Superseded by T HR CI 12135 ST

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Technical Note

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Subject: Withdrawal of ESC 430 *Rainfall Monitors* and TMC 431 *Rainfall Monitors*

This technical note is issued by the Asset Standards Authority as a notification to remove from use the following RailCorp documents:

- ESC 430 *Rainfall Monitors*, Version 1.1
- TMC 431 *Rainfall Monitors*, Version 1.1

ESC 430 and TMC 431 are presented as legacy documents and should be used for reference purposes only.

ASA standard T HR CI 12135 ST *Rainfall Monitors*, Version 1.0 supersedes these documents.

Authorisation

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ESC 430

RAINFALL MONITORS

Version 1.1

Issued December 2009

Engineering Standard

Owner: Principal Engineer Geotechnical

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Document control

Revision	Date of Approval	Summary of change
1.1	December, 2009	Changes detailed in Summary table below
1.0	September, 2006	First issue as a RailCorp document. Replaces C 2480, C 2490

Summary of changes from previous version

Section	Summary of change
Document Control	Three year review. Change of format for front page, change history and table of contents
All	Minor editing and formatting.
Various	Minor additional criteria specified

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1 Purpose, Scope and Application

This standard specifies the requirements for the design of the systems for the automated monitoring of rainfall.

The appropriate engineering and operating response regime is specified in the document.

This document is applicable to all RailCorp infrastructure districts.

2 References

2.1 Australian and International Standards

Nil.

2.2 RailCorp Documents

Nil.

2.3 Other References

Nil.

3 Design

3.1 General

An automatic rainfall monitoring device is an instrument to measure changes in environmental conditions that may alter the level of risk to train operations.

When the level of risk exceeds predetermined limits, train operations are to be restricted accordingly and engineering staff notified for immediate action.

Civil Maintenance Engineers shall determine where an automatic rainfall monitoring system is to be installed.

When determining the need for the installation of an automatic rainfall monitor, the location, the acceptable level of risk to be adopted and the system configuration, due consideration shall be given to:

- Local geography
- Local geology
- Climatic conditions
- Local rainfall history
- Characteristics of catchment area
- Drainage capacity of the waterways and existing drainage structures
- Earthworks stability (stability of track formation, embankments and surrounding cuts)
- Train operating factors (such as speed, load, tonnage, response time etc.)
- Engineering measures and actions.

3.2 Geotechnical

The Principal Engineer Geotechnical or nominated representative shall provide advice regarding the following issues:

- rainfall conditions which are critical for geotechnical features around the railway track, at least in general terms, and

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- preferred geotechnical options or monitoring, such as:
- slip detectors rather than rainfall monitors,
- piezometers rather than rainfall monitors,
- a rainfall monitor on site,
- a rainfall monitor in the general area in conjunction with some other monitoring,
- generalised monitoring in the general area.

3.3 Hydrological

The hydrological design shall determine:

- waterway capacities at nominated critical location/s,
- critical storm events (duration and intensity), time to peak flow (concentration time), and return periods for critical waterways,
- critical storm events (duration and intensity), and return periods for critical geotechnical feature/s,
- catchment details such as boundaries, area, slope, length of waterways and ~~return period of various storm events,~~ determination of which catchments are likely to be critical (ie. to be first to generate major storm events),
- assessment of the past rainfall events where the impact was known, eg. the return period, intensities and durations of storms,
- assessment of significant climatic factors in the study area such as the expected variability of rainfall distribution, the propensity for unexpected high intensity storms and the impact of tides on coastal waterways;
- Assessment of the Probable Maximum Flood (PMF) for different return periods at critical location/s;
- Assessment of the impacts of detention structures and vegetative cover on retarding of the probable floods;
- Assessment of the impacts of human activities such as roadway cuttings, mining, urban development, landscaping, etc on retarding or intensifying of the probable flood.

3.4 Risk Characteristics and Protection Levels

The risk characteristics of the nominated sites shall be assessed in order to determine the level of protection required.

Factors to be considered include:

- traffic density,
- type of traffic,
- whether long freight trains are running which require long stopping distances,
- whether there is life threatening risk to adjoining landholders,
- level of risk involved in the rainfall generated problems.

3.5 System Characteristics

Each automatic rainfall monitoring system shall have a two level alarm system:

- Red: stop trains
- Yellow: warn trains and inspect track.

