: Geotechnical Design (parts 1 & 2). Also referred to in the UK as BS EN 1997.

FoS – Factor of Safety

ORR – Office of Rail and Road

PR23 – Periodic Review 2023 (ORR's review of Network Rail's 5-year plans for CP7)

RAM – Route Asset Manager (note: this job title was still in use at the time of the interviews for this TAR, but has since changed as part of Network Rail's Putting Passengers First reorganisation. The job title and responsibilities are now different in each Region)

TAR – Targeted Assurance Review

WRACCA – Weather Resilience And Climate Change Adaptation plan

Definitions

CAPEX	Short for ‘Capital Expenditure’. In this context this is the amount it costs to complete a one-off engineering project to renew an asset. After it is renewed, there will be ongoing costs to maintain the asset and keep it operational (known as ‘Operational Expenditure’, or ‘OPEX’).
Effective Volumes	A system to combine the volume of renewals with smaller interventions (refurbishments and maintenance) as a single number. For earthworks, Network Rail apply the following weightings: 1xRenewal = 1 effective volume; 1xRefurbishment = 1/6; 1xMaintenance = 1/60.
Maintenance	Engineering work by Network Rail where: “The earthworks are maintained in a more or less steadystate by carrying out regular or targeted cleaning of drainage, management of vegetation and vermin, and minor repairs.” (definition from Network Rail’s standard NR/L2/CIV/086).
Refurbishment	Engineering work by Network Rail where: “The likelihood of the earthworks failing is reduced by carrying out major repairs, local replacement, local reprofiling, or the installation of additional drainage works or local support.” (definition from Network Rail’s standard NR/L2/CIV/086).
Renewal	Engineering work by Network Rail where: “The likelihood of the earthworks failing is significantly reduced by carrying out major works that result in permanent changes to the asset. For example, full regrading, the installation of major retaining structures or other major support measures.” (definition from Network Rail’s standard NR/L2/CIV/086).

1. Executive Summary

In CP6, Network Rail plan to deliver more than 1,500 earthworks renewals volumes. But ‘1 renewal volume’ could range from placing gabion baskets at track level over a 20m length, to installing soil nails on a steep slope over a 100m length, to repairing a landslip. The cost of these individual renewal projects varies significantly – and the benefit in terms of risk reduction also varies.

Network Rail report the total number and cost of renewals, but this does not provide transparency on the “difficulty” or “quality” of renewals. As earthworks are the most variable asset type, ORR undertook this Targeted Assurance Review to measure the variability between individual earthworks renewals and to identify any risks or issues, not visible in the high-level data. We collected information on 29 earthworks renewals, and 17 drainage renewals for comparison. This evidence was used to identify key factors driving renewal costs and to identify what mechanisms Network Rail have to control these factors.

Our key findings were:

1. Identification of nine key factors driving renewals cost: length of intervention, design standards, site conditions, access, inefficiency, reactive works, NR efficiency, supply chain efficiency and whole-life-cost savings.
2. Decision making on individual renewals was often driven by a desire to achieve a target ‘unit rate’, even though these average unit rates are not intended for this purpose (due to the variability in earthworks renewals).

The use of unit rates highlighted in this report is not considered best practice and could be resulting in sub-optimal renewals. Notwithstanding this, Network Rail’s management of earthworks renewals was broadly in line with best practice. However, we concluded that greater transparency of the key factors driving costs is achievable and is necessary for Network Rail, ORR and other stakeholders to make informed decisions for CP7.

We have identified five recommendations for Network Rail, as follows:

1. Director of Business Planning & Analysis to develop guidance on use of unit rates.
2. Regions (DEAMs) to develop policy on their approach to design standards and length of interventions.
3. Regions (DEAMs) to develop policy on balancing proactive and risk funding.
4. Regions (DEAMs) to propose measures/KPIs for the nine factors driving renewal costs.
5. Regions (DEAMs) to provide clarification on factors driving renewal costs for CP7.

ORR will use the outputs from these recommendations to hold Network Rail to account for any inefficiency in CP6 and this extra transparency for earthworks renewals will ensure that the effectiveness and efficiency of plans are clear at our PR23 Periodic Review.

2. Introduction

2.1 Background

Network Rail divides earthworks into ‘5-chain-lengths’ (approximately 100m long sections); each 5-chain-length section defined as ‘one asset’. Network Rail reports the volume of renewals it carries out as the total number of ‘5-chain-lengths’ where renewals were done. In reality, a renewal may only involve part of one ‘5-chain-length’, yet it is classified as one renewal volume.

Engineering requirements vary between different locations, depending on earthwork height, gradient, ground strength, groundwater conditions, drainage, space constraints, etc. Furthermore, Network Rail’s supply chain deliver renewals and suppliers may choose to use different approaches for each asset.

Network Rail acknowledged this variability between earthworks renewals and explicitly stated in its Strategic Asset Management Plans for CP6 that earthworks volume and cost forecasts in the five-year plans were uncertain and may be subject to change as individual projects progress.

ORR’s monitoring of Network Rail’s renewals is mainly based on a comparison of ‘planned’ versus ‘actual’ costs and volumes, i.e. “are Network Rail delivering as many renewals as they set out in their 5-year plan – and are they within budget?”. Due to the variability between earthworks renewals, examining only the total number and cost of renewals results in a lack of visibility and highlights three questions:

1. How much variability is there between individual renewals? For example, is it reasonable for the cost per 100m to vary by ±10%? or ±1000%?
2. What factors cause the variation and which are the most important? For example, are the key factors outside Network Rail’s control, such as geology or neighbouring land use? Or are the key factors within Network Rail’s control, such as material choice, or how they manage the supply chain?
3. Are these issues consistent across the different Network Rail Regions?

2.2 Purpose

The purpose of this TAR is to provide ORR with sufficient evidence to answer the three questions above; enabling ORR to better understand any risks to safety, train performance or efficiency within CP6. It will also inform discussions around funding for CP7, as part of our next 5-yearly review (Periodic Review 2023).

2.3 Scope

(a) Scope

This TAR focussed on earthworks renewals projects, from initially identifying the need for a renewal, through to option selection, design and delivery.

This TAR included similar reviews on a sample of drainage renewal projects because: drainage is an integral part of earthworks management; and, drainage renewal volumes are reported in metres, rather than '5-chain-lengths', so should be subject to less variability than earthworks.

This TAR was originally intended to cover three out of the five Regions: Wales & Western, Eastern and Southern; however it was identified that average renewal costs have been consistently lower in Scotland for many years, so the TAR was extended to obtain evidence from the Scotland Region.

(b) Objectives

The first objective of this TAR was to measure the variability in cost and scope for earthworks renewals and to identify key factors driving this variability.

The second objective was to gain assurance that Network Rail are following best practice in their planning and delivery of earthworks and drainage renewals.

The third objective was to establish a possible framework for how ORR and Network Rail can discuss changes within CP6 and plans for CP7 more transparently.

2.4 Methodical Approach

This TAR was delivered in four steps:

(1) ORR interviewed all Network Rail Route Asset Managers (RAMs) for earthworks and drainage across all five Regions to discuss: the Regional approaches to variability in earthworks renewals; and, any issues they encounter. For the four Regions covered by this TAR, the RAMs were asked to provide a list of 5 to 10 earthworks and drainage projects which were, in their view, good examples of these issues, along with associated costs and volumes. A total of 56 projects were identified.

Note: These projects were not selected at random – they were selected by the RAMs, with input from ORR, to provide clear examples for this TAR. As such, these projects may represent extreme cases and not all Network Rail projects will vary as much from the average cost.

(2) We interviewed 13 Network Rail delivery managers (Project and Programme Managers), responsible for 46 of the projects provided (of which: 29 earthworks and 17 drainage). The remaining 10 projects were omitted because the managers had moved to a different role or left Network Rail. Each interview focussed on one project but included general questions on processes and current issues. The 13 delivery managers provided written information and supporting documents for the remaining 33 of the 46 projects, which were not discussed in detail during interviews. The list of questions is provided in Appendix A; detailed responses are not included in this report due to the commercial sensitivity of the information. However, summaries are provided in Section 3.

(3) To validate the information from steps 1 and 2, we carried out interviews with a sample of contractors and designers from Network Rail's supply chain. Discussions with staff from Network Rail's Technical Authority, Finance and Weather Resilience & Climate Change teams were also held.

The contributors to this TAR are summarised in Figure 1; we are grateful to all contributors for taking the time to assist with this TAR and for providing such open and honest information.

(4) ORR compiled all the available evidence, summarised and carried out analysis of different factors for presentation in this report.

