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Qatar traffic control manual

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The Qatar Traffic Manual, compiled by the Civil Engineering Department of the Ministry of Public Works in collaboration with the Ministry of the Interior and Traffic Police, aims to standardize traffic management practices in two key areas: road signing and sign design. The manual's standards apply to all highway works, and submission to the Traffic Section for approval is mandatory. The first volume consists of two parts: Part One, "The Traffic Signs Manual," which covers directional signs, regulatory, warning, and information signs, as well as road markings; and Part Two, "The Traffic Design Manual," which addresses sign face layout, construction, illumination, and vehicle crash barriers. The second volume contains working drawings for signface layouts and the "Traffic Control at Roadworks" booklet, detailing standards for temporary warning signs and diversion signing. The "Highway Code" is a separate document aimed at promoting good driving practices through non-technical means for the general public. The manual has adopted principles from the Vienna Convention on road traffic signs and signals and UK highway design practices, acknowledging future revisions to reflect changing driver behavior and technological advancements. The loose-leaf format facilitates ease of revision, and users are encouraged to contact the Head of Traffic Section with queries. The road network in Qatar has three main tiers: Primary Routes, Secondary Routes, and Tertiary Routes. **Primary Routes**: These are high-capacity roads that connect the city of Doha to regional centers and the national border. They are typically dual carriageway roads with a strategic importance. The primary routes are numbered from 1 to 7 and extend radially outwards from the D-Ring Road, which is designated as Route No. 1. **Secondary Routes**: These roads serve as area distributors, connecting primary routes or feeding traffic into tertiary routes. They are usually dual carriageway but may be single carriageway in rural areas. The major secondary routes are also shown on the present system maps (Fig. 1.1 and Fig. 1.2). **Tertiary Routes**: These include district distributors, local roads, and access roads that provide connections to primary or secondary routes. Tertiary routes have a low design speed and are typically single carriageway. The road network in Qatar uses a Route Numbering System, with primary route numbers ranging from 1 to 7, except for Route No. 59, which connects the national border to Route No. 5. Secondary and tertiary route numbers follow a branching system based on the primary route numbers. The route number is displayed on all direction signs associated with it, in a rectangle with a yellow background. The Direction Signing System in Qatar provides drivers with advance warning and crucial information about upcoming junctions, routes, and destinations. The system includes Advance Direction Signs, which are categorized into three types: Far Advance Direction Sign (FADS), Advance Direction Sign (ADS), and Route Confirmatory Sign (RCS). These signs use a combination of colors, symbols, and text to convey vital information such as the type of junction, alternative destinations, and distances. The FADS is used in advance of interchanges where vehicles leaving the through route need to negotiate a secondary junction. It displays route numbers and indicates the distance ahead but does not show the destination. The ADS is located 500 meters from the exit and should be gantry-mounted unless the verge width is limited, in which case it may be ground-mounted. The system also features Route Confirmatory Signs, which take the background color associated with the route on which they are located. Direction signs use the color of the route to which they refer, ensuring that drivers receive clear and consistent information about their surroundings. All directional signing in Qatar is bilingual, with destinations and distances displayed in both Arabic and English. The system is designed to provide drivers with the necessary guidance to navigate the road network efficiently and safely. 102 IS used ahead of interchanges where the number of lanes remains constant. The sign indicates that drivers must turn off the main carriageway to reach their exit destination. Sign 104 displays the distance to the exit. For non-lane specific interchanges, Sign 100 or 101 may be used instead of Sign 102 when a sign gantry is impractical. On Primary and Secondary Routes, the ahead destination can be displayed alongside the route number. On Tertiary Routes, both the ahead destination and route number must be shown together. Sign 103 is used in advance of interchanges where the lane number decreases. This sign must never be substituted with Sign 100 or 101. The arrow on this sign indicates that drivers can reach their destination by staying in the specified lane. Sign 104 displays the distance to the exit and is usually located next to the sign showing the exit destination(s). If a standard location cannot be used, the actual distance should be measured and rounded down to the nearest hundred meters. Advance Direction Signs for at-grade junctions only require one sign per approach. The type of sign depends on the configuration of the junction. Each sign displays the destinations