

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

Schedule Management Plan

Story: SCIRT Management Plans

Theme: The SCIRT Model

A plan which describes SCIRT's approach to schedule management.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz



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Schedule Management Plan

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Rev.	Status	Prepared by	Checked by	Date
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1. ACRONYMS & SUPPORTING DOCUMENTS

The following acronyms are used in this document:

Board:	SCIRT Board
MT:	SCIRT Management Team
CCDU:	Central City Development Unit
DM:	SCIRT Delivery Manager
ECI:	Early Contractor Involvement
FWC:	Forward Works Coordination
FWP:	Forward Works Plan
GM:	SCIRT General Manager
IST:	Integrated Services Team
PRJ:	Project Centre - Project File
SCIRT:	Stronger Christchurch Infrastructure Rebuild Team
SDI:	Spatial Data Infrastructure
WSC:	Work Scope Change

The following documents can provide further detail beyond the Schedule Management Plan:

ECI Workflow Process
Delivery Team Meeting and Financial Schedule
SCIRT Central City Delivery Management Plan
SCIRT Document Naming Manual
SCIRT Delivery Initiated Work Scope Change Process
SCIRT Prioritisation Plan

2. PURPOSE

This procedure describes the approach to schedule management taken by the Stronger Christchurch Infrastructure Rebuild Team (SCIRT).

3. OBJECTIVES

The objective of this procedure is to ensure accurate schedule management of the Christchurch Horizontal Infrastructure Rebuild Schedule such that rebuild works are completed by planned completion dates.

The methodology has been developed to provide the framework for the development and maintenance of the schedule to allow assessment of how SCIRT'S

programme of works is progressing, as well as monitor progress at the individual project level.

The benefits of formalising this procedure are numerous, but foremost is maintaining maximum accuracy and clarity in tracking the progress of works: information which is invaluable to the project stakeholders as well as the end client, the citizens of Christchurch.

4. RESPONSIBILITIES

SCIRT's General Manager (GM) is responsible to the SCIRT Board for the establishment and maintenance of an accurate time management system for the rebuild programme. The GM has delegated responsibility for implementation of the schedule frameworks set out in this management plan to the Design and Delivery Managers within the SCIRT Management Team.

The Lead Scheduler is responsible for the carrying out and overseeing the scheduling activities set out within this Schedule Management Plan and for reporting of schedule outcomes and issues to the wider SCIRT team.

5. DEFINITIONS

Scheduling manages the time component of a project by breaking down a project into distinct work packages (known as **activities** or **tasks**) with specific start and end dates, linked to each other through logical relationships that project management software can use to monitor progress, examine the impact of progress (ahead or behind schedule), manage resources (manpower, equipment, materials, costs, etc.). These relationships between tasks form the 'critical path' of a project that determines the minimum possible time to completion of a project. The network of these activities and the relationships between them forms the project **schedule**.

6. SCHEDULE DEVELOPMENT

6.1. Programme Schedule

Level: 1

Ownership: Lead Scheduler

Platform: Microsoft Project project management software

The Programme Schedule represents the overall schedule of works carried out under this rebuild programme and provides a framework for the development of the more detailed Project Schedules (defined below). It allows for reporting and monitoring progress of the entire rebuild programme and for co-ordination and allocation of works across the Design and Delivery Teams.

Specifically, the Programme Schedule includes the following features:

Portfolios

The first subdivision of the Programme Schedule is into Portfolios which identify the 'status' of the projects within it. Thus, they can be Active, Complete, in Handover, or On Hold. Further portfolios may be added when and if required as a means of categorisation.

Project List

Each portfolio within the Programme Schedule is further broken down into individual projects, each of which have a unique name and number and are scheduled according to Project Centre and other business reporting systems.