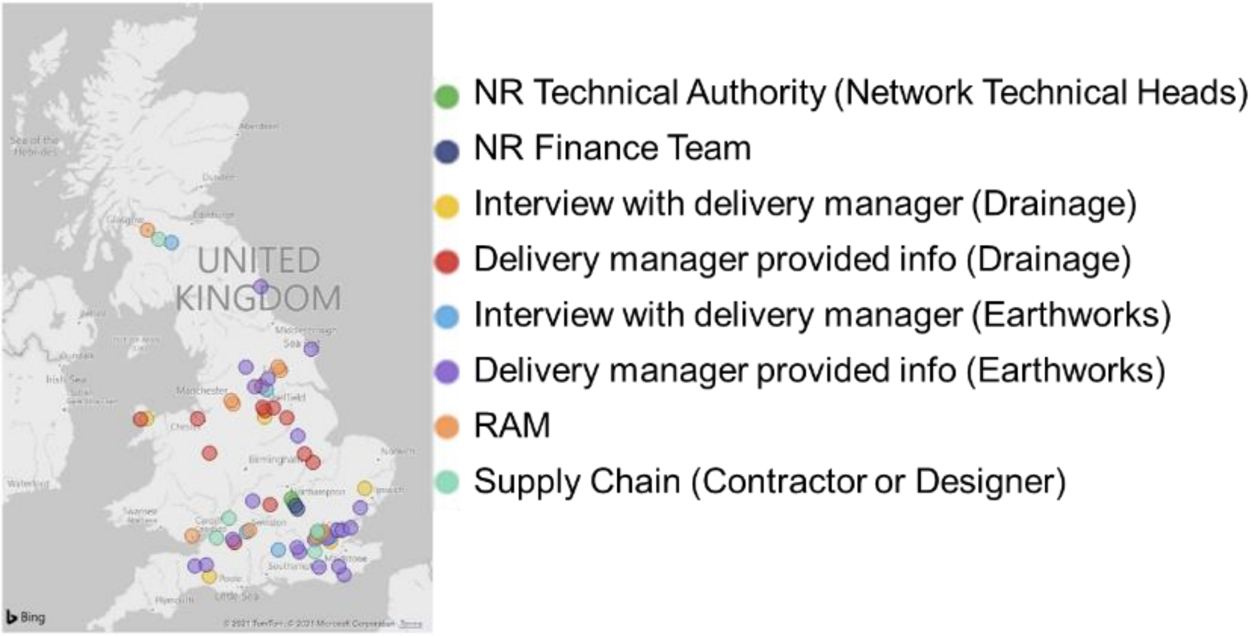

Figure 1 - Map showing locations of projects or staff interviewed for this TAR

3. Findings

There is significant variability between individual earthworks renewals, in terms of cost (see Figure 2), as well as the characteristics of the site and engineering solutions. Many of the key factors are outside Network Rail's direct control, including geology and access through neighbouring land. However, we found considerable variation caused by decisions within Network Rail's control, including choice of technical standards for design and the actual length of the renewal within each 5-chain-length. There was further variability depending on delivery set-up and supply chain management between the Regions.

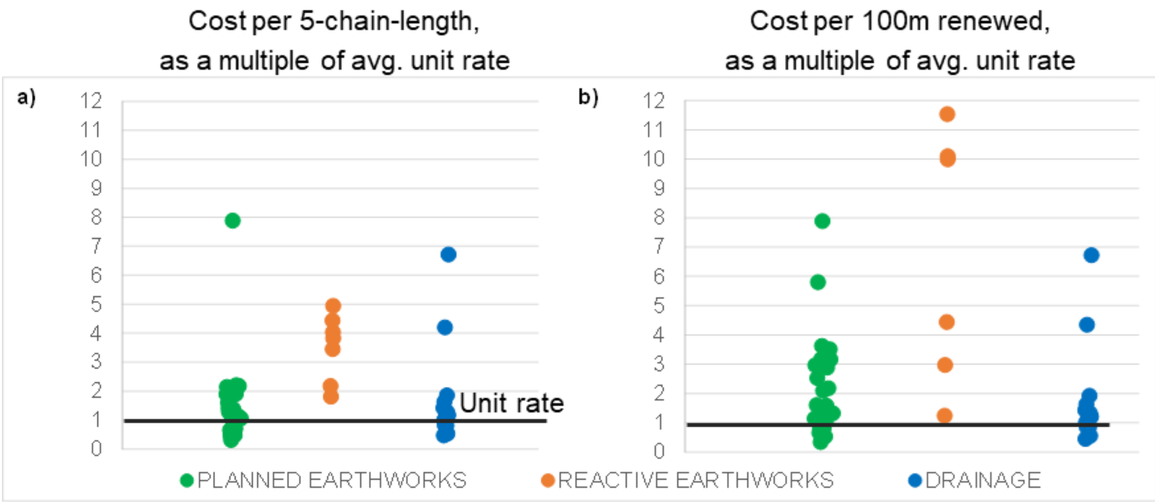

Figure 2 – Costs for the projects we reviewed, relative to National average unit rates. a) shows cost per "effective volume"; b) also considers whether the whole 5-chain-length was renewed, or just part of it

In the following sections we have used a simple, explanatory model to summarise the key factors driving the cost of individual earthworks renewals. Some of these factors are a well-known to Network Rail, but we are presenting them again here for two reasons:

(1) To allow a more transparent conversation between Network Rail and ORR about efficiency, changes within CP6, strategies for CP7 and to support benchmarking between the Regions; and

(2) To present practical examples with numbers to show how significant the different factors are.

Our explanatory model is shown in Figure 3: the right-side of the balance is the amount of renewal work being undertaken (the 'volume'); and, on the left is the CAPEX cost to deliver this volume of work. If every renewal was identical and cost the same amount (the 'unit rate'), then three volumes on the right would be balanced by three units on the left.

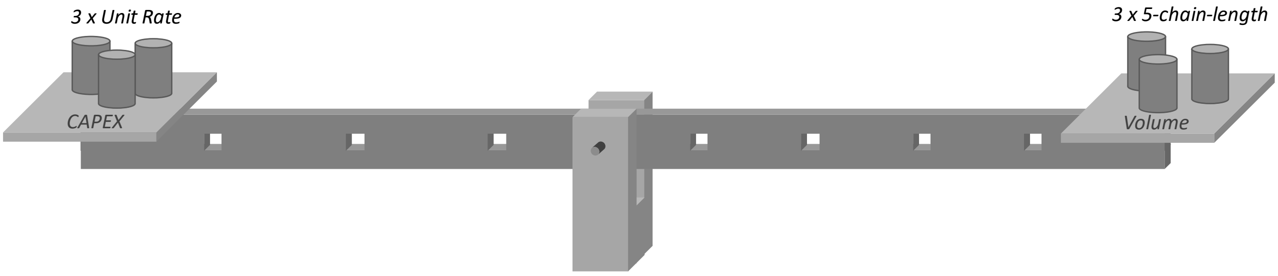

Figure 3 – A simple model, balancing unit rates and simple volumes

In reality, each renewal is different. Figure 4 shows the main engineering decisions within Network Rail's control: namely how much of the slope to renew ('Length'); and the design standards to adopt (i.e. the Factor of Safety (FoS) of the renewal design).

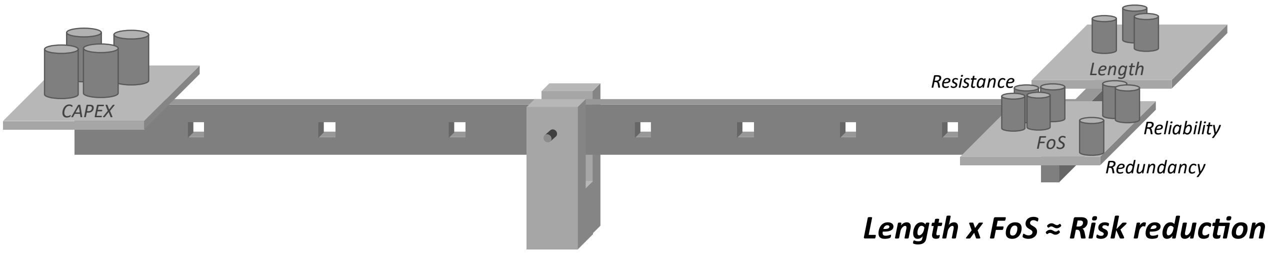

Figure 4 – A more complex model, with Length and FoS variables

3.1 CAPEX Cost

> *Examples (statements made in interviews – as recorded in our notes)*
>
> ***Capital Delivery Project Manager, Eastern Region:*** *Often have to go through many design iterations to try and meet the unit rate. Starting to analyse unit rates early, ahead of CP7, because the CP6 unit rates are hard to achieve.*
>
> ***Capital Delivery Project Manager, Scotland****: The main incentive to hit unit rates is to avoid having to go through financial re-authority. Feels incentivised to be 'best in class' – which is measured in terms of reducing the unit rates.*
>
> ***Capital Delivery Project Manager, Southern Region:*** *Currently struggling with the additional work to go through financial re-authority, on projects which cannot meet the unit rate. Unit rates are only achievable on longer projects – on shorter projects the only way to hit unit rates would be not to comply with the EC7 requirements… or only renew a portion of the 5-chain-length.*
>
> ***Two separate design consultants, Wales & Western:*** *Explained available options, to consider different design standards, or shorten length of renewals, to help Network Rail Delivery teams meet unit rates.*

In the context of limited funding available to the regions over CP6, in simplistic terms there are two ways to approach Figure 4. Firstly, delivery teams could undertake a detailed assessment of the site and determine what is the best engineering solution – then put this on the right side of the balance. This would allow projects to calculate how much CAPEX is required on the left side, to balance this out.

Alternatively, delivery teams could start on the left side and put on a fixed amount of CAPEX, based on how much funding is available. Delivery teams then determine an engineering solution on the right side, adjusting the Length and FoS until a balance is achieved. This approach can lead to one of two results:

(1) If the project is more difficult than anticipated, engineers will have to compromise on Length, or FoS, or both, in order to achieve the target cost.

(2) If the project is simpler than anticipated, there is less pressure on the engineers to optimise the design or seek efficiencies, unless they have strong incentives to deliver under the set cost.

