Compulsory Standard for

Steel Bars for the Reinforcement of Concrete (Rebars)

TTCS 8:20XX, *Steel Bars for the Reinforcement of Concrete – Compulsory requirements*

Virtual Webinar

December 2nd November, 2020

TRINIDAD AND TOBAGO
BUREAU OF STANDARDS

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Background (1)

- Carbon steel bars are widely used in construction
- Versatile, readily available, low strength/cost ratio.

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Concrete

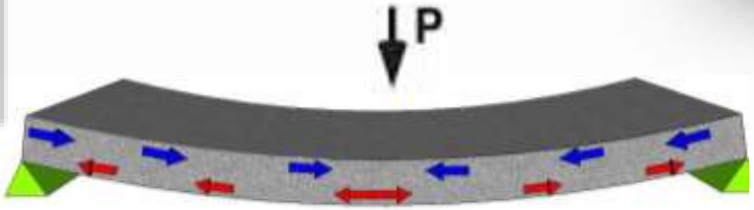
- Available
- Versatile
- Inexpensive
- Weak in tension

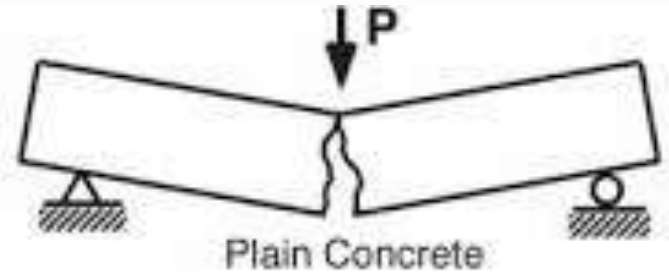
Steel

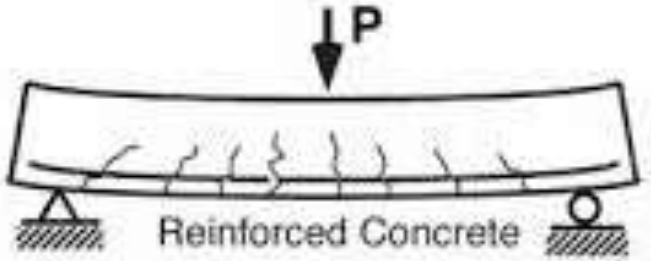
Strong in tension & compression

Reinforced concrete

- Composite material
- Combines Concrete and Steel
- Beams, Columns, Roof/Floor slabs, Driveways, Foundations







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Background (3)

- No local production, imported product
  - Largely ASTM A615M
  - Sizes 9.5 mm to 32 mm
  - Sources: Turkey, China and USA
- Construction is 6.1 % of GDP
  - Sector outlook: positive
  - 3% GDP growth for 2021
  - TTD 1.5 billion in infrastructure and development spending

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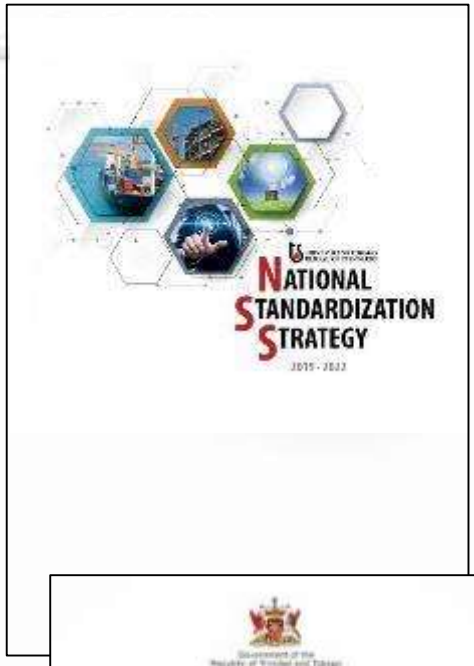
Background (4)

- Reason for development
  - Request from the TTBS, Implementation Division - February 2019.

- Rationale for standard
  - To ensure that carbon steel bars used in concrete reinforcing applications are fit for purpose.
  - To ensure building safety and disaster risk resilience
  - To ensure value for money in private and public sector construction projects.

Main benefits of TTCS 8:20XX

- **General**
  - Compliance with this standard will ensure that rebars are capable of withstanding service loads specified in relevant building codes.