that can be reached from each exit, along with the route number if applicable. Sign 105 is used in advance of simple priority or signal-controlled junctions. It indicates the directions needed to reach various destinations and may have inclined arrows for free flow maneuvers. A map type Advance Direction Sign is used in advance of an at-grade roundabout or complex priority junction. The sign displays a plan view of the junction with exits shown as near as possible to their correct orientation. Signs are essential for providing clear direction to drivers on roadways. There are several types of signs used, including advance direction signs that indicate upcoming junctions or interchanges. Directional signs provide information about destinations and routes, while interchange signs cater to specific lane changes. At-grade junction signs display exit information, with confirmatory route signs ensuring consistency along primary and secondary routes. Signs for special purposes include military and recreational area signs, such as those directing drivers to zoos or museums. These signs have unique formats, colors, and borders that distinguish them from standard direction signs. Temporary directional signs are used during major diversions and share the same black text on a yellow background design as diversion signs. Special purpose signs must meet siting requirements similar to standard direction signs, with both types of signs installed together on the same posts where necessary. Additionally, route reference markers are provided on numbered routes to form the Route Referencing System for use by government agencies and the traffic police. To ensure other drivers are not distracted, directional signs must be installed at designated demarcation posts as shown in Fig. 1.10. The location of these signs depends on various factors such as the junction type, vehicle speed, and road layout. Generally, the assessment for minimum clear visibility distance should be made between 200 to 400 meters before the sign's potential position. For interchanges, Advance Direction Signs are sited at a distance of around 1 km from the junction reference point, which is defined as the point where the carriageway widens to form the exit road. If site conditions do not allow for this standard distance, the sign should be relocated further away or placed as close as possible to its standard position. At-grade junctions have a slightly different approach, with Advance Direction Signs situated based on the 85th percentile vehicle speed that approaches the junction. The minimum clear visibility distance varies depending on the approaching speed and is outlined in Table 1.2. Additionally, direction signs are typically located at the junction itself, taking into account individual judgment to ensure they remain visible to drivers during approach and while making necessary maneuvers. Movement and Sign Placement Guidelines Movement signs are clearly positioned at designated locations, ensuring no confusion about which exit is intended. Signs should be placed immediately beyond the point where a turning manoeuvre must be made, as illustrated in Figs. 1.14 to 1.18. Preferred alternative sign placements include: - A specific location for Directional Slgn signs at Non Lane Speelfc Interchange (Fig. 1.15). - A location for Otrectlcn Signs at a Non Lane Spedflc Free Flow Interchange (Fig. 1.16). - A location for Direction Slgns at a Lane Specific Interchange (Fig. 1.17). Route Confirmatory signs should be placed approximately 200 metres beyond the last point where a vehicle can join the main carriageway after negotiating the junction. These signs may also be provided between junctions on major routes, spaced less than 1000 metres apart. Stop signs must be installed at intersections where visibility criteria cannot be met. They should be placed 1-3 meters in front of road markings. A minimum speed of 50 km/h is required to see a stop sign 500 meters away. STOP signs are necessary below a certain distance from the intersection, as shown in Table 2.2. At roundabouts with two or more lanes or a central island, an additional STOP sign should be placed on the offside footway or central island. Temporary manual signs are used to control traffic during roadworks where carriageway width is reduced. The new sign size of 758mm is the minimum used. 2.2.10 PASS EITHER SIDE Sign 212 is used to indicate an obstruction, such as a traffic island in a one-way street where the same destination may be reached by passing either side of the obstruction. At all entry points onto the restricted road, it is crucial that signs are placed in such a manner as not to cause confusion regarding which road they apply to. To achieve this, signs can be slightly set back into the junction mouth or angled towards approaching traffic for better visibility at all times. The 'No Entry' sign (225) prohibits entry by all vehicles unless supplemented with plate 226, exempting certain categories from the restriction. If plate 226 is used in conjunction with sign 225, specific vehicle categories can be excluded from the prohibition. Permitted legends on plate 226 are: Except buses, Except buses and taxis, and Excepl for access. Signs 227-229 prohibit entry by motorized vehicles, buses, and lorries respectively. Sign 228 also restricts vehicles carrying more than 12 passengers, while sign 229 applies to goods vehicles. If the prohibition