The evidence collected in this TAR indicated that 95% of the planned earthworks were using ‘average unit rates’ as the initial project budget when Network Rail delivery teams started working on them. We know this either because the delivery managers said so explicitly, or because many projects in the same Region had exactly identical initial costs, per 5-chain-length. Unit rates were typically determined as an average cost per 5-chain-length from renewals in the same route, over the last control period. But some interviewees mentioned that national averages were being used, often highlighting that more rural parts of the network were bringing down the unit rates and making them unachievable elsewhere.

All of the interviewees from central teams (Technical Authority and Finance) and all of the Route Asset Managers noted that every project has to be given an initial budget estimate as part of 5-yearly cost plans and that, where no other information was available for a project, they might use the average unit rate as an initial estimate. These interviewees all noted that a unit rate is an average over a whole portfolio (one Route, or National), but it is unlikely that any individual projects will cost this amount – some will be more expensive and some less, averaging out over the portfolio. They noted that, where unit rates were used as an initial estimate, the budget could be revised once more engineering information was available, through a process of change control and re-authority to approve additional funding.

However, on more than 80% of the projects which started with the unit rate as an initial budget, we found some indication that the delivery managers were treating the unit rate as a target cost and that they were seeking engineering solutions which allowed them to hit the unit rate – which often meant reducing the Length or FoS from the initial assumptions (discussed in more detail in section 3.2). Several delivery managers clarified that they do not 'need' to hit the unit rate and that they had the option to seek re-authority for more funding, but they would often try reducing Length or FoS first, because the re-authority process was arduous, in terms of time and project resources.

All of the teams we interviewed from the supply chain corroborated this, stating that they were all aware of Network Rail projects where Length or FoS had been reduced specifically to hit (or get closer to) unit rates. In several cases they noted that they have visibility of the unit rates Network Rail's delivery managers are targeting and suppliers often try to present at least one design option which meets the unit rate.

Several interviewees raised the issue that low unit rates are self-perpetuating. Due to budget constraints in earlier control periods (CP4 and CP5), Network Rail had to either select projects which were easier and cheaper to deliver; or they had to compromise on Length or FoS to keep projects within budget. These projects then became the 'historical projects' used to calculate the average unit rates for use in CP6. So, if Network Rail try to hit these unit rates, again they either need to compromise on Length or FoS; or defer expensive projects to later control periods. This is shown as a flowchart in Figure 5.

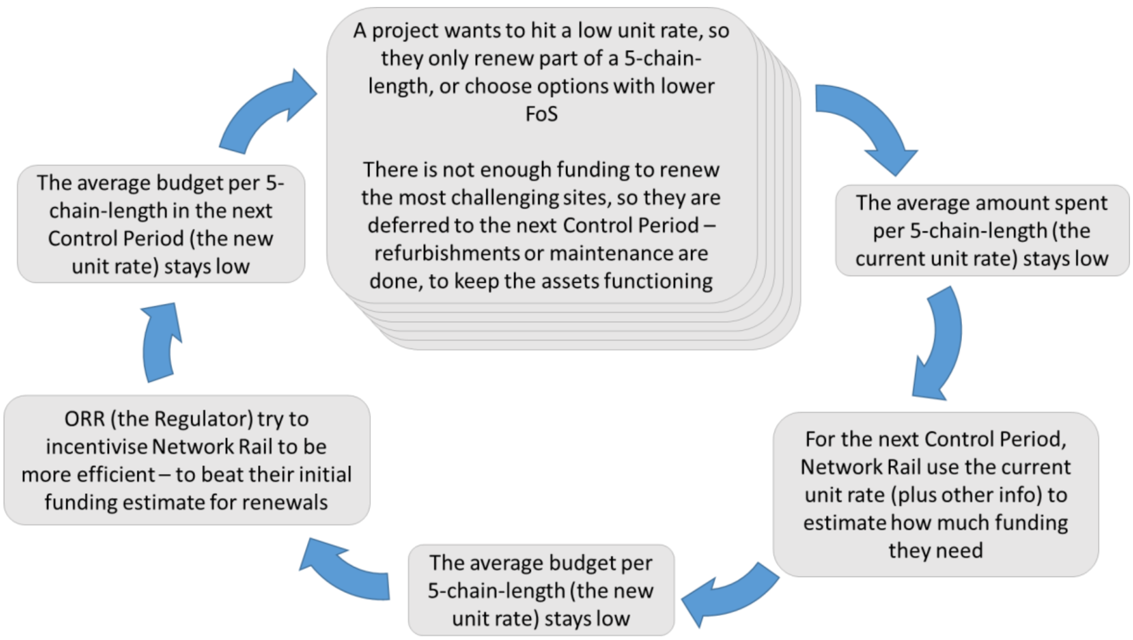

Figure 5 – Flow chart showing how decisions to try and hit low unit rates, lead to unit rates staying low in future Control Periods

For the drainage renewals projects, none of these issues were raised. Delivery managers were aware of average unit rates for materials and installation (per meter of pipe or ditch, or for each catchpit) and were aware if their designs were above or below average, but they were not adapting designs in order to hit unit rates. It should be noted that most of the drainage renewals were delivered by Works Delivery, Network Rail's in-house delivery contractor, who manage plant, labour and materials internally and who draw down from a total budget in each route. Conversely, most earthworks renewals were larger and so were delivered by Capital Delivery, who contract design and delivery out to the external supply chain and who have separate budgets assigned to each individual project.

We recognise that Network Rail has a constrained budget and that reducing the Length or FoS on some projects may be the best way to manage the risk across an entire portfolio. However, there is so much variability within earthworks renewals that it is not best practice for individual projects to fix average unit rate as a target cost; nor for the re-authority process to be (or to be perceived as) so arduous that people are discouraged from using it. Best practice would be to assign more realistic initial estimates; to have a re-authority process which is proportionate in effort and encouraged; and to have sufficient transparency that any reductions in length or FoS can be factored into future unit rates used in planning. See REC R1.

3.2 Factor of Safety vs Length

Example: ***Thankerton soil cutting, Scotland Region***

The original design was to regrade the slope at the highest risk locations (totalling around 50m length) and add drainage at the crest of the cutting. However, due to the Covid-19 pandemic, elderly landowners at the crest refused to give Network Rail access across their land, or to sell them any land. The design had to be revised to a less significant regrade over the full 220m length, with a rock blanket and additional counterfort drains. Because they could not buy land to move the crest back, the slope angle was fixed at 1:1.5, which did not comply with the Factors of Safety in EC7, but Network Rail and the designer agreed that this provided an acceptable reduction in risk because it was a 'betterment' compared to the existing condition; and protected a longer length of the slope. The final cost per 5-chain-length was close to the average unit rate.

As noted in 3.1, one of the two main engineering decisions within Network Rail's control is the technical standard which the renewal will be designed to.

When this TAR was started, it was mandatory for geotechnical designs on all public projects in the European Union to comply with 'Eurocode 7: Geotechnical Design'. Eurocode 7 is also known by its UK designation 'BS EN 1997', or by the abbreviation 'EC7'. In this report we will refer to it as EC7. EC7 specifies the factors of safety (FoS) which designers must apply to loads or to soil strength parameters for different types of geotechnical structures.

The Network Rail internal standard for Geotechnical Design [NR/L3/CIV/071] states that "*Where applicable,* ***new designs*** *shall be undertaken in accordance with the suite of Structural Eurocodes, with geotechnical designs following the requirements of BS EN 1997*". However, the Network Rail standard goes on to discuss 'repair, maintenance and emergency works' and states that "…*in many cases the Eurocodes would not be applicable to such works*".

A 'renewal' is not defined in [NR/L3/CIV/071], but Network Rail's other standards define a renewal as "*carrying out major works that result in permanent changes to the asset. For example, full regrading, the installation of major retaining structures or other major support measures"*. This leaves some ambiguity as to whether earthworks renewals qualify as 'new designs' and hence need to comply with EC7, or whether they can be classed as 'repairs', which do not need to comply with EC7.

In our interviews, Network Rail staff in several regions used the term "betterment". They clarified that this meant designs where the FoS was not compliant with EC7, but was "significantly better" than the current condition of the asset. This implies that these projects were treating these designs as 'repairs', rather than 'new designs'. More than 40% of the projects we discussed in detail in this TAR indicated they were adopting a betterment approach, rather than full EC7 compliant designs.

All of the supply chain contractors and designers we interviewed corroborated the suggestion that earthworks renewals sometimes use a 'betterment' approach. In several cases suppliers indicated that 'betterment' was the standard approach and that full EC7 compliant designs were only considered in cases where the current asset condition was extremely poor. One supplier even noted that they had helped Network Rail to develop a series of generic standard details, which followed a betterment approach. The supply chain were clear that the additional risk, by not designing to full EC7 compliance, was accepted by the RAMs and we found evidence that this was being stated in their design documentation (Form 1 reports).

Several projects included some element of 'refurbishment' and delivery teams made a clear distinction between renewals (which are providing a permanent solution) and refurbishments (which simply extend the life of the existing solution – for example by installing additional drainage or installing netting to hold back any falling material).

In the context of design standards, the FoS is referring to 'resistance', or how much load the asset can withstand, compared against the loads it is expected to encounter. A second factor to consider is 'redundancy' or 'spare capacity', which might include mechanisms to catch any failing material before it reaches the track, or extra drainage capacity to allow for climate change. EC7 explicitly states that designers must include future climate projections when determining the design loads. This is not explicitly stated in the Network Rail earthworks standards.

