

Title: **FUNCTIONAL
SPECIFICATION FOR THE
DESIGN AND
CONSTRUCTION OF THE
400kV G.I.S BUILDING FOR
PHILIPPI SUBSTATION**

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EXECUTIVE SUMMARY

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When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

This document has been developed with the aim at setting standards and specifications in order to design a suitable building to house the gas insulated switchgear together with all the related facilities as part of it.

1. INTRODUCTION

Eskom will be constructing a new 400kV (Gas insulated switchgear) GIS building as part of the City of Cape Town Strengthening. The gas-insulated switchgear (GIS) will be housed within a building. This specification sets out the requirements for the design and construction of the GIS building and associated equipment.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

The purpose of the document is to specify Eskom's requirements for the design and construction of the NEW 400kV GIS Philippi Transmission Substation. It gives a clear description of what is required from the professional team and the building design.

2.1.2 Applicability

This document is applicable to the project team involved in the detail design of the building and services.

2.2 NORMATIVE / INFORMATIVE REFERENCES

Normative

- [1] SANS 1200 Standardized Specification for Civil Engineering Construction
- [2] SANS 204:2011 Energy efficiency in buildings.
- [3] SANS 10400-XA:2011 Energy usage in buildings.
- [4] SANS 10114-1 Interior lighting Part 1 Artificial lighting of interiors.
- [5] SANS 10114-2 Interior lighting Part 2, Emergency lighting.
- [6] SANS 10142-1 The wiring of premises – Part 1: Low-voltage installations.
- [7] 240-82172806 Air conditioning in transmission substation buildings and telecommunication sites

2.3 DEFINITIONS

2.3.1 Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

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2.4 ABBREVIATIONS

Abbreviation	Description
SANS	South African National Standard
SACAP	South African Council for the Architectural Profession

2.5 ROLES AND RESPONSIBILITIES

Not applicable

2.6 PROCESS FOR MONITORING

None

2.7 RELATED / SUPPORTING DOCUMENTS

None

3. DESIGN INFORMATION

THIS INFORMATION IS RELEVANT FOR A FUNCTION SPECIFICATION. IT WILL BE INCLUDED AS PART OF CONTRACTING UPON CONTRACT AWARD.

3.1 RESPONSIBILITY OF CONTRACTOR

The contractor shall render professional services by providing functional, cost effective and architecturally acceptable design solution in accordance with the scope of work and technical requirements. The contractor is responsible for the entire design, documentation and execution of the project. This responsibility includes, amongst others the following:

1. Obtaining complete and correct site information.
2. Compliance with the functional requirements of the Client.
3. Compliance with the Eskom policies, standards and other requirements of Eskom by studying the full range of manuals and guides of Eskom and by liaising with the Project Manager.
4. Compliance with the SANS standards and requirements of Local Authorities and other statutory requirements.
5. Execution of the project within the stated space norms and cost limits including the certification of compliance with these. This responsibility includes the redesign and re-documentation at own cost if required to bring the project within the stated space norms and cost limits.
6. Full responsibility for the timeous and complete exchange of information between the contractor and Eskom's appointed representatives during all stages of the project. Regular co-ordination meetings with the Professional Team are required.
7. Setting up of a detailed program for design and documentation of the project and the strict adherence to the target dates set for all stages of design and documentation. The programme to include the work of all disciplines.
8. Monthly reports on progress during design and documentation.

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9. Presentation of designs for review by Eskom.
10. Submission of complete design package to Eskom. Documentation will not be checked by Eskom. Documentation may be spot checked by the Eskom, but the final responsibility of the documentation is still the appointed consultant's responsibility.

3.2 APPROVAL OF DESIGNS

3.2.1 Official approval

Until formal approval of sketch plans has been given by Eskom in writing, Eskom may require you to effect any amendments thereto at any stage in the preparation thereof, or in its sole discretion may require you to prepare new sketch plans without any obligation for additional payment except in case of a major amendment to the brief.