on sign 229 is based on weight, plate 230 should be used; if based on specific hours, use plate 231. Signs 232-235 impose restrictions on axle load, gross weight, height, and length, respectively. Signs 237-240 restrict entry by certain vehicle classes from particular lanes or roads entirely. Sign 237 specifies the class of prohibited vehicles, lanes they cannot use, and may include signs like 229-236. When using these prohibitory signs, an alternative route must be provided with directional signage along this route if necessary. Signs 238-240 prohibit specific activities on roads: pedal cycles (sign 238), animals being herded or animal-drawn vehicles (sign 239), and unspecified activity restricted by sign 240. When entering a road or defined area, cyclists are restricted to using pedal cycles only as indicated by Sign 241. This sign instructs cyclists to follow a specific route and prohibits other types of vehicles from using it. To prohibit overtaking, Signs 242 and 244 use "NO OVERTAKING" messages with Plate 346 (End) at the end of the restriction. On longer distances, Sign 242 can be repeated while reduced in size according to Table 23. Sign 245 restricts the sounding of horns, while Sign 246, accompanied by supplementary Plate 247, indicates where parking is prohibited. These signs are typically placed near the ends of restrictions and must include a single arrow pointing towards the restriction's direction on intermediate signs. The "NO WAITING" or "* No Parking 8:30 - 16:00" sign restricts parking only during specified hours. This is used in conjunction with road markings 526 for time-limited restrictions and marking 527 for permanent prohibitions. The text on Plate 247 has a height of 65mm (x-height 37.5mm) and the signs are mounted parallel to the kerb. Sign 248 prohibits drivers from stopping unless in an emergency or directed by Traffic Police, while Sign 250 indicates temporary restrictions by Traffic Police Officers. Sign 251 restricts access at specific locations to police vehicles only, and Sign 252 is used at Customs Houses or border stations for all drivers to stop and report to officials. Sign 253 provides advance warning of prohibitions or restrictions where necessary, especially when no other method can be found. It should note that a triangular warning sign (not specified) usually provides this kind of warning. Warning signs are crucial for alerting drivers to potential hazards on the road ahead, and most of these signs have a triangular shape with a red border surrounding a black symbol on a white background. The symbols provide a pictorial indication of the like hazard. In certain cases, supplementary plates may be added to provide extra information. These signs come in five sizes, with the appropriate size, sitting distance, and minimum clear visibility distance specified in Table 3.1. There are different types of warning signs, including those for: * Priority junctions: Sign 300 is used to warn of a junction ahead controlled by Sign 209 (STOP) or Sign 203 (Give Way), and may only be used with supplementary plate SGNL 301 or 302. * Roundabouts * Merging traffic * Bends in the road * Road narrows * End of dual carriageway * End of one-way working * Traffic signal operation * Pedestrians and children * Animals The table below specifies the height of warning triangles, sitting distance from hazards, minimum clear visibility distances, and required sizes of text for supplementary plates: | Height of Warning Triangle | 85th Percentile Speed | Distance of Sign from Hazard | Minimum Clear Visibility | Supplementary Plate Text | Alpha-height (x-height) | kph | m | rnm | | --- | --- | --- | --- | --- | --- | --- | --- | | 0-45 | -600 | 40-50 | 60 | 85(50) | 45-60 | 750(600) | 50-100 | 60 | | 45-60 | 900 | 60-80 | 130 | 170(75) | 200-300 | 1200 | Over 80 | 1500 | Note: Alpha-height and x-height are defined in Part Two, Chapter One. Slender objects such as traffic signal poles and lamp columns may be ignored. The smaller alternative sizes shown in brackets should only be used where amenity considerations or physical restrictions apply. Reference must be made to the Ministry of Public Works prior to the specification of a 1500mm sign, as its use implies that certain other measures, e.g., to reduce vehicle speed, may be required. Signs and markings for warning drivers of junctions, bends, and other hazards on roads are crucial for safe navigation. For urban areas, the exit from a one-way street can be indicated by specific signs. Where two successive junctions are close together, the sign for the second junction should be placed immediately after the first to ensure minimum clear visibility distance. On high-speed roads, sign 308 can serve as a supplementary plate to junction warning signs. The use of roundabouts is facilitated by sign 309, accompanied by countdown marker plates (414-416), which warns drivers approaching a roundabout. These signs are positioned at both sides of the carriageway. Signs 310 and 311 are used where two streams of traffic merge, each with equal priority. However, they should not be used if one stream has priority over the other. Sign 312 is used to give advance warning of a severe bend, while sign 313 warns of double bends. The direction of the bend symbol in sign 312 or 313 is reversed when the first bend is to the right. On dual carriageway roads with speeds exceeding 80 k.p.h., sign 312 should be provided