- **National Standardization Strategy**
  - Standard for structural steel products listed in the 3-year work plan for completion in 2019-2010.

- **Vision 2030 -** (National Development Strategy 2016-2030)
  - Improved quality for construction products will support Government objectives of ensuring that citizens live in
  - "*safe, peaceable and environmentally friendly communities*“,
  - "*cities and human settlements are inclusive, safe, resilient and sustainable*" (Goal 11)

Intended users of TTCS 4:20XX

- ***Manufacturers*** - in the production process;
- ***Importers and distributors*** - in the procurement process;
- ***Building professionals*** - in the design and specification of components & materials;
- ***Building contractors*** - in procurement for installation;
- ***Regulatory agencies*** - in assessing compliance to building codes;
- ***Certification and inspection bodies*** - in conformity assessment activities;
- ***Public or private sector agencies*** - in specifying building components for procurement; and
- ***Consumers and homeowners*** - in verifying that rebars satisfy minimum quality and performance requirements thus ensuring value for money.

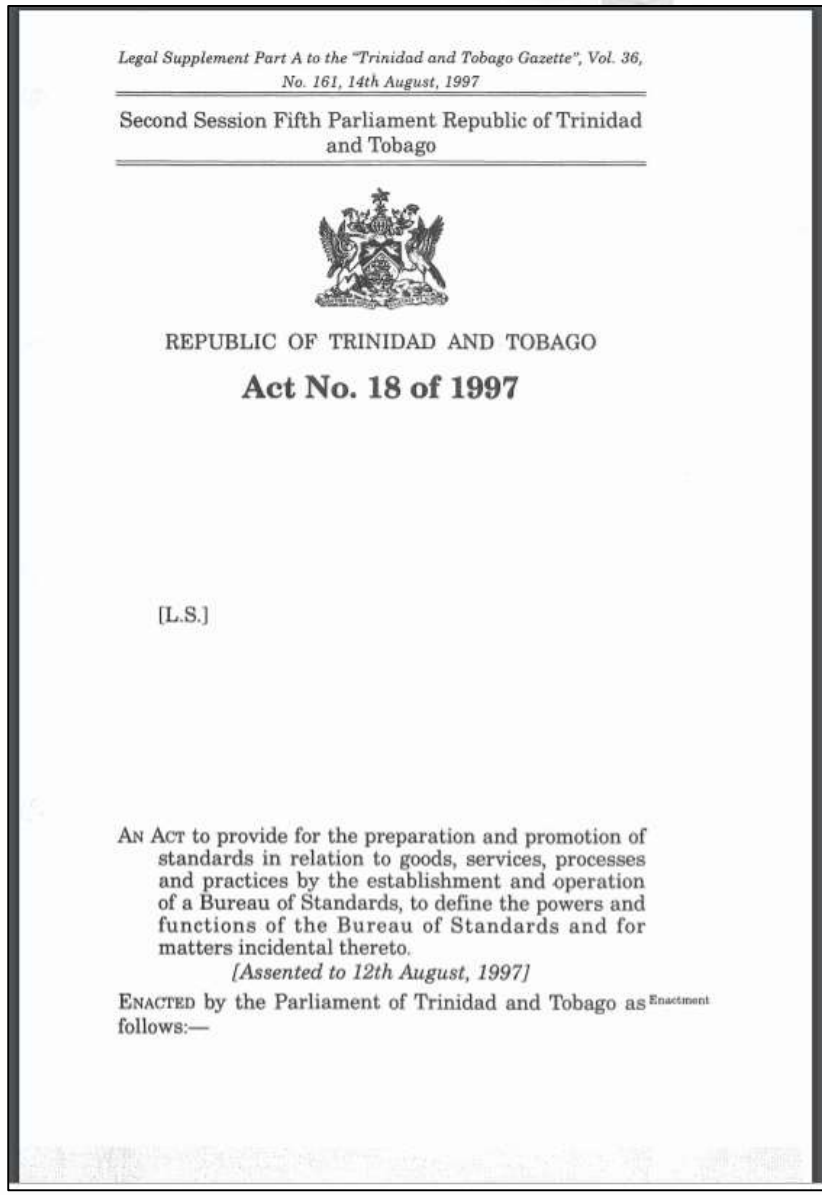
Compulsory standards

Standards Act #16 of 1997, Clause 18. (1)

A standard which is intended primarily to

(a) protect the consumer or user against danger to health or safety;

(b) protect public or industrial health, welfare, or safety;



Legal Supplement Part A to the "Trinidad and Tobago Gazette", Vol. 36, No. 161, 14th August, 1997

Second Session Fifth Parliament Republic of Trinidad and Tobago

REPUBLIC OF TRINIDAD AND TOBAGO

Act No. 18 of 1997

[L.S.]

