Provision of informative materials for the correct use of child restraint systems: Guide for manufacturers

Version 1

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Glossary

CALD – Culturally and linguistically diverse.

Correct use – The child restraint system installed, and the child secured as intended by the manufacturer.

Mode (of use) – Forward-facing mode or rearward-facing mode.

p< or p= – Refers to the p value, or probability that the finding is due to chance, i.e., it does not reflect a real association. E.g., $p<0.05$ means there is less than 5% chance that the association found by the study was only due to chance (or there is a 95% chance that there is a real association).

Quick Guide – Summarised information on how to use the restraint correctly on each trip.

Quick Reference Guide – Written steps with images that highlight the critical tasks for the correct use of the child restraint.

Two-armed trial – A study (or trial) where there are two groups of study subjects, one is the test condition, and the other is the control condition.

Foreword

The incorrect use of child restraint systems is common, with significant negative effects on crash protection for child passengers. The incorrect use of child restraint systems is a long-standing and widespread problem. In Australia, the latest available estimates are that over 72% of children have errors in the way they are restrained when travelling in cars [1]. Routinely supplied instructions in their current form are frequently difficult to understand [2]. The provision of clear and comprehensible materials on correct use supplied with child restraint systems at the point of sale has remained as a gap.

About the Guidelines

These guidelines aim to improve the correct use of child restraint systems by users by providing guidance for clear and comprehensible instructional materials on correct use. They are designed for child restraint manufacturers who sell child restraint systems within Australia. They offer focused evidence-based recommendations specific to the content and format of child restraint informative materials including instructions, labels and videos.

Purpose and Scope

Purpose – To provide guidance to manufacturers so they can produce comprehensible and usable informative materials that will reduce the level of incorrect use of child restraint systems.

Scope – These recommendations are specific to written materials and video instructions. The instructions pertain to first installation as well as routine checks of child restraint systems. They cover seatbelt attached rearward-facing and forward-facing harness-style child restraint systems. They do not include ISOFIX compatible child restraint systems, nor booster seats.

Intended Users

This set of guidelines is intended for use by Australian child restraint manufacturers. They have been developed in consultation with manufacturers and child restraint experts to ensure that the terminology and details are in line with AS/NZS 1754 Child Restraint Systems for Use in Motor Vehicles.

Methodology and Evidence for Recommendations

The evidence underlying the recommendations in these guidelines has been developed from a systematic progression of experimental research conducted between 2015 and 2022. This section summarises the methods used to test and develop the recommendations presented; these include tests conducted in the laboratory, real-world settings, and in focus-group-based consultation with parents of young children.

The body of research was undertaken via the following steps:

1) Focus groups to identify what parents and carers need and want in the way of clear instructions
2) Development of a first-round set of instructions based on findings from focus groups
3) Laboratory trial to iteratively refine the first-round instructions with input from consumers
4) A laboratory-based randomised control trial (RCT) to determine the difference in correct use rates and comprehension of information between the refined instructions and manufacturer-supplied product information

5) A field-based randomised controlled trial to evaluate the effectiveness of the refined instructions in reducing incorrect child restraint use over 6 months of use
6) Laboratory trial of manufacturer instructional material developed using draft guidelines to confirm if the use of the draft guidelines were effective in reducing the likelihood of error
7) Consultation with manufacturers and child restraint experts to align draft guidelines with the current Australian Standards

Each of the above steps are detailed below, in turn.

1. **Focus groups** – Focus groups were used to explore perceived barriers to correct child restraint use, focusing on potential problems with current child restraint informative materials and mechanisms of change. This was achieved using six focus groups with high and low socioeconomic populations and culturally and linguistically diverse (CALD) child restraint users in Sydney, Australia. A further two focus groups were conducted assessing preferences for instructional videos.

   The results indicated current child restraint informative materials are poorly understood, particularly among those whose first language is not English. From the findings of this work, 11 key user recommendations were identified and to be applied to the design of new prototype instruction manuals, labels, and videos [2].

2. **Development of materials** – Based on the findings from the focus groups and evidence from past research, new prototype materials were developed for a child restraint currently on the Australian market, including:
   - An A3 instruction sheet (an illustrated step-by-step guide for installation of the child restraint, buckling the child in the harness, and checks for errors),
   - Swing tag labels (to adhere to the child restraint as a visible reminder of what to check prior to each trip), and
   - Supplementary videos (demonstrating the steps outlined in the A3 instruction sheet) linked via Quick Response (QR) code available on the A3 instruction sheet and the swing tag labels.