for any bend with a radius less than 400 meters. Elsewhere, each site must be individually assessed based on bend radius, approach speed, visibility, carriageway superelevation, and surface skid resistance. The presence of a double bend is evaluated using table 3.3. Supplementary Plate 340 (Extent of Hazard) can be used when providing individual signs for bends becomes impractical due to the distance between them. Sign 314 is specifically used in situations like sharp bends or roundabouts, and its placement is guided by specific rules based on the severity of the bend and the angle involved. The application of these signs and plates requires consideration of various factors such as road geometry, traffic speed, and driver visibility, ensuring that drivers are adequately warned of potential hazards. The design and construction of traffic signs, including their supports, mountings, and foundations, are crucial for ensuring their functionality and longevity. A well-maintained sign constructed to the standards outlined should have a useful life of at least 10 years. The permissible sign sizes vary based on speed, with different sizes detailed in tables such as Table 3.4. Signs 315 and 376 are used to warn drivers of carriageway width reductions where the taper is more severe than given values in Table 3.5. Sign 317 and 318 warn of transitioning from dual to single carriageway, with specific guidelines for their placement. Traffic signs have different construction types, including sheet construction (where one or more flat sheets are mounted on a frame) and plank construction (where channel sections are assembled into a rigid sign plate). The size of the sign face and its support should be proportional according to Table 2.1, with minimum dimensions and ratios specified for circular, triangular, rectangular signs, among others. Following methods:(i) Providing a stiffeningfwIIe, generally formed Fmm L-section or C-section metal strip. This frame may also act as the mounting frame. (ii) Forming a flange around the edges of thie shset(s).The flanges should be at l e k t 12 rnm deep. (iii) Using heavy gauge sheeys). If a proprietary brand of sUffeninp Iram is proposed, the manufacturer must show that the system meets the requinments of the specification. PLANK CONSTRUCnQN The length of the sign pkate should equal that of the sign face. The height of the sign plate is determined by whole number multiples of the plank height anddore may be slightly greater than that of the sign face. (In this case, the sign face should ber set out so that it Is centred vertically on the sign plate and the 'empty' areas above and below the sign facei should be cotaured grey.) All cul ends a! plank sections musl be formed to give a flanged appearance. . . Rank type signs generally will require only verlica1 stiffening. This may be achieved by the rigid attachment of the sign plate to its support. However, the manufacturer of any proprietary system must show that it meets these requirements. FIXING AND MOUNTING Irrespective of the type of sign tsnstntction, the layout and fixing of both sign plats and kame should be as simple as possible to achieve the required rigidity. Fixing ot adjoining members and of the sign plate to the frame maybe by wy of the following methods, so long as the method can be shown to be adequate for its pam'cular application. ti) Welding (ii) Rivets - where these are used prior to the application of ihe sign face material, they should be countersunk into the sign plate so as to maintain as smooth a surface as possible. Where rivets a ~ eapplied after the sign face material has been affixed, their heads must be coloirred to match the surraounding area of sign face. H~ilowrivets must be capped to prevent light shining through. (iii) Bolts - where these appeqr on the segn face, they must be coloured to match their surrounding area Sign face material, such as reflective sheetrng, must not be applied over bolt heads. (iv) Adhesives. Where materrais that have different caefficientsof expansion are joined together, the joints must be . designed to prevent their failure by shear. % - SITING OF SIGNS Many factors combine to determine good sign positioning. The position in advance of, or at, a junction or hazard at which a sign should be placed has been described in Part 1, together with the concept of Min~mumClear Visibility Distance. Further considerations are discussed below:LATERAL POSlnQNlPJS All signs must be set back from the carriageway to avoid damage from passrng vehicles. The amount of set back varies according to location, as shown in Fig. 2.3. WITH KERB Fig. 23 - Required Sef Back Distances VERTICAL CLEARANCE Signs erected over footpaths and other areas where pedestrians are Drsent must b m n t & sa that the hibjght lo the unrleetside of the sign is 2.f metres. Elsewhere, the mounting height may be between 0.9and 1.S metres. ORlEEITATION To minirnise the e%ct of specula reflectionfrom the sign face, the sign siaoukJ be positioned so that it is at w angle af appraximatety gS"0 ~ncbmingtraffic, as shawn in Fig. 2.4. Sign 0rieflMlb angle. FQ.2 4 - Sign Qrientatron MULTIPLE USE OF S I N Q ~ ESUPPORT Where it is intended to provide When designing signs for a dual carriageway, the order of the signs from top to bottom should be warning, regulatory, and informational. Each sign should be separated from its neighbor by a distance equal to 0.5 times the