AN ACT to provide for the preparation and promotion of standards in relation to goods, services, processes and practices by the establishment and operation of a Bureau of Standards, to define the powers and functions of the Bureau of Standards and for matters incidental thereto.

[Assented to 12th August, 1997]

ENACTED by the Parliament of Trinidad and Tobago as follows:— Enactment

Rationale for Compulsory Standard

Rebar products are high risk items:

- High level of local use
- All the product is presently imported
- Key component in structural systems
- National earthquake and hurricane risk
- Regulatory framework for building approvals

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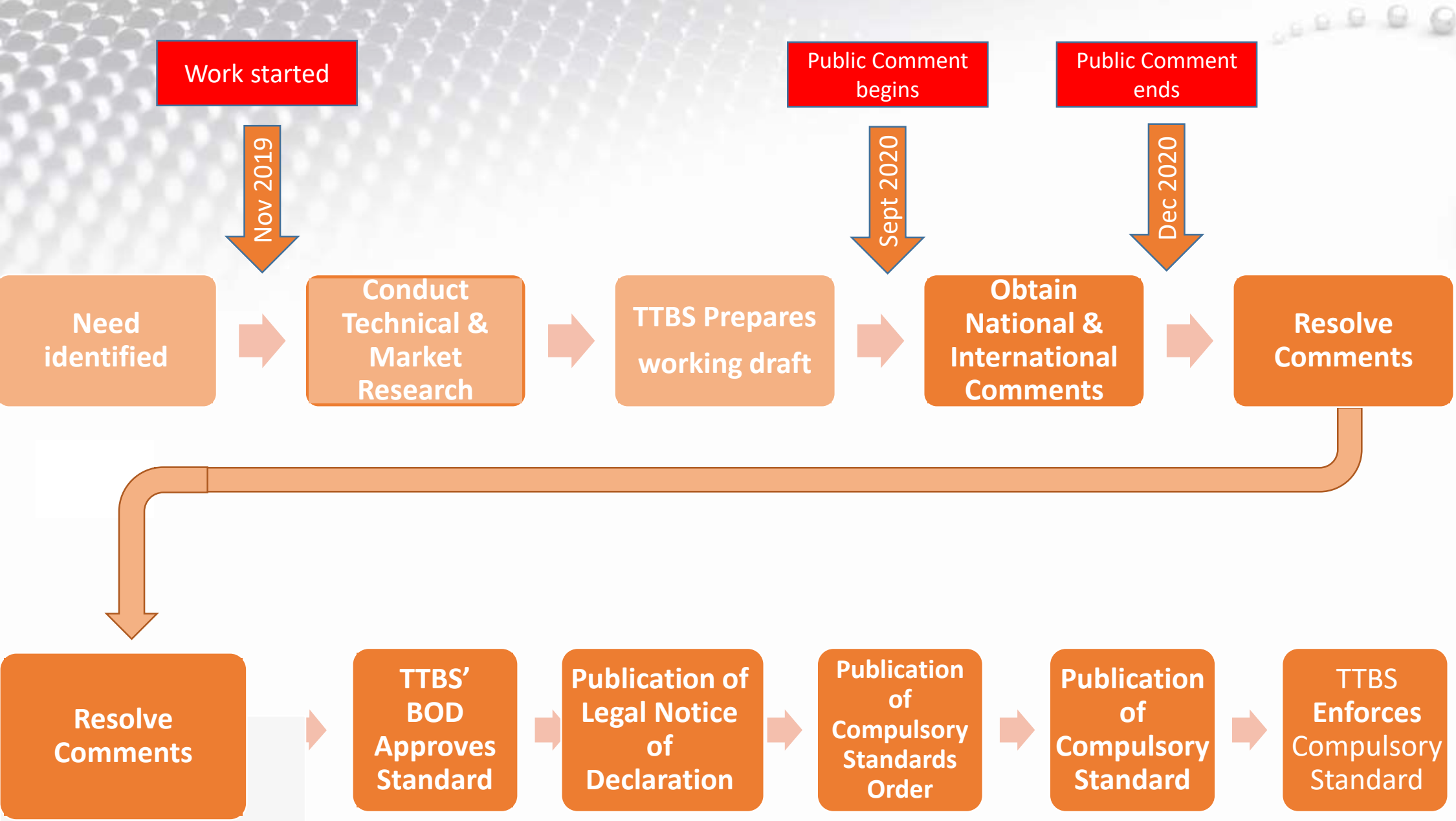
Compulsory National Standards for Steel Products