   The format and design of prototypes were based on the findings from the focus groups and an evidence review which incorporated an examination of health literacy and human factors design principles.

3. **Iterative testing** - Four lab trials were conducted to iteratively refine the set of A3 instructions, and two trials for each of the video and the swing tags, until the criterion of an average correct child restraint installation and securing rate of >80% was achieved. Input was obtained from 59 participants and refinement of the prototype materials in response to participant input progressively resulted in increases in the correct installation of the child restraint system, securing of the child, and comprehension of information (for information provided in the A3 instructions) [4].

4. **Final laboratory trial** - A laboratory-based randomised controlled trial (RCT) was used to determine the difference in correct use rates and comprehension of information between the new instructions (the intervention group) and current manufacturer-supplied product information (the control group). There was 27% more overall correct use (a statistically significant difference, $p=0.042$) and a higher mean comprehension score in the intervention group (mean scores of 17 for the intervention group compared to 12 for the control group, $p<0.001$). In terms of comprehension errors, the intervention group had an average error rate of 14% while the control group had an average error rate of 23% ($p=0.056$)[3].

5. **Field test of new materials** – An RCT was conducted with over 400 primary carers who purchased a new child restraint system and were followed-up six months after its installation. When they received their new child restraint system, primary carers in the intervention group were provided with the same final set of materials tested during the final laboratory trial plus the manufacturer's instruction manual. The control group were provided with a postcard simply outlining the Australian child restraint legislation (with no instructions about installation or use) plus the manufacturer's instruction manual [Brown et al., manuscript under review].

   The results indicated that 6 months after purchase, those exposed to new materials were 1.5 times more likely to correctly use child restraints (OR 1.5 95%CI 1.02-2.37). Incorrect use was defined as one serious error, or 2 or more minor errors. We found a significantly higher level of comprehension of key information related to correct use among those exposed to the prototype material than those exposed to the manufacturer's instruction manual [manuscript under review].

6. **Laboratory trial of materials developed using draft guidelines** - A laboratory-based study using a two-arm randomised controlled design compared correct child restraint use between participants exposed to instructional material designed with reference to the draft guidelines, and the manufacturer's instruction manual (intervention), and participants exposed to the manufacturer's instruction manual only (control).

   The results indicated that the intervention group had a higher rate of correct use than the control group (correct use - intervention: 17.4% vs. control: 8.7%). Incorrect use was defined as one serious error, or 2 or more minor errors. The odds of correct use were more than 2 times greater when using materials developed with reference to the draft guidelines, compared to the manufacturer's instruction manual only (OR 2.27, 95% 0.35-14.73), controlling for previous experience with child restraint use. Although fewer errors were observed in the intervention group, this did not reach significance as this study was powered to see an effect of 15%, based on the effect size seen in the field test of the new materials. However, this level of effect was not reached in the current study. These results are promising given that the draft guidelines were used and were not well-followed by the manufacturer. As a result, manufacturers were consulted to clarify, and make the guidelines easier to follow.

7. **Consultation with manufacturers and child restraint experts –** Revisions were made to the draft guidelines to provide consistency and better alignment to the current Australian Standard, AS/NZS 1754 Child Restraint Systems for Use in Motor Vehicles. The following guidelines are a result of this process.

Conclusions

By using a novel performance-based user-testing method, child restraint instructions, swing tags, and videos can be designed to accommodate user needs and increase the correct use of a child restraint system. Although the field trial conducted over six months was exposed to more external factors that may have influenced the effect size compared to the final laboratory trial, differences of correct use between the two study groups were still present six months after the child restraints were initially installed. The laboratory trial of instructional material developed in reference to draft guidelines showed promising results, where exposure to the material resulted in greater correct use. This work has led to the development of this guide, in consultation with manufacturers, for designing informative materials to be supplied for child restraint systems going forward. The guidelines may be applicable to the design of informative materials in other safety product contexts.

How to use this Guide

This guide is an evidence-based set of recommendations on how best to develop materials that will provide child restraint users with easy-to-follow instructions on how to:

a) Install a child restraint system in a motor vehicle
b) Secure a child within a child restraint system – and check when the harness straps may need to be adjusted for a growing child or for use by another child, or assess if a child has outgrown a forward-facing child restraint system or the rearward-facing direction of a convertible child restraint system
c) Conduct a quick check of the key safety features of the child restraint system before each trip.