A third factor to consider is the design life or ‘reliability’ of the asset. The Network Rail standard [NR/L3/CIV/071] clearly specifies design service lives of 120 years for retaining walls, most buried structures and anchors; or 60 years for gabion walls and ‘repair works’, including rock bolts and soil nails. We did not record the exact design life on every project, but multiple projects mentioned design lives between 60-75years and none of the projects explicitly mentioned a 120 year design life.

The Network Rail internal standards for designing drainage renewals [NR/L2/CIV/005 – Drainage Systems Manual] are more focussed on the ‘return period’ of the worst weather event which the drainage system can handle (e.g. 1-in-50 years), as opposed to the ‘design life’ before the components are no longer serviceable (e.g. 120 years). The standards specify a return period of 1-in-50 years (1-in-25 years for rural or freight lines) and that the impact of 1-in-200 and 1-in-500 year events needs to be assessed for high-risk drainage locations. This standard also clearly states the need to include allowances for climate change projections.

Further examples of how Network Rail consider ‘resistance’, ‘redundancy’ and ‘reliability’ are discussed in a separate TAR on Earthworks and Drainage Weather Resilience[1].

Example: ***Whitmore soil cutting landslip, Northwest & Central Region***

A landslip occurred at the site in 2010. Because of underfunding at the time, the project team only renewed the section which had failed, using a rock blanket. This did not treat the root cause of the failure, which was poor drainage. In June 2020 another landslip occurred adjacent to the 2010 failure and appears to have the same root cause (poor drainage). When interviewed for this TAR, the Regional team noted that their current policy is to assess and renew the surrounding slope, rather than just fixing the failure. This costs more in the short term, but it is more efficient to do a larger renewal while the contractor is already on site – and it is significantly cheaper than doing emergency works to repair a landslip.

The second engineering decision is the length of the renewal. For all projects relating to reactive works (fixing the site of a landslip) Network Rail’s approach appeared to consider assessing the surrounding slope and either renewing it at the same time as emergency works or coming back as a later phase of the project, allowing more time to produce an optimised design.

For the planned earthworks renewals, more than 20% of the 5-chain-lengths worked on were only renewed over part of their length. Roughly 15% were because the work spilled

[1] Earthworks and Drainage Weather Resilience TAR: https://www.orr.gov.uk/media/22457

over several 5-chain-length sections (‘Overspill’ in Figure 6) – for example, a 220m renewal might cover 2 full 100m sections, then extend 20m into a third section. But around 5% of the short lengths were because Network Rail chose to renew only the part of the slope which posed the highest risk. This was much more common in reactive renewals (around 45%).

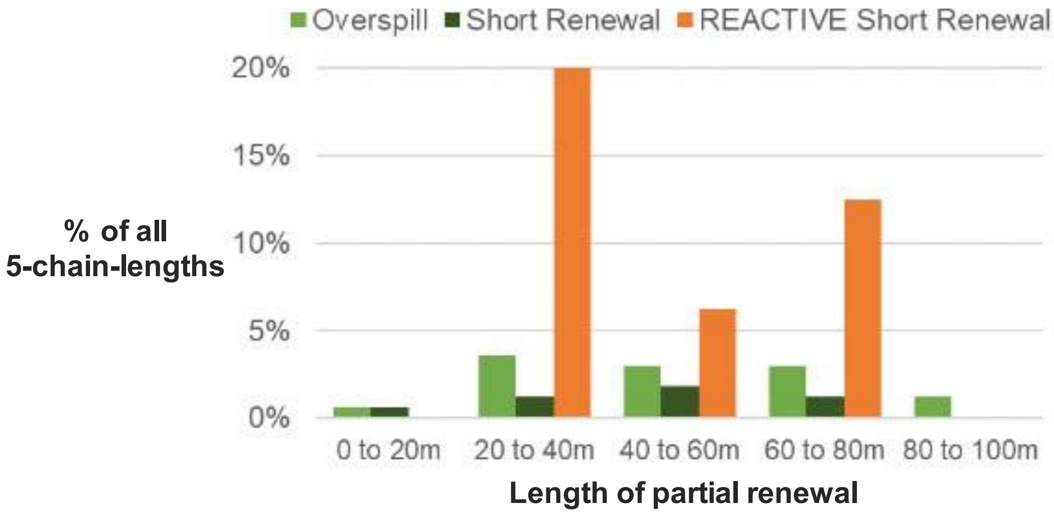

Figure 6 – Histogram of renewal lengths less than the full 5-chain-lengths

Most of the RAMs we interviewed mentioned reducing the length of renewals as a way to deliver all their planned renewals, while staying within their overall budget. None of the RAMs explicitly mentioned using a lower design standard or reducing the FoS as a way to reduce cost, although many mentioned that they would consider downgrading from renewals to refurbishments once the designers and contractors had outlined the engineering options. Delivery managers typically mentioned both reducing the length and considering options with a lower FoS as options to control costs. The supply chain noted that considering options with different FoS was their main mechanism to reduce costs, as the decision on the length of renewals was up to Network Rail, not the suppliers.

Network Rail’s policies and standards allow them to adjust both the Length and FoS of individual renewals. We agree that this is a reasonable approach to managing risks within a constrained budget. However, this is not being done transparently. Before conducting this TAR, we had no way of seeing that so many renewals were shorter than the full 5-chain-length and we were not aware that lower design standards were being applied so extensively in all Regions. As noted in 3.1 and Figure 5, if these decisions are made and not reported transparently, the average unit rate can change (or stay unhelpfully low) without explanation, making it more difficult to fund longer, higher FoS renewals in future control periods. See REC A1.

3.3 Access

As well as the engineering decisions noted in 3.2, there are several negative factors outside of Network Rail's control, as shown in Figure 7. These are on the right side of the figure, so Network Rail must either find additional funding, or reduce the Length or FoS, in order to restore the balance.

The first of these factors is 'access' and covers difficulties in accessing the site, in order to deliver earthworks renewals.

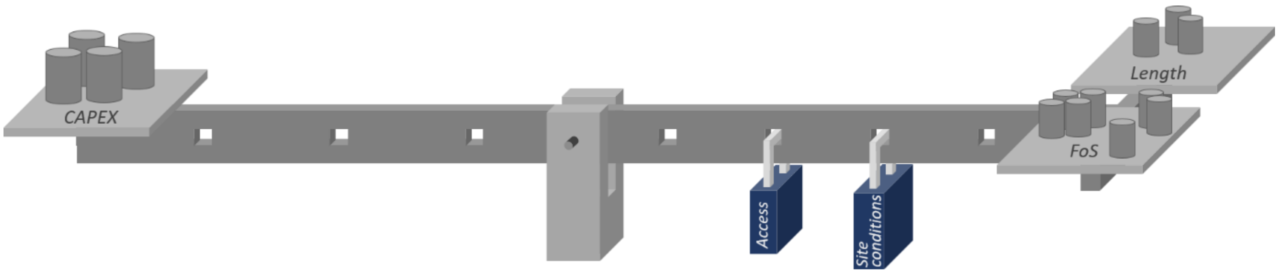

Figure 7 – Schematic model with additional negative factors

> Example: ***Langport embankment, Wales & Western Region***
>
> *Just to gain access the site, the project needed to get a Flood Risk Activity Permit, for their access road to bridge over a stream on a flood plain Also, multiple private landowners were involved in the negotiations for land rental and restorations. Once work had started, a badger moved onto the site and had cubs, so work was delayed on part of the site until the badger sett could be closed and the badgers relocated. Just the issue with the badgers added nearly 15% to the total cost.*

More than 65% of projects noted issues negotiating with neighbouring landowners to set up construction sites or basic access roads on their land. Where we have cost information about this, land access costs were roughly 5-15% of the total project cost. A smaller number of projects (<15%) had to construct large-scale access roads, costing as much as 25% of the total project cost. Several projects noted ecological issues such as 'great crested newts' and badger setts which, in the worst case, cost around 15% of the total project value to resolve.

The delivery managers consistently stated that renewals projects do not bear the 'Schedule 4' costs (the compensation paid by Network Rail to train operators for planned disruptions to their services) and these costs are borne at route level.

However, it was noted by several people in the supply chain that projects on the railway are often more expensive than their projects for highways or other sites, because work may need to be broken down into a series of short shifts to work around train timetables, or they may require specialist plant to run on rails, or to fit beneath overhead electrification. When asked about access issues, delivery managers and the supply chain also noted additional costs when access plans or interfaces with other projects changed at short notice. Unlike 3rd party or ecological issues, these issues are within Network Rail's control.

It was noted that reactive renewals (emergency fixes at the sites of landslips) often avoided the costs for using neighbouring land, because they could set up equipment on the tracks while the lines were closed. These projects also benefitted from much simpler planning processes (less 'red tape').

3.4 Site Conditions

Example: ***Barnehurst soil cutting, Southern Region***

The site is a 12m deep, oversteep cutting, constructed in 1895, with 14 historical landslips nearby. The original remit was to renew just the 5-chain-length (100m length) with the highest risk. But, once they had done ground investigations and assessed the stability along the cutting, the project has ended up renewing nearly 700m, using sheet piles and kingpost walls. Around 55% of the renewal has now been completed, with the remainder due in 2022/23; and the current cost estimate for the whole job is nearly 90% higher than the average unit rate.

In any earthworks renewal, the engineering options available will depend on the geology, the groundwater conditions and the geometry of the slopes. The evidence indicated that more than 30% of the earthworks projects were limited to only one viable option by the site conditions and hence Network Rail had less ability to control the cost.