Ownership of the Programme Schedule, its revisions, updates, monitoring and management, is exclusive to the Lead Scheduler. They are responsible for the preparation and maintenance of the Programme Schedule, which includes the following key actions:

- Ensuring priority of projects determined in accordance with the SCIRT Prioritisation Plan.
- Maintenance of the Programme Schedule, such that the logic within the schedule is preserved through the rebuild programme. This function includes incorporation of new projects into the Programme Schedule and maintaining alignment between the Programme Schedule and other systems within SCIRT.
- Actively working with the Professional Services Manager, Design Coordinators, Delivery Teams, and Project Coordinators to ensure that the information being provided is an accurate reflection of the current status of the works at the time of reporting,
- Working with the Commercial Team and the Management Team to extract project management level reporting from the Programme Schedule.
- Reviewing key reporting information on the current status of the SCIRT programme of works such as progress of current activities, potential and actual delays, etc. and communicating such information to key team members.

6.2. Project Schedule

Level: 2

Ownership: Lead Scheduler

Platform: Microsoft Project project management software

The Project Schedule is a further breakdown of the Programme Schedule into individual projects by specific delivery teams. It provides key dates for the start and finish of activities, key milestones and logical links (relationships) between the various activities.

Project Schedules include the following features:

Gate Staged Structure

Each individual project is structured in a staged approach whereby projects progress through 10 project “gates” or phases, identifying all key dates (e.g. commencement, completion, handover, commissioning, etc. These phases are as follows:

0. Project Definition
1. Design Allocation
2. Concept Design
3. Detailed Design
4. TOC
5. Construction Allocation
6. Construction
7. Handover
8. Practical Completion
9. Project Completion

The above framework is required to align with the SCIRT Data Warehouse and other project systems.

Construction Duration

It should be clarified that the Construction activity represents the start and finish of the Delivery Team’s physical presence on site and at this level, provision is made for pre-construction activities (such as procurement) by a logic link and ‘lag’ (duration of time) between the end of the TOC activity and the start of the Construction activity. The end date of construction includes post-construction activities such as walkovers for final inspection and snag lists.

Project Allocations

The Project Schedule identifies the allocation of Projects to both design and delivery teams, allowing the schedule to be filtered for reporting purposes, and in order to identify the project 'owner' responsible for updating at any time in the project's lifecycle.

Cost Management

The Project Schedule incorporates TOC estimate project values on each individual project, which are used to predict forward cash flow assessments and to assess workload allocations across delivery teams.

Project Baselines

Once timeframes for delivery of the project schedule have been prepared and agreed this information is "baselined" and subsequently used to report actual progress against the expected delivery dates. More on this process is explained below.

The SCIRT Scheduling Team will be responsible for reviewing the preparation and maintenance of the Project Schedules to ensure consistency with the Programme Schedule. The Delivery Teams should provide a valid timeframe for execution of their works and progress updates which are an accurate reflection of the current status of the works at the time of reporting. Inconsistencies within information present will be addressed and mitigated as part of this process.

Ownership of the "live" Project Schedule, its revisions, updates, monitoring and management, is exclusive to the Lead Scheduler.

6.3. Detailed Construction Schedule

Level: 3 and below

Ownership: SCIRT Delivery Teams

Platform: Various project management software

The Detailed Construction Schedule is a further breakdown of the Project Schedule in order to indicate the detailed construction works undertaken within each project. The Delivery Teams are responsible for its creation and management and for interfacing with the Lead Scheduler for frequent updating of progress. Each delivery team is free to develop their own format, platform and methodology for maintaining the Detailed Construction Schedule, however, updates and information sent to the Lead Scheduler must be in a format acceptable to them as well as at a level of detailed in accordance with the gated structure of the Project Schedule described above.

The detailed construction schedule must be accurate, well prepared and well maintained to enable the successful completion of construction for each project. It must be created with sufficient detail to enable schedule risk management at a project, portfolio and programme level. All construction schedules must be detailed enough to enable members of the IST and the Delivery Team to be fully informed at any time of the Delivery Teams' intentions and expectations.