The guidelines are intended for use by manufacturers to develop informative materials to provide within the packaging of the child restraint system. They are not intended to replace the more detailed manufacturer's booklet (required in the Australian Standard AS/NZS 1754) but to provide a comprehensible, quick reference that has been informed by testing by a representative group of novice and experienced child restraint users, shown through laboratory and field testing to reduce serious errors in installation and use.

Development of the informative materials using this guide will require detailed knowledge of, and experience with, the make and model of child restraint to which they apply, graphic design specialists to assist with the design and layout of the materials, videographers to film the tasks described in the materials as they pertain to the particular model for which materials are being developed, and people with IT expertise to link the various resources electronically.

Guidelines

Item	Guideline
1.	**Information format**
	a. Provide a Quick Reference Guide in an instruction booklet or sheet, the instructions for installing and using the child restraint system. b. Provide a Quick Guide that is securable to the child restraint system which serve as a reminder of things to check. c. Provide scannable links to videos. d. All instructional information should be ordered chronologically – the order for which the steps must be performed to install/use the child restraint system for the first time. e. Group installation/use information in the Quick Reference Guide by mode of use (e.g. rear facing mode). f. Use numbering to order steps – (e.g., "Task 1, 2, 3"; "Step 1a, 1b, 2, 3"). g. Use consistent layout, headings, colours and text (in line with items 3, 4 and 5 below). h. Use adequate white space to reduce clutter.
2.	**Information content of the Quick Reference Guide**
	a. The Quick Reference Guide should use written steps with images to cover the critical tasks required to use a child restraint system correctly: Task 1) Ensure appropriate use (using shoulder height markers as per AS/NZS 1754), Task 2) Adjust the headrest/shoulder straps to fit the child, Task 3) Ensure the seat is in the right mode for the child, Task 4) Attach the seatbelt (or ISOFIX), Task 5) Attach the top tether strap, and Task 6) Secure the child into the child restraint system. b. The Quick Reference Guide should provide checkpoints for critical tasks (see checkpoint recommendations in Item 5 below). c. Use descriptive task headings, with steps as subheadings. d. The information within each of the tasks should reflect the steps required by the specific product. However, for universal tasks relating to using the seatbelt, tether, and harness straps, the key steps in 2.e.-2.h. are recommended. e. For Task 1 (check appropriateness of child restraint and mode) steps must include the following in order: use of shoulder height marker to determine appropriate mode of use with specific reference to the best-practice use of that child restraint. NOTE: An example is, "Use rearward-facing when child's shoulders are below the middle shoulder height marker". f. For Task 4 (attach seatbelt) steps must include the following in order: feed seatbelt through [colour-coded] path, remove twists, attach seatbelt [click], remove slack from seatbelt, and make it firm. g. For Task 5 (attach tether) steps must include the following in order: Use vehicle manual to find the "Top tether anchor" or "Child Restraint Anchorage Point", loosen tether strap, attach tether strap to anchor point, make it very firm, store loose tether in pocket, check tightness of tether strap. h. For Task 6 (secure child into seat) steps must include the following in order: loosen harness straps, check shoulder straps are at the same level as child's shoulders, remove twists, engage harness buckle, make harness straps very tight [pulling on chest straps first then pulling on adjustment strap], check harness is not loose, check tightness of harness straps.