More than 65% of projects noted some difficult site conditions and around 50% required more invasive engineering solutions (such as sheet piling, kingpost walls or soil nailing), as opposed to simpler solutions (such as regrading slopes to a shallower angle or placing gabion baskets at track level).

An approximate analysis of the evidence found that the more invasive options were typically 1.5 to 5 times more expensive per meter of slope renewed than the simpler engineering options. This gives an indication of how significant poor site conditions can be in driving up project cost.

For the drainage renewals, geology, groundwater and geometry were not noted as major concerns. However, some drainage renewals noted additional costs due to constraints from other railway infrastructure, for example installing draining in tunnels, near station platforms or in the 6-foot (the gap between two lines of track) because there was no space to install drainage in the cess (the space at the side of the track, used as a safe area for workers to stand while trains pass). Costs for these projects with geometric constraints were around 2 to 5 times more expensive per metre than typical projects, similar to the variability for earthworks. However, these issues were far less common on drainage projects (<25%) than they were for earthworks (65%).

3.5 Inefficiency

As shown in Figure 8, there are two other negative factors, which are often outside of Network Rail's control, but which Network Rail would look to minimise wherever possible. Again, these are on the right side of the balance, so Network Rail must either find additional funding or reduce Length or FoS to compensate for them. The first of these is 'inefficiency'.

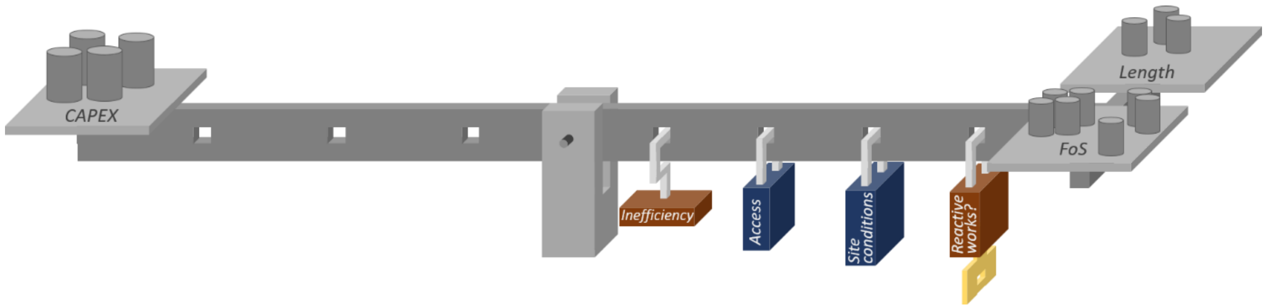

Figure 8 - Schematic model with additional negative factors

> Example: ***LTN1 (Great Eastern Mainline) 106 Embankment, Eastern Region***
>
> *This project remit asked for counterfort drains at 6m spacing, as a 'refurbishment' (just extending the embankment's life, rather than a full renewal). The framework designer in CP5 insisted on a 50year design life, which was not affordable. The design was revisited under a new framework designer in CP6. The delivery team wanted a design which met the unit rate, but this would require 30m spacings. The designers were willing to compromise on design life, but such wide spacings did not comply with EC7 standards. In the end, there were more than a dozen iterations before agreeing on a 12m spacing, with a final cost more than 80% over the unit rate.*

The most common inefficiency noted by interviewees was repeated design work. This issue was raised several times by both delivery managers and the supply chain. We have insufficient evidence to put a value on the inefficiencies for these projects, but we know from our regular engagement with Network Rail that design costs on a typical project range from 5-10% of the total cost, so repeating large portions of the design can have a significant impact on total cost.

As well as creating additional costs, several interviewees from the supply chain noted that delays from Network Rail in making decisions, or requests for more design iterations put pressure on suppliers (and Network Rail) to meet schedule milestones. In one case, repeat design iterations to try and reduce costs took so long that there was a landslip at the renewal site shortly before the work began. The design iterations reduced the cost estimate by nearly 20%, but because the slope failed and needed emergency works, as well as the permanent renewal, the total cost ended up more than 90% higher than the cost of the original design, before all of the iterations.

3.6 Reactive works

Example: ***Mount Bures soil cutting, Eastern Region***

Following a landslip, Network Rail's internal Works Delivery team were given a 24hour remit to remove the landslip material and install 40m of ballast bags to make the slope safe enough to re-open the line. Then they were given a 7day remit to install a 'permanent fix' – in this case 61m of gabion baskets and regrading the upper slope, with a design life of 60 years, plus additional drainage. To achieve this in 7days, the project did not need to go through the full option selection, design and approval stage-gates like a planned renewal. A budget of approximately 4 times the average renewal cost was made available, if needed, but the project came in at around 1.5 times the average renewal cost.

7 out of the 29 earthworks renewals considered in this TAR were reactive (fixing the site of landslips). As noted in 3.4, reactive projects may save on access costs, because they can work from the track while it is blocked. However, the evidence collected in this TAR suggests that reactive projects were consistently more expensive per 5-chain-length than planned renewals; they were 125% more expensive on average (this can be seen in Figure 2a).

Figure 6 also showed that reactive projects were far more likely to only renew a small portion of the slope. On average, reactive projects were around 280% more expensive per metre than planned renewals (this can be seen in Figure 2b).

There were also indications that these reactive renewals might only use a 'betterment' approach to FoS, on the assumption that a more long-term renewal would be carried out later. Adding up the costs for both a short-term fix and coming back to do another renewal in a few Control Periods' time, these reactive sites become significantly more expensive than planned, preventative works.

The processes for selecting a contractor to deliver reactive works varied between Regions, with some Regions using Works Delivery (Network Rail's internal delivery resource), while other Regions could quickly engage supply chain contractors and designers from framework contracts. We only have evidence from a limited number of projects, but the costs were roughly 30% lower on average, when using Works Delivery rather than the supply chain, through Capital Delivery. In either approach, these projects did not need to go through the same processes as planned renewals to secure funding, so there was no mention of trying to hit unit rates.

We know from our regular engagements with Network Rail that the source of funding for reactive works varies between Regions, with some Regions (notably the Southern Region) relying more heavily on regional and national risk funds, while other Regions will defer planned renewals to free up funding for reactive works. This access to risk funding leads to a different risk appetite around fixing earthworks after they have failed, rather than spending additional funds to try and renew them proactively. The evidence from this TAR suggests that reactive renewals are significantly more expensive per 100m that planned renewals, so there is a clear efficiency benefit to taking a more proactive approach. See REC A2.

3.7 Network Rail efficiencies

As shown in Figure 9, there are three positive factors, which Network Rail would seek to maximise. These are on the left side of the balance, so they allow Network Rail either to reduce the CAPEX cost of a renewal, or to deliver more Length or FoS for the same cost. The first of these factors is efficiency driven by Network Rail.

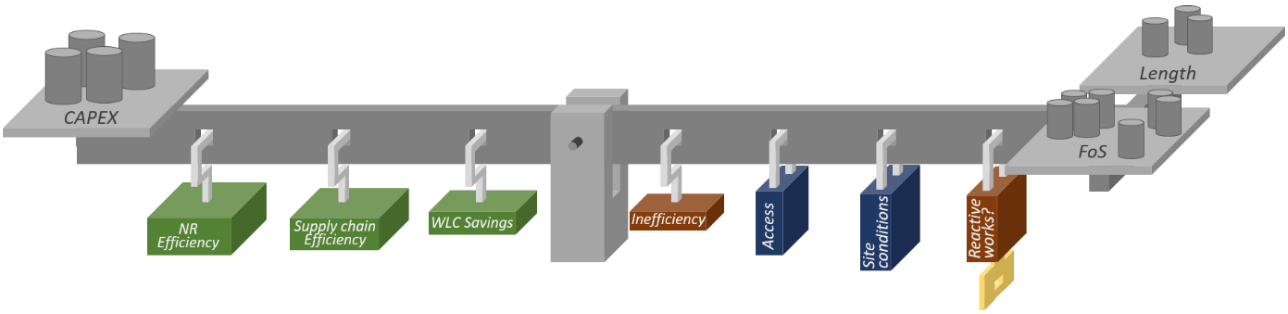

Figure 9 - Schematic model with additional positive factors – showing all nine key factors

> Example: ***Muston Cottage Embankment, Eastern Region***
>
> *The design included installing 230 screw piles to stabilise the embankment. Before installing a secondary row of piles in the cess, Network Rail installed monitoring on the slope and left it over the winter to measure any movements. They were able to do additional computational analysis (Finite Element Modelling) and prove that the secondary row of piles was not required. This saved approximately 10% of the total project cost. The analysis was done by NRDD (Network Rail's in-house designers) rather than using external suppliers, producing a further 3% saving.*

The most common efficiencies mentioned in interviews were Network Rail challenging the designs; Network Rail sourcing cheaper materials or recycling waste material; and coordinating large amounts of work or even multiple projects, to be delivered in large blockades, allowing the use of larger, more efficient plant and avoiding repeated mobilisation and demobilisation costs. All three of these efficiencies typically ranged from 2-15% of the total project cost.

Other, less common efficiencies included Network Rail procuring materials or specialist resources (e.g. ecologists) internally, rather than using external suppliers. Some projects also achieved efficiencies by using Network Rail's own internal Design Delivery team (NRDD) to design solutions. Following this, they would either deliver them using the internal Works Delivery team or via a contract to the supply chain for delivery only (as opposed to the more commonly used Design & Build contracts).