Should the contractor wish to use any proprietary and/or imported articles, finishes, materials or building elements whose use it considers unavoidable, it shall submit such a list thereof before working drawing stage together with written motivation for approval by Eskom.

If the use of proprietary articles, finishes, materials or building elements is approved by Eskom, they shall be clearly specified by name and the suffix "or equal approved" be used. All possible acceptable alternatives should also be specified.

3.2.2 Substitution of uneconomical elements

Where components, materials and/or finishes or other design or constructional elements not specifically indicated on the approved sketch plans, but incorporated in your working drawings, are considered by Eskom to be unnecessary, whether the agreed cost limit is thereby exceeded or not, Eskom reserves the right to require the contractor to amend the documents to substitute with less costly elements without payment of any additional remuneration.

3.3 THE SITE

3.3.1 Location and boundaries

Eskom is responsible for supplying the contractor with relevant documentation for the Site and for setting out purposes. The contractor is responsible for obtaining all other site particulars which are necessary to enable him to design and document the project and for the accuracy and completeness thereof.

3.3.2 Site particulars required

The particulars which the contractor must obtain and verify are:-

1. Levels and dimensions.
2. Physical features and their sizes and positions.
3. Means of access.
4. Adjoining roads and buildings.
5. Services available with sizes, positions, capacities and depths.
6. Servitudes and encroachments, if any.
7. Regulations of Local Authorities.

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8. Local availability of materials including material restrictions
9. Floor space ratios - wind direction
10. Height restrictions - access restrictions
11. Coverage

3.4 THE DESIGN

3.4.1 SCOPE OF WORK (See point 4.4)

Design and construct a GIS and control building and related services for the Philippi Transmission Substation as specified in this and other related documents.

The contractor shall perform architectural designs for Stages 1 to 6 as stipulated below according to South African Council for the Architectural Profession.

Stage – 1. Inception – Full

Stage – 2. Concept and viability (concept design) – Full

Stage – 3. Design Development – full

Stage – 4. Documentation – 4.1 only

Stage - 5. Construction documentation Inspection of the work. Completion certificate

Stage – 6. Close out – facilitate the project close-out with documentation, certificates and as-built drawings.

The appointed Architect shall act as the Principal Agent for the Employer and therefore the Consultant shall work under the Architect.

3.5 DESIGN REQUIREMENTS

The GIS building envelope will be an economical but durable building of concrete, steel and masonry and must consist of the following for the successful operating of the plant. The site location is classified according to ISO 12944:2018 (part 2) as a category C5 very high corrosion environment. This should be taken into consideration in the design concerning steel work and the protection of steelwork against corrosion.

3.5.1 GIS BUILDING

3.5.1.1 Height of building

The height will be determined by the contractor taking into account electrical layout of the substation, working clearances, constructability, maintainability and accessibility for the successful operating of the overhead crane over the plant.

3.5.1.2 Width of building

- a) The width of the building shall be determined by the layout of the plant.
- b) Adequate space shall be provided on either side for maintenance scaffolding to be erected, trenches and entrance doors.
- c) Main off-loading access door shall be situated to be easy accessible from the road.
- d) The access door of suitable size shall be purpose-made steel galvanized sliding door which is electrical operated.

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- e) The door installations shall be dust proof.
- f) The design shall make provision for additional single entrance doors from the office and control room side

3.5.1.3 Cable Trenches

- a) Cable trenches shall be made of reinforced concrete.
- b) Cable trenches shall be waterproof to prevent the ingress of any water.
- c) The floor shall be screeded to drain any possible water to a sump or manhole linked to the stormwater system.
- d) The trench shall be wide enough to provide 600mm wide "O-Line" or similar purpose made cable racking to the one side with enough working space inside next to it.
- e) The contractor shall provide chequered mild steel cover plates over.

3.5.1.4 Cranes

The GIS hall to have an overhead movable crane supported on the sides of the building. The height shall be such that any part of the plant or equipment can be removed or installed to or from the off-loading area. Load capability to lift at least 1,5 times the heaviest partially assembled bay / equipment specified by GIS manufacturer. The crane must be pendant control with RF remote.