Whilst the detailed planning of all construction activities is the responsibility of the Delivery Team, it must meet a certain level of detail in order to satisfy SCIRT's Scheduling Management requirements.

The Detailed Construction Schedule must consider and allow for:

- All construction activities should be divided into discrete activities.
- All physical works activities should be under a Construction summary bar which displays the overall construction duration.
- Activity list should align with the Traffic Management Staging plans of the project.
- Significant pre-construction activities (such as Procurement) should be displayed.
- The schedule should be risk adjusted and should identify how the Delivery Team is allowing for schedule risk within the project.
- The critical path of the project should be identified.
- Any communication and property requirements should be identified.
- Procurement lead times should be included.
- Activities representing Commissioning, Testing and Inspection should be shown
- Consideration should be given to the handover phase of the project and displayed in the schedule.
- All dependencies within the project schedule should be shown. Any dependencies outside of the scope of the project (i.e.: interdependencies between projects by the same Delivery Team or other teams) should be identified and displayed.
- Any client requirements should be identified.

6.4. Scheduling Platform & Interfaces with Reporting Systems

Scheduling at SCIRT under the infrastructure rebuild is carried out using Hiviz (a bespoke SCIRT database and business system used for reporting)

Hiviz operates through a single "live" file on SCIRT's server, which can be accessed by multiple users (the members of the Schedule Management Team). This "live" file stores data in a database which allows project information to be captured and then filtered and structured for various project reports.

Access to edit the programme schedules is exclusive to the Lead Scheduler, who hold responsibility for creating, updating, monitoring and overall management of the Programme Schedule as defined above.

The Programme and Project Schedules managed by the Lead Scheduler are developed alongside and integrate with other SCIRT systems as follows:

- Project Centre – A document management and control system, which provides a web-based environment for tracking the status of each work package (project). Functions include allocation of work to design and delivery teams and recording of quality assurance approvals and associated dates as delivery of the work package progresses through the various stages of development. Data which is manually entered into Project Centre by the Lead Scheduler is (but not limited to):
 - Delivery Team Allocations (at ECI and Construction phases)
 - Forecast design phase start and finish dates
 - Construction baseline start and finish dates
- SCIRT Data Warehouse – An IT ‘data warehouse’ environment, which collects outputs from all the various project systems (financial, scheduling and document management) and forms a central environment for the preparation of project reports for tracking and control of the Programme. The SCIRT Data Warehouse is the main interface between Microsoft Project and the other project systems and extracts live schedule data automatically overnight which is processed by the IST Business Systems team for their reporting and other functions. As a data validation exercise, the SCIRT Data Warehouse also extracts project numbers, titles, phase and value from Microsoft Project and compares this data with other systems.
- GIS System - a geospatial representation of projects on a map indicating geographical location and boundaries of all projects within the SCIRT programme of works. Data displayed is extracted from the SCIRT Data Warehouse (which in turn extracts data from Microsoft Project) such as:
 - Project number and name
 - Design Team allocation
 - Delivery Team allocation
 - Project phase start and finish dates
 - Baseline start and finish dates
- Other Systems – Interfaces with Utilities and Traffic Management systems have been developed and are being refined over the life of the SCIRT programme of works.

6.5. Schedule Requirements during ECI (Early Contractor Involvement)

6.5.1. During Concept Design

At the completion of the Concept Design stage:

1. The ECI Team is required to confirm the outline construction schedule for each project they have been allocated for ECI. Since detailed information is not always available, the minimum level of detail for this schedule must have at least the start and finish construction dates.
2. This schedule must be uploaded via Project Centre to comply with the ECI Workflow Management Process.
3. When uploaded to Project Centre, the schedule will meet the SCIRT naming convention requirements:

NNNNN-PH-DC-DT-nnnn[1]description

- *NNNNN is the Project Identifier and represents the SCIRT Project Number*
- *PH is the Project Phase and represents the phase of the project*
- *DC is the Discipline Code and represents the project's technical discipline*
- *DT is the Document Type and represents the type of deliverable*
- *nnnn is the Sequence Number and is controlled by the project document*
- *[#] is the Revision Number*
- *Description is the title of the document*

EX: 11156-EC-WW-SH-0001[1] Construction Schedule

For further information on the SCIRT Document Naming Convention, please reference the SCIRT Document Naming Manual.