Several delivery managers noted that they record Headwinds, Tailwinds, Efficiencies and Inefficiencies in a 'H.E.T.I.' log at either project, programme or route level.

All delivery managers appeared to be making significant efforts to seek efficiencies and Network Rail has processes in place to record and encourage this. ORR aims to incentivise Network Rail to be more efficient. However, we do not currently have sufficient visibility to distinguish efficiencies from all the other factors in Figure 8. For example, if Network Rail managed to reduce the cost of all their projects by 1% through efficiencies, we would have no clear way of knowing that this was through efficiencies, as opposed to a 1% reduction in the length of every renewal, or just because site conditions on these renewals were more favourable than in the previous control period. See REC A3 on improving transparency.

3.8 Supply Chain Efficiencies

Example: ***Rock netting details, Scotland Region***

A contractor was regularly installing rock netting from the bottom of cuttings, which required a lot of people accessing the track and working in possessions (while trains were not running). They developed a standard detail where the top row of anchors was moved up from the face of the cutting, to 2m back, over the crest of the cutting. This allowed a large amount of work to be done from the top, without the need for track access. The savings in time were significantly greater than the cost of the extra 2m of netting.

All the suppliers we interviewed were able to provide examples of efficiencies they had provided for Network Rail projects.

Most suppliers noted that the largest efficiencies were achieved by giving suppliers better visibility of the future workbank and even allowing them to decide in which order to design and deliver all the renewals. The suppliers suggested that they were better equipped than Network Rail to determine the need for specialist resources; plant access and logistics to bring in materials and remove waste; and how much time would be needed on site – hence they are better equipped to determine which projects could be delivered together or needed to be kept apart. Control of the planning also allowed designers to get involved earlier and to plan ahead for projects with long lead times, such as sites needing extensive ground investigation before they could start to determine the engineering solutions. We were not able to quantify the cost savings from these efficiencies.

Several suppliers had provided innovative products or techniques, which had reduced project costs or schedule; or improved safety on site. These included innovative trench support boxes which were quicker to lift in and out for installing drainage; and easier-to-install, re-usable panels for temporary access roads.

3.9 Whole Life Cost savings

Example: ***Somerton drainage renewal, Wales & Western Region***

The track had been lowered through a tunnel, leading to regular maintenance call-outs to deal with flooding, wet beds and track geometry faults. The drainage had to go in the 6-foot, which was unusually narrow because of a track slew. Rather than use conventional pipe with catchpits every 30m to allow manual cleaning, the project desined bespoke catchpits and 60m lengths of thick-walled, smooth-bore pipe so it was easy to clean by mechanised jetting, for cheaper maintenance, longer life and less staff working in the tunnel.

We asked projects whether they had added anything to the project, requiring additional CAPEX spend now, in order to save money over the life of the asset; for example, by using components which last longer before they degrade or by configuring the infrastructure to make it easier and cheaper to maintain the assets. Very few (<10%) of the earthworks projects mentioned any initiatives like this. Of those that did, one example was to install new fencing while they were on site, preventing future trespassers.

Network Rail's central Technical Authority team noted that every project should be selecting the engineering options with the optimal whole life cost (or 'Life Cycle Cost') in accordance with Network Rail's 'Life Cycle Cost Manual'. In the evidence collected for this TAR, we found one example of a project ruling out an option based on the whole life cost. However, we did not see any conclusive evidence that the options Network Rail eventually chose had optimal whole life costs. 'Whole life cost', or 'life cycle cost' discussions were not recorded in the option selection reports or minutes of option selection meetings which we obtained.

Whole life cost initiatives were more common on the drainage projects (around 15% mentioned these), typically around designing pipe systems so that they can be maintained more easily in the future; one project mentioned purchasing land they needed as temporary access for the project, which was conveniently located for Network Rail parking and storage in the future.

Drainage renewals were mostly delivered by Network Rail's Works Delivery team, who perform drainage inspections in most Regions and who have regular interaction with Network Rail's Maintenance Delivery Units, so they may be more cognisant of the maintenance activities. Earthworks are mostly delivered by Capital Delivery and the supply chain, who confirmed that they always consult the maintenance teams as part of their design process, but who may have little day-to-day interface with maintenance.

One of the suppliers we interviewed noted that they had attempted to introduce a new product into one of their designs: plastic panels instead of wooden panels in a kingpost wall, which are safer and easier to handle, have a much longer design life and require no regular maintenance (whereas wooden panels do). The supplier noted that they were unable to get the product approved by Network Rail's central approvals panel, despite it being widely accepted outside the railway. They have had to seek special permission to use this product on a project-by-project basis, requiring significant additional effort from the project team.

In a previous TAR looking at Earthworks Change Controls, we found evidence that many people in Network Rail are taking positive steps to reduce the whole life cost of their assets, with a small additional cost to their projects now. However, the process to justify the additional CAPEX spend can be time and resource intensive, and there is no clear mechanism to measure any long-term savings or to capitalise on them within the earthworks portfolio. ORR aims to incentivise decisions which reduce whole life cost, but we do not currently have enough transparency of project costs to know when these decisions are being made. For example, if Network Rail spent 1% more on all of its projects because it was using new materials which would save 5% in the long-term, we would have no easy way to distinguish this from projects spending 1% more because of inefficient management, or more challenging ground conditions. More transparency is needed (see REC A3). We did not find conclusive evidence of how whole life cost is being assessed at option selection, so we intend to examine this in more detail as a future TAR, or through our business-as-usual activities.

3.10 Transparency and future planning

In sections 3.1 to 3.9 we have presented evidence from this TAR and used it to build up a simple model, summarising the key factors which we found were causing variability in earthworks (and drainage) renewals.

During this TAR, we have found this simple model useful in describing qualitative differences between individual projects, or between different Regions' approaches. For example, in Figure 10a, the balance represents a discussion where CAPEX costs for a group of projects were very low because Network Rail and their supply chain had come up with significant efficiencies; there were no major issues on site and they had decided to take a ‘betterment’ approach (lower FoS) over a larger number of sites.

Conversely, the balance in Figure 10b represents a discussion where a group of projects were struggling with very difficult ground conditions on hard-to-reach sites; they were dealing with a lot of reactive works following a storm; they had decided to use full EC7 compliant designs and were trying to minimise the length of renewals to stay within budget, but the CAPEX costs were still very high.

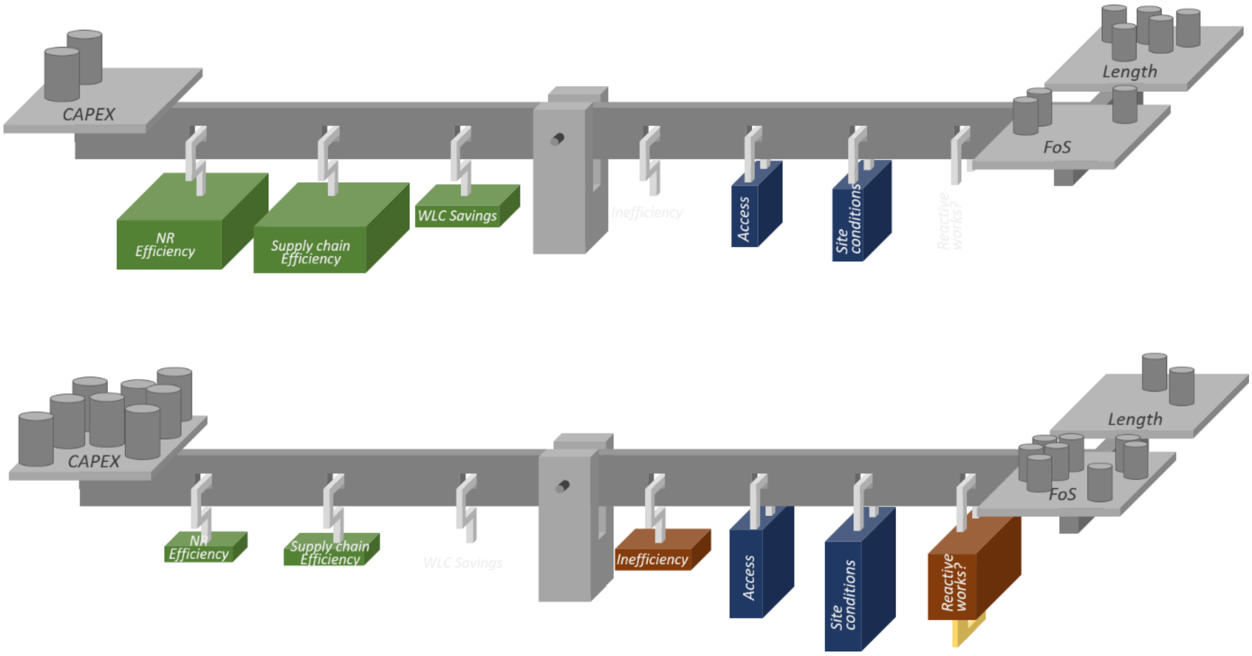

Figure 10(a & b) – Use of the schematic model to describe two different projects or portfolios

In Figure 11 we have attempted to score each project against the items on the balance, using a very approximate ‘Low – Medium – High’ system. If each item is given a weighting (e.g. assume “high” efficiency saves the project 15%), it is possible to combine all of the positive and negative items into one adjustment factor, which can be applied to the average unit rate to give a better indication of how much projects will cost. Our rough analysis gave the values shown in Figure 12, where the actual costs are much closer to the ‘factored’ unit rate than the original unit rate. This factoring is shown schematically in Figure 13.