	i. The Quick Reference Guide should allow for the user to self-check their performance. e.g. provide information on how to identify if an installation is sufficiently tight. j. An illustration should be provided, and a video is recommended (see Item 7) for each critical task. These will identify the child restraint features required in each task, by number. The child restraint feature will be numbered according to the corresponding step number/s in which they are required for use. k. For steps relating to removing twists and checking tightness of webbing, photographs of the child restraint system in the vehicle should be used in place of illustrations to provide clarity of the error, as these can show twists in webbing which feature highly in errors of use. l. Content recommendations for the Quick Guide and videos are found in Item 8 and 7 respectively.
3.	**Typography and Sentence Structure**
	a. Use black text on white background, unless noted otherwise in recommendations. b. Use sentence case for all information. Running capitals should only be used for cautionary information/correct use behaviour (e.g. “LOOSE”). c. Use bold font only to emphasise cautionary information. d. Write numbers as numerical figures (e.g. “1” not “one”). e. Sentence length should be short, preferably not exceeding 70 characters. f. Use active voice, personalised and conversational tone, unless emphasising an action that should be avoided (e.g., “Check shoulder straps are at the same level…”). Frame messages in positive, action-oriented way (e.g., “Pull out stabiliser bar”). g. Use standardised/consistent terms to refer to the features of the child restraint. h. Use precise verbs, pure verbs, and strong auxiliary words when possible. (e.g. “Store excess tether strap in pocket”) i. Use the colour red for cautionary information (e.g. “LOOSE”), and the colour green for correct behaviour (e.g., “FIRM”). j. Avoid jargon and acronyms. Use lay terms. k. Clarify ambiguous terms with descriptive words (e.g. “firm”)
4.	**Cautionary information**
	Cautionary information should be provided as follows: a. Provided within the information for the corresponding step. b. Written in red and uppercase letters. c. Be specific, short, and provide an accompanying illustration/graphic. d. Regarding loose strapping, cautionary information should be followed by an illustration showing how to check the strap is tight. e. The following specific cautionary information is recommended for rearward and forward-facing child restraints: Task 4: Caution against twists in the seatbelt with illustration of seatbelt with twist and text “[cross symbol] TWISTS”, Task 5: Caution against use of luggage tie down when connecting tether point with picture of luggage tie down and text “[cross symbol] LUGGAGE TIE DOWN”, and caution against loose tether strap with illustration showing slack in the tether strap and text “[cross symbol] LOOSE”, Task 6: Caution against twists in the harness straps with illustration of a twisted harness strap and text “[cross symbol] TWISTS”, and caution against loose harness straps with illustration of pinch test showing loose strap and text “[cross symbol] LOOSE”. f) Checkpoints: See recommendations for checkpoints in Item 5 below.