Rebars	• TTS/ASTM A 615M:2010, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement • TTS/ASTM A706M:2010, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement	Currently being enforced. Standards being replaced
Roofing Sheets	• TTS 69:2019, Profiled steel sheets for roofing and siding applications - Specification (2nd Revision)	Partially enforced
Framing Members	• TTS 598:2019, Cold-formed steel framing members for structural applications - Specification (1st Revision)	Due for enforcement
Structural Steel	• TTCS 4:2020: Rolled structural steel products – Bars, plates, shapes, sections and sheet pilings – Compulsory Requirements	Due for enforcement


Work started
Nov 2019
Public Comment begins
Sept 2020
Public Comment ends
Dec 2020
Need identified
Conduct Technical & Market Research
TTBS Prepares working draft
Obtain National & International Comments
Resolve Comments
Resolve Comments
TTBS' BOD Approves Standard
Publication of Legal Notice of Declaration
Publication of Compulsory Standards Order
Publication of Compulsory Standard
TTBS Enforces Compulsory Standard

Key Stakeholders

- Government Regulators
  - Ministry of Works and Transport, Construction Division, Design Engineering Branch
  - Ministry of Rural Development and Local Government
- Academia
  - UWI, Faculty of Engineering
  - UTT, Project Management and Civil Infrastructure Systems
- Conformity Assessment
  - TTBS, Laboratory Services Division
  - TTBS, Implementation Division
  - Caribbean Industrial Research Institute
- Importers/Distributors
  - Trinrico Steel and Wire Products Ltd.
  - Thomas & Sons Ltd.
  - Southern Wholesale Stores Ltd
  - Bhagwansingh's Hardware
  - Everett Steel Structures
  - Yorke Structures Ltd.
  - C.J. Lumber Ltd.
- Engineering Design Firms
  - Atlantic Project Consultants Ltd.
  - Planviron Ltd.

Public Comment Period

- 3 Newspaper ads
  - Published on …. Sept 20th, 23rd and 25th 2020
- TTBS' website notice
  - Draft Standard
  - Link to submit comments
- Stakeholder Consultation on Dec 2nd 2020

Scope of TTCS

Applies to	Plain and d • **non-wel** • **weldabl** • epoxy-c • zinc-coa
Compulsory Requirements	• Dimensi • Mechan • Chemica • Finish • Marking
Compliance mechanisms	• Mill cert • Test Rep
Does not apply to	• Headed • Steel wi[illegible] • Steel bars used for concrete prestressing • Steel bars not used for concrete reinforcement