Cranes on each floor need to be specified for C5n environmental conditions.

Roof lighting must be serviceable from the crane.

3.5.1.5 Access to upper floors

Provide adequate moving space or openings in floor of min. 10 x 5m for movement and lifting of partially assembled OEM parts or equipment. These areas must be accessible by the crane and be able to lift 1,5 times the heaviest partially assembled bay / equipment.

Provide a separate workspace of 12 x 15m on each floor of the GIS building

3.5.1.6 Building Walls

The walls shall be smooth-plastered and painted with a special durable CES 16U Acrylic coating system or similar to prevent the need to paint regularly. The paint need to last 10 years.

3.5.1.7 Building Floor

The floor shall have a non-slip industrial hard wearing epoxy coating.

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3.5.1.8 GIS Building roof

1. Flat roofs

Flat concrete roofs covered with built up waterproofing membranes generally fail due to a variety of causes and subsequently leak. The use of flat roofs shall be restricted to very specific sections of a building and only on approval by Eskom.

2. Elimination of box gutters

Box gutters are defined as gutters which are so designed that rainwater cannot freely overflow the outer edge for the full length of the gutter, so enabling the water to fall on to the ground outside the building, thus preventing any leakage to the inside.

Box gutters, regardless of material, including those of reinforced concrete lined with a waterproofing membrane, are not acceptable and shall therefor not be used.

3. Pitched roofs over slabs

In all cases where a concrete slab occurs at roof level for constructional or thermal reasons, such as for security or fire protection, the slab is to be covered by a pitched roof. The pitch and covering material may be determined by circumstances of locality, climate and design.

3.5.2 STORE BUILDING

Provide a store building near or attached to the GIS building for SF6 and strategic spares.

The building must be 15m wide x 30m long x 5m high min.

Provide a 4m high crane inside the building of 3 ton capacity and pendant control with RF remote. The crane must extend to the outside to Eskom requirements to be provided.

Roller door size to be 4m wide x 4,5m high and be electrical operated. Provide an additional access door..

Provide electrical socket points every 6m inside on the perimeter wall – height to be provided.

Provide a 3 phase socket point near the entrance of the building.

Lighting to be serviceable from the crane beam.

3.5.2.1 Racking

1) Three systems of 30m, 15m and 24m long against the walls.

Racking shall be of a lightweight galvanised system of 1m wide x 3m high.

Racking intervals at 500mm crs.

Each rack to carry 400kg distributed load.

Horizontal beams of 2,3m long to carry 400kg.

Shelving to be galvanised regtagrid.

2) Three standard duty systems of 24m equally spaced in the middle of the floor.

Racking shall be of a lightweight galvanised system of 1m wide x 3m high.

Racking intervals at 900mm crs.

Each rack to carry 400kg distributed load.

Horizontal beams of 1,8m long to carry 600kg.

Shelving to be treated SAP timber.

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3.5.3 MEWP (machine Elevated Working Platform)

Provide a MEWP and storage building for the spray wash trailer.

The building must be 6m wide x 20m long x 5m high min. It does not have to be attached or next to the GIS building. Access to the entrance door must be concrete.

Roller shutter door size to be 4m wide x 4m high. An additional single entry door to be added for access.

Provide adequate lighting and socket points

3.5.4 GIS EQUIPMENT STORES BUILDING

Provide a stores building adjacent to the GIS, close to the open access area to the upper floor.

The building must be 10m wide x 10m long x 3m high min.

Roller shutter door size to be 2,5m wide x 2,1m high. An additional single entry door to be added for access.

It must house 2 x Dilo gas handling units with 1 X 1000kg Dilo gas storage tank (2,5 x 2 x 1,5m)

Gas storage for 36 x 60kg bottles. Bottles to be secured in racks against wall or separate stands.

Provide a 3 phase and single phase socket points.