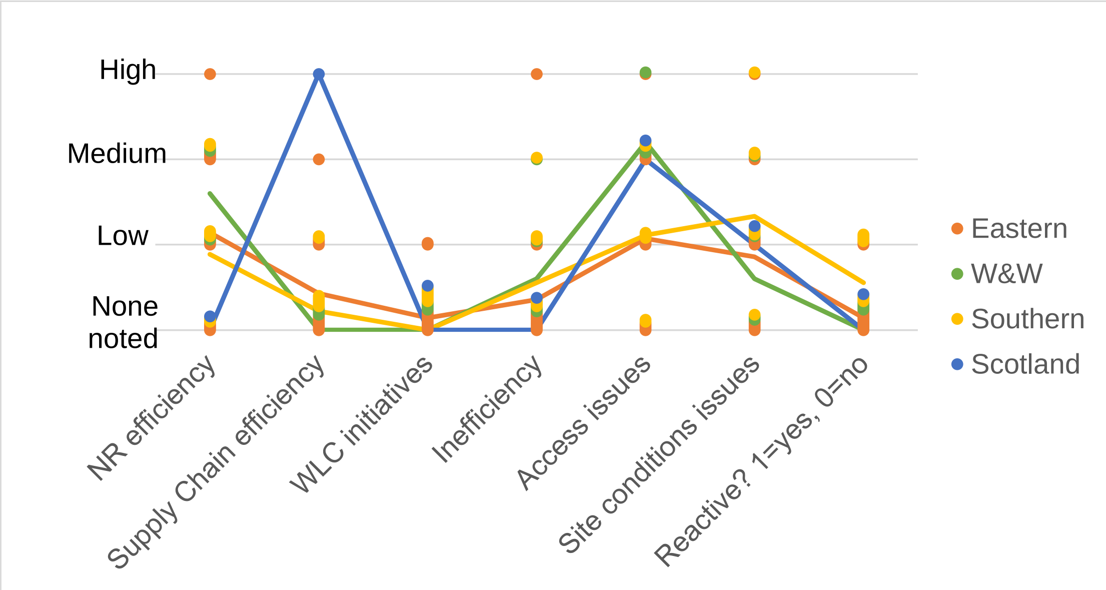

Figure 11 – individual project scores (dots), for each of the items in the simple balance model (solid lines are Regional average – note there was only one project for Scotland)

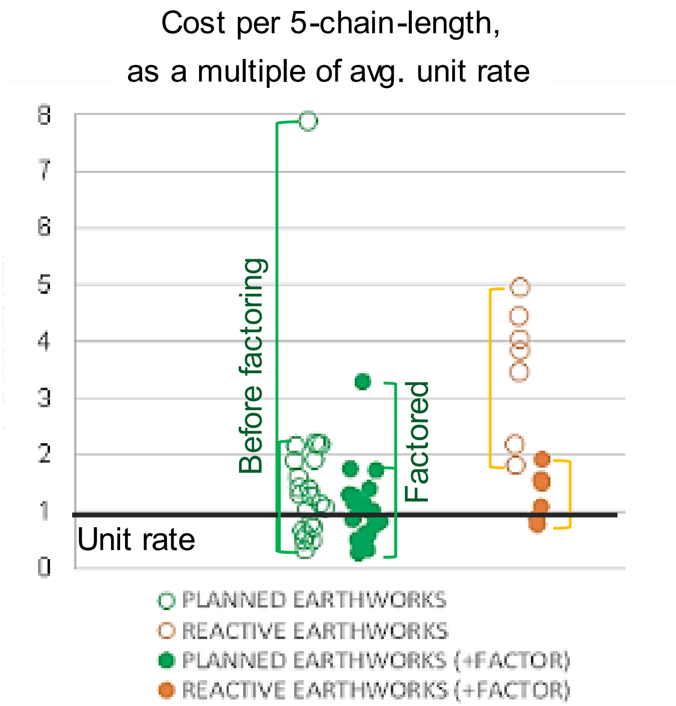

Figure 12 – Hollow dots show costs per effective volume (as shown in Figure 2a); solid dots show the same data, if the unit rates were factored for the items in the simple balance model

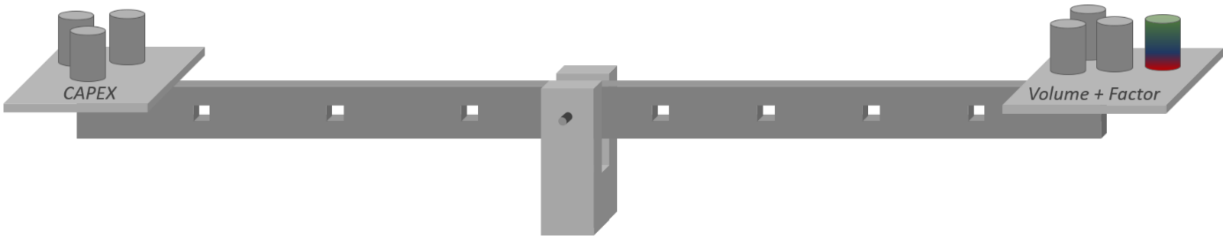

Figure 13 – Schematic model with a single, combined weighting factor

We are not suggesting that Network Rail needs to adopt this model. Network Rail already has reasonable processes in place to manage some of these factors individually (such as H.E.T.I. logs for efficiencies; and many of these factors will be discussed within the text of re-authority papers asking for additional funds). What we are suggesting is a need to discuss a mechanism to collect all of this information at Regional level and present it transparently, so that all stakeholders can understand what the cost and volume data is telling us in each Region, plan better for CP7 and incentivise good decision making. See REC A4.

4. Conclusion and Recommendations

4.1 Conclusion

Overall, the evidence collected in this TAR assured us that Network Rail and its supply chain are delivering earthworks in a reasonable way. However, we identified that **Network Rail may not be following best practice** when using portfolio average unit rates as target costs on individual earthwork renewals; **we are recommending additional guidance**.

There are several areas where additional transparency would help ORR, stakeholders and Network Rail themselves to make better informed decisions. For example, for CP7 some Regions may need to request more funding per renewal volume (on average across the portfolio, before efficiencies) to improve overall weather resilience, or to deliver challenging projects which have been deferred from previous control periods. However, this change in funding will be difficult to justify unless all parties are clear how the end-products are changing. Conversely, some Regions may propose less funding per renewal volume because of funding constraints, in which case it is essential that all parties are clear on what is being compromised to achieve this reduction. **We are recommending additional transparency around the nine key factors and providing Regional policies on how the factors within Network Rail's control should be applied**.

4.2 Recommendations

Our recommendations are summarised in Figure 14.

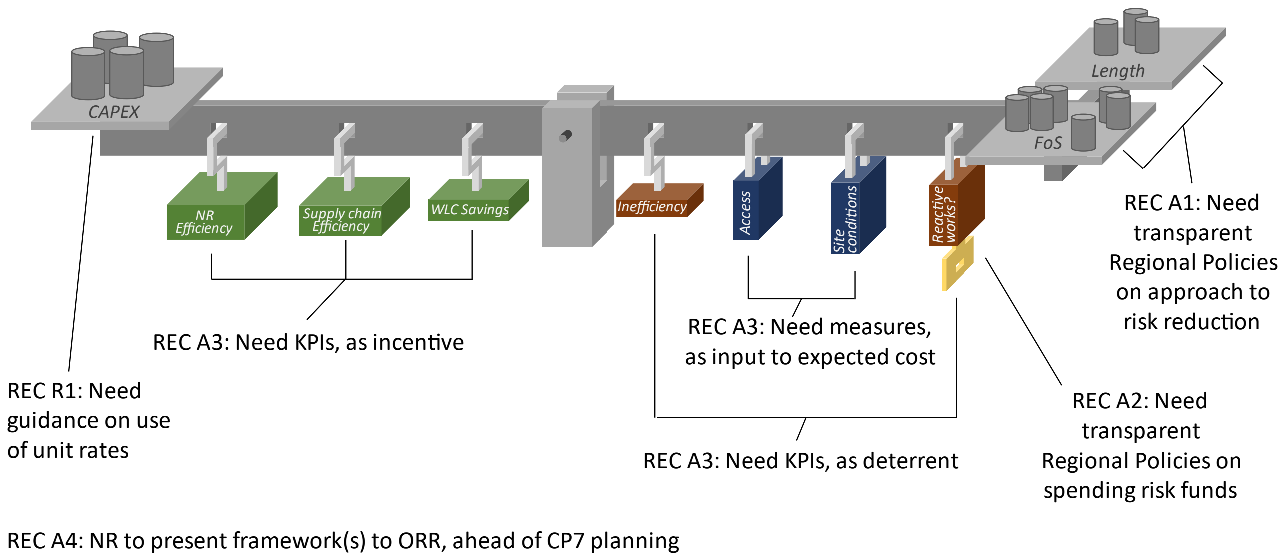

Figure 14 – Schematic model, showing the nine key factors and all recommendations for Network Rail

Some recommendations provided may describe actions Network Rail is already planning as part of its Strategic Business Plans for CP7. We are open to discussing alternative methods to achieve the required level of transparency.

(a) Red recommendations – where Network Rail may not be following best practice and we recommend action as soon as practicable.

REC R1 Network Rail (nationally) should develop guidance on the intended use of portfolio-averaged unit rates by Regional asset management teams, finance teams, delivery teams and the supply chain. This guidance should clarify that portfolio-averaged unit rates are not intended for use as a target cost for individual projects. This guidance should be communicated to all relevant personnel including central, Regional and delivery teams.