maximum height applicable for signs at that location. The vertical clearance to the underside of the bottom sign must meet certain requirements, except in specific cases where the clearance can be reduced to 0.9 meters. There are three types of sign supports available: hollow circular posts, hollow rectangular posts, and I-beam sections. Signs with an area less than 3 square meters can only be supported by hollow section posts, while larger signs can be supported by any of the permitted sections. The sign support nomograms provided can be used in most cases to determine the required number of supports for each type of support. However, if a sign would be exposed to constant wind speeds exceeding 100 kph, a separate structural analysis should be performed. To use the nomogram, you need to plot the sign face area and the height of the center of the sign above ground level on their respective scales, then join these points with a straight line that continues until it intersects the pivot line. From this point, draw a horizontal line to intersect the post reference lines, and select the required number of supports based on the nomogram. Additionally, there are certain guidelines to follow when designing the sign support system: * The span between adjacent supports should not exceed 3.6 meters. * The overhang from the outer support to the edge of the sign plate should not exceed 1.2 meters. * Where two intersection points occur in the same column, the first point should be reached and then the correct calculation performed. * Sign supports should be positioned as shown in Fig. 2.7. There are four nomograms provided for determining the required number of supports: Fig. 2.8a-d. The nomogram is used to determine the number of posts based on the sign face area, height of the center of the sign above ground level, and type of support. **Installation of Sign Supports** Two scenarios are presented: 1. **Urban Area**: A direction sign with a face area of 1.02 square meters and a height to the center of 2.375 meters needs to be installed in an urban area. To determine the number and size of supports, follow these steps: * Calculate the sign face area * Determine the mounting height (assuming pedestrians are present) * Use Fig. 2.8a to determine the number and size of supports * Result: 2 Type 0 supports are required 2. **Rural Route**: An advance direction sign with a face area not specified and a height to the center of 3.65 meters needs to be installed on a major rural route. To determine the number and size of supports, follow these steps: * Calculate the sign face area * Determine the mounting height (maximum permitted in rural areas) * Use Fig. 2.8d to determine the number and size of supports * Result: 4 Type H posts are required **Design of Sign Support Foundations** Two types of foundations are available: 1. **Type 1**: Used for small direction signs and regulatory signs with up to two supports. 2. **Type 2**: Used for medium and large direction signs with more than two supports. To design the foundation, follow these steps: 1. Determine the required length of foundation (L) from Fig. 2.10 2. Plot the height of the sign plate and project it horizontally until it intersects with the projected line 3. Plot the breadth of the sign plate and project it vertically until it intersects with the horizontal line 4. Read the required length of foundation (L) from the band in which the intersection falls 5. Compare the value obtained to the minimum permitted width given in Table 22, for the chosen size of sign support 6. If the calculated value is less than the minimum permitted width, increase it to the minimum. Note: This design assumes a standard condition; if poor ground conditions or limited foundation depth are encountered, additional calculations may be required. **Determining the Type and Size of Foundation** For large signs, exceeding 1Sm in size, a Type 2 foundation is required. To determine the type and size of foundation for a sign, follow these steps: * Consult Fig. 2.11 to select the appropriate column based on the mounting height (hd) being used. * Plot the height of the sign face (hs) against the vertical axis and extend it horizontally to intersect with the chosen column. * Read the required value of L from the band in which the intersection falls. * Compare this calculated value with the minimum permitted length of foundation for the chosen size of sign support. If it's less, increase it to the permitted minimum. **Foundation Types** There are two types of foundations: 1. **Type 1 Foundation**: For signs with a single support, the minimum permitted length is 0.6m. 2. **Type 2 Foundation**: For signs with more than one support or exceeding 1Sm in size, this type of foundation must be used. **Sign Reflectivity** All road traffic signs must be reflectorized by applying reflective material to all parts of the sign face (except for black-colored letters or symbols). The required coefficients of retro-reflectance are specified in Table 2.3: | Class | Coefficient of Retro-Reflection | | --- | --- | | 7 (High Intensity Grade) | 0.250 - 0.400 | | 2 (Engineering Grade) | 0.150 - 0.250 | Class I reflective material must be used on all signs located in areas where road traffic is heavy or complex. Given text has been rewritten as follows: Lighting is a crucial aspect of sign design, and its presence or background lighting level can affect the material used. Class 