3.5.4.1 Racking

5,5m long against the wall.

Racking shall be of a lightweight galvanised system of 600mm wide x 2,25m high.

Racking intervals at 450mm crs.

Each rack to carry 400kg distributed load.

Horizontal beams of 1,8m long to carry 400kg.

Shelving to be galvanised regtagrid.

3.5.5 REPAIRS AND MAINTENANCE

An area within the GIS building is to be available for repairs and maintenance. Provide a separate workspace of 12 x 15m on each floor of the GIS building

The area must be a separate room and easy accessible to transport the parts due for maintenance or repairs.

The way the parts will be transported to the maintenance area must be taken into consideration.

The size of the area must be large enough to comfortably carry out such work necessary on any part of the plant.

The room may be open in front.

The room should be provided with suitable galvanised steelworkbenches with steel plate worktops.

Provide an industrial type vice (300mm) fitted

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Provide powder coated steel wall mounted racking.

Provide steel lockable cupboards.

Provide single phase and three phase electrical points at each workbench.

Provide adequate ventilation and lighting.

3.6 PARKING

Provide covered parking space for three min. vehicles and open parking for 5 cars. The parking must be close to the control room.

3.7 ENERGY EFFICIENCY DESIGN

- a) The building and related services shall be designed to be energy efficient.
- b) The contractor shall provide an energy efficiency report that complies with the SANS 10400 and SANS 204:2011.
- c) The contractor shall provide a fenestration calculation diagram. The aggregate conductance and solar heat gain of the glazing and frame must be calculated and not to exceed the limit.
- d) No windows in the control and battery rooms.

3.8 CONSULTATION WITH LOCAL AUTHORITY

It is the responsibility of the contractor to contact the Local Authority in order to clarify any statutory town planning regulations, building lines, height restrictions, coverage, floor space ratios, safety, fire management and other requirements and approvals.

You must and should consult the Local Authority and Eskom in respect of service connections, such as water, electrical power, sewage and stormwater and comply with their requirements.

3.8.1 STATUTORY REQUIREMENTS

3.8.1.1 Submission of plans to Local Authority

The contractor shall submit the sketch plans to the Local Authority for information and comments. A copy of the submission letter shall be sent to the Eskom representative.

The contractor shall submit the final Eskom approved building plans to the local council for approval. The contractor shall not start construction until the plans is approved by the council.

3.8.1.2 The National Building Regulations

The contractor shall comply with all the National Building Regulations as stipulated in the following standards:

SANS 10400

SANS 204:2011

SANS 10400 – XA

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3.8.1.3 Occupational Health and Safety Act

You must ensure that the finished building complies with the Act in all respects. If on inspection

by the Department of Labour the building is found not to comply you may be held responsible.

3.9 BUILDING ECONOMY

3.9.1 Preference to South African Materials

Imported products may only be used with the prior approval by Eskom. Applications for such approval shall be submitted in writing. The contractor shall then provide written proof to Eskom that no South African product or alternative local material/product is available.

3.9.2 Economy in design

The contractor is required to devote special attention to economy of design in respect of planning, simplicity of form and regularity of structure.

3.9.3 Height of rooms

For economy, room height should be kept to the practical minimum. This will depend on the shape, size and use of the room, due allowance being made for necessary clearance below lighting, other ceiling fittings and lintels.

3.10 OTHER GENERAL REQUIREMENTS

3.10.1 Schedule of finishes

The contractor shall provide a list of a schedule of the main internal and external finishes, either on the plans, sections and elevations or in the right hand column of the relevant design drawings.

3.10.2 Use of trade names

In describing materials, components and finishes the contractor may use descriptive terms. The use of trade names is allowed to describe a product.

3.10.3 Insulation of ceilings

In all buildings the ceilings are to be thermally insulated as stipulated in SANS 204:2011.

3.10.4 Downpipes

In all cases rainwater downpipes must be on the outside of the buildings, not encased in the walls or structure. No downpipes smaller than 100 mm diameter may be employed.