1 Scope

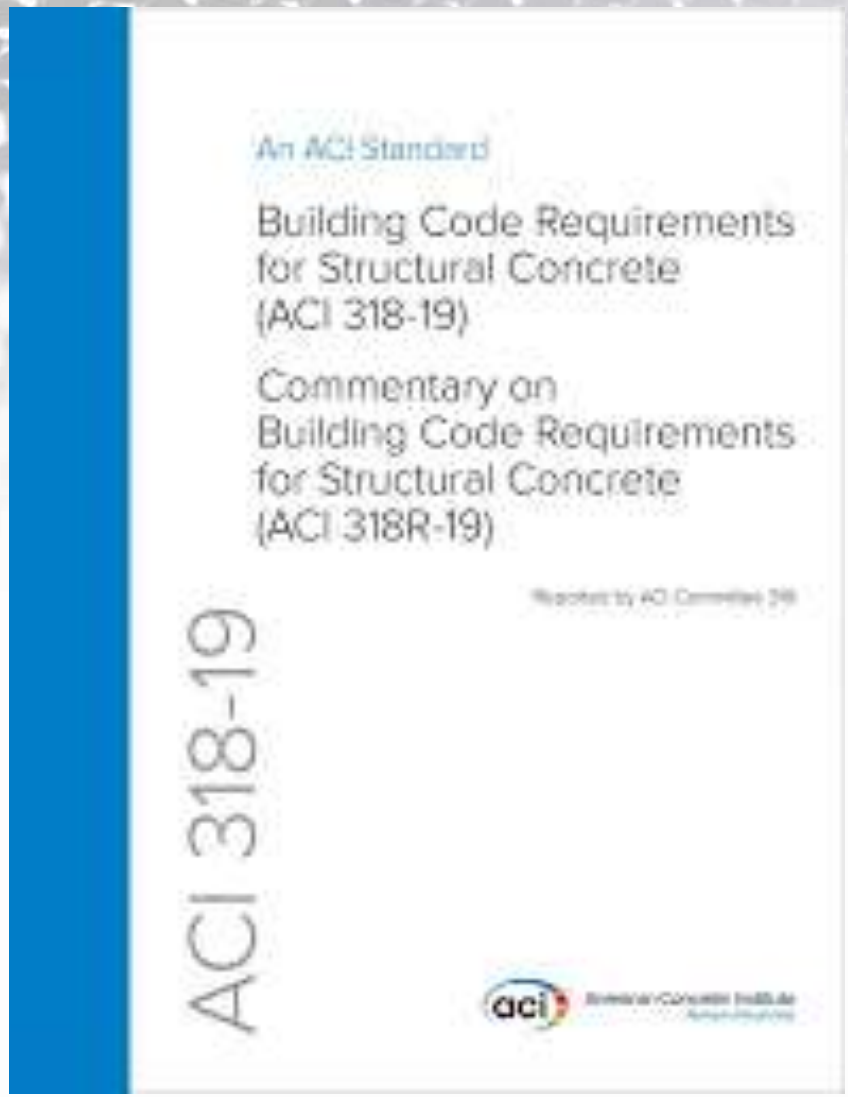
This standard applies to plain and deformed steel bars for the reinforcement of concrete. It is applicable to the following types of concrete reinforcing bars:

- non-weldable steel bars;
- weldable (low-alloy) steel bars;
- epoxy-coated steel bars;
- zinc-coated steel bars;
- stainless steel bars;
- epoxy-coated, prefabricated steel bars;
- rail-steel bars;
- low-carbon, chromium, steel bars; and
- zinc and epoxy dual-coated steel bars.

This standard outlines the compulsory requirements for the above products, mechanisms to demonstrate compliance to these requirements as well as measures to be taken in the event of non-compliance.

This standard does not apply to headed bars, steel wire used for concrete reinforcement, steel bars used for concrete prestressing or steel bars not used for concrete reinforcement.

NOTE Steel bars intended for use in structural applications, other than for concrete reinforcement, shall conform to TTCS 4:20XX, *Rolled structural steel products – Bars, plates, shapes and sheet piling – Compulsory requirements*. TTCS 4:20XX is currently in development and is expected to be finalized by the time that TTCS 8:20XX is declared.



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UN-COATED BARS

3.5.3 — Deformed reinforcement

3.5.3.1 — Deformed reinforcing bars shall conform to the requirements for deformed bars in one of the following specifications, except as permitted by 3.5.3.3:

(a) Carbon steel: ASTM A615;

(b) Low-alloy steel: ASTM A706;

(c) Stainless steel: ASTM A955;

(d) Rail steel and axle steel: ASTM A996. Bars from rail steel s

3.5.3.3 — Deformed reinforcing bars conforming to ASTM A1035 shall be permitted to be used as transverse reinforcement in 21.6.4 or spiral reinforcement in 10.9.3.

3.5.3.4 — Bar mats for concrete reinforcement shall conform to ASTM A184. Reinforcing bars used in bar mats shall conform to ASTM A615 or ASTM A706.