2 materials may be employed in cases where there isn't sufficient light. The color of the material must meet Table 2.4 standards for optimal compatibility. Chromaticity diagram (Fig. 2.12) illustrates this data to simplify reference. Material luminance factors should align with Table 2.5 guidelines. Suitable lighting options for signs include high-lumen output lamps with good rendering properties, such as gocad wlour, for consistent illumination throughout their lifespan. Colaur corrected, high-pressure mercury fluorescent lamps of Type MBF complying with BS 3677 are also suitable due to their high output-to-size ratio, particularly beneficial for large sign face areas and gantry mounted signs. Tungsten halogen lamps can be used but have lower efficiency and shorter lifespans compared to other options. Sign lighting control systems should be implemented to switch lights on when ambient light falls below 70 lux and off at 100 lux. Low-wattage tubular fluorescent lamps may operate continuously, balancing increased burning hours against reduced lamp life. Where local control is required, each sign must have a photo-electric cell programmed to switch the lights on or off at specified levels of ambient light. In cases where remote control is used, time-switches or photo-electric cells linked to street lighting controls are preferred. A backup system should be provided in such scenarios. Regular maintenance inspections must be conducted on sign lighting and control equipment, including visual inspection by night as well as day. A maintenance program should include the replacement of faulty lamps, bulk replacement on a rolling basis, external cleaning of lanterns, internal cleaning of lamps and reflectors, testing of control gear, and other necessary tasks to ensure continued functionality. When selecting materials for sign construction, factors such as durability (up to 15 years), environmental conditions, and level of maintenance should be considered. Aluminum and steel are commonly used but not the only options; alternative materials must meet similar standards and be capable of accepting appropriate surface finishes. Given article text here Would be applied to metal sign plates if there is any doubt regarding their suitability proposed material field tests must be carried out determine whether acceptable. For alumjnjum sheet plank form must be at least 2 mrn thick similarly steel I .25 mm thick all sheets planks angle sections joined together must be materailsthat do not inter-react so that bi-metallic corrasian does not occur. Prior application of sign face treatments Hot dip galvanising Anodising Vitreous enamelling Plastic coating approved painting system rear S I Q plate same material or one af the following The rear sign plate must coloured grey. Materials used form sign face meet requirements Section 2.6 In practice usuatly achieved use reflective sheeting material which consists minute gtass beads held thin plastic film colours used on sign faces surrounds conform standards Table 2.6 Red Blue Yellow Green Grey White Black Given article text here cannot be paraphrased due to its length and complexity. However, a summary of the main points can be provided: **Temporary Signs** * Must meet the same standards as permanent signs * Lightweight enough for two men to carry but robust enough to withstand wind speeds up to 100 km/h * Supported at an angle of not more than 25° to the vertical * Frame must not distract drivers' attention from the sign face **Limited Use Signs** * Durable materials such as treated board and timber posts can be used * No retroduction in standard of materials is permitted for the sign face * Design, layout, shape, and size must meet permanent sign standards * Sign supports and rear plate should have a grey-colored finish **Vehicle Crash Barriers** * A crash barrier is a structure capable of absorbing vehicle energy without causing damage or injury * Purpose is to reduce accident severity and prevent vehicles from intentionally entering the carriageway * Criteria for barrier provision include: + 85th percentile vehicle speed exceeds 80 km/h + Obstructions such as bridge piers, sign gantry legs, or trees are present + Lighting columns are present + Median channel levels differ by more than 1 meter and/or the slope across the median exceeds a certain threshold (v) In situations where unauthorized turning or crossing movements pose a hazard to other road users, barriers are installed at various locations on the road network. FOR W-SEGMENTS: (i) Barriers are placed at obstructions such as bridge abutments, posts supporting Advance Direction Signs and gantry legs. (ii) Where the 85th percentile vehicle speed exceeds 85 km/h and there are substantial obstructions within 15 meters from the edge of the nearside running lane. (iii) On embankments that are generally higher than 2 meters or on other embankments where hazards or features require protection at or near the foot of the slope. (iv) On other embankments where there is a hazard or feature requiring protection at or near the foot of the slope. There are four types of approved barriers for general highway use in Qatar: untensioned blocked-out beam, tensioned corrugated beam, tensioned wire rope, and New Jersey profile concrete barrier. Other barrier types that protect highway structures such as bridge piers are considered integral to the structure and are specified individually. 