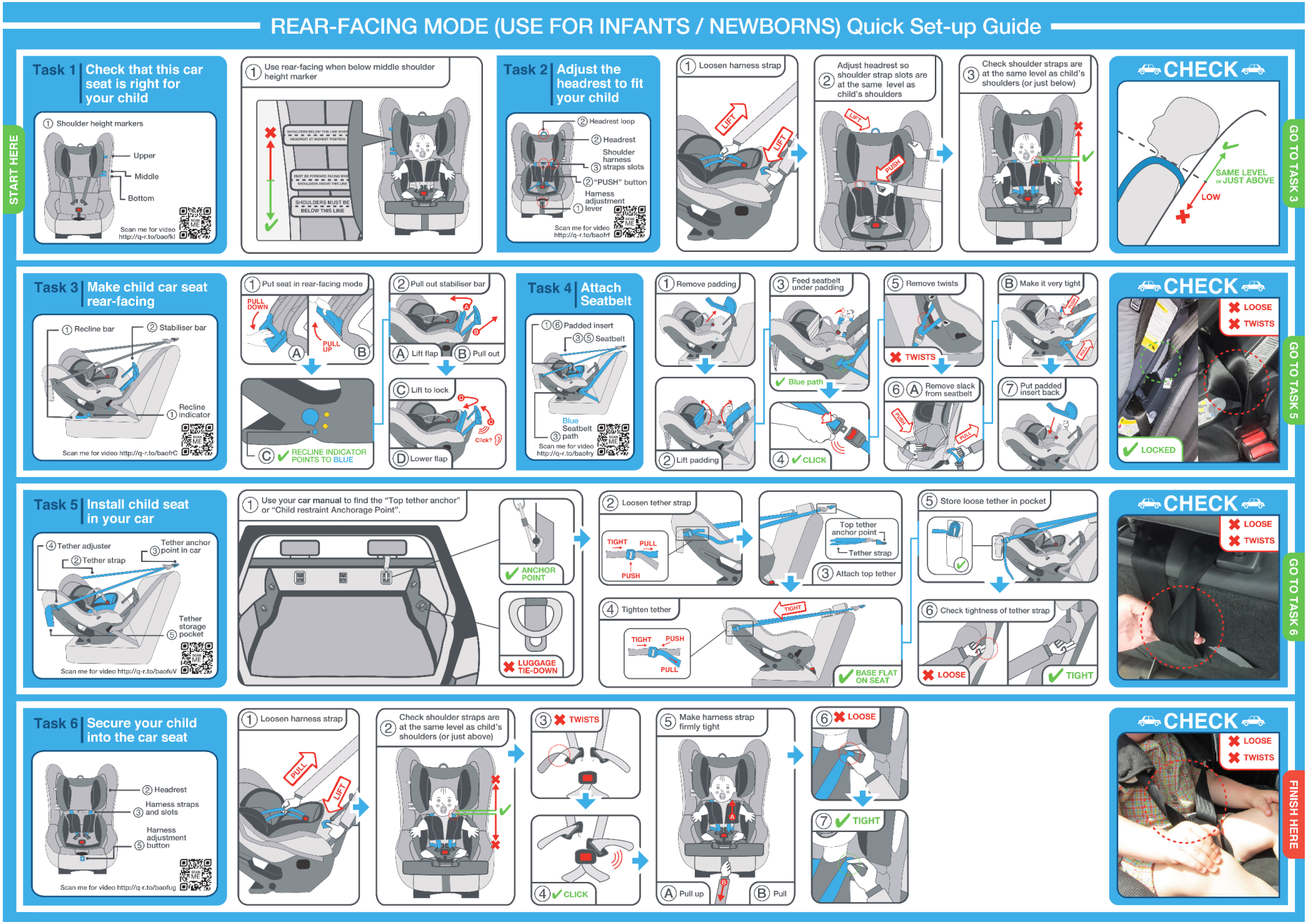
5.	**Checkpoints**
	Through user-testing, frequent critical errors have been identified. These relate to shoulder harness height, the top tether, the harness and seatbelt tension and twisting. To avoid these, the following checkpoints should be provided at the end of the task sequence: a. For Task 2: illustration showing the correct shoulder harness height relating to child's shoulders with text "[tick symbol] Shoulder straps at height closest to child's shoulders". b. For Task 4: picture of child restraint installed in car with twisted and loose seatbelt with text "[cross symbol] TWISTS" and "[cross symbol] LOOSE" c. For Task 5: picture of tether strap secured to the anchor point showing slack in the strap (with hand beneath belt for reference) and twists, with text "[cross symbol] TWISTS" and "[cross symbol] LOOSE" d. For Task 6: picture of child secured into the child restraint system with slack and twists in the shoulder harness straps with text "[cross symbol] TWISTS" and "[cross symbol] LOOSE"
6.	**Illustrations and Graphics**
	Illustrations and photos should be provided as follows: a. Checkpoints relating to using the harness should use real photos of a child restraint and child in the car to aid comprehension and relatability for the user, as these are used as references for how the child restraint should not look when installed. b. All other pictures of the child restraint can be illustrated. c. Use colour coding to show mode of use that is consistent through all informative materials. d. Combine text and illustrations to explain key tasks. e. Avoid symbols, except for the use of a cross for incorrect and a tick for correct. f. To illuminate a feature being referenced in a step, the corresponding border colour for the restraint mode of use (yellow - for forward facing, blue - for rearward-facing, red - for booster seat) should be used to colour the referenced design feature. For example, when explaining the attachment of the top tether anchor strap in a child restraint used in rearward facing mode, the anchor strap should be highlighted in blue.
7.	**Videos**
	Videos of the installation and use of the child restraint systems should be as follows: a. Complete videos including the installation and use of child restraint systems should be a few minutes long. Online videos should be uploaded to the web as one complete installation and use video, and a series of short videos which focus on one task each. b. Videos should contain all the tasks and steps outlined in the Quick Reference Guide, and use the step descriptions as subtitles in English on the video. c. Videos should feature one model who installs the child restraint system, and use a real child for the securing process.
8.	**Quick Guide**
	A Quick Guide should be provided on the child restraint system where it can be accessed and read by the user when installed. If provided, the Quick Guide should include the following: a. Summarised information on how to use the child restraint correctly on each trip, including: (i) how to check the seatbelt is correctly routed and tensioned, (ii) how to check the tether is correctly routed and tensioned, and (iii) how to secure the child in the child restraint system correctly.

	b. Each step outlined in the tasks below (f) should have an illustration or a graphic to aid users. The attached Quick Guide should be colour coded to match the mode of use of the child restraint system (i.e., blue, yellow, or red) and the Quick Reference Guide. c. The same or similar graphics to the Quick Reference Guide should be used in the Quick Guide to ensure consistency between formats. d. The front page of the Quick Guide, when provided as a swing ticket, should inform the user of the three tasks required for using the child restraint system for each trip i.e. correct use of the seatbelt or alternative lower anchorage, top tether anchorage, and harness. e. The Quick Guide should provide a scannable link to the online video relating to that task and the relevant restraint type. f. The following information for each task is recommended for the Quick Guide: (i) Attach seatbelt correctly: A. check it is clicked, B. remove twists, C. make it firm, and D. check it is firm. (ii) Attach top tether correctly: A. attach to anchor point, B. remove twists, C. remove the slack, and D. store excess tether strap in pocket. (iii) Secure your child in the harness correctly: A. click harness buckle, B. remove twists, C make it firm on the child, and D check it is tight.