6.5.2. During Detailed Design

At the completion of the Detailed Design phase and prior to TOC development:

- The ECI Team is required to provide a detailed construction schedule to aid TOC development.
- This schedule must be uploaded via Project Centre to comply with the ECI Workflow Management Process.
- When uploaded to Project Centre, the schedule will meet the SCIRT naming convention requirements.

EX: 11156-EC-WW-SH-0001[1] Construction Schedule

6.6. Baselines

6.6.1. Setting of the Baseline Detailed Construction Schedule

Prior to construction commencing, the Delivery Team must supply the IST with a Detailed Construction Schedule (see above for typical requirements) for agreement, which becomes the Baseline Schedule for the project. Specifically:

- Agreement of start and finish baseline dates between the Project Coordinator and the Delivery Team will take place within one week of the end of Allocation (the start of Construction gate), or at a later time with the approval of the Delivery Manager.
 - a. Communication of these dates to the Lead Scheduler is to be via Project Centre and they will be set immediately in Project Centre by the Lead Scheduler.
- The Baseline Schedule indicating the agreed baseline start and finish dates will be submitted to the Lead Scheduler by the Delivery Team following agreement with the Project Coordinator during the Pre-Start Handover Meeting prior to physical construction start.
 - a. Submission of the Baseline Schedule to the Lead Scheduler must be via Project Centre, and must follow SCIRT naming convention (EX: 11156-CN-WW-SH-0001[1] Baseline Construction Schedule).
- This schedule will be the baseline against which project progress will be measured and reported.
- The only way for baseline dates to be amended is through the Work Scope Change process.

Please also refer to the appended Construction Baseline Administration Process.

6.6.2. Baseline Adjustments

When applying for a Schedule Adjustment resulting from a WSC, the Delivery Team must provide details in order to justify the time adjustment being requested. These details typically take the form of a revised Baseline Detailed Construction Schedule as well as the original Baseline Detailed Construction Schedule (or previous revision) in order to present a clear “before and after” picture of the impact of the WSC to the Critical Path of the project.

Over time, significant changes made to a project (reflected in Work Scope Changes) are reflected in the various versions of the baseline schedule (each of which is uploaded to Project Centre for future reference). These

revisions of the baseline are a separate schedule from the “live” or “current” schedule which is updated on a monthly basis by the Delivery Teams.

Please also refer to the Work Scope Change process (separate document) and Construction Baseline Administration Process (in Appendix A) for additional detail.

7. PROGRESS REVIEW AND SCHEDULE UPDATING

7.1. Detailed Construction Schedule Updates

During the Construction phase, the Lead Scheduler requires monthly construction progress updates on each Delivery Teams’ portfolio of SCIRT works, that is all projects allocated to a Delivery Team for ECI and Construction. These monthly updates will meet the below requirements:

- Updates the current status of each project within a Delivery Teams’ portfolio of projects.
- Submitted on a frequency not less than monthly.
- The submission deadline for monthly reporting is the last Wednesday of each month, in order to allow for input of the data into the Programme Schedule by the Lead Scheduler for accurate alignment with Financial reporting.
- The progress update can be sent by email but must also be stored in Project Centre (by the Lead Scheduler or Delivery Teams) for future reference.

Beyond the regular monthly updates, the Lead Scheduler will only become involved in detailed scheduling in support of exception based reporting.

7.2. Project Schedule Updates

At a higher level, progress and performance for the larger infrastructure rebuild programme will be monitored at the Project Schedule level by the SCIRT Scheduling Team and be measured against baselines on a monthly basis (or more frequently).