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3.11 MECHANICAL REQUIREMENTS

3.11.1 Noise and pollution

- a) The contractor shall plan the position of mechanical plant, such as air-conditioning, compressors and ventilation, where it will create the least disturbance, but within practical and economic constraints. The contractor shall not place such plant immediately above or below offices, nor near office rooms.
- b) Adequate access to mechanical equipment (for maintenance or replacement) must be provided.

3.11.2 Planning of air-conditioned spaces

- a) Under no circumstances shall the plan for air-conditioning be finalised without the prior written approval by Eskom.
- b) Fenestration design must be in accordance with SANS 204 and orientated such as to minimize the use of air conditioning.
- c) Windows are not to be double glazed, but where exposed to excessive direct sunlight external protection is to be provided.
- d) Where air-conditioning plants are to be provided, the floors shall be waterproofed. An adequate water overflow shall be provided.

3.11.3 Forced ventilation requirements

- a) Forced ventilation by means of extractor fans shall be provided for the extraction of build-up heat and for the extraction of leaked gasses with in the GIS building.
- b) In the event of a fire, the extractor fans shall automatically shut down when the fire alarm is triggered.

3.12 LIGHTING AND POWER REQUIREMENTS

Under no circumstances shall the plan for lighting and power be finalised without the prior written approval by Eskom.

3.12.1 Indoor lighting

- a) The lighting shall conform to the SANS 10114-1.
- b) The general lighting shall consist of high bays or an equivalent type luminaire.
- c) Task lighting shall consist of luminaires installed against the walls, at a height of 3 meters.
- d) Emergency lighting shall comply with the requirements of SANS 10114-2.
- e) The emergency lighting shall be positioned against the wall, and it shall be of a Self-contained, maintained mode.

3.12.2 Outdoor lighting

Adequate outdoor lighting shall be provided for save access around the GIS building.

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3.12.3 Power requirements

Adequate power points shall be provided within the GIS building.

3.13 FIRE PROTECTION REQUIREMENTS

3.13.1 Determination of planning requirements

The planning requirements for fire protection shall be in accordance with the National Building Regulations and requirements of the Local Authority and the local Fire Chief.

3.14 FACILITIES FOR DISABLED PERSONS

3.14.1 Minimum provision

Provision for disabled persons shall be made in accordance with Part S of the National Building Regulations.

3.15 SUBMISSION PROCEDURE OF DESIGN DOCUMENTS

3.15.1 General procedure

- a) Concept drawings shall be submitted to Eskom for review comment and acceptance.
- b) The contractor shall submit a schedule of submission of design documents.
- c) The contractor may be required to present designs in person at the relevant Eskom design review teams.
- d) In case of presentations at the design review teams, the presentation, in the prescribed format, together with the design package (including drawings, calculations and design reports) shall be submitted at least three (3) weeks before the scheduled review date.
- e) For design reviews, the contractor must prepare presentations.
- f) Design review acceptance shall serve as design freeze and the design will thereafter be base-lined.

3.16 AMENDMENTS TO DESIGN DRAWINGS

3.16.1 Notification of amendments

- a) The contractor will be advised of any amendments required by the Eskom Project Manager and whether these are to be made on the design drawings and resubmitted, or incorporated in the working drawings.
- b) Comments, deviations and corrections shall be communicated to the contractor in writing, together with the decision of the review.

3.16.2 Amended design drawings

- a) Where the contractor is required to amend or redraw designs, the first amended set is to be renumbered with the suffix B and C, D etc., in case of subsequent amendments.

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- b) Designs that are not accepted shall be corrected and resubmitted for review and acceptance again.

4. APPROVAL OF DESIGN DOCUMENTS

Upon acceptance of the contractor's designs, the contractor will be notified by the Eskom project manager in writing.