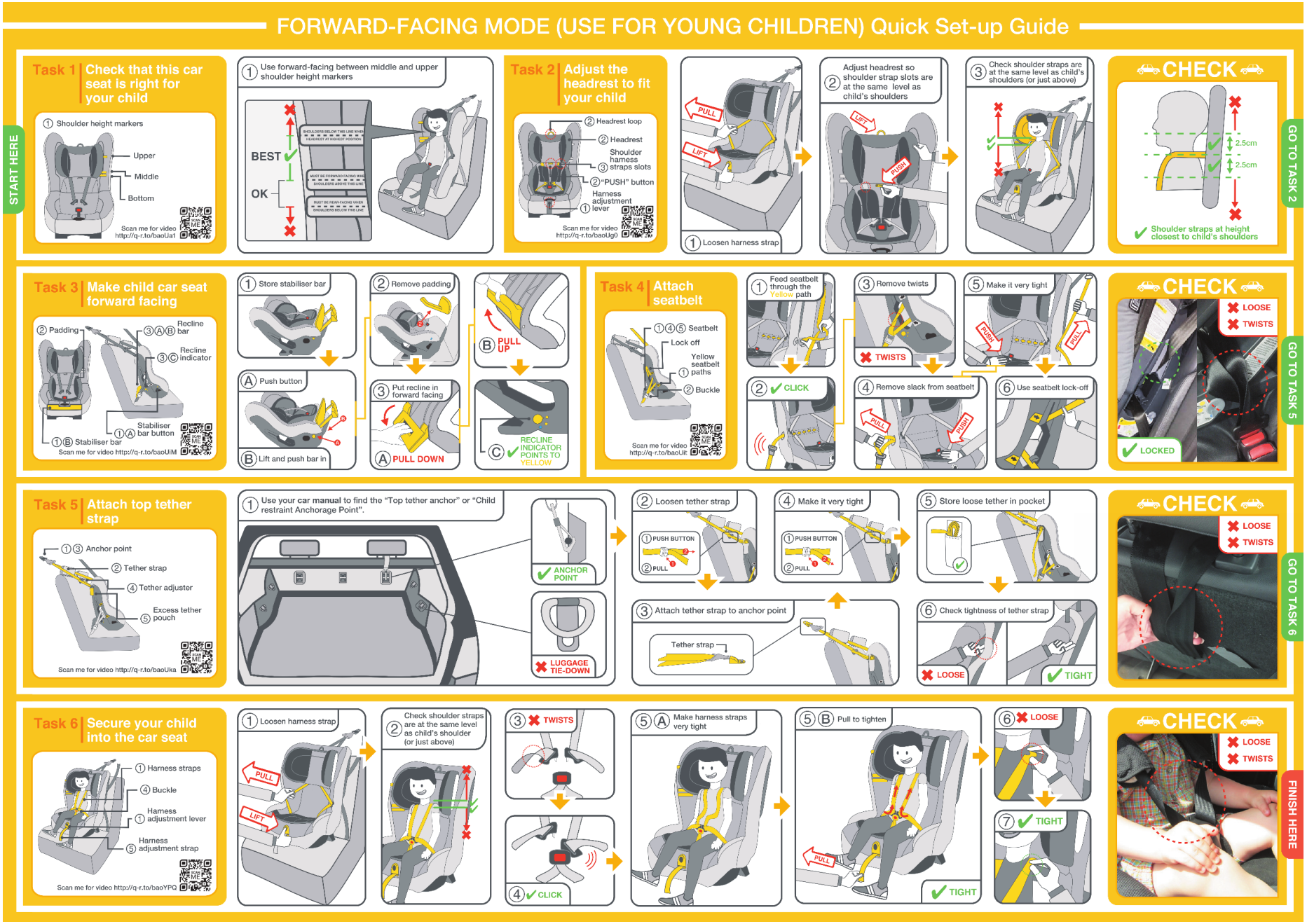
Appendices

The materials presented in Appendix A and Appendix B are examples of instructional materials constructed prior to consultation with manufacturers and child restraint experts. For this reason, inconsistency may be present with current AS/NZS 1754 Standard. Despite this, they give an example of the intent of materials developed using the final guidelines.

Appendix A – Rearward-Facing Mode Quick Reference Guide



Appendix B – Forward-Facing Mode Quick Reference Guide



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