This guidance may need to include advice and support on Network Rail's re-authority processes; or this may be better achieved by separate guidance in each Region.

Action on Director of Business planning & Analysis to develop guidance and communication plan.

(b) Amber recommendations – where there is opportunity for significant improvement and we recommend actions ahead of Network Rail issuing Strategic Business Plans for CP7.

REC A1 Network Rail Regions should develop transparent policies for CP7, explaining their approach to risk reduction for earthworks renewals. This should be in terms of length of renewals and design standards (i.e. factor of safety, design life and allowance for climate projections). This should outline decision-making processes, for example: a baseline for each project and criteria (or thresholds) which would trigger a change in length or design standard.

Action on DEAMs in each Region to develop policies.

REC A2 Network Rail Regions should develop and implement transparent policies for CP7, explaining their approach to funding reactive works. This should clarify decisions on funding allocation between planned renewals and risk; and the decision-making process including criteria (or thresholds) for using risk funds, as opposed to re-prioritising other planned works.

Action on DEAMs in each Region to develop policies.

REC A3 Network Rail (regionally, or agreed nationally) should *either*: identify existing Network Rail measures/KPIs *or* develop new measures/KPIs to quantify the nine key factors in Table 4.1; and describe these in a written clarification to ORR. It should be possible to summarise these measures/KPIs at portfolio level, to allow reporting to ORR annually by Region or sub-Region, to help interpret regulatory reporting. *Examples are given in the table below for discussion purposes only and may not be achievable.*

Action on DEAMs in each Region to provide written clarification to ORR, with new or existing measures.

Measures to quantify Network Rail project decisions, or policy targets	'Length' *e.g. average length of intervention in each 5-chain-length, summarised from Form1 reports?*
	'Factor of Safety' *e.g. Average renewal design life, or % of renewals designed to EC7, summarised from Form1 reports?*
Measures to quantify factors outside of Network Rail's control	'Access' *e.g. average land rental costs by line of route? Or a difficulty rating for rural vs urban areas?*
	Site conditions *e.g. input parameters from EHC/EACB calculations, reflecting geology, geometry and groundwater?*
Measure to quantify actual proportion of works	Reactive renewals *e.g. % of renewals which are reactive?*
KPIs to quantify efficiencies, with targets to incentivise good decision making	Inefficiency *e.g. % overspent, summarised from H.E.T.I. logs?*
	Network Rail efficiency *e.g. % saved, summarised from H.E.T.I. logs?*
	Supply Chain efficiency *e.g. % saved, summarised from H.E.T.I. logs?*
	Whole Life Cost savings *e.g. % extra cost and average Benefit:Cost ratio, summarised from authority papers?*

Table 4.1 Nine key factors and examples of possible measures

REC A4 Network Rail Regions should quantify factors currently affecting earthworks renewals in CP6 and any planned (or foreseeable) changes in CP7; and describe these in a written clarification to ORR. This should address all the nine key factors presented in this report. We do not require Network Rail to use the exact model presented in this report and they may choose to present an equivalent system of their own.

Action on DEAMs in each Region to provide written clarification to ORR.

REC A5 ORR should carry out benchmarking between all Regions, based on the information provided from the recommendations above; and present this to Network Rail before we begin our detailed technical reviews for PR23. This should outline any areas where there remains a lack of transparency, so these can be clarified, rather than ORR having to rely on assumptions in PR23.

Action on ORR Asset Lead for earthworks & drainage to present benchmarking to DEAMs.

5. Appendix A - Questionnaires

5.1 Questionnaire sent to Network Rail delivery managers for each project, discussed at interviews, answers provided by delivery managers in writing after the interviews.

Subject area:	Question:	Answer:
Project Info	Route or Region	
	Project	
	In delivery / Delivered?	
	Delivery Agent (CapDel / WorksDel)	
	Contact	
	Design contractor	
	Contact	
	Delivery contractor	
	Contact	
Benefits	How did you (or someone else) define the benfefits this project will deliver?	
	What was the Earthworks Hazard Category -or- Drainage Condition Score?	
Scope evolution	Briefly describe the initial scope/specifications given to you by "your client"	
	What options were considered at Option Selection?	
	Which option was selected for GRIP4>?	
	What scope changes occurred after GRIP3? (and who's idea was it?)	
	Were there any particular access/other issues?	
	Were any particular efficiencies identified?	
Cost range evolution (where you were involved)	Start of project	
	What was the cost range for the GRIP3 options?	
	End GRIP3	
	End GRIP4	
	End GRIP5	
	End GRIP6	
	Final reported	
	System used to report cost	
	Costs for any particular access/other issues?	
	Saving from any particular efficiencies?	
"NR Volume" evolution (e.g. 5-chain-lengths of earthwork, or m of drainage pipe)	Start of project	
	Single option selection	
	Final reported	
	Date reported	
	System used to report vol	
"Engineering volume" evoultion (e.g. no. of soil nails, m of sheet pile)	Start of project	
	Single option selection	
	Final	
	How were these reported?	
	How long was the intervention? (m)	
Benefits	How do you (or someone else) measure the delivered benefits?	
	What is the new Earthworks Hazard Category -or- Drainage Condition Score?	

5.2 Questionnaire sent to Supply Chain teams for selected projects, discussed at interviews, answers written up by ORR and sent to Supply Chain for any comments.

Subject area:	Question:	Answer:
Project Info	Route or Region	
	Project	
	In delivery / Delivered?	
	Delivery Agent (CapDel / WorksDel)	
	Contact	
	Design contractor	
	Contact	
	Delivery contractor	
	Contact	
Benefits	For each project, what are you given in terms of Aims, Outcomes or Benefits (as opposed to specifications)	
	Do you know about Earthworks Hazard Category -or- Drainage Condition Score?	
Scope evolution	How is the project scope communicated to you?	
	How does the process of scope evolution happen? (are you active or passive)	
	On this project how was the final scope agreed?	
Cost range evolution (where you were involved)	Do you have any unit rates (agreed with NR or your own)	
	Please talk us through how you provide initial cost estimates to NR?	
	On this project, did NR set you an initial cost target (before doing design)?	
	How did you develop the final agreed cost?	
	Was this job lump sum? T&M? D&B? Does this have any impact on your conversations on scope with NR?	
	Do you have standard markup? Or do you adjust for each job?	
	Did your final invoice match the estimate? if not why not?	
	From your point of view, were there any site specific issues? E.g. location, existing facilities, neighbours etc?	
	Were there any supply chain driven efficiencies?	
"NR Volume" evolution (e.g. 5chain lengths, or m drainage)	Do you quantify in term of "5 chain length" volumes?	
"Engineering volume" evoultion (e.g. no. of soil nails, m of sheet pile)	For this project - do you have any evidence you could send us, summarising the PLANNED quantities - e.g. number of anchors, length, diam etc	
	as above, for ACTUAL quantities	
	Do you provide/promote any innovative materials or techniques?	
Portfolio and other factors	Do you have any targets (from NR or internal) un sustainability / environmental / carbon etc?	
	To what extent are you involved in conversations about Weather Resilience & Climate Change (with NR or others)	
	Internally, how do you post-analyse these projects - e.g. unit rates? NTOT? Any other measures/KPIs?	
	How much visibility do you have of future NR projects? Is this an issue/concern for your internally planning?	
	Do you have any concerns about availability of people/plant/labour (looking forwards to CP7)	
	Do you have any input into NR's planning?	
	What factors cause you to charge NR MORE or LESS than other clients for the same work? E.g. railway safety/training, paperwork etc	
	Are there any factors working with NR which could improve your cost efficiency?	
Benefits	Please talk us through the handover / as-builts process (e.g. H&S file, final accounting etc)	
	Do you have any tracking/follow up on the projects after handover?	

5.3 Questionnaire discussed at interviews with RAMs in 4 Regions (Eastern, Scotland, Southern, Wales&Western), answers written up by ORR and sent to RAMs for any comments.

Question:	Answer:
Route/Region	
Attendees	
Date	
Intro – purpose of this discussion For earthworks and drainage, the high level costs and volumes reported to ORR are opaque on what renewals are actually delivering. Hence, this TAR will collect detailed cost & vol information for a small sample of individual renewals. This meeting is to pick the sample and get deliverers' contact details	
Q1: At what (GRIP?) stages do you track cost & vol numbers for each project? Starting from "policy says we need a renewal…"	
Q2: What processes/ systems do you use for reporting costs and volumes? (e.g. Hyperion? Ellipse?) Target + Actual	
Q3: Do you (/how do you…) challenge the numbers from deliverers? Or is that up to CapDev?	
Q4: Are you happy with your current delivery agents? (CapDel?)	
Q5: Are you happy with your current procurement set-up? i.e. your CP6 framework contractors + ….?	

5.4 Table provided to RAMs in 4 Regions (Eastern, Scotland, Southern, Wales & Western), populated by RAMs in writing after the interviews.

Type	Renewal	Contact details for NR delivery team	Details of design/delivery suppliers (if known)	Any info available on evolution of cost/vol?			Final values
				GRIP0/assumed unit rate	GRIP 3 estimate	GRIP 5 estimate	
Delivered				Cost: Vol:			
				Cost: Vol:			
				Cost: Vol:			
GRIP1-5, not yet delivered				Cost: Vol:			NOT YET DELIVERED
				Cost: Vol:			
				Cost: Vol:			

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