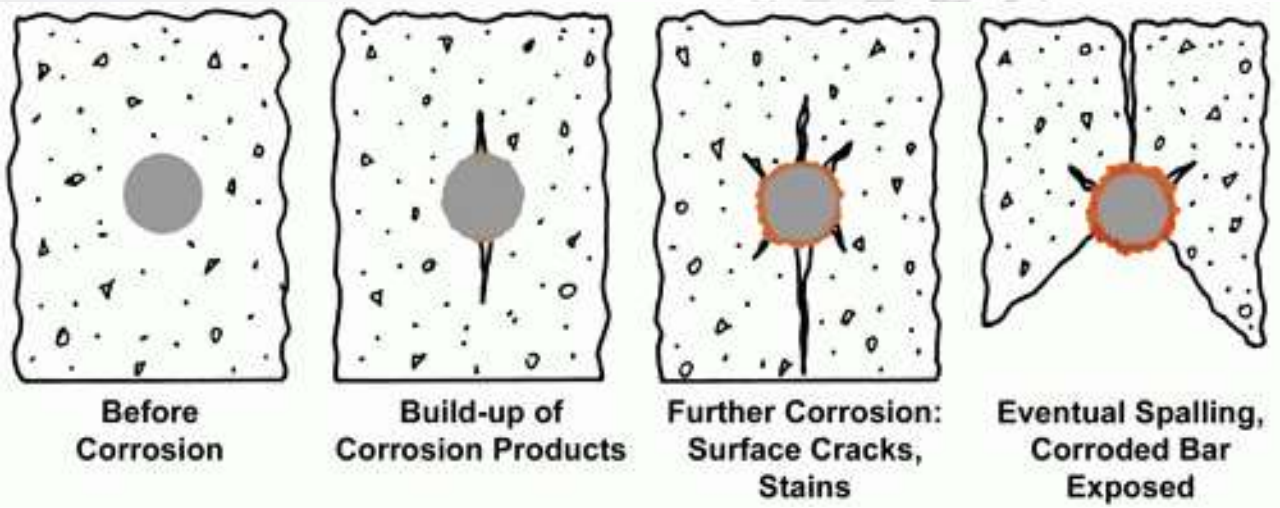
- Plain carbon steel
- Low-alloy steel
- Stainless steel
- Rail steel
- Low Carbon, Chromium

COATED BARS

3.5.3.8 — Zinc-coated (galvanized) reinforcing bars shall conform to ASTM A767. Epoxy-coated reinforcing bars shall conform to ASTM A775 or to ASTM A934. Zinc and epoxy dual-coated reinforcing bars shall conform to ASTM A1055. Bars to be zinc-coated (galvanized), epoxy-coated, or zinc and epoxy dual-coated shall conform to one of the specifications listed in 3.5.3.1.

- Galvanized steel
- Epoxy coated
- Epoxy coated-prefabricated
- Zinc and Epoxy dual coated

Rebars and Corrosion



- loss of reinforcement
- damage to surrounding concrete
- Reduced load bearing capacity

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Relationship to International Standards


TRINIDAD AND TOBAGO STANDARD

CONCRETE MASONRY UNITS – COMPULSORY REQUIREMENTS

Public Comment

TTCS 8, *Steel bars for the reinforcement of concrete – Compulsory requirements*

Coated bars


ASTM A775

Epoxy-coated steel bars


ASTM A767

Zinc-coated steel bars


ASTM A996

Rail & Axle steel bars


ASTM A1055

Zinc and Epoxy dual coated steel bars


ASTM A934

Prefabricated epoxy-coated steel bars

Un - Coated bars


ASTM A615

Non-weldable steel bars


ASTM A706

Weldable (low alloy) steel bars


ASTM A955

Stainless steel bars


ASTM A1035

Low - carbon chromium steel bars

Bar type	Definition	Applications
carbon steel, non-weldable bar	bar without requirements for alloying elements which are not intended for use in applications where high ductility or weldability is required	• general purpose
weldable, low-alloy	bar with restrictive mechanical properties and chemical composition for specific tensile performance and to enhance weldability	• controlled tensile properties • restrictions on chemical composition to enhance weldability
stainless steel	material that conforms to a specification that requires, by mass percent, a minimum chromium content of 10.5% or more, and a maximum carbon content of less than 1.20%	• high corrosion resistance or controlled magnetic permeability are required.
rail-steel	material that is wear-resistant and crack-resistant due to careful control of the chemical composition and cooling process	• hardness and wear resistance is required
low-carbon, chromium steel	material, which as a result of its chemical composition and controlled manufacturing process produces a ductile, high strength material that is corrosion resistant	• high strength, ductility and corrosion resistance are required • typically used in high-rise towers, bridges and coastal marine structure