4.1 DOCUMENTATION STAGE

4.1.1 GENERAL WORKING DRAWINGS REQUIRED

4.1.1.1 Compliance with departmental requirements

Since the full detail design of a project is approved at sketch plan stage by Eskom, you are required to comply strictly with the approved sketch plans and any amendments thereto during the preparation of the working drawings.

4.1.1.2 Compliance with National Building Regulations

- a) Construction drawings shall comply with the National Building Regulations.
- b) The contractor is required to submit a certificate stating compliance of designs with the National Building Regulations to Eskom.
- c) The contractor shall submit drawings to the Local Authority as was done with sketch plans.

4.1.1.3 Responsibility for inspection

The contractor is required to provide full inspection services to ensure that the Works conforms to the provisions of the contract.

4.2 QUALITY ASSURANCE

4.2.1 Site inspections

The contractor is required to provide full inspection services to ensure that the Works conforms to the provisions of the contract. Supervision of engineering matters in a building service is the responsibility of the relevant contractor.

4.2.2 Quality control

- a) The contractor shall provide technical assurance during construction to ensure that constructed works is also in accordance with the design.
- b) The contractor is responsible for exercising and correlating quality control of all workmanship, materials, components and finishes.
- c) No deviations from design shall be implemented during construction without prior notification, updating, review and acceptance by Eskom.

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4.3 AS- BUILT DRAWINGS

4.3.1 Preparation of drawings

The contractor shall be responsible for the preparation of accurate as-built drawings on plan and detail section of all foundations.

4.3.2 Submission of drawings

The contractor shall be required to submit copies of all marked-up as-built drawings to Eskom.

4.4 APPROPRIATION (AS-BUILT) DRAWINGS

4.4.1 Drawings required

The contractor shall be required, within three months after first delivery, to furnish the Project Manager with a set of as-built drawings in the form of full size paper prints as well as PDF version.

- a) Drawings shall be correct and clearly marked or stamped with the words "As Built" and signed and dated.
- b) Where applicable, the contractor shall also submit correct quantities of installation, operational, maintenance and any other relevant manuals to Eskom.

4.5 SITING

4.5.1 Site Characteristics

- a) The area where the building will be situated will be on a constructed flat terrace with a maximum fall of 1:100.
- b) Geotechnical information of the site will NOT be provided by Eskom. The contractor shall be responsible to conduct his own geotechnical investigation.

4.5.2 Site Layout

The site layout will indicate all the infrastructure of the substation as follows:-

- a) Security substation boundary fences.
- b) Access gates
- c) On terrace roads
- d) Buildings position
- e) Transformers

4.6 UTILITIES REQUIREMENTS

- a) Eskom will provide the water supply to the required connection point.
- b) Eskom will provide the electrical connection point for construction supply.

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4.7 DESIGN CONFORMANCE ASSESSMENT

4.7.1 Environmental Assessment

The design and construction of the building and related services shall conform to all the applicable technical, legal, regulatory, safety and environmental requirements.

4.7.2 Reliability, Maintainability Assessment

The building design shall be durable with reliable mechanical equipment. The building must have a low maintenance profile. Life-Cycle Cost Assessment shall be provided at tendering.

4.7.3 Safety Assessment

- a) Safety-in-design assessments shall be done to prove that the designs are safe to construct, operate and maintain. A safety assessment report shall be submitted for the major components of the design.
- b) A constructability analysis report shall be submitted at tender stage.
- c) The contractor shall submit detailed construction method statements.

4.7.4 Fire Safety Assessment

A fire- assessment report shall be performed by a fire engineer to satisfy the requirements of the National Building Regulations SANS10400 Part T.

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5. AUTHORISATION

This document has been seen and accepted by:

Name	Designation	Revision
Abdullah Kaka	Civil Engineer – Substation Engineering	1
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6. REVISIONS

Date	Rev.	Compiler	Remarks
15-06-2020	1	D. Naude	Store and maintenance reqd. added
	2		
	3		

7. DEVELOPMENT TEAM

Dawie Naude – Prof Architectural Technologist - SACAP

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8. ACKNOWLEDGEMENTS

None

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