Specifically, the SCIRT Scheduling Team is responsible for coordinating with the Design, Commercial and Delivery Teams over the updating of progress on their respective activities in the Project Schedule and identifying any gaps and omissions in the process. The Lead Scheduler also reviews items such as slippage, scope changes and relationships between projects across the Programme.

The Design Coordinator will communicate updates to start/end dates of the design phases (Design Allocation, Concept Design, Detailed Design) to the Lead Scheduler, who will update manually the relevant Project Schedules in Microsoft Project,

examine the logic, sequencing and other criteria and respond with queries where required.

The Commercial Team shall communicate updates to construction estimate (TOC) dates to the Lead Scheduler, who will update manually the relevant Project Schedules in Microsoft Project, examine the logic, sequencing and other criteria and respond with queries where required.

Updates to the Project Schedule by the Lead Scheduler are a critical component of the time management of the Alliance's programme of works, and there is constant communication between the Lead Scheduler and the Delivery Teams to discuss any potential time issues, rescheduling, reprioritisation, etc.

7.3. Programme Schedule Updates

The Programme Schedule update is the highest-level result of the monthly review of the updated Detailed Construction Schedule submitted to the Lead Scheduler by the various Delivery Teams, and the updates made to the individual Project Schedules by the Lead Scheduler.

8. CENTRAL CITY PROJECTS

Due to the additional coordination requirements of all Central City works with CCDU and external stakeholders, these projects require an increased amount of schedule management and visibility from the Delivery Teams to the Lead Scheduler and IST.

SCIRT is also required to provide scheduling input to the SDI system, which provides an integrated view of all rebuild activity in the Central City.

Every project that falls within the Central City or significantly affects any Central City project must meet the following additional Schedule Management requirements.

1. Unless instructed otherwise, an increased frequency of progress updates is required as specified by the Lead Scheduler. These progress updates must report on any changes to the forecast detailed construction schedule in a format suitable for input into the SCIRT SDI Tool as instructed by the Lead Scheduler.
2. The weekly update will be submitted by the Delivery Team Scheduler to the FWC email address: fwc@scirt.co.nz

For more information, requirements and methodologies associated with the delivery of the horizontal works within the Central City, please refer to the SCIRT Central City Delivery Management Plan.

9. CRITICAL PATH AND FORMATTING

It is required that ***all*** of the schedules referred to in this document, and in particular those generated by the Delivery Teams, follow some universally accepted standards of presentation, regardless of whether they are a preliminary ECI schedule or a detailed construction schedule. This could include, but not limited to, the following features:

- A clear and representative list of activities, with corresponding duration (in days) and start/end dates
- A bar chart (Gantt chart) visually representing the above list of activities
- Visible logic links (relationships) between the various activities in a schedule, with no “open ends”
- Colour coding or other notation to indicate the Critical Path
- A page border or frame including at least the following information:
 - Project number (SCIRT project number) and title (this can be shown in individual bars if the schedule is a portfolio of multiple projects)
 - Delivery Team logo/name
 - “Data date” of schedule (which may or may not be the date of printing)
 - Printing/output date
 - Page numbers
 - Contact person (if not the Delivery Team scheduler)

10. HANDOVER AND PRACTICAL COMPLETION SCHEDULING

The Handover phase has a default duration of two months. After the Project reaches the Handover phase, the Delivery Team in conjunction with the Handover Coordinator and the Lead Scheduler can modify the duration by manually entering a “Target Handover Date” in the PRJ file.

The Defect Liability phase is required to be twelve months. However, for many projects the twelve month period has expired. In order to schedule the various requirements of this phase, Delivery Team in conjunction with the Completions Coordinator and the Lead Scheduler can modify this end date. This date is controlled by the “Expected Defects Liability Completion Date” in the PRJ file.

APPENDIX A – CONSTRUCTION BASELINE ADMINISTRATION PROCESS