An assessment needs to be made of the response characteristics of the Train Control/Civil Maintenance organisation such as:

- Length of time for trains to be warned/stopped,

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- Length of time for civil staff to inspect the track if it is closed,
- Impact of holding up traffic, eg. a peak hour Red alert, particularly if unnecessary due to a false alarm and/or low importance of the event.

3.6 Design Outcomes

3.6.1 Remote Sensors

For installation of remote sensors, the following items should be determined:

- Locations (generally which sites are to have devices)
- Placement (the exact physical placement)
- Type to be used (type and characteristics of device/s)
- Security details (housing, disguise, placement considerations)
- Backup (secondary devices, multiple gauges if required).

3.6.2 Communications

The following communication options may be employed:

- From remote site/Telstra line/Railcorp line radio link
- Connection to phone network if applicable
- Connection to Control Centre
- Communications protocol to be used.

3.6.3 System Software and Hardware

In relation to the required software and hardware, the following information is to be provided:

- Capacity of data collection devices to be used on site
- Capacity and location of computers or other devices for control of the system
- Particular software and hardware devices to be used.

3.6.4 Alarm Settings

The settings of alarm system at each site to detect the critical rainfall events shall be specified based on the information collected in accordance with Clauses 3.1 to 3.5.

3.6.5 Procedures

The adopted procedures shall include the following items:

- Schedule of responses required by operating staff for alarms at each site or section, covering:

Red alarm	where to stop trains
Yellow alarm	what speed or other restrictions to apply and where and how trains are to be warned
Faulty device	procedures for dealing with faulty devices

- Additional responses may be required such as notifying emergency services groups, and notifying adjoining landholders in some locations
- Schedule of responses by engineering staff to alarm conditions (including equipment failure) covering who is to carry out inspections for what areas and how is it to be co-ordinated, who is to be spokesperson for instructing control on applying and removing restrictions. Procedures need to cover both minor and major events including situations where alert conditions may continue for several days. Procedures should provide for moderating the impacts of unnecessarily stopping trains. For instance, the response may vary depending on the preceding rainfall that has occurred.

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- Maintenance and testing schedule for the equipment involved, detailing the equipment, testing/ calibration required and testing/calibration intervals
- Data collection arrangements nominating who is responsible for data collation and evaluation and how and when alarm settings are to be adjusted.

4 Installation

Rainfall monitoring systems shall be installed in accordance with manufacturers' equipment specifications and relevant Australian Standards and RailCorp requirements, which shall be specified during the design process.

5 Commissioning

Commissioning of automatic rainfall monitoring systems can only be done when:

- Equipment is in place, functioning and fully tested/calibrated,
- An adequate burn in period has been allowed of at least 48 hours for computer and communications equipment,
- Operational and testing/calibration schedules are in place and relevant handbooks are available,
- Staff are trained in the new systems and issued with the appropriate handbooks,
- Appropriate amendments to the local appendix have been issued by weekly notice,
- Staff duty statements have been amended and staff clearly instructed in their revised duties,
- At least one trial exercise has been held for alert conditions.

6 Response Regime

Reports are to be on the basis of a two level Alarm System:

Yellow alarm:

- Trains to be warned of yellow alarm conditions
- Civil engineering staff to be called to inspect the track and report

Red alarm:

- All trains in the critical area to be stopped immediately
- Civil engineering staff to attend and report
- Modified operating conditions to apply, when authorized by Civil engineering staff
- Normal conditions not to apply again until track certified fit for operations.

The system is to be established so that the primary alarms are situated in the Operations Control Centre as appropriate for each line.

Secondary systems for monitoring the system or its data may be installed in the infrastructure office.

Each monitoring system shall be designed and constructed to provide a continuous self check mechanism and provide assurance to the operations control staff of its accurate, continued operation.

7 Design Documentation

The design process shall generate the following documentation:

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- Design and selection specifications
- Installation and commissioning procedures
- Maintenance and testing procedures
- Establishment of and alterations to alarm limits
- Calibration and control of false alarms;
- Management system
- Operating and response requirements.

8 On-going Assessment

In view of the likelihood of changing conditions over time, the Civil Maintenance Engineer shall be alert for the need for automatic monitoring systems at new locations and the adequacy of the existing systems.

Regular assessment is needed to check the accuracy of the system based on previous performances.

Reassessment shall be conducted at 2 yearly intervals, or less if specified by the Civil Maintenance Engineer.