Bar type	Definition	Applications
Zinc-coated steel galvanized steel	material that has undergone a process of immersion in molten zinc which causes a metallurgical reaction between iron from the steel surface and molten zinc	• corrosion resistance of reinforcement is of concern • parking structures, bridge structures, and other highly corrosive environments
zinc and epoxy dual coated steel	material with a dual coating consisting of a zinc-alloy coating as well as an epoxy coating applied by an electrostatic spray	• corrosion resistance of reinforcement is of concern • parking structures, bridge structures, and other highly corrosive environments
epoxy-coated steel	steel coating containing pigments, thermosetting epoxy resins, crosslinking agents, and other additives which is applied in the form of a powder onto a clean, heated metallic substrate and fuses to form a continuous barrier layer	• corrosion resistance of reinforcement is of concern • parking structures, bridge structures, and other highly corrosive environments
Expoxy-coated prefabricated	overs deformed and plain steel reinforcing bars which are prefabricated prior to surface preparation and then coated with a protective fusion-bonded epoxy coating by	• Bars of specific shapes which are formed before the coating process

Technical Requirements

- Labelling/Marking
- Dimensional accuracy
  - Section profile
  - Mass/length
- Physical properties
  - Yield Strength
  - Tensile Strength
  - Ductility
- Chemical (product) properties

UN-COATED BARS

Non-weldable carbon steel bars

Weldable (low-alloy) steel bars

Stainless steel bars

Rail-steel bars

Low-carbon, chromium, steel bars

Bar Marking & Surface Finish

+

Nominal size & Deformations

+

Mechanical Requirements (tensile & bend)