3.13.1 BLOCKED-OUT BEAM This type of barrier employs a beam with corrugated sections attached to steel posts using blocking-out brackets. Its primary use is to provide short-term protection (typically up to 50 meters) at obstructions, particularly where space for deflection is limited. However, blocked-out beams do not offer as high a degree of containment as tensioned barriers and are not recommended for use on roads with speeds exceeding 85 km/h. Fig. 3.1 Blocked-out Beam 3.13.2 TENSIONED CORRUGATED BEAM Tensioned corrugated beam consists of corrugated sections attached to steel posts using shear bolts, with the end beams anchored and the complete barrier tensioned. It may be used in either single or double-sided configurations on the median strip and verge, where installations of barriers greater than 5 meters are required. Fig. 3.2 Tensioned Corrugated Beam 3.13.3 TENSIONED WIRE ROPE Tensioned wire rope barriers employ one or more steel ropes supported by collapsible posts. It provides an alternative to beam-type barriers in situations where larger sections would cause drifting sand accumulation on the carriageway, cross-carriageway visibility is important, or environmental impact needs to be minimized. Fig. 3.3 Tensioned Wire Rope Due to its method of action, it is crucial that wire ropes are installed with a constant height relative to the general ground level. The run-off area between the carriageway and barrier should be hardened to provide a firm running surface. Where possible, this hardening should extend 2 meters beyond the line of the barrier to allow for deflection under impact. NEW JERSEY CONCRETE BARRIER situations where median strips or verges are restricted in width, making it difficult to achieve the required deflection clearances for other barrier types. This restriction may also be used temporarily to separate opposing flows on dual-carriageway contra-flow systems. The height at which a vehicle contacts the barrier is critical, and therefore, the run-off area between the carriageway and barrier should be hardened. Prior to installation, all steel components must be galvanized by the hot-dip process in accordance with BS 729. Protective pretreatment and components are essential for ensuring the integrity of the barrier. The horizontal alignment of the erected barrier may not deviate from the carriageway alignment by more than 30mm, and any deviation must not exceed 10mm in two successive connected lengths of barrier. The vertical alignment may not vary from that specified in Table 3.1 by more than 30mm, and any deviation must not exceed 5mm in two successive connected lengths of barrier. Deformable materials are used for the outer panel, nose cover, guidance cable anchor, and bolt. The deformable material nose piece is designed to absorb energy during impacts. Post foundations must be set in concrete block foundations, which must comply with the requirements of the Qatar National Building Specification. Tensioned corrugated beam and steel wire rope barriers must be installed according to the manufacturer's recommendations. The minimum tensile strength of tensioned corrugated beams should be 330kN, and steel wire ropes should have a minimum applied tension of 130kN. Pedestrian guard railing is used to channelize pedestrians to select crossing points and prevent uncontrolled crossings, which can be hazardous to both pedestrians and drivers. Criteria for providing guard railings include: * Where pedestrians are crossing near but not at an existing designated crossing point * Where uncontrolled crossing causes a hazard * At any new designated crossing point Typically, these sites are located in urban areas and include: * Unmarked pedestrian crossings * Marked crossing points remote from junctions * Pedestrian-operated signal-controlled crossings * Dual-lane crosswalks with an offset between the two lanes Barriers should be installed to prevent pedestrians from entering the area between the two crossings. There are various types of pedestrian guard railing, including: * 'See-through' guard railing, where the panel infill of vertical bars is terminated below the top rail * Offset railing, where the vertical bars are offset from the centerline of the railing to improve visibility Guard railings should comply with typical details as illustrated in Fig. 3.11. Specifically, they should be set back at least a certain distance from the edge of the roadway (JOGmm). Before installation, all steelwork must be thoroughly cleaned and coated with a thickness of at least OAmm of ethylene vinyl acetate (EVA) applied by fluidized bed or other approved methods. The horizontal alignment of the erected guard railing should not deviate from the designed alignment by more than 3mm. The barrier must also be erected such that it is truly vertical. Foundations for posts and sign supports must comply with the requirements of the Qatar National Building Specification. The text then provides a series of tables and diagrams (Figs. 2.10, 2.8b, and 21aa) that outline the details of post foundations, sign support nomograms, and mounting heights. The figures show different types of foundations (Type 1 Single Support and Twin Support) and provide information on pivot line heights, centerline heights, and other relevant measurements. Overall, the text provides detailed specifications for the design and installation of guard railings and sign supports in Qatar.