+

Chemical Analysis


KD TR 6 5 60

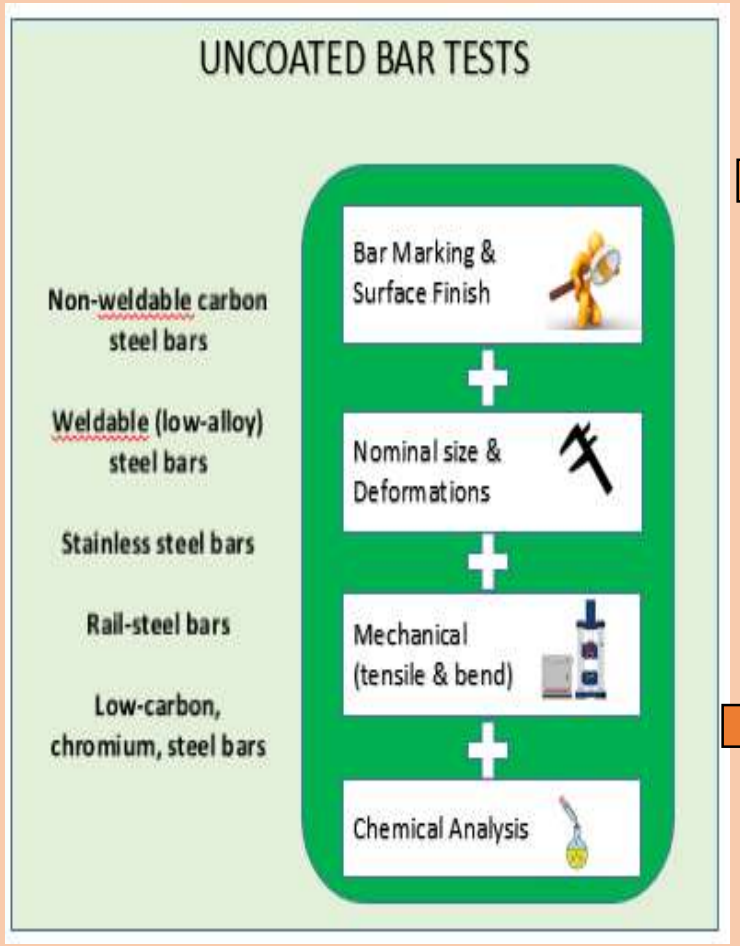
COATED BARS

Epoxy-coated steel bars

Zinc-coated steel bars

Prefabricated epoxy-coated steel bars

Zinc and Epoxy dual coated steel bars

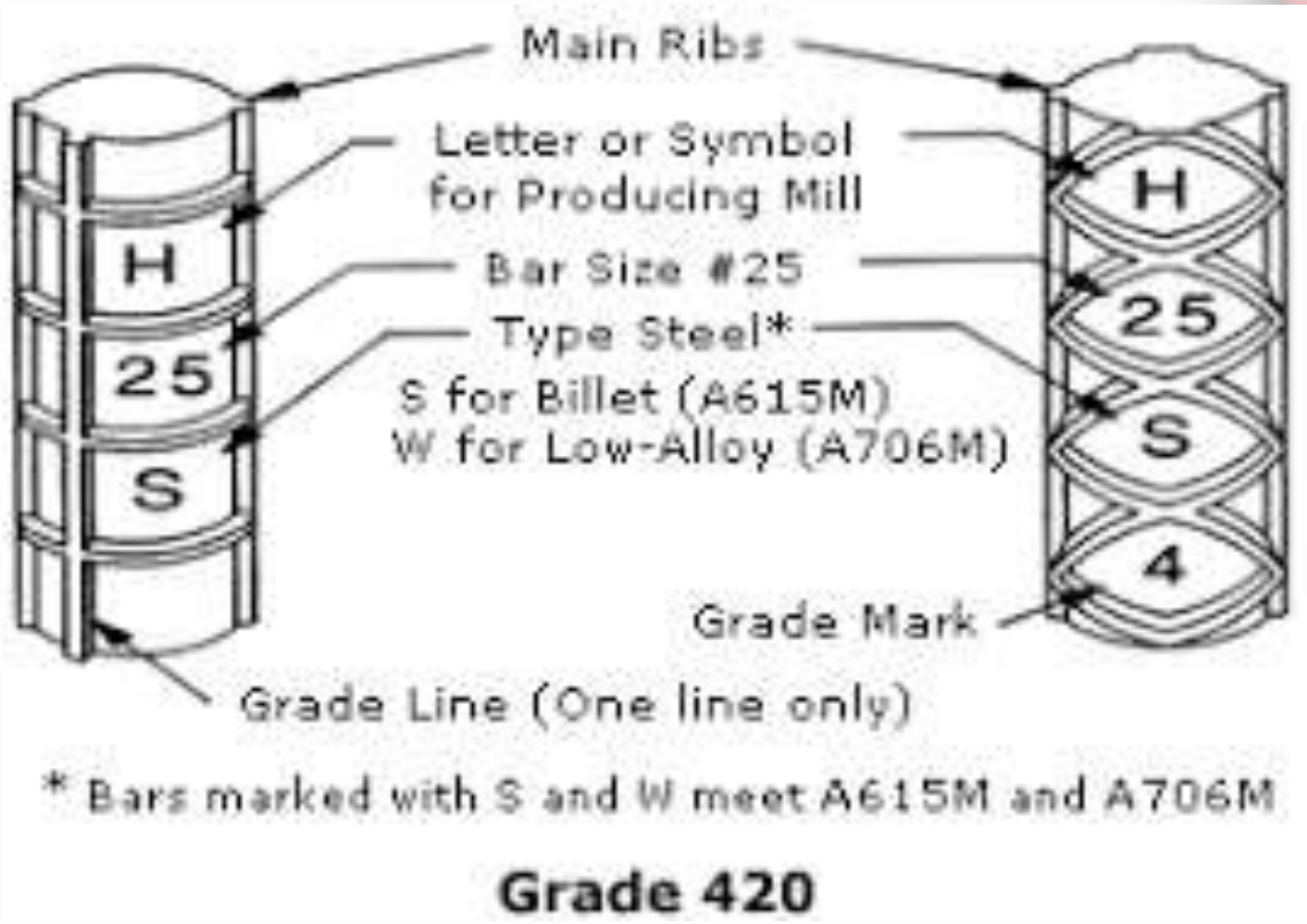


Zinc Coating Test

Epoxy Coating Test

Bend test with coating

Marking and Labelling



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Enforcement

- Compulsory standard, to be enforced by TTBS
- Primary application pathway is through inspection activities conducted by the Implementation Division

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Discussion Issues

- Low-alloy/ductile bars
- Epoxy-Coated bars
- Plain bars

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Thank you for your attention

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